

Report No. 12083-IND

# Indonesia Environment and Development: Challenges for the Future

March 21, 1994

Environment Unit  
Country Department III  
East Asia and Pacific Region

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## **CURRENCY EQUIVALENTS**

(As of February 1994)

Currency Unit = Indonesian Rupiah (Rp)

US\$ 1 = Rp 2,105  
Rp 1 million = US\$ 475

## **FISCAL YEAR**

April 1 - March 31

## **ABBREVIATIONS AND ACRONYMS**

<b>AMDAL</b>	-	GOI's "environmental impact assessment" program
<b>BAKOSURTANAL</b>	-	National Mapping Agency
<b>BAPPEDA</b>	-	Provincial Development Planning Board
<b>BAPPENAS</b>	-	National Development Planning Agency
<b>BAPEDAL</b>	-	Environmental Impact Management Agency
<b>BKBN</b>	-	GOI's Investment Coordinating Board
<b>BPN</b>	-	National Land Agency
<b>Dinas</b>	-	Provincial government Sector Development Offices
<b>GOI</b>	-	Government of Indonesia
<b>Kabupaten</b>	-	District (Level II local Government)
<b>Kanwil</b>	-	Provincial office of a central line agency
<b>Kotamadya</b>	-	Municipality (Level II local Government)
<b>MLH</b>	-	State Ministry for Environment
<b>NGO</b>	-	Non-Governmental Organizations
<b>PROKASIH</b>	-	GOI's Clean Rivers Program
<b>PSL</b>	-	University-based Environmental Studies Center
<b>Pusat</b>	-	Central or Head Office
<b>Regions</b>	-	Provincial and local (kotamadya and kabupaten) governments
<b>Repelita</b>	-	Five Year Development Plan
<b>UNDP</b>	-	United Nations Development Program
<b>UNEP</b>	-	United Nations Environment Program
<b>WID</b>	-	Women in Development

## CONTENTS

	<u>Page</u> <u>No.</u>
PREFACE .....	v
EXECUTIVE SUMMARY .....	vii
CHAPTER 1. ENVIRONMENT AND DEVELOPMENT: AN OVERVIEW .....	1
A. Introduction .....	3
B. Past Successes and Future Goals .....	4
C. Changing Roles and Development Transitions .....	8
D. Environmental Implications of Growth and Development .....	12
E. Sustainable Development: The Challenges of Integration .....	26
CHAPTER 2. CHALLENGES IN THE MANAGEMENT OF NATURAL RESOURCES .....	33
A. Introduction .....	35
B. Land Resources Management .....	35
C. Ecosystems and the Management of Protected Areas .....	42
D. The Management of Forest Resources .....	50
E. Water Resources Management .....	56
F. The Management of Energy Resources .....	59
CHAPTER 3. THE GROWING THREAT OF ENVIRONMENTAL POLLUTION .....	65
A. Introduction .....	67
B. Pollution from Urban Sources .....	67
C. Pollution from Industrial Sources .....	74
D. Pollution from Other Sources .....	84
E. The Costs and Consequences of Environmental Pollution .....	87
CHAPTER 4. INFLUENCING ENVIRONMENTAL OUTCOMES: POLICIES AND INSTRUMENTS .....	95
A. Introduction .....	97
B. Establishing Priorities .....	97
C. Choosing the Right Approach .....	102
D. Improving the Management of Natural Resources .....	108
E. Protecting the Urban Environment .....	117
F. Controlling Industrial Pollution .....	127

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This report was prepared by a core team consisting of Richard Calkins (Task Manager), Andres Liebenthal, Swati Ghosh, Don Hanna and David Wheeler, supported by a large number of other contributors who are listed in Annex A.

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<b>CHAPTER 5. THE COSTS AND FINANCING OF ENVIRONMENTAL PROTECTION</b>	<b>141</b>
A. Introduction	143
B. Public Sector Expenditures and Investments	143
C. Sources of Public Sector Finance	149
D. Private Sector Costs and Financing Issues	152
E. The Private Sector Response: Attitudes and Innovation	159
F. Costs, Tradeoffs and Priorities	163
<b>CHAPTER 6. THE CHALLENGES OF IMPLEMENTATION</b>	<b>167</b>
A. Introduction	169
B. The Politics of Environmental Management	169
C. The Critical Role of Information	174
D. The Importance of Institutional Strengthening	179
E. The Need for Constructive Participation	192
<b>CHAPTER 7. CONCLUSIONS AND RECOMMENDATIONS</b>	<b>207</b>
A. Introduction	209
B. What Needs to Be Done	210
C. Additional Elements of the Strategy	212
D. An Agenda for the Medium-Term	215
<b>ANNEX A. Contributors to this Report</b>	<b>231</b>
<b>ANNEX B. Tables</b>	<b>233</b>
<b>ANNEX C. Methodologies Used in this Report</b>	<b>239</b>
C1 Basic Economic Projections	239
C2 Demographic Projections	241
C3 Indonesian Manufacturing Projections	243
C4 The Industrial Pollution Projection System	245
C5 Estimating the Costs of Environmental Pollution	248
C6 Priority Rankings for Major Issues	260
<b>ANNEX D. The Global Warming Issue</b>	<b>263</b>
<b>ANNEX E. Indonesia's AMDAL (EIA) Program</b>	<b>269</b>
<b>ANNEX F. The Management of Aquatic Resources</b>	<b>274</b>
<b>ANNEX G. Selected References</b>	<b>280</b>

**MAP**

Text Tables

<u>Table No.</u>		<u>Page No.</u>
<u>Chapter 1</u>		
1.1	Human Resource Development, 1960-1990	6
<u>Chapter 2</u>		
2.1	Land Use in Indonesia	36
2.2	Estimates of Deforestation in Indonesia	52

Text Tables (con'd)

Chapter 2 (con'd)

2.3	Water Supply and Demand in Java, Average and Dry Years . . . . .	57
2.4	Energy Conservation Potential in Selected Industries, 1985 . . . . .	61
2.5	Projected Savings from Demand Side Management Program . . . . .	62

Chapter 3

3.1	Spatial Perspectives of Urban Population and Industrial Growth . . . . .	68
3.2	Pollution Intensities: Processing vs. Assembly . . . . .	78
3.3	Avoidable Health Costs of Pollution in Jakarta, 1990 . . . . .	89

Chapter 5

5.1	Priorities for Public Sector Investment . . . . .	148
5.2	Cost of Pollution Abatement, United States, 1989 . . . . .	153
5.3	Cost-Effective Clean Technology Investments in the U.S. . . . .	160

Text Figures

Figure No.

Page No.

Chapter 1

1.1	GDP Growth and the Changing Structure of Production . . . . .	9
1.2	Population Growth and the Urban Transition in Java . . . . .	11
1.3	The Contribution of Natural Resources to GDP . . . . .	15
1.4	Pollution from Urban Sources: DKI Jakarta - Human and Solid Waste . . . . .	23
1.5	Pollution from Urban Sources: DKI Jakarta - Vehicle Emissions: Particulates . . . . .	23
1.6	Pollution from Industry: Indonesia Totals - Water and Air . . . . .	24
1.7	Pollution from Industry: Indonesia Totals - All Media: Toxic Pollutants . . . . .	24

Chapter 3

3.1	Manufacturing Sector Trends (Processing/Assembly) . . . . .	75
3.2	Manufacturing Sector Trends (Urban/Rural) . . . . .	76
3.3	Pollution Intensity Trends . . . . .	79
3.4	Pollution Load Trends . . . . .	79
3.5	Total Pollution Loads, Java and Off-Java . . . . .	80
3.6	Pollution Loads in Java . . . . .	80
3.7	Total Load of Particulates (Tons), 1980-2010 . . . . .	82
3.8	Particulate Concentrations and Exposed Population, 1990-2010 . . . . .	83
3.9	The Rising Health Costs of Air Pollution in Jakarta . . . . .	90

Chapter 4

4.1	Energy-Related TSP in Jakarta . . . . .	126
4.2	Lead Emissions in Jakarta . . . . .	126
4.3	Major Sources of Pollutants by Industry . . . . .	138

Chapter 5

5.1	Industrial Pollution Abatement Costs, Total and Composition . . . . .	154
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Text Boxes

<u>Box No.</u>		<u>Page No.</u>
<u>Chapter 1</u>		
1.1	Concepts of "Sustainable Development" . . . . .	13
<u>Chapter 2</u>		
2.1	Land Administration in Indonesia . . . . .	37
2.2	Approaches to Soil Conservation in the Uplands of Java . . . . .	40
2.3	The Economic Benefits of Living Ecosystems: The Bintuni Bay Mangroves . . . . .	45
2.4	An Example of Integrated Conservation and Development: The Kerinci-Seblat National Park, Sumatra . . . . .	48
2.5	The Decline of the Trochus Fisheries in Maluku . . . . .	49
<u>Chapter 3</u>		
3.1	Contamination of Urban Water Supply . . . . .	69
<u>Chapter 4</u>		
4.1	Global Environmental Concerns: Indonesia's Role and Commitment . . . . .	103
4.2	Macroeconomic Policies and the Environment: Myths and Realities . . . . .	105
4.3	Land Banking: Experience in Other Asian Countries . . . . .	110
4.4	Complimentarities in the Adjustment of Fuel Prices . . . . .	115
4.5	Managing the Urban Environment--The Allocation of Responsibilities . . . . .	123
4.6	An Historical Perspective on Industrial Pollution Control . . . . .	128
4.7	Overview of the PROKASIH Program . . . . .	133
4.8	Toxic Release Inventories in the U.S. . . . .	135
4.9	Choice of Technology--The Case of Caustic Soda Production . . . . .	139
<u>Chapter 5</u>		
5.1	Revolving Loan Funds: Experience in China . . . . .	157
5.2	Subsidies for Industrial Pollution Control: Why and How? . . . . .	158
<u>Chapter 6</u>		
6.1	The Institutional Framework for Environmental Management . . . . .	180
6.2	Indonesia's Environmental Studies Centers . . . . .	183
6.3	Essential Elements of the AMDAL Program . . . . .	185
6.4	The Benefits of Participatory Development: Emerging Lessons . . . . .	193
6.5	Private Participation in Village Water Supply and Sanitation: Experience in Other Developing Countries . . . . .	195
6.6	Defining Community Needs: An Innovative Approach in Surabaya . . . . .	196
6.7	IPM: A "Farmer-Centered" Approach to Agricultural Extension . . . . .	198
6.8	Development Impacts on Natural Resource-Dependent Communities . . . . .	199
6.9	Mapping Community-Managed Forest Lands in Long Uli . . . . .	201
6.10	A Case of Polluted Shrimp Ponds in North Aceh . . . . .	202

## PREFACE

This is the second major environmental sector review undertaken by the World Bank in Indonesia. The first focused primarily on issues of natural resources management and was intended to assist the Government in assessing the emerging issues of "sustainable development" as an input to REPELITA V.<sup>1</sup> Much has been accomplished since then, especially in the areas of policy reform and institutional strengthening, and the messages of this report should in no way be seen to detract from those accomplishments. A major aim of this report is to build on the findings of the earlier study and the lessons learned since then about the challenges of implementing a sustainable development strategy in Indonesia. We have also benefitted significantly from the analysis and conclusions of the World Development Report 1992,<sup>2</sup> and have attempted to apply the lessons of experience summarized in that report to the challenges of sustainable development facing Indonesia in the years ahead.

An earlier draft of this report was intended to serve primarily as a resource for the Government in the preparation of its next Five-Year Development Plan (REPELITA VI) and Second Long-Term Development Plan. It also represents, however, a stock-taking exercise on the issues of sustainable development that will be used by the Bank to review its programs of operational support for the coming years. To respond to growing concerns about urban environmental management and industrial pollution control, for example, will require that these issues feature more prominently in future Bank support than they have in the past. A major study on the provision of urban services is nearing completion, and a study focused exclusively on the issues of industrial pollution control will be initiated shortly. In both cases, the results will be incorporated in the design of future lending operations, consistent with Government priorities for Bank support under REPELITA VI.

Because of the relatively broad scope and coverage of this report--looking back over the past twenty-five years and, rather more challenging, ahead another twenty-five years, and covering current issues and future challenges in a large number of sectors and sub-sectors--it has not been possible to deal with every issue in as much detail as might be desirable. In most cases, however, additional details are available from the reference materials noted in Annex G.

This report was prepared by a Core Team led by Richard Calkins, which included Andres Liebenthal, Swati Ghosh, Don Hanna and David Wheeler. Producing it would not have been possible without the written contributions, advice and guidance of a large number of individuals, including officials of the Government of Indonesia, others in academic and non-governmental institutions, and colleagues from across the Bank. The Core Team wishes to extend its sincere appreciation to each of these individuals, who are listed in Annex A.

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<sup>1</sup> World Bank, Indonesia: Forests, Land and Water - Issues of Sustainable Development, published as a World Bank Country Study, June 1990.

<sup>2</sup> World Bank, World Development Report 1992: Development and the Environment, March 1992.

## **EXECUTIVE SUMMARY**

### **A. Introduction**

1. Indonesia has been remarkably successful in achieving its development objectives over the past twenty-five years: income per capita has risen from US\$50 in 1967 to US\$650 today; poverty has been reduced from 60% of the population to an estimated 15%; life expectancy at birth has increased by 20 years (almost 50%); and, with the achievement of universal primary education, the adult illiteracy rate has been cut by two-thirds. While still a low-income country, its tradition of sound economic management, the structural reforms of the 1980s, and past investments in human resources and infrastructure have laid the foundation for continued progress in the decades ahead.
2. The Government is currently formulating its Second Long-Term development Plan and its Sixth Five-Year Plan, both of which begin April 1, 1994. The pursuit of "growth with stability" will continue to be a central element of Indonesia's development strategy for the longer term. With an estimated 27 million people still living in absolute poverty, GCI's long-standing concern for equity will be pursued through further improvements in access to education and health care, and a more targeted approach to the pockets of poverty on Java and the more remote communities in the outer islands. Attention to quality in the process of development will also be needed, including the quality of education and training to support the transition to higher-technology jobs and the quality of economic infrastructure to support the growth and competitiveness of domestic production.
3. Issues of environmental quality and sustainability represent a more recent addition to GOI's development concerns. This is not surprising given the challenges that existed at the start of the First Long-Term Plan, and what was known at that time about the relationship between economic activities and the underlying ecosystems upon which they depend. The growing attention to these issues in GOI's development strategy is a result of the worsening environmental conditions in Indonesia today, due to the pace and pattern of growth in the past, and the increasing awareness of the costs and risks of continued environmental degradation in the future. The aim of this report is to examine these issues, to assess their implications for the achievement of GOI's development goals in the longer term, and to suggest an action plan that would help to ensure that those goals will be met.
4. The pursuit of those goals will be shaped by a future fundamentally different from the past. The story of the past is one of oil (the rise and fall), rural development (rice and trees), and the reduction of poverty (even in the face of oil price shocks), based primarily on a natural resource-intensive growth strategy. The story of the future is one of transitions, already well underway: from a dependence on oil and agriculture to a reliance on rapid industrialization; from a largely rural society to a predominantly urban one; and from a low-income to a solidly middle-income country, based on a development strategy that emphasizes the increasing efficiency and competitiveness of domestic production and higher productivity and value-added for the growing labor force. The private sector, with support from the Government, is expected to be the main "engine of growth".
5. These transitions will have major implications for the environment. The analysis of current environmental conditions and trends, and the likely impact of future growth and development under existing policies and practices, leads to three main conclusions. First, that future growth and development, including the process of industrialization, will depend increasingly on Indonesia's stock of key natural resources (land, forests, water and energy) and the sustainability of critical ecosystems

(including groundwater aquifers in urban areas, and watersheds and coastal and marine ecosystems throughout Indonesia). Current inefficiencies in the allocation and use of natural resources, however, and the prospects for continued degradation of critical ecosystems, call into question the sustainability of even current levels of economic activity in a number of key sectors.

6. **Second**, industrial sector growth will continue to be concentrated in urban areas, especially on Java. Industrial pollution, combined with pollution from urban sources (human waste, solid waste and vehicle emissions), poses an immediate threat to health and human welfare. Growing congestion and pollution in Indonesia's main urban centers, however, will erode the efficiency of public and private sector investment, reduce Indonesia's ability to attract foreign investment, and eventually lead to strong community resistance to industrial expansion, particularly in urban areas, with serious implications for the rate of growth of the economy as a whole. **Third**, as a result of rapid economic growth, conflicts over the use of land and access to other natural resources are increasing, and growing numbers of people are exposed to environmental pollution which threatens their health and livelihoods and jeopardizes their prospects for a higher quality of life in the future. The poor are particularly vulnerable, but they also contribute to environmental degradation through unsustainable production practices and the unsafe disposal of human and other wastes. Environment-related issues of equity, therefore, will become increasingly important over the coming years.

7. The emergence of these issues has led to a growing awareness in Indonesia of the need to improve the management of natural resources, reduce the level of urban and industrial pollution, and enhance equity in the outcomes of future growth and development. To deal with these issues will not be easy. The main challenge will be to integrate environmental issues and concerns into the development process, taking maximum advantage of the positive linkages, and dealing effectively with the inevitable tradeoffs. This will require continued improvements in the policies and incentives for environmentally responsible behavior, a substantial increase in investments in environmental protection by both the Government and the private sector, and sustained efforts to strengthen the institutions responsible for environmental planning and management. Indonesia is fortunate in being in a position to learn from the experience of other countries and to avoid their worst mistakes. The single most important lesson of experience is that "prevention is better than cure"—especially in view of the potentially irreversible loss of critical ecosystems and the often prohibitive costs of cleaning up toxic and hazardous wastes. Given the existing environmental conditions, however, and the expected rapid pace of future growth, GOI has a relatively narrow window of opportunity in which to act.

## **B. The Key Issues of "Sustainable Development"**

### **Challenges in the Management of Natural Resources**

8. As a result of growing population pressures and changes in the nature and intensity of economic activity throughout Indonesia, issues of **land use** have become increasingly important. On Java, the encroachment of landless farmers into upland forests and the conversion of coastal wetlands to agricultural use (especially aquaculture) have led to increasing soil erosion, flooding in low-lying areas, and the loss of valuable marine resources. Similar issues arise in the outer islands, where the conversion of both forest land and coastal wetlands to agricultural use (planned and unplanned, and often in an unsustainable manner), is compounded by the commercial exploitation of timber resources,

as noted below. The rapid, but uncoordinated, expansion of urban areas contributes to urban sprawl and inefficiencies in the provision of infrastructure. Industrial firms continue to concentrate in and around urban areas, with little regard for potential impacts on ecologically sensitive areas or the health and welfare of surrounding communities. Land-related issues of equity throughout Indonesia arise in part from the process of land acquisition for development purposes that sometimes occurs without sufficient compensation or other arrangements to ensure that the livelihoods of those affected are fully restored. They also arise, however, as a result of the unintended effects of development on natural resource-dependent communities, especially in the outer islands where the expansion of forest concessions, plantations and other development projects has led to increasing conflicts over traditional ("adat") land-use rights and continued access to natural resources by local communities.

9. GOI clearly recognizes the importance of protecting its most valuable terrestrial and marine ecosystems, upon which so much of the country's economic activity depends. These assets, especially Indonesia's tropical rainforests, also play a vital role in maintaining global ecosystems, and contain much of the world's remaining biological diversity. Accordingly, GOI has set aside 19 million ha (hectares), 10% of its total land area, as **parks and reserves**, and another 30 million ha as **permanent protection forests** to safeguard critical watersheds. Designated and proposed **marine conservation areas** amount to an additional 30 million ha. Properly managed, these areas would be sufficient to protect both Indonesia's biological diversity and many of its critical ecosystems. Effective management, however, is constrained by the shortage of staff, expertise, infrastructure and budget, compounded by the vast size and often remote location of the areas that need to be protected.

10. **Indonesia's forests** are second only to Brazil's in size, and represent 10% of the world's remaining tropical rainforest. Nearly 75% of Indonesia's total land area is classified as "forest land" (about 144 million ha), and some 100-110 million ha are estimated to be "closed canopy" forest, of which about 60 million ha are designated as production forests. GOI has encouraged the exploitation of commercially valuable timber in these production forests by the granting of more than 500 forest concessions. Government regulations specify a "selective cutting" approach to concession management that, combined with careful logging and replanting, was expected to allow these production forests to be managed sustainably. Poor logging practices, however, and the failure of replanting efforts, have resulted in extensive degradation in many of these concessions and, together with the opening up of forest areas through logging roads, contributed to the loss of forest cover. The rate of deforestation is a matter of growing concern, but weaknesses in the available data have led to widely varying estimates--ranging from 1.3 million ha to less than 300,000 ha per year.

11. To improve the management of its forest resources, GOI has prepared a Tropical Forest Action Plan and has declared its intention to ensure that its exports are from "sustainably managed forests" by the year 2000. To achieve this goal, while also meeting the needs of the wood processing industries, will not be easy. As a result of export bans or prohibitive taxes, combined with relatively low Government fees on timber extraction, the domestic price of raw logs is significantly below world market prices. Low domestic prices for logs, in turn, have led to lower rates of efficiency in the wood processing industries, reduced incentives to conserve, and thus growing pressure on the natural forests. Some of the pressure on natural forests, particularly from demand by the pulp and paper industry, could be offset through the development of forest plantations, provided they are located on already degraded forest lands. GOI is encouraging the development of such plantations, but it is too early to tell whether these efforts will be successful.

12. Issues of **water resources management** will be increasingly important in the years ahead--especially on Java, which has 60% of the population, 70% of irrigated agriculture, and 75% of industry. Issues of water quantity include emerging conflicts between competing uses (agriculture, industry and municipal), and between surface and groundwater in rapidly growing urban areas. While Java is well endowed with rainfall, it is highly seasonal. Dry season flow in the main rivers is only 20% of annual flows--and as little as 10% in a dry year. River basins on Java are relatively steep and short, and most of the wet season water runs unused into the sea. Reservoirs hold less than 5% of total river flows. While additional sites have been identified for future dams, implementation will be constrained by high population densities and the social and economic costs of resettlement. Industrial and municipal water needs represent only about 2% of current demand, but will grow to about 5% by the year 2010. To meet this demand will require a shift of water in the dry season from agriculture to municipal and industrial use. To minimize the social and economic costs for farmers, and potential disruptions to agricultural output, will require that water resources be managed on an integrated river basin basis, an approach GOI is currently in the process of adopting. This will need to include the reduction of groundwater use, since many of the aquifers in Java's rapidly growing urban centers are already suffering from over-extraction, resulting in salt-water intrusion and ground subsidence in coastal areas. The challenges of meeting the demand for water in the dry season is complicated by pollution from growing volumes of urban and industrial waste, as noted below.

13. The domestic demand for **energy** has grown very rapidly in the past, averaging nearly 7% per annum in the 1980s, but will grow even faster in the future--increasing nearly 3-fold in the 1990s, and an estimated 14-fold by the year 2020. Indonesia has a large base of primary energy resources, including oil, natural gas, and coal, as well as hydroelectric and geothermal potential. These resources are sufficient not only to meet domestic demand, but also to provide substantial export earnings. With the rapid growth of domestic demand, however, Indonesia will become a net oil importer, possibly by the year 2000. GOI's strategy for the energy sector, therefore, involves the substitution of petroleum with hydro, geothermal and gas-fired generating capacity to the maximum extent possible, with the remaining power needs met by coal--thus conserving petroleum for use in transport. Energy conservation will be important, with potential savings of as much as 20% of future demand. Renewable energy resources are also important, but will only account for about 10% of total energy supply over the longer term due to technical and economic constraints. The expected rapid growth in the consumption and production of energy has important implications for the environment. The use of petroleum fuels, mostly by transport and industry, is concentrated in urban areas and constitutes a major factor in the deteriorating ambient air quality of Indonesia's major cities. The use of coal for power generation by P.I.N and industrial firms is also a concern in terms of both local emission of particulates and the contribution to global warming. Other concerns include the environmental effects of oil spills, coal mining, and effluents from power plants.

### **The Growing Threat of Urban and Industrial Pollution**

14. Urban areas have been growing rapidly in recent years (over 5% per annum), and this trend is likely to continue: from only 15% in 1970, Indonesia's urban population is now over 30% and, by the year 2020, half of the entire population may reside in urban areas. The urban transition is occurring more rapidly on Java, which is already 36% urban and could reach 60% by 2020. As a result, Java's rural population will actually begin to decline in absolute terms, possibly as early as the year 2000, and this will help to relieve some of the pressure on ecologically sensitive rural areas.

15. Substantial economies of "agglomeration" are possible in urban centers, but the concentration of people in urban areas simultaneously increases both the concentration of pollution from human and economic activity and the number of people exposed to the health effects of that pollution--with the urban poor least able to protect themselves. Similarly, while rapid expansion of industry will result in more productive (and higher-paying) jobs for the growing labor force, as well as the growth of non-oil exports, the concentration of industrial firms (and industrial waste) in urban areas represents a serious and growing threat to the health and welfare of Indonesia's urban citizens.

16. The key issues of pollution from urban sources include **human waste, solid waste and vehicle emissions**. Unsafe water is one of the major sources of disease in Indonesia, and the lack of adequate **sanitation facilities** is a primary cause of fecal contamination of urban water supplies. Few Indonesian cities have even a rudimentary sewerage system, so most households rely on private septic tanks or dispose of human waste directly into rivers and canals. Septic tanks, however, are rarely maintained properly, causing overflows which contaminate groundwater supplies, including the shallow wells upon which most urban households depend for their water. Even when the sludge from septic tanks is collected, most of it is disposed of into rivers and canals. Because of deteriorating pipes and low water pressure in many urban water supply systems, even piped water is contaminated. With the exception of bottled water, therefore, most urban water supplies are not safe to drink. The transmission of water-borne diseases is also dependent on hygiene habits, which are frequently related to the availability of adequate supplies of water. Effective solutions, therefore, will have to deal with water supply and sanitation in combination.

17. **Urban solid waste** is likely to expand more than twice as fast as the population, since the amount of waste per capita increases as incomes rise. At present, an estimated 15-40% of such waste is not getting collected at all, and much of what is collected ends up in uncontrolled dump sites, leading to leachates that contaminate ground water and contributing to the proliferation of disease-carrying pests. Some uncollected wastes are burned, adding to urban air pollution. An estimated 30%, however, ends up in rivers and canals, sometimes blocking them up and causing flooding and the spread of contaminated water in low-lying residential areas. The health effects of inadequate solid waste management are difficult to isolate from those arising from other causes, but more effective management of solid waste will be essential to ensuring a clean and healthy urban environment.

18. The available evidence on **air pollution** in Indonesia's largest cities indicates that current conditions exceed national ambient quality standards for several pollutants at least some of the time, including suspended particulate matter and, in selected areas of heavy traffic, also lead, sulphur dioxide and nitrogen oxides. Given the expected growth of urban populations, rapid growth in vehicles and increasing road congestion, and the expansion of air pollution from industry in and around the major urban centers, the condition of the air in the largest cities is likely to worsen dramatically if nothing is done. Vehicle emissions are the largest and most rapidly growing source of urban air pollution, and the greatest damage is caused by the health effects of particulates and lead.

19. Total **industrial output** has increased 8-fold since 1970 and is likely to expand another 13-fold by the year 2020. There has been a gradual shift in sectoral composition, with "processing" industries growing more slowly than "assembly-type" industries. Since the former are by far the most pollution-intensive, there has been a noticeable decline in the **pollution intensity** of total industrial output since 1970. With the rapid growth of industrial output, however, future **pollution loads** will

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increase substantially for virtually all pollutants: BOD ("biological oxygen demand") from water pollutants will increase 10-fold by the year 2020; emissions of suspended particulates into the air will increase 15-fold; and emissions to all media of bio-accumulative metals (e.g., mercury and lead) are projected to increase by as much as 19-fold. The health impacts of industrial pollution are heightened by the fact that they are concentrated in urban areas and in those provinces with the highest population densities. Java's share of toxic pollutants, for example, will remain roughly constant (about two-thirds of the total, and more than 75% of the bio-accumulative metals), and 85% of these will be concentrated in urban areas. While the share of total industrial pollution in urban areas will decline from 70% today to 60% in 2020, the absolute level of industrial pollutants in Indonesia's cities--assuming current policies and practices--will expand nearly 10-fold from their current levels.

### **The Costs and Consequences of Environmental Degradation**

20. In connection with this study an attempt was made to estimate the health effects of pollution in Jakarta and their economic costs. While the total cost varied widely, reflecting the uncertainties involved in the methodology and the data used in the model, the central value estimate for 1990 is more than US\$500 million. In addition to health effects, urban and industrial pollution can raise the operating costs of "downstream" economic activities--and even put them out of business. Brackish-water shrimp production on the north coast of Java, for example, is increasingly threatened by pollution and could have to be relocated. There is anecdotal evidence of similar losses to communities in the outer islands due to the rapid growth of processing industries, with pollution incidents sometimes involving serious health effects as well. The cost of "flushing" key rivers on Java during the dry season has a high "opportunity cost" in terms of foregone agricultural output. Industrial toxic waste represents a serious risk to human health, adds to the vulnerability of rapidly growing shrimp exports (worth about US\$900 million in 1992), and will be extremely expensive to clean up. Uncontrolled pollution from human and solid waste in some of the most popular resort destinations in the country also represents a serious potential threat to the growth of tourism receipts--which amounted to US\$3.2 billion last year.

21. Growing congestion and pollution in its main urban centers will make it increasingly difficult for Indonesia to compete for foreign investment, especially in the higher-technology industries needed to enhance the productivity of the labor force. With urban populations expected to double over the next 25 years, and with a potential 10-fold increase in industrial pollution in urban areas, growing community resistance to uncontrolled pollution will inevitably lead to pressures to slow the expansion of industrial output in those areas where future growth is most likely to occur.

22. Similar costs and risks arise from the unsustainable management of natural resources. The conversion of mangrove forests, and the loss of coral reefs due to urban and industrial pollution and siltation from logging in upland watersheds, has already resulted in declining fish catches in some parts of Indonesia, upon which many coastal villages depend for their livelihoods. Poor logging practices, combined with inefficiencies in the wood processing industries, waste timber resources equivalent to a third of the sustainable harvest. Including estimates of illegal logging, the rate of timber extraction from Indonesia's natural forests currently exceeds the assumed rate of regeneration, calling into question the long-term supply of logs for domestic production. The failure to protect its rainforest effectively, however, has also led to calls for a boycott of Indonesia's timber products, thus threatening one of its largest non-oil sources of foreign exchange (US\$3.7 billion in 1992).

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## C. What Needs to Be Done

### Environmental Priorities

23. With limited financial and administrative resources, it will not be possible for GOI to take on every environmental issue with the same degree of urgency. The establishment of priorities, therefore, should be based on a careful assessment of the costs and benefits involved. While there are serious limits to the availability of data in Indonesia, and thus considerable uncertainty about the precise level of some costs and benefits, existing "order of magnitude" estimates are sufficient to identify at least the highest priority issues. On the basis of the analysis contained in this report, these would appear to be: **water supply and sanitation, solid waste management and vehicle emissions in Indonesia's main urban centers, industrial pollution control--particularly on Java, and the management of forest concessions in the outer islands.** In each case there are serious implications for achieving GOI's development objectives of growth, equity and sustainability.

24. Other important issues include the protection of regional and local watersheds and coastal and marine ecosystems, and issues related to the sustainable management of natural forests, including their conversion to agricultural uses, efficiency of the wood processing industries, and the development of forest plantations. In many cases, progress in these areas will also help to deliver on Indonesia's commitments to the sustainability of global ecosystems and the protection of biodiversity.

### Improving the Management of Natural Resources

25. Improving the management of natural resources will be important for economic as well as environmental reasons but, in a growing number of cases, there are also issues of equity and burden-sharing involved. Recommended actions focus on three key areas: greater reliance on market forces to improve efficiency in allocation and use; appropriate and targeted Government interventions to protect critical ecosystems and ensure equity; and significant strengthening of the institutions responsible for the management of key natural resources--especially at the regional and local levels.

26. Improving efficiency in the allocation and use of **land** will require a major effort to strengthen market forces, by reducing and simplifying land regulations, expediting land titling and registration, improving the availability of land information, and relying on competitive auctions (wherever feasible) to allocate public lands. "Deregulating" land markets will help to ensure that land is put to its highest and best use, but market interventions are needed to protect critical ecosystems from continued degradation. Recent legislation provides an improved legal framework for spatial planning, and the issuance of implementing regulations should be given a high priority. To ensure equity in the acquisition of land for development purposes, Government intervention should take the form of a clearly articulated and carefully implemented policy on compensation for lost property rights and the resettlement of affected people, with particular attention to restoring their livelihoods.

27. Until recently, the management of **parks and protected areas** has focused primarily on the enforcement of restrictions on entry. Given the vast size of these areas, the large number of people living near (or within) their boundaries, and the limited number of Forestry Department staff, however, such efforts are unlikely to succeed. On Java, the lure of higher paying jobs in rapidly growing urban areas will help to reduce the pressure on rural areas, but this will happen more slowly

in the outer islands. Ultimately, therefore, success will depend on the cooperation and support of local communities. GOI interventions will have to combine conservation activities within protected areas with income-generating activities outside their boundaries, with a major emphasis on community participation--such as the current proposals for the Kerinci-Seblat National Park in Sumatra.

28. To reduce poverty in the outer islands, some of the remaining forests and wetlands will be converted to agriculture use--including tree crops--mostly through GOI-sponsored development programs. To ensure the sustainable use of these converted lands will require improvements in agricultural research and extension and the design of farming systems tailored to local ecological conditions. Highest priority should be given to improving existing schemes (e.g., replanting of tree crops using better seedlings, and better design and implementation of drainage schemes in swamp reclamation areas), and the use of already degraded forest lands ("alang alang" grass areas) for both agricultural expansion and (especially) the development of timber plantations.

29. Improving the management of production forests will require a combination of efforts, including: raising domestic log prices to international levels; changing the duration of logging concessions from the current 20 year's to one of indefinite length, renewable every five years, but subject to satisfactory performance; intensifying research on sustainable logging and replanting practices; improving the management plans for individual concessions; and strengthening enforcement of forest regulations. Monitoring and enforcement will be increasingly important with higher log prices, which will increase incentives for illegal logging. This will require the devolution of authority to regional and local agencies, a review of the mandates and organization of forest agencies, and investments in human resources. One option being considered is an independent inspection service to provide advice and guidance to concessionaires and, at the same time, report to the authorities on the adequacy of current practices. Penalties for poor performance could involve "performance bonds", but a more powerful incentive--assuming the advent of "green labeling"--would be for the inspection service to certify whether a given concession complies with international standards of sustainability.

30. Higher log prices would also improve the profitability of forest plantations, thus stimulating investment by the processing industries in their development. Incentives are also needed to ensure equitable treatment of forest-dwelling and forest-adjacent communities. A major effort is needed to improve the delineation of concession boundaries and to better recognize existing "adat" rights. New approaches will be required to ensure community participation in decision-making on forest management, and a more equitable sharing in the benefits to be derived from forest resources.

31. GOI is currently formulating a more integrated strategy for water resources management, with institutional development focused on water resources within an entire watershed, including the conjunctive use of surface and groundwater. Improved pricing and cost recovery policies will be especially important for demand side management, but are also needed to finance additional investments (e.g., in urban water supply) and to fund "O&M" (such as the recent introduction of "service charges" for irrigation water to be used by local water users groups to carry out system maintenance). Better coordination of water pricing among different users will also be needed. Piped water for households is subsidized by much higher rates for industry, which uses excessive amounts of groundwater because it is cheaper. The subsidy for households, however, generally fails to reach the poor, since only about 10% have access to piped water. Many of the rest rely on water from vendors, sometimes paying as much as 40 times the price of piped water.

32. Subsidized prices for energy have been seen as a way of stimulating more rapid growth. Recognizing that Indonesia may soon become a net importer of oil, however, President Soeharto recently announced the elimination of nearly all of the remaining budgetary subsidies on fuels. Similar opportunities exist in the power sector, where low electricity prices for industry, and lower still for residential use, have encouraged the rapid growth of demand and weakened incentives for conservation. They also constrain the ability of the national power company (PLN) to finance the expansion of supply. One result has been the need for industry to invest in "captive" generating capacity, which is not only a less efficient source of power but also results in higher levels of air pollution in urban areas where most industries are located. While the intention of subsidized rates for residential use is to make electricity more available to the poor, most of the subsidy goes to relatively better-off households, with only about 4% reaching the poor—who consume little or no electricity.

### **Protecting the Urban Environment**

33. To deal with the rapid growth of urban areas, and to meet the existing backlog of demand for urban services, will require a substantial increase in public sector investment. It will also require more effective policies and incentives for environmentally responsible behavior by firms, households and individuals, and greatly enhanced institutional capacities for urban environmental planning and management. The main challenge is to define a strategy for the management of urban areas that accommodates the need for growth while protecting the quality of the environment. At stake is not only the efficiency of the "urban enterprise"—with significant implications for overall economic growth—but also the health and welfare of Indonesia's urban citizens.

34. In most large cities, improving the **availability of safe water** will require a major expansion of the piped water supply. While the distribution network will need to be extended, most cities could increase in the supply of treated water significantly simply by reducing "unaccounted for" water in the current system, which is often as high as 35-40%. Increasing the number of connections is constrained by the high "up-front" cost of connection. To overcome this difficulty, part of the connection fee could be included in the monthly charges for water. Supply interruptions and low pressure in the pipes force many households to install home reservoirs, to use pumps applied directly to the pipes, or rely on other sources of supply (e.g., shallow wells). Given the deteriorating condition of many large urban water supply networks, low water pressure, combined with fecal contamination of groundwater, leads to contamination of piped water through infiltration. To improve quality and reliability will require a major effort to improve the quality of construction and "O&M". This will also help to reduce "unaccounted for" water, and thus improve the reliability of the system. Greater reliability of piped water is also needed to reduce the demand for groundwater in cities where excessive extraction for industrial and residential use is a major problem.

35. To reduce fecal contamination of urban water supplies will require a significant improvement in the availability of **sewerage and sanitation services**. Many parts of most Indonesian cities can continue to rely on "private sector" approaches (pit latrines and septic tanks), but the conditions of their use will have to be improved (e.g., the proper removal and disposal of septic tank sludge). Water-borne sewerage collection systems are highly expensive, and are unlikely to be economically justifiable for most residential areas in the near future. The intensive development of commercial areas, however, may justify the investment costs needed in trunk lines, and could be cost-effective for high-rise buildings that would otherwise have to invest in their own treatment plant to

meet local environmental standards. GOI has already initiated a planning exercise covering up to 25 cities to assess their sanitation needs. Preliminary indications are that up to 60% of the urban areas can continue to rely on-site solutions, but the rest will need to be connected to a sewerage system. The "least cost" technical options will need to be defined, and issues of financing and cost-recovery--and the institutional arrangements for managing the system within each city--will need to be resolved.

36. Improvements are needed in both the collection and disposal of **urban solid waste** in all of the larger cities of Indonesia. Even in the poorest neighborhoods, waste removal is a high priority, and primary waste collection is often managed by local residents. Greater involvement of the private sector in waste collection should be encouraged, including the design, construction and operation of "transfer stations" in larger cities. Long-term planning is needed for the siting of future landfills, and improved management of existing landfills should be a high priority--especially those located in environmentally vulnerable areas. Waste recycling can reduce the need for landfills, and is already a thriving activity in many cities--with strong support from non-governmental organizations.

37. The number of motorized vehicles in Indonesia more than doubled during the 1980s, to 9 million vehicles, a third of which are in urban areas, and this trend will continue. Expansion of the urban road network, however, has lagged behind, leading to rapidly growing **traffic congestion and vehicle emissions** in the major metropolitan areas. Reducing the growth of traffic congestions will be essential for minimizing efficiency losses and for protecting the health of the urban population. (In Bangkok, for example, nearly a third of the city's potential GDP is lost because of congestion-induced travel delays.) While much can be accomplished in the medium term through a combination of policy reform and public sector investments, longer-term solutions will require a comprehensive approach, including: more effective land-use planning; improved traffic management and engineering; higher technical standards for motor vehicles; the introduction of cleaner fuels; expansion of public transport systems (and their quality and reliability); and more effective policies for demand-side management.

38. The potential for reducing energy-related air pollution in Jakarta was examined in a recent Bank report. That report concludes that pollution-based fuel taxes, together with the introduction of unleaded gasoline and CNG (Compressed Natural Gas), would pay significant dividends. Compared with a six-fold increase in SPM (suspended particulate matter) by the year 2020 under the "unchanged practices" scenario, SPM would only increase by about 90%, and emissions of lead would decline by 80%. The economic benefits, in terms of reduced health costs, would be quite significant. Health damages from energy use would be reduced by 84%, and total health damages from SPM and lead would be reduced by over 50%. As these results suggest, however, without complementary measures to control the emission of non-energy-related pollutants (from industry and the burning of solid waste), the health costs of air pollution will continue to rise.

### **Controlling Industrial Pollution**

39. There are two key issues of industrial pollution control facing Indonesia today: (a) what to do about pollution from existing firms; and (b) how to "delink" future pollution loads, and the damage they cause, from the expansion of industrial output. The first is important, given the current level of industrial pollution, but the second is the more critical issue: by the year 2010, assuming continued rapid growth, existing firms will represent only about 15% of total industrial output and, by the year 2020, less than 8%. Coming late to the challenges of industrial pollution control carries with

it enormous advantage--not least of which is the opportunity to learn from the mistakes of others. The most important lesson of experience in the West is that **pollution prevention pays**--for society as a whole and, in many cases, for individual firms as well. The main challenge will be to integrate that principle into the development of the industrial sector over the next twenty five years.

40. The recommended strategy for cleaning up pollution from existing firms involves six key elements. **First**, continue to improve the incentives framework for efficient private sector growth, including market-based prices for natural resources and "full-cost" pricing of urban services. **Second**, carefully target the pollution control effort, by industry, by pollutant and by area--focusing on the worst polluters and the most damaging pollutants in the most threatened areas of the country. **Third**, continue efforts to strengthen the institutional capacity for pollution monitoring and the enforcement of pollution standards, especially at the provincial level. **Fourth**, give highest priority to encouraging the adoption of "clean technology", and especially waste minimization initiatives, to reduce pollution loads at the least cost while simultaneously enhancing industrial efficiency and competitiveness. **Fifth**, rely increasingly on the power of public information--about trends in ambient environmental conditions and firm-specific pollution practices--to build consensus, capture the attention of industry leaders, and bring community pressure to bear on unresponsive firms. **Finally**, move quickly to develop and implement plans for controlling toxic and hazardous waste, including storage, transport and treatment issues, with special attention to the needs of smaller firms and emphasizing the importance of reducing the use of such materials in the production process.

41. Reducing the level of pollution from new and expanding firms will require more effective attention to environmental issues and concerns at the initial stages of project design and approval. The recommended strategy includes four key elements. **First**, use existing environmental impact assessment ("EIA") procedures for prior review of potential environmental effects, but target the effort and ensure professional and expeditious reviews--possibly by "contracting out" with an experienced firm. **Second**, expand the review to include issues of technology choice. Wherever there are significantly different options available, require further justification for adopting older, less inefficient and more highly polluting technologies. **Third**, ensure that provisions are made for appropriate "end-of-pipe" pollution abatement in new and expanding firms, to avoid more expensive "retro-fitting" latter on. **Fourth**, ensure effective local government input on location issues, especially for major projects but also for any that are highly polluting, and encourage the location of medium- and larger-scale firms in private sector-sponsored industrial estates.

#### **D. The Costs and Financing of Environmental Protection**

42. This report suggests the need for a substantial increase in public sector investments for environmental protection. Investments in urban water supply and drainage, sewerage and sanitation, and solid waste management, which amounted to Rp 2.0 trillion (0.2% of GDP) in REPELITA IV, would need to increase to about 0.4% of GDP in future years. Similarly, to deal with the growing problems of traffic congestion and vehicle emissions, investments in urban roads and other transport-related infrastructure will need to expand substantially, within the growing allocation for road transport. (A rapid-transit system for Jakarta, for example, has been estimated to cost as much as US\$3.1 billion.) Urban transport investments in future years, therefore, could amount to as much as 0.5% of GDP (excluding investments needed to develop unleaded gasoline and CNG).

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43. Allocations for "O&M" related to these investments will also need to increase. Order of magnitude expenditures would be 3-5% of the incremental investments in water supply, 2-3% for (relatively newer) investments in sewerage systems, and 5-6% for urban roads. In rough terms, other recurrent account expenditures on environmental protection (including support for institutional strengthening and other initiatives to improve the management of natural resources) could amount to about 1% of total public sector expenditures, or 0.1% of GDP. On the basis of these estimates, Indonesia's total public sector expenditures on environmental protection in the coming years would represent about 1% of GDP. To maintain the pace of progress over the longer term, further increases will be needed in subsequent periods--especially for urban sewerage and transport systems.

44. It should be possible to cover most of these increases through environment-related policy reforms involving the pricing of natural resources and cost-recovery for urban services and, at the same time, enhance the prospects for sustainable growth. The recent removal of most subsidies on petroleum products will, by itself, yield savings of about US\$1.5 billion a year (1.1% of GDP). It will also improve efficiency in the allocation and use of petroleum products and encourage the substitution of less-polluting fuels. Similarly, increasing the domestic price of logs, and collecting a higher share of "economic rent" from forestry, could raise public sector revenues by a multiple of current levels (about US\$385 million per year). Resulting efficiency gains in wood processing would reduce pollution and motivate the search for additional uses of waste material--such as the production of particle board. Higher prices for water and electricity would encourage firms (and individuals) to conserve, as well as provide an important stimulus to industry for the adoption of waste-minimizing "clean technology". Eliminating the remaining subsidies on fertilizers would generate additional budget savings of about US\$350 million a year and further reduce water pollution from agriculture.

45. But there are tradeoffs as well. Higher prices for natural resources and utilities, together with the cost of "end-of-pipe" abatement equipment, will raise the cost of doing business for industrial firms. This could lead to slower economic growth, and hence fewer jobs, and reduce the growth of (non-oil) manufactured exports. There is growing evidence, however, that the severity of these tradeoffs may have been overestimated in the past, especially when the health effects and other costs of uncontrolled pollution are taken into account, and clear evidence that the costs of pollution control are coming down. New production technologies developed in response to the increasingly stringent environmental standards in the West are less polluting, but often economize as well in the use of natural resources. Technical advances in the design of pollution abatement equipment continue to reduce the unit costs of abatement, and there appears to be significant scope for additional adaptation to conditions in the developing countries, with further savings in inputs and/or reduced pollution.

46. The costs of abatement for existing industry in Indonesia, assuming reasonable standards, would be relatively modest (an estimated US\$70 million per year, or less than 0.5% of total industrial sector sales, and 0.6% of GDP). More importantly, there appears to be considerable potential for offsetting the costs of abatement through cost-saving innovations in waste minimization and waste recycling. At the moment, the incentives for the private sector to search for such savings are not strong--either in terms of the prices of natural resources and utilities, or the effective enforcement of environmental standards and regulations. A significant change in the attitudes of the business community, however, and strong Government support for waste-minimizing innovations (through "Pollution Prevention Pays" campaigns, for example), could go a long way toward achieving those savings and, at the same time, significantly reduce the level of industrial pollution in Indonesia.

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### E. What Else is Needed

47. **A Sense of Urgency--and Realism.** In all too many countries of the world, serious attention to issues of environmental degradation, and especially the health risks of urban and industrial pollution, came only after a catastrophic event galvanized government action: England's London fog, Minimata Bay in Japan, the Love Canal in the U.S., etc.. Indonesia has not yet experienced such an event, but many of the ingredients either are, or soon will be, in place. GOI has an opportunity to avoid such experiences, but only if action is taken sooner rather than later. Improvements in urban environmental quality involve a long lead time, and the rapid growth of the industrial sector means that further delay will increase the costs as well as the risks. Policy reform, however, is an inherently political activity, and environmental policy is no exception. To overcome vested interests, and other mutually reinforcing barriers to action, will take time. It will also require strong political leadership and a concerted effort to broaden the consensus in favor of environmental protection.

48. **Creative Interim Solutions.** Institutional shortcomings represent the most serious impediment to sound environmental management in Indonesia today. Diffused institutional mandates lead to a fragmentation of effort and conflicts of interest in decision-making. Sectorally-oriented development planning, combined with a strongly hierarchical administrative structure, seriously constrains inter-agency coordination. The tradition of central government planning, which was highly effective in the past, is increasingly ill-suited for dealing with the emerging issues of environmental management at the regional and local level. Administrative capacity is hampered by a shortage of critical skills, exacerbated by the higher salaries available in the private sector. In short, the agenda for institutional strengthening is quite daunting, and substantial progress will take a generation or more. Some problems can't wait. In the interim, creative solutions must be found--such as the PROKASIH Program--to tackle the most urgent problems in spite of these shortcomings.

49. **Partnerships and Participation.** While GOI has primary responsibility for establishing environmental priorities and for implementing development programs consistent with those priorities, it cannot--and need not--do it all. Recent experience in Indonesia confirms that a more open and inclusive process of establishing environmental priorities can help not only to ensure that those priorities are the right ones, but also to broaden the consensus among the various stakeholders in favor of those priorities. The spirit of cooperation engendered by that participation also provides the foundation for more effective collaboration, and thus can help to mobilize the additional talents, energy, skills and financial resources needed to achieve those goals. In some cases, the participation of affected communities will be needed to ensure greater equity and harmony in the process of growth and development. But there is growing evidence that such participation will also be necessary to ensure the design and implementation of development projects that are effective and sustainable.

50. Indonesia has been a leader, particularly among developing countries, in articulating a sustainable development strategy and in putting in place the essential elements of the framework needed to support that strategy. Much has been accomplished in the past, but much remains to be done. GOI's intentions are clear. As President Soeharto stated recently: "We will consolidate, expand and deepen all that is good. We will put in order what has been neglected." GOI's well-established reputation for "doing the right thing" provides grounds for optimism regarding the final outcome. Managing the process will require vision and courage, and will not be easy. Its success, however, will contribute immeasurably to an enduring legacy of social and economic progress.

## **CHAPTER 1**

### **ENVIRONMENT AND DEVELOPMENT: AN OVERVIEW**

# CHAPTER 1

## ENVIRONMENT AND DEVELOPMENT: AN OVERVIEW

### CONTENTS

	<u>Page No.</u>
A. INTRODUCTION . . . . .	3
B. PAST SUCCESSES AND FUTURE GOALS . . . . .	4
The Pursuit of Growth and Economic Stability . . . . .	4
Progress in Poverty Reduction and Human Resources Development . . . . .	5
Future Goals and the Development Strategy . . . . .	6
C. CHANGING ROLES AND DEVELOPMENT TRANSITIONS . . . . .	8
Government and the Private Sector . . . . .	8
Structural Change: The Importance of Industrialization . . . . .	9
Demographic Change and the Urban Transition . . . . .	10
D. ENVIRONMENTAL IMPLICATIONS OF GROWTH AND DEVELOPMENT	12
The Ecological Foundations of Economic Activity . . . . .	12
Environmentally Responsible Growth and Development . . . . .	14
Indonesia's Increasing Reliance on Natural Resources . . . . .	14
The Spatial Patterns of Growth and Development . . . . .	16
Future Challenges in the Management of Natural Resources . . . . .	18
The Growing Threat of Urban and Industrial Pollution . . . . .	22
E. SUSTAINABLE DEVELOPMENT: THE CHALLENGES OF INTEGRATION	26
Complementarity and Tradeoffs . . . . .	26
National Priorities and Global Concerns . . . . .	27
Influencing Environmental Outcomes: Policies and Instruments . . . . .	28
The Costs and Financing of Environmental Protection . . . . .	30
The Challenges of Implementation . . . . .	31
Growth, Equity and Stability: Striking a New Balance . . . . .	32

## ENVIRONMENT AND DEVELOPMENT: AN OVERVIEW

### A. INTRODUCTION

1.1 **Objectives.** Issues of "sustainable development" have become increasingly important for Indonesia over the last decade. While the Government's past development efforts have been remarkably successful in stimulating growth and reducing widespread poverty, the pace and pattern of development have led to growing concern about the sustainable use of natural resources (land, forests, water and energy) and the social and economic costs of urban and industrial pollution. The aim of this report is to explore these issues, to assess their implications for the achievement of Indonesia's long-run development objectives, and to suggest an action plan for the near and medium term that would help to ensure that those objectives will be met.

1.2 **How the Report is Organized.** Chapter 1 provides an overview of the challenges of environmental sustainability facing Indonesia in the decades ahead. To understand these challenges requires both an historical perspective and a forward-looking assessment of the challenges of economic development. We begin, therefore, with a brief summary (in Section B) of what has been accomplished over the past twenty five years and the development goals and strategy for the future. The pursuit of these goals will be shaped by a number of fundamental transitions--already well underway--in the roles of the Government and the private sector, the structure of the economy, and the size and location of the population. These transitions are described in Section C.

1.3 Reflecting these transitions, Section D highlights the environmental implications of future growth and development, and the three main conclusions of this report: (a) that future growth and development, including the process of industrialization, will depend increasingly on Indonesia's stock of key natural resources and critical ecosystems, and the care and efficiency with which they are managed; (b) that the growing volume of urban and industrial pollution poses a serious threat not only to health and human welfare but also to the prospects for continued rapid growth; and (c) that, as a result of rapid growth, issues of equity and budensharing will become increasingly important in the years ahead. To deal with these challenges will not be easy. As in most developing countries, the gap between official Government policies and the realities of implementation is large. A "business as usual" approach, therefore, will not be adequate. A final section suggests what needs to be done. The main challenge will be to integrate environmental concerns into the development process--taking maximum advantage of the positive linkages, and dealing effectively with the inevitable tradeoffs.

1.4 Chapters 2 and 3 focus on specific issues--the management of natural resources, and the growing threat of environmental pollution. The aim of these chapters is to assess the nature and importance of specific environmental concerns as a first step toward establishing priorities for action. Chapter 4 examines the policies and instruments needed to influence environmental outcomes. The focus includes regulatory, "market-based" and other approaches (including community participation) for achieving the desired results in a "least-cost" (and more harmonious) manner.

1.5 The need for public and private sector investments in environmental protection is explored in Chapter 5. Issues for the public sector include the level of desirable (and feasible) Government expenditures, and the potential sources of finance. Private sector issues include the impact on growth and employment of a more rigorous effort to reduce industrial pollution, and the prospects for adopting a "clean technology" approach that would minimize costs while enhancing international competitiveness. Chapter 6 reviews the key challenges of implementation, including the "politics" of environmental management, the critical role of information, the importance of institutional strengthening, and the need for constructive participation. A final chapter provides a summary of the recommendations from earlier chapters in the form of an action plan for policy reform, investments by the public and private sectors, priorities for institutional strengthening, and areas for further study.

## **B. PAST SUCCESSES AND FUTURE GOALS**

1.6 Twenty five years ago, Indonesia was one of the poorest countries in the world. In 1967, its per capita income was only US\$50, about half that of Bangladesh, India and Nigeria. Poverty was widespread, with an estimated 60 percent of the population (nearly 70 million people) living in absolute poverty. Life expectancy at birth was well below that of developing countries as a whole, while its infant mortality rate was significantly higher. It also lagged behind in education, with a much higher adult illiteracy rate and much lower primary and secondary enrollment rates than those of its neighboring countries. With a large and rapidly growing population (about 115 million people, expanding at 2.4% annually), Indonesia's primary assets were its people and the wealth of its vast--and relatively undeveloped--natural resources.

### **The Pursuit of Growth and Economic Stability**

1.7 Against this backdrop, the New Order Government's First Long-Term Development Plan was formulated. The initial development strategy focused on rural areas--where 85% of the population lived--with a primary emphasis on increasing income and employment through the productive use of labor and natural resources. Public expenditures were directed to the development of agriculture, with a massive effort to increase the production of a single commodity--rice. This involved major investments in irrigation, primarily on Java, and the introduction of hybrid seeds, fertilizers and pesticides, all of which were subsidized to encourage rapid adoption by farmers. (The emphasis in the outer islands was on treecrops, including rubber and palm oil, and the exploitation of forestry resources.) This was accompanied by investments in related infrastructure (transport and power), supportive industrial capacity (including fertilizer production), and the development of human resources (education, health and family planning).

1.8 From 1973-81, Government revenues increased dramatically due to the rising world market price for the country's oil exports. Indonesia used its oil revenues well, channeling them into the rapid expansion of agricultural output and the development of social and physical infrastructure. GOI also maintained sound macroeconomic management and adopted a conservative external borrowing strategy. The economy grew at nearly 8% per annum during the 1970s and, by the end of the decade, the current account of the balance of payments was in surplus and debt-service payments were below 13% of exports.

1.9 The sharp drops in oil prices in the 1980s and associated changes in the international economy drastically altered the economic environment for Indonesia. In 1982, the weakening oil market, the onset of a worldwide recession, and the decline in the prices of several important primary exports caused serious problems. In 1986, Indonesia suffered a second set of external shocks when oil prices fell by almost one-half, non-oil commodity prices weakened further and the decline of the US dollar raised debt service payments sharply. The Government responded to these events with two types of policy adjustments. First, since 1982, GOI has adopted more austere macroeconomic policies in two successive stabilization programs. Second, it embarked on a major program to restructure the economy so as to reduce the dependence on oil as a source of foreign exchange and budget revenues, and to change the sources of growth through an outward-looking, private sector-oriented growth strategy.

1.10 As a result of fiscal austerity and careful management of monetary policy, considerable progress has been made in restoring financial stability through reductions in both current account and fiscal deficits. Inflation has been held below 10% per annum. Policy reforms designed to restructure the economy have included comprehensive financial sector and tax system reforms to mobilize domestic resources, and a series of trade-related reforms--including the overhaul of customs, ports and shipping operations, the elimination of a sizable proportion of import licensing restrictions, across-the-board tariff cuts, two major devaluations of the Rupiah, and a significant reduction in investment and industrial regulations (including for foreign investment).

1.11 Despite the external shocks, which together accounted for 8-9% of GDP, Indonesia still managed to achieve an average growth rate of 5.3% per annum during the 1980s, with the non-oil export sector leading the way. Non-oil exports, for example, doubled between 1986-89, exceeding the value of oil-related exports for the first time since 1973. In 1982 oil accounted for about 70% of government revenues and 72% of exports; by 1992 it accounted for only 36% of government revenues and 30% of exports. Structural adjustments greatly improved the competitiveness of domestic industry, with manufactured goods now the fastest growing non-oil export--increasing an average of 27% a year for the past five years.

### **Progress in Poverty Reduction and Human Resources Development**

1.12 Sustained rapid growth has allowed living standards to improve significantly--with a 4.5% annual increase in per capita income since 1970. The focus of growth in rural areas has also enabled Indonesia to achieve a substantial reduction in poverty: from 60% in 1970 (about 70 million people), and an estimated 15% today (about 27 million people). In fact, according to a recent World Development Report, over the last two decades Indonesia has had the highest annual average reduction in the incidence of poverty among all countries studied. At the same time, there have been major improvements in the indicators of both health and human resource development. Infant mortality rates have fallen from 225 per thousand live births in the early 1960s to around 64 per thousand live births in 1989 (and an estimated 60 per thousand in 1992), and the average life expectancy at birth has increased by 20 years, or almost 50 percent, during the same period. The adult illiteracy rate has fallen by nearly two thirds, while the primary and secondary enrollment ratios have increased by over one and a half times and seven times respectively.

**Table 1.1: HUMAN RESOURCE DEVELOPMENT - 1960-1990**

	Life expectancy at birth (years)		Infant mortality rate /a		Adult illiteracy rate /b		Primary enrollment ratio /c		Secondary enrollment ratio /d		Population per physician	
	1960	1990	1960	1989	1960	1990	1960	1989	1960	1989	1960	1984
<u>Indonesia</u>	41	61	225	64	61	23	71	118	6	47	46,780	9,410
<u>East Asia &amp; Pacific</u>												
- Philippines	53	64	134	42	28	10	95	111	26	73	na	6,570
- Malaysia	54	70	105	22	42	22	96	96	19	59	7,020	1,930
- Thailand	52	66	149	28	32	7	83	86	13	28	7,950	6,290
- South Korea	54	71	120	23	29	4	94	108	27	86	3,540	1,160
<u>South Asia</u>												
- India	43	59	165	95	72	52	61	98	20	43	4,850	2,520
- Sri Lanka	62	71	71	20	25	12	95	107	27	74	4,490	5,520
<u>All Developing Countries</u>	46	63	233	65	na	40	na	105	na	43	na	4,980

/a Number of infants per thousand live births, in a given year, who die before reaching one year of age.

/b Proportion of the population over the age of fifteen who cannot, with understanding, read and write a short, simple statement on their everyday life. Illiteracy rate is for 1960 except for the following: Indonesia and India (1961); Malaysia (1970); and Sri Lanka (1963).

/c Gross enrollment of all ages at primary level as a percentage of primary school-age children.

/d Computed in the same manner as the primary enrollment ratio.

Source: World Development Report, various issues; The State of The World's Children 1989.

### Future Goals and the Development Strategy

1.13 The tradition of sound macroeconomic management, the structural reforms of the 1980s, and past investments in infrastructure and human resources have laid the foundation for further progress in the decades ahead. To maintain the momentum of success, however, will require continued rapid growth and sustained efforts to strengthen and diversify the economy. It will also require much greater attention to issues of quality and environmental sustainability.

1.14 **The Unfinished Agenda.** With a per capita income of only US\$650, Indonesia is still a low income country. The number of absolute poor remains quite high (about 27 million), with many millions more just above the poverty line. Further progress is also needed in a number of social indicators for health and education. For the medium term at least, therefore, poverty reduction and human resource development will remain a high priority.

1.15 **Longer-Term Goals: From Quantity to Quality.** With continued rapid growth, Indonesia could reach a per capita income of US\$1000 by the end of the decade and more than US\$2000 by the end of the Second Long Term Development Plan. With increasing incomes, the aspirations of Indonesian citizens will also rise, not just in the volume of goods and services they consume, but the quality of those goods and services. Issues of the "quality of life" will also become more important, including the extent to which the environmental conditions in which they live and work contribute to (or constrain) their physical and mental health and their enjoyment of recreational and other leisure-time pursuits that are possible with a higher income.

1.16 Attention to quality in the process of development will also be needed to meet Indonesia's medium and longer term goals. In the past, quantified targets have been indispensable for reducing poverty and stimulating growth--the construction of a school and health clinic in nearly every village, for example, and annual targets for the production of fertilizer and rice. As GOI has already recognized, however, greater emphasis is needed on the quality--and not just the quantity--of public (and private) services and investments--the quality of education and training to support the transition to higher technology jobs, and the quality of construction and "O&M" for transport, telecommunications, and power to support the growth and competitiveness of domestic production.

1.17 **The Development Strategy: Growth, Equity and Sustainability.** The pursuit of "growth with stability" will continue to be a central element of Indonesia's development strategy for the longer term. GOI's long-standing concern for equity will be pursued through improvements in the quality and accessibility of education and health care, and by a more targeted approach to the pockets of poverty on Java and the more remote communities in the outer islands. The issues of environmental sustainability discussed in this report represent a more recent addition to Indonesia's development strategy. This is not surprising given the challenges that existed at the start of the First Long-Term Plan and what was known at that time about the relationship between economic activities and the underlying ecosystems upon which they depend. The growing attention to these issues in GOI's development strategy is a result of the increasing awareness of the costs and risks of environmental degradation, the environmental conditions in Indonesia today due to the pace and pattern of growth in the past, and the environmental challenges of the coming years, as described in this report.

1.18 The emerging issues of environmental sustainability, in fact, have important implications for the pursuit of both growth and equity. The implications for growth arise from the continued heavy reliance on natural resources--some of which are already showing signs of stress--to support the expansion of output, employment and trade, combined with the growing threat of urban and industrial pollution for the prospects of further expanding economic activity in a number of critical areas where industrial sector growth has been--and will likely continue to be--concentrated. The implications for equity arise in part from the fact that poor people are more vulnerable to the negative effects of environmental degradation and are less able to protect their own interests in disputes over land or continued access to key natural resources. In the absence of capital, skills and security of tenure, however, they also contribute to environmental degradation through unsustainable production practices and the unsafe disposal of human and other wastes. An important conclusion of this report, therefore, is that the pursuit of growth, equity and sustainability should not be seen as separate and distinct objectives, but rather as mutually interdependent aspects of the same ultimate goal: improving the quality of life for all of Indonesia's citizens.

### C. CHANGING ROLES AND DEVELOPMENT TRANSITIONS

1.19 The story of the past is one of oil (the rise and fall), rural development (rice and trees), and the reduction of poverty (even in the face of oil price shocks), based primarily on a natural resource-intensive growth strategy. The next twenty five years should witness the much-anticipated "take-off" stage. The story of the future, however, is one of transitions, most of which are well underway: from a dependence on oil and agriculture to a reliance on rapid industrialization; from a largely rural society to a predominantly urban one; and from a "low income" to a solidly "middle income" country, based on a development strategy that emphasizes increasing efficiency and competitiveness of domestic production and higher productivity and value-added for the growing labor force. Accompanying these economic and demographic transitions is a fundamental shift in the roles of the Government and the private sector in the implementation of Indonesia's development strategy.

#### **Government and the Private Sector**

1.20 Throughout the oil-boom years of the 1970s and early 1980s, Indonesia relied heavily on public investment to stimulate growth and employment, with oil providing the necessary fiscal revenues and foreign exchange earnings to support a relatively inward-looking growth strategy. The private sector (particularly foreign investment) was highly regulated and the incentive structure was oriented toward supplying the domestic market, resulting in a "high cost" and globally uncompetitive economy. As noted above, in response to the oil price shocks of the 1980s, GOI's structural reform program has been aimed at restoring growth and promoting a more diversified and resilient economy, based on a private sector-led, export-oriented growth strategy. As a result, the role of the Government has been significantly redefined, and now focuses on three key objectives:

- o **Providing an enabling environment for private sector growth**, including the maintenance of macroeconomic stability, the implementation of further trade reforms and deregulation of industry, strengthening the financial sector, and improving the overall legal and institutional framework within which the private sector operates;
- o **Investing in infrastructure and human resources development**, to ensure that private sector growth is not constrained by the lack of power, transport, telecommunications, etc., and to increase the technical skills and capacity of the labor force to support higher technology and higher value-added employment; and
- o **Initiating targeted interventions to reduce poverty and protect the environment**, wherever market forces fail to ensure equity in the development process or to take into account environmental "externalities"--positive and negative.

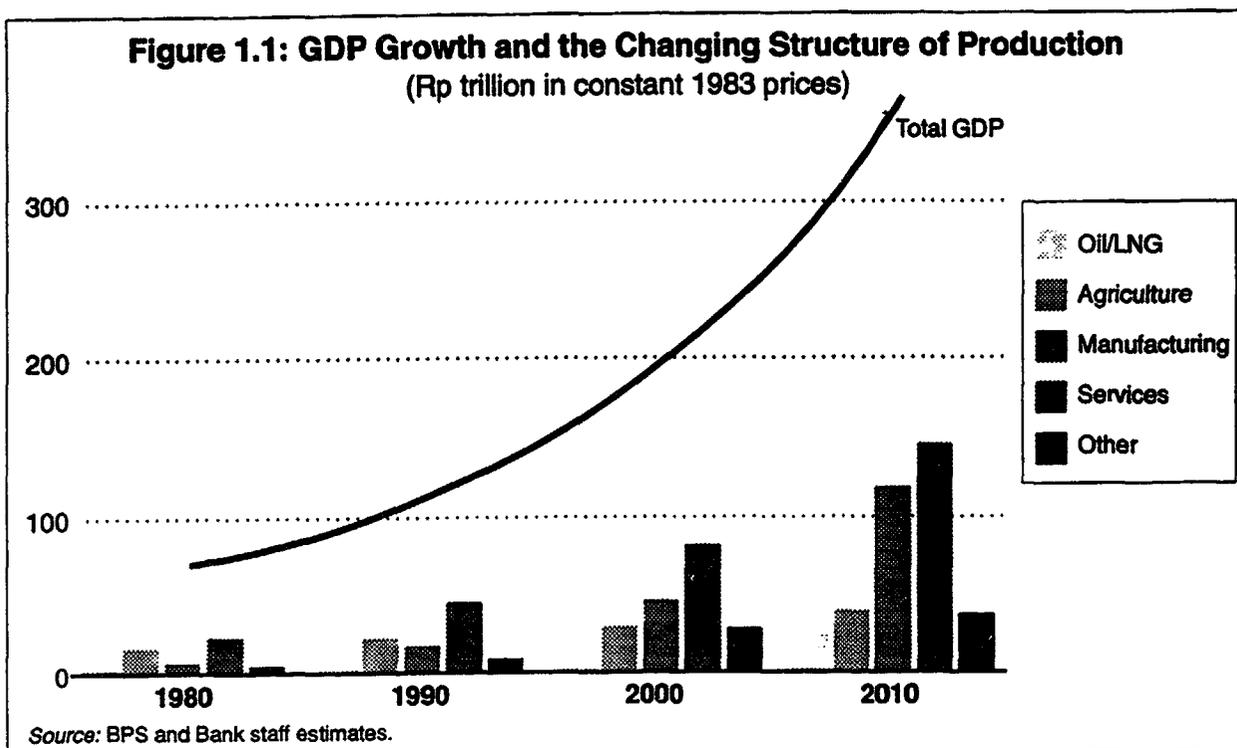
1.21 The response of the private sector to the opportunities created by GOI's new strategy has been truly remarkable. Since 1983, the private sector has grown at about 7.3% per annum, contributing 72% of total growth, and 79% of the growth in non-oil exports. Since 1986, private investment has increased an average of 11% per annum, with 79% of these investments in manufacturing and services. Foreign investment approvals rose tenfold in the same period, amounting to 21% of total investment approvals. As the new "engine of growth", the private sector has also contributed to fundamental changes in the structure of the Indonesian economy.

**Structural Change: The Importance of Industrialization**

1.22 In broad terms, changes in the structure of the Indonesian economy are following the pattern established earlier by both the developed countries and the rapidly industrializing economies of East Asia: an initial reliance on agriculture and services to meet basic needs; followed by a process of gradual industrialization--beginning with agricultural processing and simple assembly, followed by heavy industries (steel, chemicals, etc.), expanding into higher technology products (e.g., electronics and machine tools) and finally, full-scale, integrated production of a wide range of manufactured goods for both the domestic and export markets; with a parallel evolution in "services" and related sectors (trade, finance, construction, telecommunications, etc.), from relatively simple activities to an ever expanding array of increasingly sophisticated services which, in the final stage, results in a "services-oriented", high-technology economy that is fully integrated with global markets. Past trends and expected developments in Indonesia, consistent with this pattern, are shown in Figure 1.1 below.

1.23 Indonesia's reliance on industrialization for continued rapid growth of output, exports and employment is even more striking than the shift in sectoral shares reflected below.

Manufacturing, which contributed only about 13% of total GDP growth in the 1970s, and 23% in the 1980s, is expected to contribute more than 33% in the 1990s and nearly 45% in the following decade; its contribution to the growth of exports, only 7.5% in the 1970s, grew to 47% in the 1980s, and is expected to account for over 80% in the next two decades. Its contribution to employment growth, 12% in the 1970s and an expected 23% in the 1990s, is lower--reflecting the large absolute share of employment in agriculture and services--but critical for increasing the productivity of labor.



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## Demographic Change and the Urban Transition

1.24 With a population of about 180 million people, Indonesia is now the fourth largest country in the world, following only China, India, and the United States. Demographic change, as in the case of the economic transitions noted above, appears to be following a pattern similar to that of the developed countries. These changes, including a significant decline in fertility rates and the rapid growth of the urban population, will have important implications for the dynamics of the development process and for the achievement of the country's social, economic and environmental objectives.

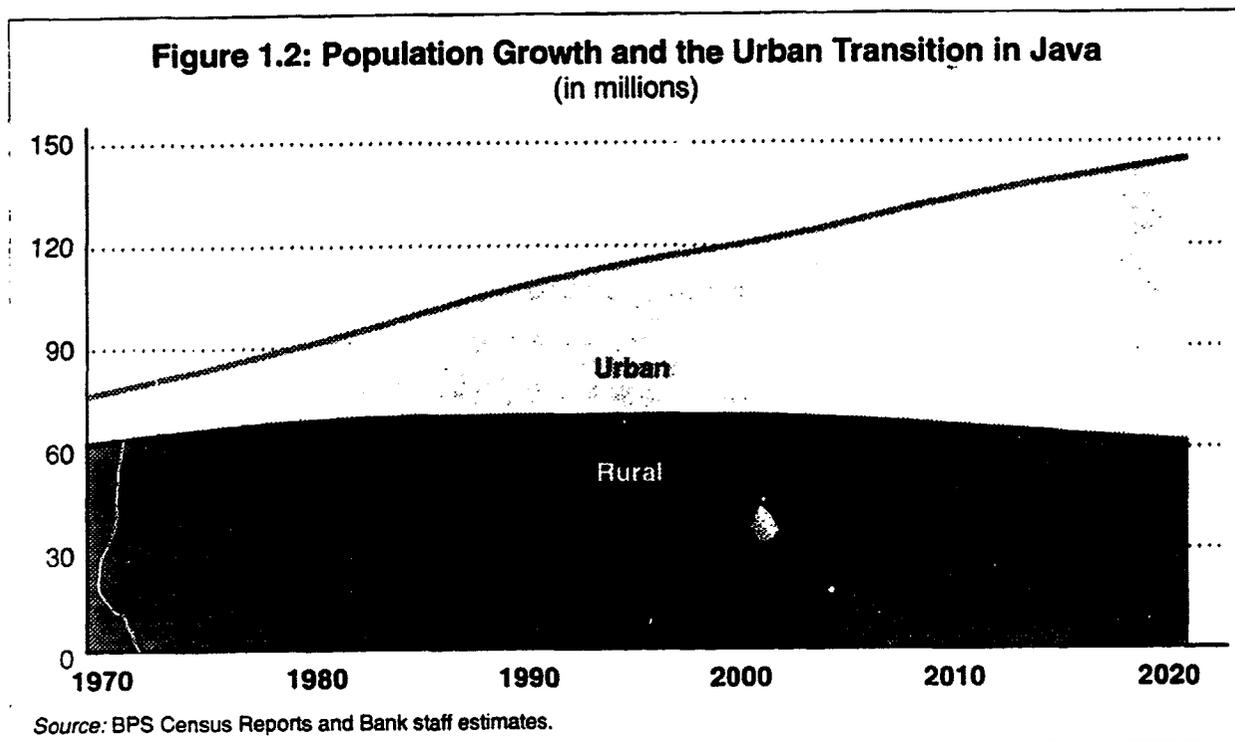
1.25 **Population Size and Growth Rates.** Beginning in the late 1960s, GOI launched a family planning initiative designed to slow the rate of growth of the population. This effort succeeded in raising the prevalence of contraceptive use among married couples from 10% in the 1960s to 19% by the mid-1970s, to more than 45% in the late 1980s. Combined with rising incomes, the expansion of health care facilities, the achievement of universal primary education, and an increase in the average age of marriage, the Indonesian family planning program has resulted in one of the most impressive demographic transitions in the developing world. From 1970 to 1988, while the mortality rate was being cut nearly in half (from 17.3 deaths per thousand to 9.1), the fertility rate declined even faster (from 41.4 births per thousand to 28.0). As a result, the overall population growth rate fell from 2.4% per annum in the late 1960s to 1.8% in the late 1980s, to an estimated 1.6% today.

1.26 Although further increases in contraceptive prevalence will be more difficult to achieve, continued progress could result in Indonesia reaching replacement level fertility rates before 2010. The number of women reaching child-bearing age, however, will continue to grow for some time, and zero population growth may not occur until late in the 21st century--with a stationary population exceeding 300 million. Still, as a result of reduced fertility rates, there will be significant changes in the age structure of the population over the next several decades. The number of children entering primary school age, for example, has already peaked and is now beginning to decline. Eventually, this will translate into slower growth in the labor force, and hence fewer new jobs that will have to be created. While the younger age groups are declining, however, the proportion of the population over age 50 will increase significantly--from 11% (about 13 million people) in 1970, and 13% (23 million people) in 1990, to an estimated 21% (and 53 million people) by the year 2020. Among this segment of the population the prevalence of heart disease, cancer and respiratory illness begins to rise. Depending in part on environmental conditions, therefore, the aging of the population could portend significant changes in the costs of--and demands on--the country's health care system.

1.27 **Spatial Distribution and Densities: Java Versus the Outer Islands.** Indonesia's population is not evenly distributed. Java alone, which has only about 7% of the land area, accounts for nearly 60% of the total population. This results in a population density of about 815 people per square kilometer--one of the highest in the world today. While there will be some further out-migration arising from the transmigration program, and the success of the family planning program on Java has led to lower growth rates than in the outer islands, Java's population will continue to grow. By the end of the decade, population density is likely to exceed 900 and, by the year 2020, the number of people per square kilometer may be over 1,100. Bali also has a relatively high population density (about 500), but in most of the outer islands it is distinctly lower--77 in Sumatra, 65 in Sulawesi, 17 in Kalimantan, and only 4 in Irian Jaya.

**1.28 The Urban Transition.** As a result of GOI's concentrated attention on the development of agriculture, and rising rural incomes, the share of Indonesia's population in urban areas is smaller than what might be expected for its current stage of development. Urban populations throughout Indonesia, however, have been increasing rapidly--exceeding 5% per annum in the 1980s. This reflects the structural changes in the economy noted above, and the growing opportunities for employment in the industrial and service sectors in Indonesia's urban centers. If the experience of other countries is any guide, this process will continue unabated for the next several decades. From a level of only 15% in 1970, Indonesia's urban population has already reached 30% and, by the year 2020, half of the entire population may reside in urban areas. With a much larger total population, this would represent about 125 million people--or more than the entire population in 1970.

**1.29 Implications for Java.** The urban transition is occurring more rapidly on Java, which is already 36% urban and could exceed 60% by the year 2020. Compared with a total population of about 76 million in 1970, Java's urban population was 38 million in 1990. It is likely to exceed 50 million by the end of this decade, and may reach 85 million by the year 2020. There are two major implications of this trend. The good news is that Java's rural population will actually begin to decline in absolute size, possibly as early as the year 2000. To the extent that this reflects the migration to urban areas of the poor and landless, it should begin to relieve some of the pressure on ecologically-sensitive rural areas (e.g., from unsustainable farming practices in the uplands). It also means, however, that Java will have to accommodate, on average, as many as 1.5 million additional urban residents a year over the next three decades, adding substantially to the congestion and environmental pressures--already quite evident--in its main urban centers.



## D. ENVIRONMENTAL IMPLICATIONS OF GROWTH AND DEVELOPMENT

1.30 Continued rapid growth will be essential to meet Indonesia's development goals in the years ahead. As in the past, this growth will rely extensively on the country's vast natural resources. The rapid growth of industrial output, most of which is based on the processing of raw materials, will add to the pressure on natural resources and critical ecosystems in the coming years. The majority of industrial sector growth is concentrated in urban areas, particularly on Java. Industrial pollution, combined with pollution from urban sources, poses an immediate threat to health and human welfare. Unless pollution levels can be reduced, and "delinked" from future urban and industrial expansion, they may also jeopardize the assumption of continued rapid growth. To understand the nature of these emerging challenges requires a brief digression on the concept of sustainable development.

### The Ecological Foundations of Economic Activity

1.31 Public awareness of environmental issues has grown exponentially over the past twenty-five years. At the same time, the number and complexity of such issues has expanded dramatically--from the traditional concerns of "soot and sewage" to issues of toxic and hazardous waste, acid rain, global warming, destruction of the ozone shield, deforestation, and the loss of biodiversity--all of which are now commonly subsumed under the heading: "issues of sustainable development". While the definition is a matter of some debate (see Box 1.1), the concept itself has enormous intuitive appeal. In contrast to the attitudes of earlier generations--when natural resources were considered a "free good", ecological services were taken for granted, species other than our own were ignored, and infinite economic growth seemed eminently reasonable--today's concerns are based on the recognition of two fundamental propositions (Costanza, 1991):

- o *First*, that human economic activity is a *subsystem* that operates within a *larger global ecosystem*. This reality highlights not only the *interaction* between these two systems, but the *fundamental dependence* of the economic system on that larger ecosystem.
- o *Second*, as a result of the rapid growth of both human population and economic activity, involving *ever-increasing use of natural resources* in production, and *ever-increasing volumes of waste* created by production and consumption, we may already have begun to *exceed the "carrying capacity"* of the earth's ecosystem--reflected, for example, in growing problems of acid rain and increasing rates of species extinction.

1.32 As in the case of human economic activity, ecosystems operate at both the "macro" and "micro" levels (the global ozone shield, regional watersheds, local coral reefs, etc.). These ecosystems--which are often quite complex, and whose functions are often not fully understood or appreciated--provide a range of goods and services that are vital for economic growth. Some are used directly, in consumption and production, while others provide indirect support (e.g., the assimilation or carrying away of waste). Similar to economic systems, the uninterrupted flow of ecological goods and services requires that a balance be maintained within the system. Most environmental problems arise from a combination of increasing population density and changes in the nature and intensity of economic activity. Uncontrolled, their cumulative effects may reduce the ability of the underlying ecosystem to maintain the necessary balance. If certain thresholds of depletion or degradation are exceeded, the sustainability of the ecosystem--and the economic activities it supports--may be lost.

### Box 1.1: Concepts of "Sustainable Development"

Few would argue with the broad concept of sustainable development articulated by the Brundtland Commission in its 1987 report *Our Common Future*--"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"--or the two key concepts underlying that definition:

- o the concept of *needs*, particularly the essential needs of the world's poor, to which overriding priority should be given; and
- o the idea of *limitations*, imposed by the state of technology and social organization, on the environment's ability to meet both present and future needs.

The literature is filled, however, with alternative--often conflicting--concepts. (Pezzey, 1989, for example, lists several dozen.) Some would argue for the *sustainable use* of natural resources, at least those resources (such as tropical forests) that are "renewable". This concept is based on the assumption that the existing stock of natural resources should be kept essentially intact, in part due to uncertainty about current ecological balances, and in part out of respect for the needs of future generations.

Others would argue for a concept of *sustainable growth*, where the consumption of natural resources beyond their regenerative capacity is acceptable, providing that national income accounts reflect the declining value of the country's stock of natural resources, *and* that the portion of the resulting "revenues" representing "depreciation" (or "depletion" for non-renewable resources) is invested in other forms of capital (human and man-made) to maintain a comparable stream of benefits in the future. This concept involves an explicit assumption that human and man-made capital can substitute for natural resources to sustain overall growth, and--in many cases--at least an implicit assumption that technological progress will permit an ever-increasing expansion of production despite the declining stock of natural resources.

Still others would argue for a rather less optimistic concept, one which assumes that infinite economic growth is--by definition--ecologically unsustainable. This view, which is more in line with the Brundtland Commission concept, focuses primarily on "doing more with less", through efficiency gains that serve to reduce the "throughput" of natural resources in the production process and, simultaneously, the volume of waste that is deposited into the global ecosystem. It is usually combined with the assumption that population growth must be slowed as quickly as possible, and reduced to zero in the longer term, as an essential requirement of sustainable development. Continued economic growth would be required, however, at least until global poverty is eliminated and the world's population has stabilized.

The Brundtland Commission estimated that the elimination of poverty would require a further five- to ten-fold increase in industrial output over the next 50 years. More recently, however, some have suggested that the scale of global economic activity has already exceeded the limits of ecological sustainability. Their concerns are based less on natural resource *use* as a binding constraint, and more on the ability of the global ecosystem to absorb the volume of *waste* being generated by *current* economic production. They argue for a concept of sustainable development that would seek to stabilize production--in terms of both throughput and waste emissions--at something closer to the current levels. This would imply a substantial reduction in natural resource use in developed countries to permit continued expansion in the less-developed countries. While many find this argument too pessimistic (and politically unrealistic), the debate goes on.

## Environmentally Responsible Growth and Development

1.33 Indonesia's policy-makers have a well-established reputation for responsible economic management and for ensuring appropriate balance in the country's macroeconomic accounts. They have also had a long-standing commitment to the basic concepts of sustainable development and have made significant efforts to ensure the necessary balance in its critical ecosystems. Consistent with the Brundtland Commission's concept of sustainable development (Box 1.1), considerable attention in the past has been given to reducing widespread poverty. With a per capita income of only US\$650, and with 27 million people still below the poverty line, raising the overall standard of living will remain the highest priority. This will require continued economic growth, with some inevitable consequences for the environment. It will obviously not be possible, for example, to preserve intact the existing stock of natural resources, or all of the country's remaining ecological assets. Indonesia, therefore, has adopted a policy of *sustainable growth* that allows for the continued conversion of natural resources into other forms of capital as an essential and integral part of the development process.

1.34 There are two major caveats to this approach. First, *some natural resources must be protected*: to *preserve critical ecosystems* (e.g., upland forest cover for watershed protection, coastal wetlands and coral reefs to protect valuable marine resources, and groundwater aquifers that provide drinking water for urban populations); to *avoid foreclosing on future options* (including the protection of biodiversity and its potential—if unknown—value for future development); and to *maintain the amenity values* of the natural environment for the enjoyment of current and future generations. Second, *wherever natural resources are converted* to other forms of capital (exploiting mineral resources, cutting down tropical forests, or converting land from one use to another), sound environmental (and economic) stewardship requires that those resources *not be wasted*. This implies that the *efficiency* with which they are used (or converted) *should be given a high priority*, so as to maximize their contributions to growth and to the prosperity of Indonesia's future generations.

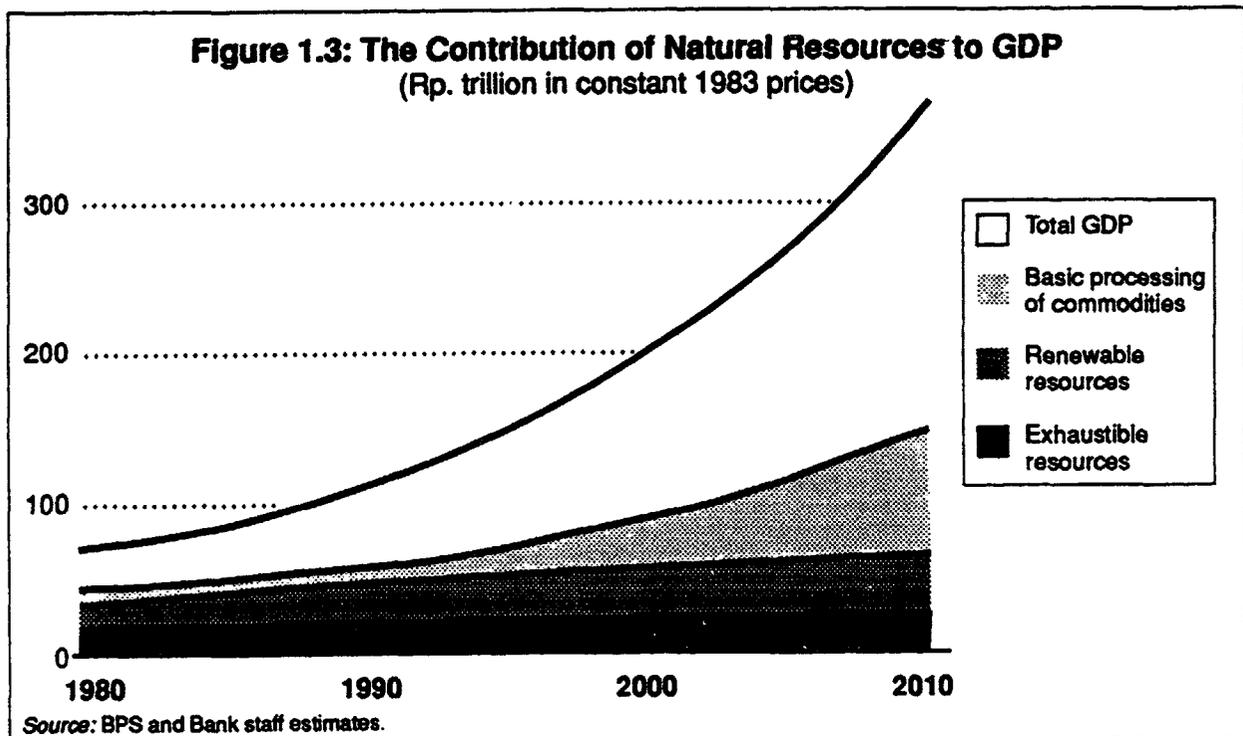
1.35 These caveats are fully reflected in official GOI policy statements on the environment, such as the Tropical Forest Action Plan and the National Biodiversity Action Plan, both of which are entirely consistent with an environmentally responsible development strategy. The difficulty lies in implementing such policies effectively (see below, and Chapter 2). While the contribution of natural resources to future growth—in terms of commodities—will decline in relative terms, the reliance on natural resources in absolute terms will continue to expand. Protecting the essential functions of critical ecosystems will become increasingly important, especially in those areas of the country where human population and economic activity are likely to be most concentrated.

## Indonesia's Increasing Reliance on Natural Resources

1.36 At the start of Indonesia's First Long-Term Plan, the production and exploitation of primary commodities contributed about 60% of total GDP: minerals (primarily oil) provided 27%; agricultural output (food and other crops, plus livestock) accounted for 28%; and fishing and forest resources added another 5%. The *first-stage processing* of basic commodities (logs into sawn wood, hides into leather, etc.) contributed only about 4%, and further downstream processing (sawn wood into furniture, leather into shoes) less than 2%. The export of primary commodities accounted for 94% of total foreign exchange revenues, and two-thirds of the labor force was employed in the primary sectors. This picture has changed significantly since then, in both relative and absolute terms, with significant implications for the environment.

**1.37 Reliance on Primary Commodities.** As a result of more rapid growth in other sectors, the *relative share* of primary commodities in total GDP has declined markedly, and will continue to do so in the future: from 60% in 1970, and 39% today, to an estimated 17% in 2010. Their contribution to exports is following a similar path, declining in relative terms from 94% of the total in 1970 to about 60% today. Employment in the commodity sectors has fallen from 65% to less than 55%, and this trend will also continue. In *absolute terms*, however, the value added of primary commodities has more than doubled over the past twenty years--from Rp 21,300 billion in 1970 to Rp 44,300 billion in 1990 (in constant 1983 prices)--with "exhaustible" resources (oil, LNG and other minerals) up by 128%, and "renewable" resources (agriculture, fishing and forestry) up by 91%. While these sectors will grow more slowly over the next two decades, their total value added is likely to increase by a further 50% by the year 2010. Similarly, the value added of commodity exports has increased by 130% over the past twenty years, and will continue to increase in the medium term.

**1.38 The Expansion of Processing Activities.** Since the early the 1970s, industries involved in the *basic processing* of commodities--agricultural and industrial chemicals from oil and gas; plywood, pulp and paper from timber; food and beverage products from agricultural crops, etc.--have expanded dramatically. In absolute terms, the value added from these activities has grown from Rp 1,600 billion in 1970 to Rp 12,400 billion in 1990, a nearly eight-fold increase. These industries are expected to continue to grow at a rapid rate over the next two decades, expanding their share of total GDP from about 11% in 1990 to more than 20% in 2010. In absolute terms, the output of basic processing industries is likely to increase another six-fold by the year 2010--to an estimated Rp 77,000 billion. In addition to the impact this will have on the consumption of natural resources, these industries also contribute the majority of water, air and toxic pollution from industrial sources.



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## The Spatial Patterns of Growth and Development

1.39 The emerging issues of sustainable development in Indonesia are closely related to the spatial patterns of economic growth in the past and likely trends in the future. These patterns are distinctly different between Java and the outer islands and, within Java, between the main urban centers and the rural areas.

1.40 **Development Patterns on Java.** Rural development on Java has focused predominantly on the expansion of rice, and virtually all of the land suitable for agriculture has already been brought under intensive cultivation. Although Java is well endowed with rainfall, most of its rivers are less than 50 kilometers long and have small catchments. With seasonable variations in rainfall, this results in water shortages during the dry season, and especially in dry years. Agricultural intensification, therefore, has included a major investment in irrigation facilities. Forest cover is limited primarily to the uplands. While most of the upland forests are designated as watershed protection areas, there has been an increasing problem of encroachment--especially by poor and landless farmers. Along the coast, as a result of increasing population pressure, the once-extensive mangrove forests have been largely depleted or converted to other uses--particularly for rice paddies and fish and shrimp ponds. The development of shrimp ponds by local communities and, more recently, by commercial interests has been especially rapid on Java's north coast.

1.41 The process of urbanization has been more rapid on Java than in the outer islands. In large part this reflects the spatial pattern of industrial sector growth which, in the past, has been highly concentrated on Java, much of it in or near the urban centers. In the early 1970s, for example, over 85% of all industrial output was located on Java, 23% in Jakarta alone. From a very small base, the value of Indonesia's industrial output has increased eight-fold over the past twenty years. Much of this increase, as noted above, has involved the processing of basic commodities, and many of these industries have located in the outer islands. As a result, Java's share of industrial output has fallen to about 75% of the total. As the focus of manufacturing sector expansion has shifted to further downstream processing and assembly-related activities, however, Java has continued to attract the majority of new industrial investment. The nature of these activities, many of which require a factory-experienced labor force, has led to an increasing concentration in and around Java's main urban centers. In the early 1970s, for example, about 55% of industry on Java was located in urban areas. Since then, this share has risen to 60%. Four cities alone (Jakarta, Surabaya, Bandung and Semarang) account for 36% of Java's--and 27% of Indonesia's--total industrial output.

1.42 **Development in the Outer Islands.** With much lower population densities, less access to Indonesian and global markets, and a smaller share of industry, most communities in the outer islands have relied primarily on natural resources for their livelihood. Economic growth has depended mostly on the development of agriculture and the exploitation of forest resources. Soils in the outer islands are not as productive as on Java, and the terrain and hydrological features limit the prospects for irrigated rice. GOI-sponsored development projects, therefore--including the transmigration program--have concentrated on expanding the land area under agricultural production, with a major emphasis on smallholder tree crops (rubber, coconuts and oil palm). This has included development of a tree crop processing industry in the "nucleus estates". (Tree crops have played an extremely important role in reducing poverty in the outer islands.) The transmigration program has also supported the conversion of coastal swamplands for agriculture, fish and shrimp production.

1.43 Since the late 1960s, GOI has actively encouraged the exploitation of commercially valuable timber resources, 97% of which are located in the outer islands, through the grant of more than 500 "forest concessions". To promote the development of higher value added through the expansion of a wood processing industry, the Government banned the export of raw logs in 1985, and sawn wood in 1987, and encouraged concessionaires to invest in plywood manufacturing facilities. Led by plywood, total output from the forestry sector has grown rapidly, and now accounts for about 7% of total GDP and 20% of non-oil exports. As discussed elsewhere in this report, the commercial exploitation of Indonesia's timber resources has contributed to the loss of forest cover and increasing concern about the overall rate of deforestation. A large--but unknown--number of forest-dwelling people and forest-adjacent communities are also exploiting both timber and non-timber resources in the outer islands. While the extent of their impact on deforestation is a matter of some debate, growing population pressures and insecurity of tenure undoubtedly contribute to this problem.

1.44 **Likely Future Patterns in Agriculture and Forestry.** The rapid growth of urban areas on Java is resulting in the conversion of irrigated rice land to municipal and industrial uses--as much as 10% may be converted over the next two decades. According to a recent assessment there are good prospects for maintaining Indonesia's current self-sufficiency in rice, despite this conversion, through further technological advances. As a result of the changing structure of domestic demand, however, a major challenge for the future will be to diversify agricultural production--with particular attention to higher value food crops (fruits and vegetables), livestock (especially poultry) and fisheries (including aquaculture). Attention to poverty and regional development, together with the scarcity of land on Java, would suggest the need for a stronger focus on agricultural development in the outer islands, where the possibilities for non-farm employment and income generation are lower than on Java. The available evidence also suggests that there is considerable scope for further agricultural expansion in the outer islands on already degraded forest lands, particularly through more intensive development (and replanting) of tree crops and the expansion of higher value food crops.

1.45 Major trends in the forestry sector in the outer islands are more difficult to predict. GOI has begun to encourage the development of forest plantations, to take some of the pressure off natural forests while meeting the growing need for timber in the wood processing industries. The demand for wood by these industries, which has also included a major expansion of pulp and paper and, more recently, furniture production, is likely to grow considerably over the next two decades.

1.46 **Future Trends in Manufacturing.** According to Bank staff estimates, total industrial sector output could expand seven-fold between 1990 and 2010, and 13-fold by 2020. An assessment of the likely structural changes in industrial output, based on a comparison with a large sample of other industrialized and industrializing countries, suggests that the share of basic processing industries will fall from 75% in the early 1970s, and 72% today, to about 65% in 2010 and 60% in 2020, reflecting the more rapid increase in downstream processing and assembly-type activities. Trends in industrial "deconcentration" are likely to continue. While industry will grow more rapidly in the outer islands, however, its relative share may only increase from 25% in 1990 to about 30% by 2010, and 35% by the end of the Second Long-Term Plan. This is consistent with the underlying reality that Java--with a more highly-trained labor force and greater availability of supportive infrastructure--is likely to attract most of the assembly-type investments (with processing industries falling to 50% of the total), while the outer islands will attract most of the processing industries (where, with few exceptions, assembly-type industries will represent less than 25% of total industrial output).

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## Future Challenges in the Management of Natural Resources

1.47 Current issues and future challenges in the management of natural resources are discussed in Chapter 2, and summarized below. While the specific concerns vary widely, the main challenges reflect three common--and often interrelated--themes. These include the need for greater attention to, and significant improvements in: the *efficiency* with which natural resources are allocated and used; the *ecological sustainability* of individual resources and ecosystems; and the *economic and social impacts* of development projects on natural resource-dependent communities and other affected groups. In some cases, these challenges are complicated by the need to reconcile Indonesia's national priorities for growth, equity and sustainability with additional concerns about global sustainability.

1.48 **Land Management.** Because of its multiple roles--economic, ecological, and socio-cultural--most issues of sustainable development in Indonesia are related in one way or another to the management of land. As a result of growing population pressure and changes in the nature and intensity of economic activity throughout Indonesia, land-related issues of efficiency, sustainability and equity have become increasingly important. On Java, these issues are reflected in the conversion of upland forests and coastal wetlands to agricultural use (which has led to soil erosion, watershed degradation and the loss of valuable marine resources), the rapid--but often uncoordinated--expansion of urban areas (resulting in less-than-optimal land-use densities and inefficiencies in the provision of infrastructure), and the spread of industrial firms in and around urban areas (with little regard, until recently, to their impact on the environmental or the health and welfare of surrounding communities).

1.49 In the outer islands, the key issues arise from the conversion of both forest land and coastal wetlands to agricultural use (planned and unplanned, and often in an unsustainable manner), and the commercial exploitation of timber resources (where shortcomings in the incentives for sustainable harvest and replanting, and the difficulties of effective oversight of concession operations, have contributed to the process of deforestation). Land-related issues of equity, throughout Indonesia, arise from problems in land acquisition and transfer (where improvements are needed in institutional mechanisms to ensure appropriate compensation and the restoration of the livelihoods of affected people), and from the unintended effects of development processes on natural resource-dependent communities (particularly in the outer islands, where the expansion of forest concessions, plantations and other development projects has led to conflicts over traditional land-use rights and access to natural resources by local communities).

1.50 **Parks and Protected Areas.** Indonesia has a strong vested interest in conserving its natural resources and protecting the critical ecosystems upon which so much of its economic activity depends. The direct and measurable benefits--from agriculture, timber and non-timber forest resources (including food, medicines, and building materials), fish, shrimp and other marine products, and related revenues from tourism--are enormous. The indirect (more difficult to measure) benefits are no less important. Terrestrial and marine ecosystems: protect watersheds and coastal areas from erosion; provide an essential habitat for the growth of plants, animals and other valuable organisms; assimilate human, industrial and agricultural waste; and help to regulate micro-climates. They also play a role in maintaining global ecosystems, and are a repository of Indonesia's (and to some extent, the world's) remaining "gene pool". In addition to whatever intrinsic value may be ascribed, Indonesia's biodiversity represents a storehouse of considerable potential value to future generations (e.g., improvements in food-crop genetics and the benefits of as-yet-undiscovered drugs).

1.51 GOI clearly recognizes the need to protect these national and global ecological assets. It has set aside 10% of its land area (about 19 million ha) as terrestrial parks and reserves (a larger proportion than in most developed and developing countries), and another 15% (about 30 million ha) as permanent protection forests to safeguard important watersheds. Designated and proposed marine conservation areas amount to an additional 30 million ha. Together, these areas cover the major biogeographic regions. While some habitats are well represented, others (wetlands in particular) will need to be expanded. Properly managed, these areas would be sufficient to protect both Indonesia's biological diversity and many of its critical ecosystems. The main challenge lies in implementing all of these plans. The total number of existing and proposed parks, reserves and protected areas, for example, is over 700. Of these, 79 have a high priority for the protection of biodiversity, but only 29 have well-defined management plans--and not all of those plans have been fully implemented.

1.52 **The Management of Forest Resources.** Indonesia's forests are second only to Brazil's in size, and represent 10% of the world's remaining tropical rainforest. While there is considerable uncertainty about the precise area of the country's remaining forest cover, nearly 75% of Indonesia's land area is classified as "forest land" by the Ministry of Forests (about 143 million ha). Some 100-110 million ha are estimated to be "closed canopy" forest. As noted above, 19 million ha have been set aside for conservation purposes, and 30 million as permanent protection forests. To meet the needs of its growing population, and reduce poverty in the outer islands, another 30 million are expected to be converted to agricultural use--including tree crops. The remaining 64 million ha are designated as production forests. Since the late 1960s, GOI has encouraged the exploitation of commercially valuable timber within these areas by the grant of more than 500 forest concessions.

1.53 Government regulations specify a "selective cutting" approach to concession management that, combined with careful logging and replanting, was expected to allow these production forests to be managed sustainably. There is considerable evidence, however, that poor logging practices and the failure of replanting efforts have resulted in extensive degradation in many of these concessions and, together with the opening up of forest areas through logging roads, the loss of forest cover. The rate of deforestation is a matter of growing concern, but weaknesses in the available data have led to widely varying estimates--ranging from 1.3 million ha to less than 300,000 ha per year. How much of this is caused by forest fires, poor logging practices, development projects and traditional "swidden" agriculture is subject to the same degree of uncertainty. The impact of land clearing for swidden agriculture, for example, depends largely on whether the definition includes only forest-dwelling communities of long-standing, following traditional practices, or also includes "spontaneous migrants" who--due to lack of tenure or alternative sources of income--often turn to the natural forest as a source of livelihood for themselves and their families.

1.54 Previous studies have suggested that up to half of all deforestation may be caused by such "unplanned" activities. More recent evidence yields three important, and somewhat different, conclusions. **First**, the number of traditional forest-dwelling and forest-adjacent communities may be much larger than previously thought. **Second**, their practices may be far less damaging. In fact, many of these communities have developed highly sophisticated and quite sustainable management systems, some of which actually help to protect biological diversity. **Third**, whatever their number, there is clear evidence of a significant overlap between officially designated forest land (in all categories) and the existence of local communities, some of which have occupied the same land for a number of generations--well before the establishment of the current Ministry of Forestry.

1.55 Recognizing the need to improve the management of its forest resources, GOI has prepared a Tropical Forest Action Plan, and has declared its intention to meet the provisions of the International Tropical Timber Organization for certification that its exports are from "sustainably managed forests" by the year 2000. To achieve this goal, while also meeting the needs of the wood processing industries, will not be easy. As a result of export bans or prohibitive taxes, combined with relatively low Government fees on timber extraction, the domestic price of logs is significantly below world market prices. Low domestic prices for logs have led to lower rates of efficiency in the wood processing industries, reduced incentives to conserve, and thus growing pressure on the natural forests. At the same time, recent reviews of the forest land classification system suggest that up to 20 million ha of current production forests should be reclassified as protection forests. The recognition of traditional "adat" rights for forest-dwelling communities presently occupying production forest lands would further reduce this classification--and thus constrain future production possibilities. Some of the pressure on natural forests, particularly from demand by the pulp and paper industry, could be offset through the development of forest plantations--provided they are located on already degraded forest land. GOI is encouraging the development of such plantations by offering substantial investment subsidies. It is still too early to tell, however, whether these efforts will be successful.

1.56 **Water Resources Management.** The development of water resources over the past 25 years--irrigation systems in particular, but also water supply systems in urban areas and hydro-electric facilities to meet the growing energy demands of the industrial sector--has played a critical role in stimulating rapid growth and reducing widespread poverty. Issues of water resources management (both quantity and quality) will be increasingly important in the years ahead--especially on Java, which has 60% of the population, 70% of irrigated agriculture, and 75% of industry. Issues of water quantity include emerging conflicts between competing uses (agriculture, industry and municipal), and between surface and groundwater use in rapidly growing urban areas. In the aggregate, Java is well endowed with rainfall. The problem is one of seasonal and annual variations, with dry season flow in the main rivers only 20% of annual flows--and as little as 10% in a dry year. This is compounded by the fact that river basins on Java are relatively steep and short (less than 50 km on average), resulting in most of the wet season water running unused into the sea. While a number of dams have been built, their reservoirs hold less than 5% of total river flows. Several additional sites have been identified for possible future dams, but implementation is likely to be constrained by high population densities and the social and economic costs of resettlement.

1.57 In volume terms, water use in agriculture currently accounts for 98% of total demand, while industrial and municipal requirements together account for only about 2%. The consumption of water by households and businesses will grow rapidly over the next two decades, but their needs will still only amount to about 5% of total demand by the year 2010. To support continued rapid growth and improvements in human health and welfare, however, these needs will have to be met. This will require a shift of water in the dry season from agriculture to municipal and industrial use. Such diversions are already beginning to occur, but greater attention is needed to the process of water allocation so as to minimize the social and economic costs for farmers and the potential disruption to agricultural output. GOI is aware of the need to manage its water resources on an integrated river basin basis, and is currently assessing the regulatory and institutional changes that this would require. It will be especially important to ensure the coordination of groundwater--as well as surface water--use. Many of the aquifers in Java's rapidly growing urban centers are already suffering from over-extraction, resulting in salt-water intrusion and ground subsidence in coastal areas.

1.58 The challenges of meeting the demand for water in the dry season are complicated by the growing volume of pollution from urban and industrial sources. Most of the major rivers on Java are seriously polluted with a combination of untreated human waste, uncollected municipal refuse, and largely uncontrolled effluents from industry--including increasing amounts of toxic and hazardous waste. During the dry season, when river flows are greatly reduced, the concentration of pollution loads increases dramatically. One solution to this problem is to release water from storage reservoirs to "flush" these wastes away from urban areas. This provides only temporary relief, however, at a high cost in terms of alternative uses in agriculture. The groundwater aquifers in many urban centers are also polluted, primarily by human waste, but with increasing evidence of industrial waste as well. Fecal contamination of water supplies represents a constant hazard to human health, and this is compounded during the rainy season by the flooding of low-lying areas--in part due to the clogging of drains and canals by solid waste. Over the longer term, toxic and hazardous waste poses an even more serious threat to human health and welfare. Samples of groundwater in Jakarta, and marine life in Jakarta Bay, for example, already show evidence of contamination by toxic metals (e.g., mercury).

1.59 **The Management of Energy Resources.** The domestic demand for energy has grown very rapidly over the past 25 years, averaging nearly 7% per annum in the 1980s. At the present stage of development, however, the energy intensity of GDP is still relatively low. (With 3% of the world's population, Indonesia consumes only about 0.3% of total energy.) The combination of rapid economic growth, the changing structure of the economy and the backlog of demand from both industry and households means that energy demand will grow even faster over the next several decades--increasing nearly 3-fold in the 1990s, and an estimated 14-fold by the year 2020.

1.60 Indonesia is fortunate in having a large base of primary energy resources, including oil, natural gas, and coal, and considerable hydroelectric and geothermal potential. These resources are sufficient not only to meet domestic demand, but also to provide substantial export earnings. In the past, Indonesia has relied heavily on the development and use of its petroleum resources for power generation, transport and industrial sector needs, as well as a major source of foreign exchange. With the rapid growth of domestic demand, however, it is possible that the country will become a net oil importer as early as the year 2000. The least-cost growth path for the energy sector, therefore, will require the substitution of petroleum with hydro, geothermal and gas-fired generating capacity to the maximum extent possible, with the remaining power needs met by coal--thus conserving petroleum for use as a transport fuel. On the demand side, energy conservation will be important, with potential savings amounting to as much as 20% of future demand. Renewable energy sources will also be important but, due to technical and economic constraints, will only account for about 10% of total energy supply over the longer term.

1.61 The expected rapid growth in consumption and production of energy has important implications for the environment. The use of petroleum fuels, mostly by transport and industry, is concentrated in urban areas and constitutes a major factor in the deteriorating ambient air quality of Indonesia's major cities. The use of coal for power generation by PLN and industrial firms is also a concern in terms of both local emission of particulates and the contribution to global warming. Other concerns include the environmental effects of oil spills, coal mining, and effluents from power plants. A recent Bank study has concluded that urban air pollution is the most important environmental issue arising from energy use in Indonesia. Vehicle emissions are the principal source of this pollution, and the greatest damage is caused by the health effects of particulates and lead (see Chapter 3).

## The Growing Threat of Urban and Industrial Pollution

1.62 Current issues and future challenges arising from urban and industrial pollution are discussed in Chapter 3, and summarized below. While substantial economies of "agglomeration" are possible in urban centers, rapid and uncoordinated growth can also result in "diseconomies" of scale, increasing congestion and worsening environmental conditions. The concentration of people in urban areas simultaneously increases the concentration of pollution from human and economic activity and the number of people exposed to the health hazards of that pollution—with the urban poor least able to protect themselves from environmental degradation. Similarly, while rapid industrialization carries with it major benefits in terms of more productive and higher-paying jobs and the growth of non-oil exports, the concentration of manufacturing industries (and industrial wastes) in urban areas represents a serious and growing threat to the health and welfare of Indonesia's urban citizens.

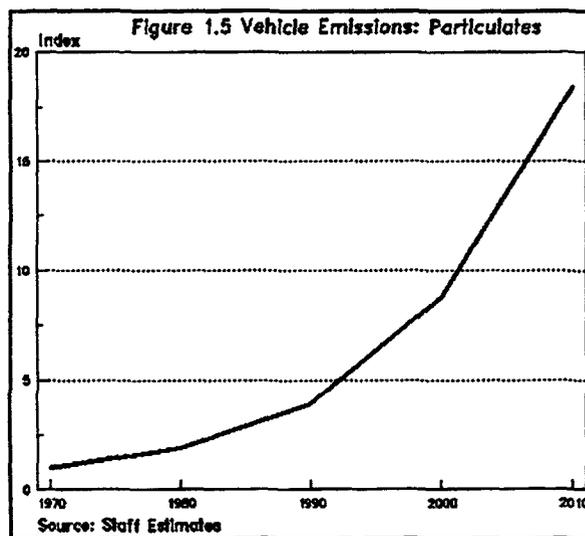
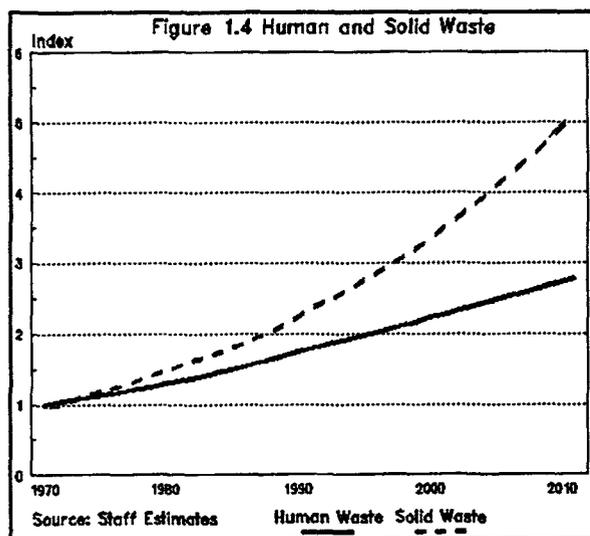
1.63 **Key Issues of Urban Environmental Management.** A review of the available evidence on current environmental conditions in Indonesia's main urban centers, together with projections of future trends and the potential costs of further environmental degradation, clearly indicates the need to pay much greater attention to issues of human waste (sewerage and sanitation), solid waste (both collection and disposal) and vehicle emissions (especially lead and particulates).

1.64 **Human Waste.** Unsafe water is one of the major sources of disease in Indonesia (diarrhea, typhoid, cholera, etc.), and the lack of adequate sanitation facilities is a primary cause of fecal contamination of urban water supplies. Since few Indonesian cities have even a rudimentary sewerage system, most households rely on private septic tanks or dispose of human waste directly into rivers and canals. Septic tanks, however, are rarely maintained properly, causing overflows which contaminate groundwater—including the shallow wells upon which most urban households depend for their water. Even when the sludge from septic tanks is collected, most of it is disposed of into rivers and canals. Because of deteriorating pipes and low water pressure in many urban water supply systems, even piped water is contaminated. With the exception of bottled water, therefore, most urban water supplies are not safe to drink. In a recent survey in Jakarta, for example, most of the shallow wells examined were contaminated with fecal coliform; tap water samples have revealed a 21% rate of contamination, and hydrant samples 58%. The transmission of water-borne diseases is also dependent on hygiene habits, frequently related to the availability of adequate supplies of water. Effective solutions, therefore, will have to deal with water supply and sanitation in combination.

1.65 **Solid Waste.** The collection and disposal of municipal solid waste represents an increasing challenge in most large cities. An estimated 15-40% of urban solid waste is not collected at all, and much of what is collected ends up in uncontrolled dump sites. In Jakarta, for example, while some portion of the uncollected wastes are burned, an estimated 30% ends up in rivers and canals; as much as 40% is disposed of in "informal" dump sites. Urban solid waste is likely to expand more than twice as fast as population growth, since the amount of waste per capita increases as incomes rise (see Figure 1.4). The burning of waste adds to air pollution, while uncontrolled dump sites lead to leachates that contaminate ground water and contribute to the proliferation of disease-carrying pests. The blockage of rivers and drainage canals causes flooding and the spread of contaminated water in low-lying residential areas. The health effects of inadequate solid waste management are difficult to isolate from those arising from other causes, but more effective management of solid waste will be essential to ensuring a clean and healthy urban environment.

**1.66 Vehicle Emissions.** The available evidence on air pollution in the major urban centers suggests that current conditions exceed national ambient quality standards for several pollutants at least some of the time, including suspended particulate matter and, in selected areas of heavy traffic, also lead, sulphur dioxide and nitrogen oxides. Indonesia currently has ten cities with more than a million inhabitants, of which seven are on Java. Given the expected growth in urban populations, rapid growth in vehicles and increasing road congestion, and the expansion of air pollution from industry and power plants in and around the major urban centers, the condition of the air in the largest cities is likely to worsen dramatically if nothing is done. Vehicle emissions are the largest single factor in urban air pollution, and are also likely to be the fastest growing source (see Figure 1.5). In terms of health costs, the most threatening pollutants are particulates and lead. Among all types of vehicles, two-stroke motorcycle engines are a major cause for concern, and their use should be phased out as quickly as possible. Controlling the growth of vehicle emissions, however, will need to involve a wide range of policy and investment actions, including (inter alia) changes in fuels and fuel prices, better traffic management and improvements in public transportation.

#### POLLUTION FROM URBAN SOURCES: DKI JAKARTA

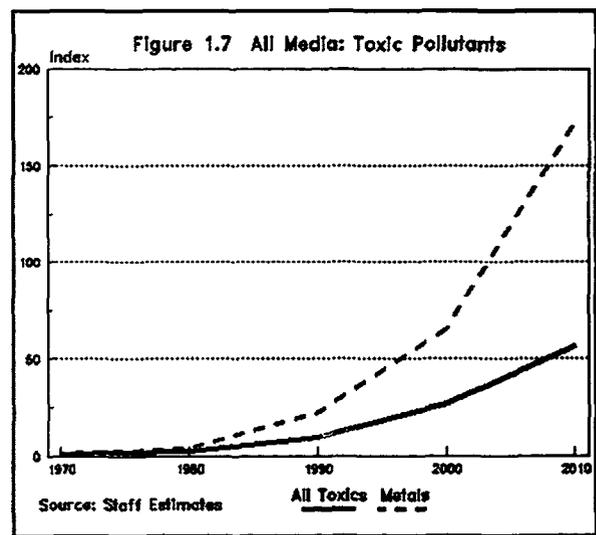
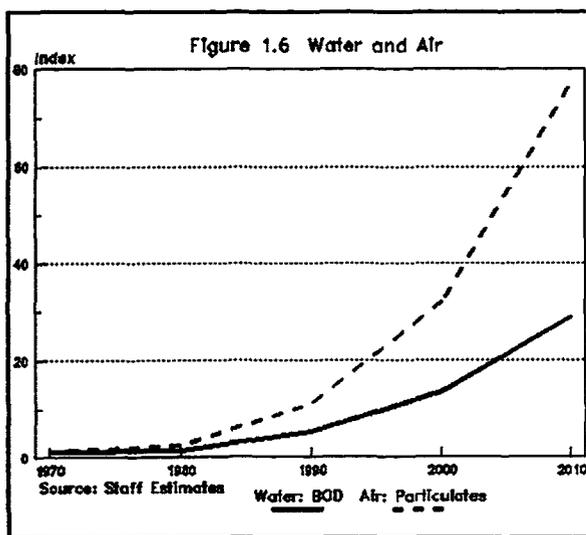


**1.67 Pollution from Industry.** Indonesia's development strategy for the Second Long-Term Plan will rely heavily on the growth of industry for the creation of higher productivity jobs and non-oil exports—with important implications for the environmental sustainability of future growth and development. As noted above, industries involved in the basic processing of commodities will continue to expand, adding to the pressure on natural resources. The more critical issues of industrial sector expansion, however, involve the growing costs and risks of environmental pollution. The nature and magnitude of future pollution loads from industry will depend on the scale of output and the intensity of various pollutants per unit of output. The damage costs resulting from increasing pollution loads will depend on the location of specific industries and the extent and concentration of the exposed population. In connection with this study, a detailed analysis of these factors has been carried out. The results—described in Chapter 3 and summarized below—are quite sobering.

**1.68 Pollution Intensities and Loads.** Total industrial output has increased 8-fold since 1970 and, according to Bank staff estimates, is likely to expand another 13-fold by the year 2020. There has been a gradual shift in sectoral composition, with processing industries growing more slowly than assembly-type industries. Since the former are by far more pollution-intensive (especially for water pollutants, but also for many of the traditional air pollutants), there has been a noticeable decline in the pollution intensity of industrial output since 1970--particularly for BOD. Projections to the year 2020 indicate that this trend will continue. The intensity of certain other pollutants, however, (including toxic materials, sulfur dioxide, and nitrogen oxides) has increased since 1970. In some cases, these will peak and then level off--or even decline--in the coming years. In other cases (such as bio-accumulative metals) intensities are likely to increase. With rapid growth of industrial output, however, pollution loads will increase substantially for virtually all pollutants. For BOD, with the most favorable results in terms of declining intensity, total loads will increase 10-fold by the year 2020; traditional air pollutants such as sulphur dioxide and suspended particulates will increase 13-fold and 15-fold, respectively; emissions of bio-accumulative metals (e.g., mercury and lead) are projected to increase by as much as 19-fold--all of which would come on top of already serious levels of pollution from industry in many areas of Indonesia today.

**1.69 The Concentration of Industrial Pollution.** The costs and risks of industrial pollution are heightened by the fact that they are concentrated in urban areas and in those provinces with the highest population densities. While Java's share in the total load of traditional water and air pollutants, for example, will decline from 60% to under 45% between 1990 and 2020, in absolute terms these pollutants will expand about 8-fold from the current relatively high levels. Java's share of toxic pollutants will remain roughly constant--about two-thirds of the total, and more than 75% of the bio-accumulative metals--and 85% of these will be concentrated in its urban centers. While the share of industrial pollution in urban areas will decline from 70% today to 60% in 2020, the absolute level of industrial pollutants in Indonesia's cities will expand nearly 10-fold from their current levels.

### POLLUTION FROM INDUSTRY: INDONESIA TOTALS



1.70 **The Health Costs of Urban and Industrial Pollution.** The social costs of environmental degradation are commonly underestimated and often invisible to key government policy-makers. In connection with this study an attempt was made to estimate the health effects of environmental pollution in Jakarta, using a computer model to predict pollution loads and their effects on the ambient quality of water and air. This was combined with dose/response measures developed in the U.S. to assess the potential impact on morbidity and mortality. Estimates of the cost of these health impacts were then made, using local values for medical costs and lost wages due to illness. "Willingness to pay" measures developed in the West--adjusted for Indonesian wage rates--were used to estimate mortality costs. The total cost varied widely, reflecting the uncertainties involved in the methodology and the data used in the model (see Chapter 3), but the central value estimate for 1990 was over US\$500 million. The accuracy of such estimates can easily be questioned, but they help to illustrate an important point: clean air, and access to safe water and sanitation, are not just about "environmental amenity" values; they entail very real and substantial human costs in terms of the physical health and longevity of Indonesia's urban citizens.

1.71 Policy-makers everywhere respond to issues of public health and safety in accordance with their perceptions of risk and potential consequences. Following a train accident near Jakarta five years ago, for example, that claimed more than 200 lives, Government officials took immediate action to enhance the safety of railway operations. Underlying the calculation of health costs noted above are reasonably conservative estimates of the number of lives that might be saved if the quality of water and air in Jakarta could be improved significantly--a total of about 6,000 lives a year. In a city of nearly nine million people, losses of that magnitude occurring individually over a year's time are simple not very visible to the municipal authorities. In the aggregate, however, they are fully the equivalent of a train wreck--comparable to the one noted above--occurring about every two weeks.

1.72 **Other Costs and Risks.** In addition to health costs, urban and industrial pollution can raise the operating costs of "downstream" economic activities--and even put them out of business. Brackish water shrimp production on the north coast of Java, for example, is increasingly threatened by pollution and could have to be relocated. There is anecdotal evidence of similar losses to communities in the outer islands due to the rapid growth of processing industries, with pollution incidents sometimes involving serious health effects as well. The cost of "flushing" key rivers on Java during the dry season involves a high "opportunity cost" in terms of foregone agricultural output. Industrial toxic waste represents a serious risk to human health, adds to the vulnerability of rapidly growing shrimp and fish exports, and will be very expensive to clean up. Uncontrolled human and solid waste in resort areas can also jeopardize the sustainability of tourism revenues.

1.73 **The Threat to Continued Rapid Growth.** With growing congestion and pollution in its main urban centers, it will be increasingly difficult for Indonesia to compete for foreign investment, especially in the higher-technology industries needed to enhance the productivity of the labor force. The larger threat to future growth, however, arises from the increasing awareness among affected communities of the social and economic costs of uncontrolled pollution. With urban populations expected to double over the next 25 years, and with a likely 10-fold increase in industrial pollution in urban areas, it is simply inconceivable that the pressure to slow the expansion of industrial firms--in those areas most critical for future growth--will not increase. The prospects for growing community resistance are confirmed by the experience of other rapidly industrializing countries in the region (e.g., Korea, Thailand and Malaysia), and elsewhere, as noted in Chapter 3.

## E. SUSTAINABLE DEVELOPMENT: THE CHALLENGES OF INTEGRATION

1.74 The emergence of the environmental issues described above has led to a growing awareness within Indonesia of the need to improve the management of natural resources and reduce the level of urban and industrial pollution, and enhance equity in the outcomes of growth and development. To deal with these issues, however, will not be easy. The main challenge will be to integrate environmental concerns into the development process, taking maximum advantage of the positive linkages, and dealing effectively with the inevitable tradeoffs. This will require a combination of efforts, including continued enhancement of the policies and incentives for environmentally responsible behavior, increased investments in environmental protection by both the Government and the private sector, and sustained efforts to strengthen the agencies responsible for environmental planning and management. Indonesia is fortunate in being in a position to learn from the experience of other countries and to avoid their worst mistakes. Given the existing conditions, however, and the expected rapid pace of future development, GOI has a relatively narrow window of opportunity in which to act. While much has already been accomplished, even more remains to be done. A more concerted effort will require, among other things, strong political leadership and a broader consensus in favor of environmental protection.

### Complementarity and Tradeoffs

1.75 **Complementarity and the Positive Linkages.** As demonstrated by the experience of other countries, there is enormous complementarity between good economic policy and an effective strategy for environmentally sustainable growth. This is perhaps best illustrated by the unfortunate results of the non-market approach followed in Eastern Europe and the former Soviet Union over the past half century. There, distortions in the price system designed to encourage industrial sector growth and other social objectives had the unintended effect of encouraging both inefficiency and pollution--with disastrous consequences for the natural environment and for the health and welfare of the effected populations. The reverse (and positive) case is equally valid. Moving to market prices for key natural resources (land, water, forests and energy), for example, will simultaneously reduce wasteful consumption (and thus conserve resources), improve the efficiency of production (and hence competitiveness), and enhance fiscal balances (by the reduction or elimination of subsidies). Clearly, GOI should take maximum advantage of such opportunities in refining its economic policies.

1.76 **"Externalities" and Tradeoffs.** Moving to market prices is a necessary, but not sufficient, condition for environmentally sustainable growth. Some environmental problems are caused by the failure of markets to take into account potential "externalities". Pollution is the classic case of a negative externality, but markets also fail to account for the positive benefits of natural ecosystems---such as the hydrological effects of forested areas in the uplands of a watershed, and the many ecological and economic benefits of mangrove forests and coral reefs. As a result, Government intervention for environmental protection will sometimes be required. Tradeoffs between economic growth and environmental protection will be inevitable, especially if the "polluter pays" principle is imposed on private sector firms. In the past, some have argued that developing countries cannot afford to protect their environment. The issue of affordability, however, has been increasingly challenged--in part due to the growing recognition of the social and economic costs of environmental degradation, and in part as a result of experience that demonstrates that pollution prevention and control are not as expensive as is sometimes assumed (see below, and Chapter 5).

## National Priorities and Global Concerns

1.77 With limited financial and administrative resources, it will not be possible for Indonesia to take on every environmental issue discussed in this report with the same degree of urgency. And not every issue is equally important. The establishment of priorities requires a careful assessment of costs and benefits, taking into account the **tradeoffs** between growth and environmental protection, the **opportunity cost** of public sector expenditures on the environment--in terms of less attention to other important social and economic needs, and whatever **uncertainties** may exist about the longer-term implications--including the health risks--of continued environmental degradation.

1.78 **Indonesia's Priorities for Sustainable Development.** While there are serious limits to the availability of data in Indonesia, and thus considerable uncertainty about the precise level of some costs and benefits, existing "order of magnitude" estimates (together with the experience of other countries in dealing with these same issues) are sufficient to identify at least the highest priority issues. As a part of this study, a simple ranking exercise was undertaken, comparing each of the issues discussed in this report against the priorities of Indonesia's long-run development strategy: growth, equity and sustainability. This (admittedly subjective) assessment of costs, benefits and risks identifies five issues that appear to have the highest priority. These include **water supply and sanitation, solid waste management and vehicle emissions in Indonesia's main urban centers, industrial pollution control--particularly on Java, and the management of forest concessions in the outer islands.** In each of these areas there are serious implications for the achievement of GOI's development objectives in both the medium and longer term.

1.79 Other issues with a high, but somewhat less critical, rating include the protection of regional and local watersheds and coastal and marine ecosystems, and issues related to the sustainable management of natural forests, including their conversion to agricultural uses, efficiency of the wood processing industries, and the development of forest plantations. In many cases, progress in these areas will also help to deliver on Indonesia's commitments to the sustainability of global ecosystems and the protection of biodiversity.

1.80 **National versus Global Priorities.** GOI has a long-standing commitment to issues of global sustainability. This concern is reflected in the positions Indonesia has taken, and the formal commitments it has made, in each of the most critical areas--from destruction of the ozone layer and global warming to the protection of biodiversity and the conservation of its remaining tropical rainforest (see Box 4.1). As noted above, the main challenge is one of implementing its commitments effectively. There are also, however, important issues of "financial burdensharing" that remain to be resolved between the developed and developing countries, and an urgent need in most of these areas for technical expertise and assistance, as well as incremental financial resources. Some of these issues have become increasingly contentious (and politicized) in recent years--reflecting the dichotomy of interests between the industrialized West and the developing world, not only in the relative priority of growth and poverty alleviation versus environmental protection, but also in the sharp differences of interest in specific issues of environmental sustainability (global versus national and local). There is a certain risk, therefore, that pressure from external sources could lead to an imbalance in addressing Indonesia's national priorities for sustainable development. Clearly what is needed, as noted by President Soeharto at the 1993 UNCED meetings in Rio, is less confrontation, greater understanding on all sides, and the development of more effective global partnerships.

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## **Influencing Environmental Outcomes: Policies and Instruments**

1.81 In broad terms, Indonesia's macroeconomic policies have been increasingly supportive of environmental sustainability, especially the structural adjustment initiatives designed to improve the efficiency and competitiveness of domestic production and to encourage foreign investment. Efforts to reduce poverty and control the rate of growth of the population have also been "environmentally friendly". Sectoral policies (particularly in the pricing of natural resources), however, and certain trade initiatives (such as the bans on raw logs and sawn wood), have been less conducive to sound environmental management, and should be reviewed. Policies for urban environmental management and industrial pollution control are at a relatively early stage of development. This represents an important opportunity to benefit from the experience of other countries with alternative approaches.

1.82 **Improving the Management of Natural Resources.** Improving the management of natural resources will require a sustained effort to strengthen the capacity of central and local agencies responsible for environmental planning and management. But relying on market forces (e.g., in the allocation of land to its highest and best use), and reducing market distortions (e.g., in the pricing of water, forests and energy), will often be the surest and most effective way to encourage sustainable use. In addition to the benefits of "complementarity" noted above, more sustainable use of natural resources will often help to reduce pollution as well. GOI's highly successful "Integrated Pest Management" Program, which eliminated subsidies on pesticides, not only improved agricultural yields and generated \$150 million a year in fiscal savings, but also reduced pesticide use significantly. Similarly, collecting a larger share of "rents" in the forestry sector will result in higher domestic prices for logs--inducing greater efficiency in their use, a more competitive wood processing industry, less pressure on the natural forest, and less production waste to be absorbed by local ecosystems. More importantly, increased revenue from the forestry sector, and savings from reduced subsidies on other natural resources, would help to finance the substantial increase needed in Government expenditures on environmental protection--e.g., for improved water supply, sanitation and drainage, and public transportation in Indonesia's key urban centers.

1.83 **Protecting the Urban Environment.** Investments in urban services will need to grow rapidly over the coming decades, both to meet the existing backlog of demand and to cope with the rapidly expanding urban population. In addition to protecting the health and welfare of urban residents, many of these investments will also contribute to the efficiency of the "urban enterprise"--which will be increasingly important since, within the next two decades, well over half of Indonesia's GDP will be produced in urban areas. Pricing and cost-recovery policies, however, will be equally important, not only as a critical element of "demand management", but also to help in financing the necessary investments and their operating and maintenance costs. Other policies will also be needed to ensure more coordinated development of urban sector growth, improve land-use density, and minimize the costs of urban infrastructure. Spatial planning will be especially important, but this should be based on broad "strategic/structural" plans used to guide investments by both the public and private sectors--not the detailed and costly zoning exercises that have failed so often in the past. The design of more effective policies and incentives for urban environmental management, and improved coordination of investment planning across the relevant infrastructure sectors, will require a substantial strengthening of the institutional capacity of municipal governments, changes in central/local government relationships in the planning and financing of urban investments, and much greater reliance on community participation in project design and implementation.

1.84 **Controlling Industrial Pollution.** There are actually two key issues of industrial pollution control facing Indonesia's policy makers: (a) what to do about the pollution from existing firms; and (b) how to "delink" future pollution loads--and the damage they may cause--from the rapid expansion of industrial output. The recommended approach is described in Chapter 4 and summarized briefly below. A major issue in both cases is how to achieve the optimal level of pollution control at the least cost. The choice of policies and instruments will be a critical factor in determining the costs of pollution abatement--for individual firms and for the country as a whole.

1.85 **Cleaning Up Existing Pollution.** Taking into account the experience of other countries and the constraints and opportunities in Indonesia, the recommended strategy for reducing pollution from existing firms is comprised of six key elements. **First**, continue to improve the overall incentives framework for private sector development, with special attention to policies that encourage greater efficiency (e.g., increased domestic competition, market-based prices for natural resources, and "full-price" cost recovery for investments in supportive infrastructure--particularly urban services). **Second**, carefully target the pollution control effort--by area, by pollutant, and by industry, taking into account the significant differences that exist in area-specific ambient environmental quality (for specific watersheds and urban centers), the size of the exposed population, and the corresponding estimate of potential damage costs--focusing on the worst polluters and most damaging pollutants in the most threatened areas. **Third**, continue efforts to strengthen the institutional capacity for pollution monitoring and enforcement, especially at the provincial level, and to design a full range of policies and incentives (regulatory, market-based and others) tailored to conditions in Indonesia.

1.86 **Fourth**, give high priority to the encouragement of "clean technology", including "pollution prevention pays" campaigns and industry-specific technical assistance, to simultaneously reduce pollution loads at the least cost while enhancing industrial efficiency and competitiveness. **Fifth**, rely extensively on the power of publicly available information--about trends in ambient environmental quality and firm-specific pollution practices, both positive and negative--to build consensus, capture the attention of industry leaders, and bring community pressure to bear on unresponsive firms. **Finally**, further develop the existing plans and procedures for dealing with toxic and hazardous waste, including storage and transport issues as well as the management of planned treatment facilities, giving special attention to the needs of smaller firms.

1.87 **Reducing Future Industrial Pollution.** This is the most critical issue of industrial pollution control: by the year 2010, existing firms will represent only about 15% of total industrial output and, by the year 2020, less than 8%. The highest priority, therefore, should be given to minimizing pollution loads--and damage costs--from newly established and expanding firms. The obvious place to start is at the investment approval stage. The suggested strategy involves four key elements. **First**, use existing (AMDAL) procedures for prior review of potential environmental effects, but target the effort and ensure professional and expeditious reviews--possibly by "contracting out" with an experienced firm. **Second**, expand the review to include issues of technology choice; wherever there are significantly different options available, require further justification for adopting older/inefficient and more highly polluting technologies. **Third**, especially for major projects, but also for any that are highly polluting, ensure local government input on location issues, and encourage the location of medium- and larger-scale firms in industrial estates. **Fourth**, to avoid more expensive "retro-fitting" later on, ensure that adequate provision has been made in project design and site selection for the implementation of appropriate abatement equipment and procedures.

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## The Costs and Financing of Environmental Protection

1.88 This report recommends a substantial increase in public sector expenditures for environmental protection. It should be possible to cover most of these costs through a combination of pricing and cost-recovery policies and increased revenues and fiscal savings from other environment-related policy reforms. Increased investments in pollution abatement by the private sector, assuming carefully designed policies and standards, would represent a relatively modest proportion of current and likely future investment in the manufacturing sector. It should be possible to offset most of these incremental costs through the adoption of "clean technologies" that minimize pollution and recycle wastes. Taking into account the social and economic benefits of a clean and healthy environment, and the growing evidence that preventing environmental pollution is cheaper than cleaning it up, the increased investments proposed for the both public and private sectors are fully justified and entirely consistent with a "least-cost" growth path for the Indonesian economy over the next twenty five years.

1.89 **Public Sector Expenditures for Environmental Protection.** Investments in urban water supply, sewerage and sanitation, and solid waste management have declined in real per capita terms during Repelita V. To meet the growing demand (as well as the existing backlog) for water, and to make a start on the investments needed in sewerage systems in the largest cities, public investments would have to expand substantially, from a level of about 0.2% of GDP in REPELITA IV to about 0.4% in future years. In the absence of clearly defined strategies for the reduction of vehicle emissions, the need for increased public sector investment in urban transport is more difficult to predict. A rapid transit system for Jakarta has been estimated to cost US\$3.1 billion, but few (if any) other cities would be able to justify such an investment. In most cases, greater attention will be needed to the quality and efficiency of bus services, which would suggest the need for greater private sector participation. Increased investments will also be needed to improve the management of forest resources and to protect biodiversity. Additional expenditures will be required for strengthening environmental institutions and improving existing information and management systems, but most of this increase (e.g., for staffing and staff development) will involve recurrent budget expenditures which are difficult to separate out on an incremental basis.

1.90 **Private Sector Investments in Pollution Abatement.** The cost to existing firms of pollution abatement will depend on the level of abatement desired and the policies and instruments used to achieve it. The "unit costs" of abatement rise with the proportion of total pollution eliminated, increasing rapidly in the higher ranges. Bank staff estimates of the aggregate abatement costs for existing firms in Indonesia indicate a range from US\$275 million at the 30% level, to US\$1.5 billion at 70%, and US\$5.7 billion at 90%. Abatement costs also vary by pollutant and by industry, and for firms within the same industry--depending on differences in scale, the age and type of technology, and the efficiency with which it is used. As a result, market-based instruments (such as a system of pollution charges and rebates) that encourage firms with lower abatement costs to generate most of the reduction, offer the potential for lower total costs--by one estimate, as much as 30% less than a regulatory system that imposes the same abatement standard on all firms. Applying the goals of Indonesia's PROKASIH ("Clean Rivers") Program to all industrial pollution (i.e., a 50% reduction standard), would imply a total cost of about US\$700 million for existing firms. Amortized over 10 years, this would be US\$ 70 million per year, or less than 0.6% of current GDP. Based on the experience of other countries, abatement costs for new or expanding firms would range from 2-5% of total investment, but this would be less than 0.5% of sales and only about 1% of value added.

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## The Challenges of Implementation

1.91 Indonesia has been a leader, particularly among developing countries, in articulating a sustainable development strategy and in putting in place the essential elements of a legal and institutional framework to support that strategy. As in most other countries, however, there remains a sizable gap between official statements of policy and the realities of implementation--between what is being done and what needs to be done. The challenges and opportunities that exist to strengthen the implementation process in Indonesia are explored in Chapter 6, and summarized below.

1.92 **The "Politics" of Environmental Management.** Policy reform is an inherently political activity, and environmental policy is no exception. Despite the complementarity between good economic policy and good environmental policy, the reforms suggested in this report would result in increased prices for natural resources for those who previously benefitted from free or subsidized use and the implementation of the "polluter pays" principle on those who must absorb the costs of abatement. While the social and economic benefits of more sustainable development policies will be substantial, policy reform means that there will be winners and losers, and the potential losers have a vested interest in protecting their existing rights. Government policy-makers will have to overcome these vested interests, and other mutually reinforcing barriers to effective action. This will require strong and committed political leadership, a concerted effort to broaden the consensus in favor of environmental protection--especially within the business community, and the encouragement of constructive partnerships among and between Government, the private sector and local communities.

1.93 **The Critical Role of Information.** Narrowing the gap between policy and performance requires knowledge and understanding. Accurate and timely information about environmental conditions and trends is essential for an understanding of the risks they may pose to human health and ecological sustainability. A careful analysis of costs and benefits is needed to establish rational priorities for action and to ensure a least-cost approach to specific concerns. For development planning and implementation, area-specific information and project-specific environmental impact analyses are required, with subsequent monitoring of actual results. Education and awareness campaigns can help to build political support for difficult policy reforms and to guide public and private decision-making. Public disclosure can be a powerful force for enhancing public sector accountability and private sector compliance with environmental standards and regulations.

1.94 **The Importance of Institutional Strengthening.** Institutional shortcomings represent the most serious impediment to sound environmental management in Indonesia today. Diffused institutional mandates and over-lapping responsibilities lead to a fragmentation of effort and conflicts of interest in decision-making. Sectorally-oriented development planning, combined with a strongly hierarchical administrative structure, seriously constrains inter-agency coordination. The tradition of central government planning and implementation, which was highly effective in achieving growth and poverty-reduction objectives in the past, is increasingly ill-suited for dealing with emerging issues of environmental management at the provincial, municipal and village level. Administrative capacity at all levels of government is hampered by a shortage of critical skills, and this is exacerbated by the higher salaries available in the rapidly growing private sector. In short, the agenda for institutional strengthening is quite daunting, and substantial progress will take a generation or more. Some problems can't wait. In the interim, creative solutions must be found--such as the PROKASIH ("Clean Rivers") Program--to tackle the most urgent problems in spite of these shortcomings.

1.95 **The Need for Constructive Participation.** The case for enhancing the participation of local communities in development planning and implementation rests partly on grounds of equity. Existing legal and institutional arrangements have been less than successful in protecting the rights of local citizens in conflicts over the use of natural resources and thus ensuring harmonious growth and development. There is growing evidence, however, that the participation of project beneficiaries and other affected groups in project design and implementation is a necessary condition for effective and sustainable development programs. In the absence of effective monitoring and the enforcement of environmental standards and regulations, negotiations between individual firms and local communities could also play an important role in reducing industrial pollution and minimizing its costs.

1.96 Community participation, consultations with affected parties, and negotiations between firms and local communities can, of course, be time consuming and expensive. In some cases, controversy will be inevitable and could lead to less than optimal results. To be effective, consultation and participation will require a constructive attitude on all sides, appropriate skills, and strong support from political—as well as administrative—leaders. Western-style forms of consultation may be inappropriate, and could even be counter-productive in the Indonesian cultural context. NGOs can play an important role in this area, but this will require a further evolution in the focus of their role, additional skills, and a more constructive relationship between NGOs and the Government.

### **Growth, Equity and Stability: Striking a New Balance**

1.97 As Indonesia's policy-makers are increasingly aware, the challenges of the next twenty five years will require that a new balance be struck among the traditional "trilogy" of GOI's development goals: growth, equity and stability. The success of the Government's past development efforts has led to a remarkable reduction in poverty and to significant improvements in the health, education and income of the vast majority of Indonesian citizens. As a direct result of rapid economic growth, however, conflicts over the use of land and access to other natural resources are increasing, and growing numbers of people are exposed to environmental pollution which threatens their health and livelihoods and jeopardizes their prospects for a higher quality of life in the future. Issues of equity and burdensharing, therefore, will become an increasingly important challenge over the coming years. To meet this challenge will require wider participation in the development process, with all of the attendant risks for social and political stability. The alternative, however, will not necessarily lead to greater stability in the longer term, and increasing participation will be required in any event to ensure that development efforts are effective and sustainable.

1.98 In all too many countries of the world, serious attention to issues of environmental degradation, and especially the health risks of urban and industrial pollution, came only after a catastrophic event galvanized government action: the London fog in England, Minimata Bay in Japan, the Love Canal in the U.S., Bhopal in India, etc.. Indonesia has not yet experienced such an event, but many of the ingredients either are, or soon will be, in place. GOI has an opportunity to avoid such experiences, but only if action is taken sooner rather than later. Improvements in urban environmental quality involve a long lead time, and the rapid growth of the industrial sector means that further delay will increase the costs as well as the risks. The Government's well-established reputation for "doing the right thing" provides grounds for optimism regarding the final outcome. Managing the process will require vision and courage, and will not be easy. Its success, however, will contribute immeasurably to an enduring legacy of social and economic progress.

## **CHAPTER 2**

# **CHALLENGES IN THE MANAGEMENT OF NATURAL RESOURCES**

## CHAPTER 2

### CHALLENGES IN THE MANAGEMENT OF NATURAL RESOURCES

#### CONTENTS

	<u>Page No.</u>
A. INTRODUCTION .....	35
B. LAND RESOURCES MANAGEMENT .....	35
Land Use Planning and Administration .....	36
Land Use Issues on Java .....	39
Land Use Issues in the Outer Islands .....	41
Issues of Equity and Burdensharing .....	41
C. ECOSYSTEMS AND THE MANAGEMENT OF PROTECTED AREAS .....	42
Functions and Value of Living Ecosystems .....	43
The Sustainable Management of Parks and Protected Areas .....	47
D. THE MANAGEMENT OF FOREST RESOURCES .....	50
The Optimal Use of Forest Land .....	51
Deforestation: How Much is Occurring and Why? .....	51
Issues in the Sustainable Management of Production Forests .....	54
Equity Issues in the Development of Forest Resources .....	55
E. WATER RESOURCES MANAGEMENT .....	56
The Availability of Water on Java .....	56
Emerging Issues of Supply and Demand .....	57
Issues of Sustainability .....	58
F. THE MANAGEMENT OF ENERGY RESOURCES .....	59
The Development and Use of Energy Resources .....	59
Energy Conservation and Demand Side Management .....	60
Prospects for "Exhaustible" Energy Resources .....	63
Prospects for "Renewable" Energy Resources .....	63
Environmental Implications of Energy Sector Development .....	64

## CHALLENGES IN THE MANAGEMENT OF NATURAL RESOURCES

### A. INTRODUCTION

2.1 Indonesia is richly endowed with natural resources including land, forests, water and energy. These resources have served as a free or low cost source of inputs that fuelled the rapid pace of development in recent decades: Indonesia's fertile soils and abundant water have supported its transformation from being the largest rice importer to rice self-sufficiency; the development of oil and natural gas has provided the financial resources needed to fund massive investments in infrastructure and human resources; and the exploitation of forest resources has played a major role in reducing the country's reliance on oil through the rapid expansion of non-oil exports. As noted in Chapter 1, the Indonesian economy is presently undergoing a fundamental transition, with rapid industrialization providing the main impetus for growth. The majority of industrial output, however, involves the processing of basic commodities, and thus the reliance on natural resources will continue to expand. Demographic change, including increasing population growth and rapid urbanization, combined with the concentration of industry in Indonesia's main urban centers, will have a major impact on environmental quality, with important implications for future growth and development. The growing threat of pollution from urban and industrial sources is the subject of Chapter 3.

2.2 The aim of this chapter is to examine the implications of future economic growth and development for the sustainable management of natural resources (land, forests, water and energy) and the protection of critical ecosystems (watersheds and aquifers, terrestrial and marine habitats), many of which are already showing signs of stress. While the specific concerns vary widely, the main challenges reflect three common--often interrelated--themes: (i) the **efficiency** with which natural resources are allocated and used; (ii) the **ecological sustainability** of individual resources and ecosystems; and (iii) the **economic and social impacts** of development projects on natural resource-dependent communities and other affected groups. There are additional aspects related to issues of global sustainability that also need to be taken into account. In many cases (e.g., the protection of biodiversity, forest conservation, and energy efficiency) there will be significant complementarities between less wasteful use of Indonesia's natural resources and the sustainability of global ecosystems.

### B. LAND RESOURCES MANAGEMENT

2.3 Because of its multiple roles--economic, ecological, and socio-cultural--most issues of sustainable development in Indonesia are related in one way or another to the management of land. As a result of growing population pressure and changes in the nature and intensity of economic activity throughout Indonesia, land-related issues of efficiency, sustainability and equity have become increasingly important. On Java, these issues are reflected in the conversion of upland forests and coastal wetlands to agricultural use, the rapid--but often uncoordinated--expansion of urban areas, and the spread of industrial firms in and around urban areas, with little regard--until recently--to their impact on environmental quality and the health of surrounding communities.

2.4 In the outer islands, where 97% of Indonesia's forests are located, the key issues include the management of parks and protected areas, the conversion of forest land and coastal wetlands to agricultural use, and the commercial exploitation of timber resources. Land-related issues of equity, throughout Indonesia, arise from problems of land acquisition and transfer, and from the unintended effects of development projects on natural resource-dependent communities, particularly in the outer islands where the expansion of forest concessions, plantations and other development projects has led to conflicts over traditional land use rights and access to natural resources by local communities.

### Land Use Planning and Administration

2.5 While accurate information is not readily available, a recent estimate of current land use in Indonesia is provided in Table 2.1, below. According to the 1984 "Consensus Land Use Plan", out of the total of 191 million ha, about 47 million ha of non-forested land would continue to be used for agriculture and human settlements (including municipal and industrial uses), and 144 million ha were officially classified as "forest land"--to be administered by the Ministry of Forestry. Of these forest lands, 19 million ha have been set aside for the protection of biodiversity (10% of Indonesia's total land area), and 30 million for "watershed protection" purposes. To meet the needs of its growing population, and to reduce poverty in the outer islands, another 30 million ha are expected to be converted to agricultural use--including tree crops. The remaining 65 million ha are designated as production forests. Actual patterns in the use of land, and the current challenges of land use management in Indonesia are discussed below.

**Table 2.1: LAND USE IN INDONESIA**  
(in millions of hectares)

Land Use Type	Java		Sumatra		Sulawesi		Rest of Indonesia		Indonesia	
	ha	%	ha	%	ha	%	ha	%	ha	%
Forest	1.2	9.1	23.3	49.1	11.3	60.5	83.9	75.2	119.7	62.7
Bush/Scrub	1.4	11.0	7.7	16.2	2.2	11.7	7.4	6.6	18.9	9.9
Grassland	0.1	0.5	2.8	5.8	1.1	6.0	6.3	5.7	10.3	5.4
Shifting Cultivation	0.3	2.2	3.4	7.2	0.5	2.8	7.5	6.7	11.7	6.1
Upland	2.3	17.3	1.7	3.6	0.8	4.1	0.5	0.0	5.3	2.8
Wetlands	3.4	25.6	2.2	4.5	0.8	4.5	1.5	1.3	7.7	4.0
Tree Crops	2.4	18.0	3.5	7.5	0.8	4.2	1.2	1.1	7.6	4.0
Urban Areas	1.8	13.5	1.4	2.9	0.3	1.6	0.3	0.2	3.8	2.0
Other	0.5	3.8	1.6	3.2	0.8	4.6	3.1	2.8	6.0	2.7
<b>TOTAL</b>	<b>13.3</b>	<b>100.0</b>	<b>47.5</b>	<b>100.0</b>	<b>18.6</b>	<b>100.0</b>	<b>11.5</b>	<b>100.0</b>	<b>190.9</b>	<b>100.0</b>

Sources: BPS; RePPProT (1990) The Land Resources of Indonesia.

**2.6 Land administration.** Land use management in Indonesia is a highly complex matter, in part due to a lack of clarity in the legal framework and in part due to the number of different agencies that are involved, as described in Box 2.1 below. In addition, land markets are not well developed, and this constrains the allocation of land to its highest and best use. The key issues include problems in land titling and registration, inadequate recognition of traditional (*adat*) property rights, the loss of revenue arising from the transfer of state land to private developers, and inefficiencies associated with the granting of "location permits" for the purchase of privately-held land for development projects. The costs and complexity of land transactions discourage more sustainable use of agricultural land, act as a deterrent to business investment, result in lower land-use density than would be desirable in urban areas, and increase the costs of urban infrastructure.

#### **Box 2.1: Land Administration in Indonesia**

**The Legal Framework:** The Indonesian Constitution of 1945 (Article 33) provides that land, water, air and the natural richness contained therein shall be under the control of the state, and used for the maximum well being of the people. Other major elements of the legal framework include the Basic Agrarian Law (No. 5, 1960) which (inter alia) provides for the registration of traditional (*adat*) land rights into modern land rights through land titling procedures, the Basic Forestry Law (No. 5, 1967) which facilitates commercial access to forestry resources, and more recent legislation on spatial planning (Law No.24 of 1992) which provides a framework for the designation of protected areas and for influencing the locational decisions for future development at the national, provincial and local levels. In total, however, there are an estimated 2,000 additional laws and regulations that relate to the administration of land.

A major effort is currently underway by BPN (the National Land Agency) and the Legal Documentation Center of the University of Indonesia to compile and categorize these laws, as the first step in the process of clarifying and simplifying the legal framework for land administration.

**The Institutional Framework:** There are at least 12 major institutions involved in land management in Indonesia. These include: **BPN** - responsible for land titling and registration, as well as management of state land and some land use planning; **Ministry of Forestry** - which controls all land under forest cover in Indonesia, currently about 70% of the total land area; **Other Central Ministries** - including Agriculture, Transmigration, Public Works and Industry, who sponsor and approve major development projects that impact on land allocation and use; **Ministry of Finance** - responsible for administration of the fiscal cadastre for land and property tax collection; **MLH** - which is responsible for environmental aspects of land management, including the coordination of spatial planning; **BAPPENAS** - responsible for the coordination of sectoral and cross-sectoral development planning, and whose Chairman heads the National Spatial Planning Coordination Agency; **BAKOSURTANAL** - responsible for the national geodetic network, the preparation of standardized base maps and natural resources mapping; **BAPEDAL** - responsible for the management of environmental impacts (including implementation of the EIA program); and **BKPM** - the Indonesian Investment Coordinating Board, which approves most major foreign and domestic investment proposals.

Improving the coordination of land administration activities among these agencies will be a major challenge in GOI's efforts to ensure the sustainable management of this vital and valuable national resource.

**2.7 Land Titling and Registration.** Under existing laws, only land outside the defined forest boundaries can be titled, of which only about 22% has been registered. The need for improved land titling is most acute in densely settled provinces (particularly on Java), and in urban and peri-urban areas. A number of special programs have been initiated to expedite land titling in several of the larger cities, with varying degrees of success.<sup>1</sup> In many areas of the country, in spite of the high formal and informal costs of registration, there is often up to a year's backlog of applications for land certificates and registration. Uncertainties about land ownership have led to premiums of 20-50% in the market value of registered land in fast-developing urban and urban fringe areas, and in some rural areas where recent investments in infrastructure have led to increased growth. In many rural areas, because of the high cost of land transactions, agricultural land is generally rented out on short term leases rather than sold. Such arrangements discourage long term investments in land improvements, since short term leases do not provide sufficient security of tenure. The absence of registration also makes it difficult for smallholders to use land as collateral for long-term financing.

**2.8 Traditional Land Rights.** The existing legal framework does not provide adequately for the registration of land rights based on traditional (*adat*) law. The Basic Agrarian Laws (UUPA and UUPK) recognize these rights, which include land ownership rights as well intermittent rights essential to the livelihood of traditional villages. The latter include the right to clear land (*hak membuka tanah*), the right to harvest forest products (*hak memungut hasil hutan*), the right to take water (*hak guna air*) and the right to breed and catch fish (*hak pemeliharaan dan penangkapan ikan*). However, existing land registration regulations only consider land ownership rights, and contain almost no provision for registering intermittent rights. This leads to social conflicts when, in the absence of registration, *adat* rights must yield to land rights granted by Government authority on the basis of other legislation (e.g., forestry law). This shortcoming creates special difficulties for indigenous people (especially in forest areas), and other problems where local villages have developed community-based systems for sustainable management of natural resources, as described below.

**2.9 Under-Pricing of Public Lands.** Currently there are several regulations which set the prices at which public land is conveyed to private developers--in each case at levels far below current market prices of land. A recent report estimates that BPN, the National Land Commission, charges about 23% of market price for vacant land and 14% for occupied land for ownership grants of state lands, about 11% and 7% respectively for 30-year leases, and about 4% and 2% respectively for 10-year leases (Hoffman, Ferguson and Rerimassie, 1991). While the original intention--to expand the use of Indonesia's vast natural resources--was laudable, the need for more efficient land use, and the increasing importance of mobilizing domestic resources for development purposes, would suggest that the virtues of competitive auctions should be considered wherever this would be feasible.

**2.10 Permits for Land Acquisition.** Another factor which leads to less-than-optimal land use in Indonesia is the existing land acquisition system. Under the current system, BPN or the local government issues a land acquisition permit (*izin prinsip* or *izin lokasi*) which authorizes a developer to purchase land from private owners in a specific area for a defined project. As the developer has an

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<sup>1</sup> These programs, which have included the registering of fixed-term (e.g., 20-year) land-use rights, rather than full ownership titles, have raised the share of registered titles to about 27% in Jakarta, 30% in Semarang and 38% in Surabaya.

exclusive right to purchase the land, this permit provides "monopsonistic" bargaining power in relation to the owners, which may lead to a low offering price for the land and a corresponding reluctance of the owners to sell. Once an acquisition permit is issued, there is no obligation for the developer to proceed with site development within a limited period of time. Consequently, in a number of major Indonesian cities there is a large stock of vacant land for which development has been approved but on which nothing is happening.

2.11 Improving the efficiency of land allocation and use will require clarification and simplification of the legal system, better coordination among the agencies responsible for land management, and greater reliance on market forces. In some cases, Government intervention will be needed—for the protection of critical ecosystems and for better coordination of development planning, especially in urban areas (see Chapter 4). Together, such measures would help to resolve many of the current issues of sustainability in the use of land on Java and in the outer islands, as noted below.

### Land Use Issues on Java

2.12 Nearly all of the land suitable for agriculture on Java has already been brought under intensive cultivation. Forest cover is limited to the uplands, most of which has been designated as watershed protection areas. Along the coast, as a result of increasing population pressure, the once-extensive mangrove forests have been largely depleted or converted to other uses—including rice paddies and fish and shrimp ponds. Current issues of land use on Java include the encroachment of farmers into protected areas in the uplands, the excessive conversion of prime (often irrigated) rice land for urban and industrial use as a result of increasing urban sprawl, and the unrestricted growth of industry—much of which is concentrated in and around the main urban centers (see Chapter 3).

2.13 **Unsustainable Agricultural Practices in the Uplands.** The encroachment of poor and landless farmers into protected areas in the uplands of Java has led to deforestation and increasing erosion from intensive cultivation of annual crops on steep slopes. An earlier study (Magrath and Arens, 1989) found that the rate of soil erosion was associated with productivity losses of 4-5% a year, and that the farmers themselves bore most of the costs of this erosion. In economic terms, the total cost of soil loss was estimated to be about \$340-400 million per year (in 1989 dollars), of which about \$315 million is due to on-site reduction in the productivity of the land, and the remainder is due to "off site" effects such as increased sedimentation of reservoirs, irrigation systems and harbors. As noted in Chapter 1, the rapid growth of employment opportunities in Java's urban centers should help to provide a solution in the longer term. In the near and medium term, however, the introduction of more sustainable agricultural practices is likely to remain a high priority.

2.14 GOI has attempted a number of initiatives to "re-forest" upland areas (through the Ministry of Forestry's "regreening" program, and through experiments with "social forestry"), but the results to date have been somewhat disappointing. It has also attempted to control erosion through the encouragement of soil conservation practices and "off-farm" structures (e.g., check dams) and, more recently, the introduction of more sustainable farming technologies (see Box 2.2). Changes in the pattern of demand for agricultural products in which upland areas have a comparative advantage (tree crops, fruits, and other horticultural products) should be helpful. Switching from highly-erosive annual crops—for which the uplands are particularly unsuited—to these "environmentally benign" crops will not only help to reduce soil loss, but will also raise the incomes of participating farmers.

**Box 2.2: Approaches to Soil Conservation in the Uplands of Java**

In contrast, to the ecologically sustainable development of irrigated rice in the lowlands of Java, agricultural practices in the uplands have resulted in a growing problem of soil erosion arising from over-intensive cultivation on steep slopes and inappropriate farming technologies. In response to growing concern over land degradation and its impact on critical watersheds, GOI adopted a program of soil conservation practices in the 1970s based largely on experience in temperate countries but modified for Java's steep slopes and intense rainfall.

This program called for heavy investment in physical structures, including minor dams, terrace construction and storm flow waterways. To encourage the adoption of these practices, an elaborate system of costly demonstrations, subsidies, and extension was created. These technical solutions, however, proved to be unprofitable and unsustainable: the physical structures took significant areas of land out of cultivation, required large amounts of labor and close cooperation by adjacent farmers, and required considerable maintenance. Only subsidies in cash and kind lured farmers to adopt portions of the proposed package, but they paid little attention to the exacting technical standards required for effective conservation or profitable farming on treated land, and ignored unsubsidized maintenance. Despite substantial investments by GOI, therefore, upland areas continued to degrade.

As recognition of the failure of this standard technical package grew, efforts were made to develop a more sophisticated and flexible approach. Attention shifted from structural approaches to a broad range of farmer controlled and farmer instituted agronomic and vegetative measures including contour hedges, agro-forestry, intercropping and other practices. An array of simple, low-cost options for soil conservation now exist that are broadly appropriate for many areas where soil erosion is a problem. A number of recent studies indicate, however, that the profitability of such techniques can vary significantly for farmers depending on their individual circumstances, such as field slope, crop mix, and labor availability. No single approach, therefore, will be best for all farmers in a given area.

Experience to date confirms that soil conservation efforts can be successful when extension services make information available on a menu of techniques, from which farmers can select those most likely to yield the best results for their specific conditions. The challenge now is to develop an effective institutional framework that will support the implementation of this new approach on a broader scale.

**2.15 The Expansion of Urban and Industrial Land.** The urban population of Indonesia is growing at about 5.6% per year, nearly triple the rate of the overall population. To accommodate this growth, land is being converted from agricultural to urban use at a rate of about 25,000 ha per year, of which 15,000 ha are in Java. As much as 10% of Java's rice lands may be converted over the next two decades. According to a recent Bank assessment there are reasonably good prospects for maintaining Indonesia's current self-sufficiency in rice, despite this conversion, through further technological advances. On a per-hectare basis, the productivity of land used for urban and industrial purposes is normally higher than that in agricultural use. Unfortunately, the distortions in the land market noted above--especially the granting of development permits--has led to relatively low-density land use patterns in the older areas of many large cities. This has encouraged urban sprawl, in areas less-well-served by urban services, and an unnecessarily rapid conversion of prime agricultural land to urban and industrial use. (Issues of urban spatial planning and industrial location policy are discussed in Chapter 4.)

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## Land Use Issues in the Outer Islands

2.16 **The Key Issues.** There are three key issues of land management in the outer islands: (i) the need to preserve the country's valuable stock of biological diversity and critical ecosystems through more effective management of the nearly 50 million ha of forests and other land set aside as parks and nature reserves and for watershed protection, most of which is located in the outer islands; (ii) the need to ensure that the 30 million ha of land that may converted to agricultural use--to reduce poverty among the growing population in the outer islands--is put to sustainable use; and (iii) the need to ensure that the 65 million ha of forest land currently designated for commercial exploitation on a sustainable basis is, in fact, managed sustainably. Challenges in the management of parks and other protected areas are addressed in Section C, below, and issues in the sustainable management of production forests are discussed in Section D.

2.17 **Agricultural Development in the Outer Islands.** Attention to poverty and regional development, together with the scarcity of land on Java, would clearly suggest the need for a stronger focus on agricultural development in the outer islands where the possibilities of non-farm employment are lower than on Java. The available evidence would also suggest that there is considerable scope for further agricultural expansion in the outer islands on already degraded forest lands, particularly though more intensive development (and replanting) of tree crops and expanded production of higher value food crops (World Bank. 1990). This strategy would also be consistent with the changing structure of domestic demand, where a major challenge for the future will be to diversify agricultural production--with particular attention to fruits and vegetables, livestock--especially poultry, and fisheries--including aquaculture (World Bank. 1992b). Greater attention to environmental issues will be needed, however, including the development of farming systems adaptable to the more fragile ecological base of converted forest lands and improved management of agricultural pests and diseases.

2.18 **Past Government programs for the development of agriculture in the outer islands** have recorded a number of important successes, including the smallholder tree crop program which has played a critical role in reducing widespread poverty. There have been failures as well, most often because of poor project design and implementation, but sometimes due to the special challenges of the underlying ecosystem. Experience with smallholder settlement in swamplands is a case in point. Both the best and the worst of GOI's transmigration settlements have been in low-lying coastal areas where the high organic content of swamp soils allow some older communities to produce two to four times as much rice as upland communities (World Bank. 1986). The technical demands of drainage systems and the problems of rats and other pests, however, put a high premium on careful project design and implementation and effective "O&M". Similar concerns apply where shrimp ponds have been the focus of development, since many of these are affected by contamination from upstream water sources and the lack of proper management techniques. To meet these challenges will require (inter alia) more effective linkages between agricultural research, extension services and farmers.

## Issues of Equity and Burdensharing

2.19 **Rapid growth and development over the past decade** has led to increasing conflicts over the use of land and access to other natural resources. A major concern is the loss of land and livelihoods for those displaced by development projects. A review of past experience highlights a number of areas of concern:

- o Levels of compensation are often not adequate to ensure that lost property can be fully replaced, especially in the project area, since land prices may rise significantly even before those affected receive their compensation payments. Cash compensation alone, therefore, may not permit the restoration of lost livelihoods.
- o People who contest the measurement of their land or the rate of compensation offered must address their complaints to the "land acquisition committee", i.e., the same entity which carried out the measurements and determined the compensation rates in the first place. This process is not conducive to an impartial review of such disputes.
- o Although consultation with affected people is provided for under the laws and regulations of the AMDAL process, and this process is expected to cover social and economic as well as environmental impacts, in practice consultations with local communities are still quite limited and are not always fully effective.
- o People displaced by projects are sometimes offered houseplots, but rarely farmland, unless they choose to join a transmigration scheme in the outer islands. For people displaced by transmigration schemes, there is the option of claiming a place within the scheme. While the benefits provided by the transmigration program conform to Bank guidelines on resettlement, fewer project-affected people are choosing to join them.
- o People who are resettled to a new area will most often suffer a high level of stress due to changes in livelihood and the disappearance of most of what is familiar to them. This is particularly true for older residents, and is one reason they choose not to join Government-sponsored transmigration schemes.

2.20 The immediate need is for a clearly articulated and carefully implemented Government policy on compensation for lost property rights and the resettlement of affected people, with particular attention to ensuring that their livelihoods are fully restored. Other issues of equity and burden-sharing include the impact of development projects on forest-dwelling and forest-adjacent communities in the outer islands (discussed in Section D, below), and the impact on communities throughout Indonesia of increasing pollution from industrial sources (see Chapter 3). These issues are examined further in Chapter 6, which includes a number of suggestions for improving the participation of local communities in the design and implementation of development projects and for the resolution of disputes between communities, firms and project sponsors.

## C. ECOSYSTEMS AND THE MANAGEMENT OF PROTECTED AREAS

2.21 Indonesia has a strong vested interest in conserving its natural resources and protecting the living ecosystems upon which so much of its economic activity depends. The direct and measurable benefits--from agriculture, timber and non-timber forest resources (including food, medicines, and building materials), fish, shrimp and other marine products, and related revenues from tourism--are enormous. The indirect benefits are equally important, albeit more difficult to quantify. Terrestrial and marine ecosystems: protect watersheds and coastal areas from erosion; provide an essential habitat for the growth of plants, animals and other valuable organisms; assimilate human,

industrial and agricultural waste; and help to regulate microclimates. They also play a role in maintaining global ecosystems, and are a repository of Indonesia's (and to some extent, the world's) remaining "gene pool". In addition to whatever intrinsic value may be ascribed, Indonesia's biodiversity represents a storehouse of considerable potential value to future generations--including, for example, improvements in food crop genetics and the benefits of as-yet-undiscovered drugs.

2.22 GOI clearly recognizes the need to protect these national and global ecological assets. It has set aside almost 10% of its land area (about 19 million ha) as terrestrial parks and reserves (a larger proportion than in most developed and developing countries), and another 15% (about 30 million ha) as permanent protection forests to safeguard important watersheds. Designated and proposed marine conservation areas amount to an additional 30 million ha. Together, these areas cover the major biogeographic regions. While some habitats are well represented, others (low-land forests and wetlands in particular) will need to be expanded. Properly managed, these areas would then be sufficient to protect both Indonesia's biological diversity and most of its critical ecosystems. The main challenge lies in implementing all of these plans effectively. The total number of existing and proposed parks, reserves and protected areas, for example, is over 700. Of these, 79 have high priority for the protection of biodiversity, but only 31 have well-defined management plans, and not all of those plans have been fully implemented (World Bank. 1990).

### Functions and Value of Living Ecosystems

2.23 Indonesia possesses what is probably the richest diversity of plant and animal species, ecosystems and genetic resources in the world. Although Indonesia covers only 1.3% of the earth's surface, it includes 10% of the world's flowering plant species, 12% of the mammal species, 16% of the reptile and amphibian species, 17% of the bird species and 25% or more of the world's fish species (see GOI/WWF. 1991). Indonesia's rainforests are of special interest because of their extreme diversity of living organisms, with often very specialized habitat requirements. Indonesia's coastal and marine ecosystems also shelter a rich variety of corals, fish and other reef organisms.

2.24 These living ecosystems are threatened by the growing rate of exploitation of natural resources, often in excess of sustainable levels, and an accelerating increase in water sediments from logging and water pollution from industrial and domestic sources (see Annex F). This is perhaps best illustrated by the environmental impacts and consequences of development on the multiple functions of coastal and marine ecosystems:

- o mangrove forests provide coastal erosion control, hatcheries for a variety of off-shore marine life (fish and shrimp), and fuelwood for local consumption. Large areas of coastal mangroves, however, have been converted into commercial fish and shrimp ponds (*tambak*), or destroyed by over-exploitation for charcoal production or as a source of woodchips for pulp and paper production;
- o coastal wetlands are important as marine hatcheries and wildlife sanctuaries, but also help to filter pollution from inland water run-off, thus protecting more fragile marine ecosystems. Many of the wetland areas on Java, however, have been converted to *tambak* or rice production, and some in the outer islands have been drained to provide land for transmigration sites.

- o coral reefs and seagrass beds also provide erosion control and support valuable marine life, and many harbor rare and beautiful fish species with the potential to attract foreign tourists. Some reefs in the outer islands, however, have been destroyed by the effects of soil erosion from logging operation in upper watersheds, and others are threatened by excessive exploitation for building material and uncoordinated tourism activities. Rare fish and other species are also being lost due to the demand for personal aquariums.
- o coastal seas serve to diffuse and carry away pollution from inland industries and urban centers. On the north coast of Java, however, wetlands rice and *tambak* production is increasingly threatened by excessive pollution from inland streams and runoff, and the marine life in Jakarta Bay already contains potentially harmful levels of mercury.

2.25 While there is no question about the importance of Indonesia's ecological assets, their precise value in economic terms is difficult to assess. This is partly due to the lack of information on the "market value" of ecological "goods and services", and partly due to methodological issues--including uncertainty about the underlying functions of many ecosystems and how they work, and problems of quantifying certain "non-market" values. It is important to try, however, since the economic value of ecosystems has been too often underestimated in the past. The usefulness of quantifying ecosystem benefits as an input to policy decisions is clearly illustrated by the recent assessment of mangrove forests surrounding Bintuni Bay in Irian Jaya (see Box 2.3).

2.26 Unfortunately, detailed analyses of ecosystem values are not available for other areas of Indonesia. While it is difficult to develop very precise estimates, a review of the available efforts to evaluate the economic benefits of biodiversity in Indonesia, suggests that the annual economic benefits of ecosystem protection run into the billions of dollars and are comparable to those of a major economic sector (UNEP/KLH. 1992). The components of this estimate are summarized below.

2.27 **The Value of Non-timber Forest Products.** Indonesia's forests yield a wide variety of products, including rattan, wild meat, fruits, vegetables, nuts, spices, perfumes, seed oils, fodder, anti-microbial agents, other potential pharmaceuticals, pesticides, food colorants, flavors, food preservatives, dyes, adhesives, resins, gums, waxes and latexes. More than 6,000 species of plants and animals are utilized in Indonesia. While many of these products have been domesticated for cultivation, most require an undisturbed natural environment, and their availability is dependent on the conservation of natural ecosystems. The economic value of these products is difficult to establish, but current research suggests that it is significant. At Bintuni Bay, the value of such products was estimated at \$29/ha per year, and could be as high as \$100/ha per year, based on a total value of non-timber forest product exports of about \$300 million per year.

2.28 **The Value of Fisheries and Other Marine Products.** Coastal and wetland ecosystems have a high degree of biological diversity and productivity, and they provide essential hatcheries, nurseries and other habitat functions for a large proportion of Indonesia's marine life. These systems are productive because this is where mixing occurs of nutrient and energy flows from the land and the sea, and the most valuable resources are therefore in the places where this mixing is dynamic--especially in estuaries and mangrove swamps. Marine ecosystems, including coral reefs and seagrass beds, also provide essential breeding, nursery and/or feeding grounds for Indonesia's near-shore and high seas fisheries.

### BOX 2.3: The Economic Benefits of Living Ecosystems: The Bintuni Bay Mangroves

Indonesia has about 4 million ha of mangroves, mostly on Irian Jaya, Sumatra and Kalimantan. One of the largest remaining mangrove forests consists of about 304,000 ha around Bintuni Bay in Irian Jaya. Proposals have been put forward both to conserve most of this area and to expand the exploitation of the forest for the production of woodchips for export. At risk are the economic benefits of near-shore shrimp (for export) and fish (for the domestic market), as well the sources of livelihood to local inhabitants, including hunting and gathering and the protection from erosion of farmland. A recent Canadian-funded study prepared for MLH (Ruitenbeek, 1991) compared the costs and benefits of the proposed options, taking into account their linkages with the other economic benefits of the different ecosystem functions:

- **Fisheries.** The most important benefit was from a shrimp harvest of about 5,500 tons annually, which was being marketed at about US\$6.25/kg, yielding a net revenue of about \$29 million/year. The sustainability of this harvest is correlated to the area of mangroves, which serve as nursery habitat for the shrimp and other marine life. In addition to the commercial shrimp harvest, there is a substantial by-catch of non-commercial fish which is sometimes eaten by the crews or traded to local people.
- **Timber.** A chipwood plant was being established with a capacity of about 300,000 m<sup>3</sup>/year of mangrove with an export value of about US\$40/m<sup>3</sup>. Given a mangrove stock of about 80 m<sup>3</sup>/ha, and a 30-year rotation period, the study compares the benefits and costs associated with various mangrove management options, ranging from a clear cut of the entire area over 20 years to a complete ban on logging, and various scenarios linking the partial or total removal of the mangrove to the sustainability of the shrimp fishery.
- **Minor Products and Local Uses.** A detailed survey of 101 households established the net benefit of traditional hunting, fishing and gathering production from the mangrove areas at about Rp 6.5 million/year/household (representing about 70% of total household income) of which only about 15% was traded through the market. For the 2,700 households in the area, the benefits from the mangrove are worth about Rp 18 billion/year (equivalent to about \$9 million/year).
- **Erosion Control.** The value of the erosion control function of the mangroves was estimated on the basis of the value of agricultural output from local production. This was estimated from the household survey to be Rp 1.9 million/year/household, equivalent to about \$2.6 million/year for the entire area.
- **Option and Existence Values.** This reflects the economic value of ecosystem as a genetic feedstock for pharmaceutical, foodcrop, cashcrop, or other products, as well as its potential amenity value. An analysis of 1987-90 foreign funding for biodiversity projects concluded that the willingness to pay for the preservation of an ecologically important and diverse ecosystem such as a rainforest that would otherwise be degraded could reach US\$30/ha/year, with typical values of approximately half that amount. On this basis, the existence value of the intact preservation of Bintuni Bay mangrove are valued at \$15/ha/year, equivalent to about \$4.6 million/year for the entire area.

Based on this evaluation, the study concludes that a selective cutting approach covering 25% of the total mangrove area was the option that maximized the asset value of the resource (i.e., the net present value of the stream of benefits from the mangroves over the long term.) An important caveat in this conclusion is the extent of uncertainty about actual linkages among ecosystem functions. The penalty for "guessing wrong" may be quite high. This would imply that a more conservative approach may be appropriate, including the adoption of additional measures (selective cutting, replanting, etc.) to mitigate the effect that timber cutting may have on other functions. This example clearly demonstrates the need for careful cross-sectoral assessment of the costs and benefits of alternative ecosystem development and conservation options.

2.29 Indonesia's fisheries represent a major economic sector, with value added of about Rp 3.8 trillion in 1991 (nearly \$2.0 billion), and accounting for about 5% of non-oil exports. As noted in Annex F, the sustainability of this activity has long been affected by overfishing, but a determination of the extent of the impact is difficult since the original stock levels are unknown. Case studies have found that a typical shrimp haul from the Arafura Sea has declined from 4-5 tons per year in 1970 to less than 1 ton in 1990. Similarly, the general trend in catch per boat and catch per fisherman has declined in many of the communities that depend for their livelihood on nearshore fishery resources. Development projects that lead to the destruction of coastal and marine ecosystems have thus had major economic effects on coastal fishing villages (see, for example, Box 6.8).

2.30 The linkage between aquatic ecosystem preservation and fisheries production can be used for the economic valuation of coastal resources. In the Bintuni Bay study, the value of the shrimp fishery linked to the coastal mangrove forest was estimated at about \$95/ha per year. While such a value cannot be readily attributed to all 4 million ha of mangrove in Indonesia, the high value of mangroves for fisheries is corroborated by reports that in areas of Sumatra and Bali, local fishermen are voluntarily replanting mangroves--in places where they have been depleted--in an attempt to reestablish fishery productivity which has been lost (Ruitenbeek. 1991)

2.31 Dependent fisheries can also be used to value coral reef. The Taka Bone Reef in Sulawesi, for example, the largest in Indonesia, covers an area of about 360 km<sup>2</sup>. In a healthy condition, it produces about 30 tons for fish/km<sup>2</sup> per year, which would be greatly reduced if the reef is degraded. Assuming a value for the fish of \$1/kg, it can be estimated that the fishery on a healthy reef has a potential value of about \$11 million/year. This does not include the value of more wide ranging species such as tuna, which may have a strong dependence of coral reefs (Tomascik. 1991).

2.32 **The Value of Ecotourism.** An increasing proportion of world tourism activity is nature tourism or ecotourism based on an appreciation of species richness and environmental integrity. This tourism can play an important role in supporting the conservation of species and ecosystems. Apart from providing tangible incentives for local people to protect habitats, direct benefits for conservation can also result from the presence of tourists in a protected area, which can deter hunters and farmers from entering it illegally. Of course, the presence of tourists can also increase damage from increased traffic, infrastructure, pollution and collection activities, and care must be taken in designing and regulating tourism to minimize these effects.

2.33 The share of Indonesia's \$3.2 billion tourism industry attributable to tourists attracted by biodiversity is difficult to determine, as local expenditures at biodiversity-related destinations would only be a fraction of their total expenditures. Even the local expenditures are difficult to establish. A 1986 study of the Mount Leuser National Park, a 793,000 ha tropical mountain forest in Sumatra, projected local revenues from ecotourism related sales and services to be about Rp 5.5 billion (equivalent to \$2.7 million, or \$3.40/ha per year) in 1990 and Rp 8.7 billion by 1995 (Costello, Anwar and Thorari. 1990). While these local revenues are only a fraction of total ecotourist expenditures, they appear to be sufficient, in relation to the projected expenditures for infrastructure development, park management and tourist services, to yield financial returns that are higher than those of alternative uses for the land, such as development of a palm oil estate.

2.34 **Option and Existence Values.** The economic benefits of natural ecosystems extend also to "option and existence" values that reflect their future amenity value as well as the potential value of their genetic endowment. Historically, the willingness to pay for the benefit of conserving biodiversity has been difficult to capture, but this situation is changing. Some aid programs (USAID, for example) have explicit grant funds available for biodiversity conservation projects. NGOs, such as the World Wide Fund for Nature, have been actively transferring money through "debt for nature" swaps to developing countries in exchange for protection of biodiversity. The Global Environment Facility (GEF), has already approved \$193 million in grant funds for projects in developing countries to combat biodiversity loss and is expecting to fund biodiversity projects at a rate of \$200-300 million per year. Follow up to the 1992 Earth Summit in Rio, including **Agenda 21**, the **Biological Diversity Convention** and the **Statement on Forest Principles**, are expected to lead to improved technical support and compensation to developing countries for the protection of biodiversity.

2.35 The full implications of these recent agreements remain to be seen. As noted above, the capturable benefits from the preservation of an ecologically important and diverse ecosystem such as rainforests that are threatened with destruction could reach \$30/ha per year, with typical values at approximately half this amount. It would obviously be unrealistic to expect such values to be applicable to all of Indonesia's 19 million ha of terrestrial reserves and 30 million ha of marine conservation areas. And, where the likelihood of success is lower, the willingness to pay for protection efforts would be correspondingly reduced. Another potential source of revenue involves royalty and other payments by pharmaceutical companies for access to specific reserves and/or a share in the patents that may ensue from samples removed from those areas. Experience to date with such arrangements is quite limited, but prospects in Indonesia should be actively explored.

### **The Sustainable Management of Parks and Protected Areas**

2.36 To protect its most valuable natural ecosystems, Indonesia has designated 303 terrestrial conservation areas accounting for 10% of total land area or about 19 million hectares. Twenty-three marine conservation areas have also been designated and another 200 are proposed which will bring the total area of marine reserves to approximately 30 million hectares. The PHPA Directorate in the Ministry of Forestry is responsible for the management of conservation areas and for preparing and implementing regulations in accordance with new legislation which came into effect in 1990. Substantial progress has been made in establishing the scientific basis for setting up the conservation area system, largely through the efforts of the PHPA and international environmental NGOs such as the World Wildlife Fund and the International Union for the Conservation of Nature. However, according to the **Biodiversity Action Plan for Indonesia (1991)** the system may still be inadequate to conserve all of Indonesia's rich biodiversity. Some habitats such as montane forests are well represented, while others like lowland forests and wetlands are poorly represented. Many of the designated conservation areas have small or nonexistent budgets and little effective management.

2.37 Effective management of parks and protected areas is constrained by a number of factors. The Bank report **Indonesia: Forests, Land and Water** (1990) identified the main constraints as: lack of participation by local people, lack of environmental awareness, lack of a management framework for identification and control of resource utilization, lack of priorities and strategies, shortages of manpower, overcentralization, and insufficient funding. All of these constraints are still present, but some progress has taken place. GOI, with assistance from the Worldwide Fund for

Nature, for example, has prepared a National Biodiversity Action Plan; most donor organizations provide support to conservation activities; and "buffer zone" style projects adjacent to conservation areas are being developed. Institutional, fiscal and human resource constraints, however, continue to impede the effective implementation of conservation and biodiversity protection programs.

**2.38 Integrated Conservation and Development.** The greatest challenge lies in the fact that much of the pressure on Indonesia's protected areas comes from the effects of local people to secure a livelihood. The impact of human activity on the management of biological resources obviously needs to be taken into account in designing and implementing conservation strategies. Particularly in cases where the establishment of conservation areas would affect traditional land use rights of local communities, effective protection will depend on a strategy to compensate these communities and to develop income-generating alternatives that will stabilize land use outside protected boundaries and increase local incomes, in order to reduce pressure for further resource exploitation within the protected area itself. The concept of an Integrated Conservation and Development Project (ICDP) has emerged as specific model to implement this strategy. An example of this approach is detailed below in Box 2.4. It should be noted, however, that the ICDP model remains largely untested.

**Box 2.4: An Example of Integrated Conservation and Development:  
The Kerinci-Seblat National Park, Sumatra**

GOI, together with a number of international and local conservation and development organizations is preparing an Integrated Conservation and Development Project (ICDP) designed to help protect the valuable ecosystems of the newly created Kerinci-Seblat National Park in Sumatra. In addition to support for project development and the coordination of arrangements for implementation, the proposed program of activities would include:

**Park Management.** This component would include (a) institutional policy development and research (plans to strengthen the institutional capacity for park management and biodiversity inventory and research), (b) park boundary rationalization, and (c) park development (e.g., general administration and operation, protection, zonation, resource management). The initial five year program would focus on laying the foundations for sustainable management over the longer term.

**Forest Concession Management.** This component would include (a) support to increase the capacity of forest concessions in biodiversity and wildlife management, watershed management, and encroachment control, (b) strengthening the institutional capacity to implement AMDAL and other operational procedures, and (c) fostering experimentation in community forest management.

**People/park Interaction.** This component would (a) strengthen local planning capacity through incorporating conservation considerations in spatial planning, (b) resource rights rationalization (i.e., land rights inventory, land titling, and community forests), and (c) local area development. These activities would involve all stakeholders, e.g., local residents, local government, landowners. Parts (b) and (c) would begin on a small scale, in many cases only in one to three sites during the initial period, and build on existing models and implementation mechanisms.

2.39 **Community-based Management Systems.** As a complement to ICDP, GOI's strategy for conservation area protection should also take into account the existence of traditional community-based systems for the management of terrestrial and marine ecosystems. The efficiency and equity of such systems are well documented. The efficiency advantage is based on the villagers' detailed knowledge of local ecosystems and their motivation to manage local resources in a sustainable manner. The equity advantage is based on the fact that traditional management systems derive their legitimacy in the eyes of local residents from their grounding in broadly accepted local notions of social justice. This allows the community to effectively enforce sanctions on individuals who transgress collectively-established restrictions. The application of informal means of social control is far more efficient than dependence of government agencies to enforce regulations, which is constrained in any event by the extensive and scattered conservation area system in comparison with GOI enforcement capacity. In some cases, however, Indonesian laws and regulations have tended to undermine, rather than to support, such community-based resource management systems.

2.40 As illustrated in Box 2.5, for example, a central factor in a traditional community's ability to manage a resource is the issue of property rights. When a community's traditional rights over natural resources are undermined and the government is unable to enforce a new system of property rights (e.g., one based on fishing licenses), an open access situation occurs, with no limits on individuals' access to and exploitation of the resource. In the absence of clear and enforceable property rights, individuals have an incentive to maximize production even at the expense of resource sustainability and long term societal good.

**Box 2.5: The Decline of the Trochus Fisheries in Maluku**

Indonesian fisheries laws and regulations do not explicitly recognize local community tenures or property rights (i.e., government fisheries policy is based on the assertion of total state management authority over marine resources and waters). The failure to recognize local community resource rights and responsibilities undermines the coastal communities' capacity to manage local resources and local incentives to comply with fisheries laws. Combined with inadequate government capacity to enforce fisheries regulations, this has resulted in de facto open access conditions to marine resources throughout much of Indonesia. Open access conditions, and the attendant lack of control, have resulted in overexploitation of fisheries in many parts of Indonesia.

This is illustrated by the trochus fisheries in Maluku (see Bailey and Zerner, 1992), where the traditional *sasi* institution governs the timing of fishing seasons, the types of gear and techniques that may be used, the species that may be taken, and zones where fishing is permitted. This system is inculcated through annual rituals and enforced by customary village-appointed officials. For trochus shells, until the 1970s, *sasi* harvest prohibitions lasted from three to five years, a period sufficient to allow populations to mature and reproduce. In recent years, a rise in market prices led local officials in some areas to assert government dominion over *sasi* rights, claiming that development needs overrode the customary right of local communities, and to encourage annual harvests from the reefs, by private sector agents as well as local villagers. This has led to the depletion of trochus stock. On Saparua Island, for example, annual harvests are yielding only 800 kg, where previous harvests on a three-year cycle were 3000-4000 kg.

2.41 Other factors tending to erode local communities' ability to manage natural resources include expanding human populations and the emergence of national and international markets for newly valuable resources. The resulting demand for larger scale exploitation has tended to attract outside commercial interests to develop the resource and often led to the loss of community control. While overall economic benefits may increase in the short term, these benefits frequently have been won at the expense of resource depletion in the long term and the erosion of resource allocation systems based on local standards of distributional equity.

2.42 To improve the management of natural resources, and reduce the risk of their being depleted through the uncontrolled action of market forces, GOI needs to recognize and support community-based environmental management institutions through formalizing their traditional rights to manage the resources. In particular, as discussed in para 2.8, explicit legal recognition needs to be given to the concepts of customary law (*hukum adat*) and local territorial rights (*hak ulayat*), e.g., through appropriate amendment of the National Fisheries Law (No. 9/85). This would provide the legal basis for local communities to regulate the exploitation of local natural resources. Also, to encourage the establishment of community-based environmental management institutions, provision should be made to enable them to incorporate as rights-holding corporate bodies (*badan hukum*). Finally, the legal standing of local management institutions needs to be recognized through appropriate revisions in the National Administrative Law (No. 5/79).

2.43 **Ex-Situ Conservation.** As a complement to the protection of specific conservation areas and the managed development of surrounding buffer zones and other areas, the strategy for natural ecosystem protection, as formulated in the Biodiversity Action Plan, also includes the expansion of the data and information available on Indonesia's biodiversity and its dissemination to policymakers and the public, and the promotion of the utilization of biological resources in ways which are sustainable and less harmful than current practices. This ex-situ component of the conservation strategy includes: (i) national facilities to collect, store, maintain and document a reasonable proportion of existing plant genetic resources; (ii) field gene banks and tissue cultures; (iii) on-farm conservation; (iv) research; and (v) training and education.

#### D. THE MANAGEMENT OF FOREST RESOURCES

2.44 Indonesia has one of the largest areas of tropical forest in the world. While estimates vary, somewhere around 110 million ha of Indonesia's land area is covered with closed canopy forest, of which about 49 million ha is located in parks, reserves and protected areas and 65 million ha is designated as production forests. Indonesia's economy derives major benefits from this resource, which accounts for about 7% of GDP and 20% of non-oil exports. The soil and water conservation benefits provided by forests are vital for agriculture and the maintenance of economic infrastructure. Overall, the natural forests of Indonesia constitute one of its most important assets. With increasing population pressures, however, and the need for continued growth in employment and exports, a number of issues have arisen in the management of Indonesia's forests. These include: (i) the rate of deforestation (about which there is considerable uncertainty); (ii) the sustainable management of its production forests; and (iii) the welfare of forest-dwelling communities. These issues are discussed below, beginning with the question of the optimal use of Indonesia's natural forests.

## The Optimal Use of Forest Land

2.45 Forests and forest land have a variety of potential uses. Some of the land occupied by forest is potentially convertible into productive, profitable and sustainable alternative uses. Properly carried out, the conversion of such land may yield not only higher economic returns than standing timber, but gainful employment for rural people who have few alternative sources of income. Indeed, the conversion of forests to agricultural use has played a key role in the early development of most of the wealthier countries of Europe and North America. Given the special importance of moist tropical forests as a storehouse of the earth's biological diversity, however, and the value of forest cover in general for watershed protection, some must be preserved. As noted above, GOI has already set aside a very large proportion of its total land area for these purposes and, with the help of NGOs and the donor community, is attempting to ensure that these ecological assets are managed sustainably.

2.46 To meet the legitimate needs of rural communities in the outer islands, GOI has also designated some of its forest lands for conversion to agricultural use. The key issue here is manage the process of conversion in a manner that leads to truly sustainable use over the longer term. Finally, to optimize the returns from its forest resources, GOI has encouraged the exploitation of commercially valuable timber in certain areas through the grant of forest concessions. Government regulations specify a "selective cutting" approach to concession management that, combined with careful logging and replanting, was expected to allow these production forests to be managed sustainably. There is considerable evidence, however, that poor logging practices and the failure of replanting efforts have resulted in extensive degradation in many of these concessions and, together with the opening up of forest areas through logging roads, an increase in deforestation. The overall rate of deforestation is a matter of growing concern, but there are a number of unanswered questions about both the rate at which it is occurring and how much is due to various causes.

### Deforestation: How Much is Occurring and Why?

2.47 The rate of deforestation is uncertain, as inadequate information exists to objectively estimate the extent of forest cover. The two most commonly cited estimates of deforestation in Indonesia are by FAO (1990), which gives a figure of 1.3 million ha per year, and the World Bank (1990), which estimates a rate of 0.9 million ha per year. A more recent study (Dick, 1991) argues that these estimates are too high, because they: (i) assume that tenure change is equivalent to conversion; (ii) assume that all causes of deforestation are additive, whereas in fact smallholders, for example, will usually occupy lands already disturbed (by logging, fire, etc.); and (iii) appear to assume that all area under shifting cultivation has been deforested in the last 10-15 years, whereas in fact shifting cultivators occupy much land which has never been forested or has been cleared for many years. By adjusting the estimates on this basis, the study derives an alternative deforestation rate of 0.6 million ha per year (See Table 2.2). (The Natural Forest Inventory estimate of the Ministry of Forestry indicates an average of 800,000 ha per year.)

2.48 One of the most interesting implications from this estimate is that programs sponsored or encouraged by the GOI account for about 67% of all deforestation. This challenges the conventional wisdom, which holds that traditional shifting agriculture is the main agent of deforestation. If correct, it points to the scope for improved Government policy to influence the process so as to make it more consistent with the optimal use of forest lands for the long term.

2.49 In several of these estimates, **smallholder conversion** of forest land for agricultural use is a major cause of deforestation. A distinction is needed, however, between spontaneous migrants, who constitute the single largest agent for land use change in the country, and traditional shifting cultivators. The traditional agriculturists generally use and re-use the same area of secondary forests, with long term rotation cycles that allow for forest regeneration and soil rebuilding. In general, such swidden farming is so much a part of the local ecological history that the continual re-use of clan-owned secondary forest should probably not be considered deforestation at all. Deforestation by traditional agriculturists is thus limited to those cases where increasing population pressures result in either expansion into primary forests or in serious soil degradation due to the too-frequent re-farming of forest lands. Such distinctions, however, cannot be made from present data sources (Dick, 1991).

**Table 2.2: ESTIMATES OF DEFORESTATION IN INDONESIA**  
(thousands of ha)

Source of Estimate	AGENT							
	Trans Dev't	Estate Crops	Swamp Dev't	Spontaneous Transmig	Trad'd Ag.	Forest Harvest	Fires	TOTAL
WB 1990 <sup>1</sup>	250			500		80	70	900
FAO 1991 <sup>2</sup>	300	274	85	461		80	113	1315
TAG 1991 <sup>3</sup>	65	11.4	30.4	156.5		NE <u>a/</u>	NE <u>a/</u>	262.9
MoFr 1992 <sup>4</sup>	300	160		300		77	478	1315 <u>b/</u>
Dick 1991 <sup>5</sup>	78.4	11.4	30.4	178.5	135.5	120	70	623

a/ NE: not estimated.

b/ Fire damage averaged excluding major Kalimantan fire loss.

Sources:

- <sup>1</sup> World Bank. Indonesia: Sustainable Development of Forests, Land and Water, 1990.
- <sup>2</sup> Food and Agriculture Organization (FAO). Situation and Outlook of the Forestry Sector in Indonesia, 1990.
- <sup>3</sup> Transmigration Advisory Group (TAG). Forest Clearance Study. Ministry of Transmigration, 1991.
- <sup>4</sup> Ministry of Forestry (MoFr). Indonesia Tropical Forestry Action Program, 1992.
- <sup>5</sup> Dick, J. Forest Land Use, Forest Use Zonation, and Deforestation in Indonesia, Background paper for UN Conference on Environment and Development, prepared for KLH and BAPEDAL, GOI, 1991.

2.50 A major concern is the **lack of registration of traditional (*adat*) rights**, as discussed in para 2.8. The fact that only a small fraction of the *adat* rights have been registered makes it difficult for existing forest dwellers to prevent spontaneous transmigrants from taking over traditional clan lands and, lacking the cultural traditions of the indigenous agriculturists, farming the soils to exhaustion before moving on in search of new land. In addition to the registration of the rights of the traditional forest dwellers, the stabilization of the forest conversion process will also require the granting of secure tenure rights to existing spontaneous transmigrants, to give them an incentive to improve the land, become settled farmers and discourage them from clearing additional forests.

2.51 After small-scale agriculture, **commercial forest harvesting operations** are the next largest cause of deforestation. As noted above, logging operations in production forest concessions are expected to be managed in a sustainable manner through implementation the Indonesian Selective Cutting System (*Tebang Pilih Tanaman Indonesia* - TPTI). This most widely applied silvicultural management approach is based on the assumption that in the course of initial logging a residual stand will be left that will grow into economically harvestable timber in 35 years. However, a recent report (FAO, 1990) raises doubts about the effectiveness of this approach as it is practiced, and concludes that "commercial deforestation" could be widespread. Among its major findings are that:

- o required pre-logging inventories and post-logging residual stand inventories are not conducted properly or reported truthfully (in fact, only 2.2% of cutover lands have ever had a residual stand inventory).
- o over-cutting within annual cutting plans, and cutting outside approved boundaries is frequent (numerous examples are reported of logging activities encroaching into protection forests, nature reserves and even national parks).
- o re-logging at more frequent interval than the 35-year cycle is not uncommon, and low logging standards have led to significant residual stand damage on many concessions.
- o for a variety of reasons, control and supervision by the Ministry of Forestry has not been effective in the past.

2.52 An alternative indication that "commercial deforestation" may be exceeding the optimal limits of managed production is provided by the evidence on **illegal logging**. A precise quantification is difficult as both the legal level of logging, as well as the actual level, are in some doubt. Regarding legal removals, the Indonesia Tropical Forestry Action Plan states that 1988 log production reached 32 million cubic meters (cum), whereas Forestry Statistics of Indonesia, gives figures of 27.6, 26.4 and 21.9 million cum for 1987/88, 1988/89 and 1989/90 respectively. Based on the production of plywood and sawn timber, however, the consumption of logs has been estimated at about 36-40 million cum annually. These estimates suggest that actual logging levels may be significantly higher than the legal removals, and also higher than the consensus estimate of the sustainable cutting level—about 31 million cum at present.

2.53 GOI is fully aware of all of these issues. Recognizing the need to improve the management of its forest resources, it has prepared a Tropical Forest Action Plan, and has declared its intention to meet the provisions of the International Tropical Timber Organization (ITTO) for certification that its exports are from "sustainably managed forests" by the year 2000. To achieve this goal, while also meeting the needs of the wood processing industries, will not be easy. Recent reviews of the forest land classification system suggest that up to 20 million ha of current production forests should be reclassified as protection forests. The recognition of "adat" rights for forest-dwelling communities presently occupying production forest lands would further reduce this classification, and thus constrain future production possibilities. The key issues are noted below. Policies and instruments for improved forestry management are discussed in Chapter 4, and the need for institutional strengthening of the relevant agencies is noted in Chapter 6.

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### Issues in the Sustainable Management of Production Forests

2.54 A recent analysis of alternatives for natural forest management concludes that the sustainable management of forests, based on an improved (monocyclic) approach which relies on regeneration from seedlings (which must grow for 70 years before being ready for logging), is a financially and economically viable low intensity land use. Thus, where soils are poor and higher intensity land uses such as treecrops and shifting cultivation have lower returns, the "highest and best" land use is to manage the forest sustainably. Infrastructure and accessibility are two other factors to consider. The analysis also suggests that decisions about the conversion of forests to other uses need to be considered with care, as the removal of a regenerating stand is essentially irreversible. Thus, while the areas where sustainable forest management is the highest and best use of land is difficult to determine in practice, it is essential that the policy framework provide appropriate incentives for decision-making. At present, however, actual incentives are highly distorted, as the prices of both land and logs have been set at levels far below their economic value.

2.55 As noted earlier, the existing system of land administration causes public lands, including forest lands, to be sold at prices far below market rates. This encourages the conversion of forest land for other uses, and undermines the incentives for the sustainable management of forests and the development of degraded lands for timber plantations, treecrop plantations or settled agriculture. In addition to encouraging the extensive--rather than intensive--use of land, the low sale price of state lands also results in a loss of revenue for the State.

2.56 The level of log prices has become central to the debate on sustainable forestry management in Indonesia. As a result of export bans or prohibitive taxes on the export of logs, combined with relatively low fees on timber extraction, the domestic price of raw logs is significantly below world market prices. The current royalty level of about \$15 per cubic meter greatly undervalues the resource, which could be worth as much as \$90 per cubic meter based on the international market price of comparable quality logs. Low domestic prices for logs, in turn have led to inefficiency in both the logging and wood processing industries and a lack of market diversification. Poor logging practices waste an estimated 8 million cubic meters annually, including damage to the remaining trees, while the lower technical efficiency of Indonesian plywood mills wastes another 3 million cubic meters. Together, this amounts to a third of the total annual harvest.

2.57 Pricing alone, however, will not resolve the problem of poor logging practices and other shortcomings in the current system of concession management. The duration of concession agreements, for example, is too short to provide the necessary incentive for sustainable long-term management. Improvements in the enforcement of forest regulations will become increasingly important, especially since higher log prices would raise the incentives for illegal logging and reduce the incentives for careful logging. As noted in Chapter 4, the solution to these challenges will require a combination of improved incentives, research, and extension services, and more effective oversight by central and local authorities responsible for the sustainable management of forest resources.

2.58 Some of the pressure on natural forests could be offset through the development of forest plantations, provided they are located on already degraded forest lands. The undervaluation of timber resource, however, also affects the financial attractiveness of timber plantation investments, to the extent that their products have to compete with natural forest timber for the production of sawnwood,

plywood and pulpwood. A review of the economics of pulpwood plantations in Indonesia indicates that higher at-mill log prices would greatly enhance the financial incentives for private sector investment in plantation forests--and essentially eliminate the need for the sizable subsidies that are currently being offered. Since, of all the inputs needed for Indonesia's wood processing industries, logs are the most likely to become a constraining factor, the development of the plantation sector could play a vital role in ensuring the sustainability of both the processing industries and the natural forests over the longer term (see Chapter 4).

### **Equity Issues in the Development of Forest Resources**

2.59 While the scale of the problem is not known, there is increasing evidence of unintended effects of development projects on forest-dwelling and forest-adjacent communities in the outer islands, where the expansion of forest concessions and plantations has led to conflicts over traditional land-use rights and access to natural resources by local communities. Estimates of the proportion of forest land occupied and/or claimed by local communities in Indonesia range from 10% to 60% of the total forest area. The size of the population that depends on the forest has been variously estimated as 1.5 million, based on a highly restrictive definition of "isolated people" used by the Ministry of Social Affairs, to as many as 65 million, which would include all forest dependent peoples, including indigenous people, established transmigrants, and recent spontaneous and official transmigrants.

2.60 Further research will be needed to determine the extent of this problem. What is clear, however, is that wherever Government-designated forest land overlaps with areas in which forest-dependent communities farm, hunt, fish and gather non-timber forest products, there is a serious potential for significant adverse impacts on local communities. Case studies and anecdotal material suggest the following major problem areas (Zerner, 1992):

- o Because of the existence of traditional or customary rights over forest land by local communities, the introduction of large scale forestry operations has sometimes led to the disenfranchisement of these traditional users, at the cost of their livelihoods;
- o The processes of road construction and site clearing (particularly in Kalimantan) have sometimes destroyed areas already under traditional agricultural use, without prior consultations with--or compensation to--the local community; and
- o In some instances, river access to markets by boat for traditional users has been obstructed by bridge work related to forestry operations. Water quality and river fisheries have also been affected by the obstruction of feeder streams.

2.61 There are numerous accounts of instances where forestry operations have commenced without adequate consultation with local communities. Protests, when forthcoming, have sometimes elicited the response that these activities have the approval of the central government, and that no further dealings with local groups are required. As noted earlier, this can lead to the erosion of local customary institutions which might otherwise offer a mechanism for more sustainable management of regenerating forest areas. As noted in Chapter 5, it may also lead to the alienation of local communities from the goals and intentions of the Government's development plans, and clearly conflicts with the stated objectives of more participatory and harmonious development processes.

2.62 GOI is aware of the growing potential for conflict between traditional land users and development projects, and has recently passed two important laws containing provisions to protect of the rights of indigenous people: Law No. 10 of 1992 recognizes the rights of "vulnerable people" to their customary territorial heritage; and Law No.24 of 1992 provides for community access to planning information and consensual participation in development activities that will affect the livelihoods of the community. While implementing regulations must still be issued, these provisions greatly strengthen the legal framework in support of natural resource-dependent communities, and clearly signal GOI's intentions to ensure them more equitable treatment in development.

2.63 The Ministry of Forestry has introduced the HPH *Bina Desa* program as one means of addressing these issues, under which concessionaires are expected to invest in income-generating programs for forest dependent communities. Implementation of the HPHBD rests with the concessionaire. Where they act in good faith and are capable, this produces good results, but otherwise there is relatively little that either GOI or the communities themselves can do to ensure good performance. Even when concessionaires have been well-intentioned, adverse results have sometimes occurred (e.g., the introduction of imported technologies, such as wet-rice farming from Java, which have failed under local conditions). The near future offers a favorable window of opportunity to improve on both the consultation process and the involvement of forest communities in the benefits of forestry management, since a large number of natural forest logging concessions (HPH) and applications for plantation concessions (HTI) are due for consideration. Within this context, it would be appropriate to consider recent proposals for the channeling of a certain proportion of forestry fees into a development fund that could be used to support income-generating activities for those communities that might otherwise be effected adversely.

## E. WATER RESOURCES MANAGEMENT

2.64 The development of water resources over the past 25 years--irrigation systems in particular, but also water supply systems in urban areas and hydro-electric facilities to meet the growing energy demands of the industrial sector--has played a critical role in stimulating rapid growth and reducing widespread poverty. Issues of water resources management (both quantity and quality) will be increasingly important in the years ahead--especially on Java, which has 60% of the population, 70% of irrigated agriculture and 75% of industry. Issues of water quantity include increasing competition between alternative uses (agriculture, industry and municipal), and between surface and groundwater in rapidly growing urban areas. These issues are discussed below.

### The Availability of Water on Java

2.65 In the aggregate, Java is well endowed with rainfall. The problem is one of seasonal and annual variations, with dry season flow in the main rivers only 20% of annual flows--and as little as 10% in a dry year (see Table 2.3, below). This is compounded by the fact that river basins on Java are relatively steep and short (less than 50 km on average), resulting in most of the wet season water running unused into the sea. While a number of dams have been built, their reservoirs hold less than 5% of total river flows. Several additional sites have been identified for possible future dams, but implementation is likely to be constrained by high population densities and the social and economic costs of resettlement.

**Table 2.3: WATER SUPPLY AND DEMAND IN JAVA, AVERAGE AND DRY YEARS (m<sup>3</sup>/sec)**

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
<b>Mean discharge from surface sources</b>												
Average	9,346	10,177	10,019	8,392	5,902	3,115	2,233	1,555	1,752	2,629	5,195	7,428
Dry Year	4,166	4,536	4,466	3,736	2,630	1,388	995	693	781	1,172	2,316	3,311
<b>Mean Requirements</b>												
Irrigation <u>a/</u>	2,840	2,840	2,840	2,840	2,840	2,840	2,840	2,840	2,840	2,840	2,840	2,840
M&I <u>b/</u>	101	101	101	101	101	101	101	101	101	101	101	101
<b>Total</b>	2,941	2,941	2,941	2,941	2,941	2,941	2,941	2,941	2,941	2,941	2,941	2,941
<b>Balance in an Average Year</b>												
	6,405	7,076	7,528	5,441	2,961	174	-607	-1,255	-1,088	-211	2,355	4,487
<b>Balance in a Dry Year</b>												
	1,224	1,595	1,524	795	-311	-1,553	-1,845	-2,147	-2,059	-1,668	-524	369

a/ Assumes year-round demand.

b/ M&I Municipal and industrial.

Source: Adopted from Indonesia: Sustainable Development of Forests, Land, and Water. World Bank, 1990.

### Emerging Issues of Supply and Demand

2.66 In volume terms, water use in agriculture currently accounts for 98% of total demand, while industrial and municipal requirements together account for only about 2%. The consumption of water by households and businesses will grow rapidly over the next two decades, but their needs will still only amount to about 5% of total demand by the year 2010. To support continued rapid growth and improvements in human health and welfare, however, these needs will have to be met.

2.67 This will require a shift of water in the dry season from agriculture to municipal and industrial use. As the competition among uses expands the pressure on water resources during the dry season, the governing principle should be to allocate water to the highest and best use. An indicator of this is the value of water in competing uses. Since the economic value of water used for irrigation, at about Rp 80-100/m<sup>3</sup>, is much lower than its value in urban and industrial uses, which ranges from 250 Rp/m<sup>3</sup> to over Rp 2,500/m<sup>3</sup> (as measured by the price users are willing to pay), the gradual shift in the allocation of water from irrigation to non-agricultural uses would be entirely in accord with the principle of highest and best use.

2.68 Except at particular localities, and mostly in the dry season, this shift should not pose a constraint on agricultural production. To the extent that urban and industrial development takes over irrigated lands, at the rate of about 15,000 ha per year, or 10% of Java's total irrigated paddy by the year 2010, the water requirements of the new users should be roughly equivalent.

2.69 Such diversions are already beginning to occur, but greater attention is needed to the process of water allocation so as to minimize the social and economic costs for farmers and the potential disruption to agricultural output. Part of the solution will come from the gradual adjustment in crop patterns away from dry season paddy towards less water-intensive food crops. The growing demand for fruits and vegetables for the urban population, for example, will require the conversion of 48,000 ha of wetland paddy and 56,000 ha of rainfed rice land (World Bank, 1992b). As localized reductions in irrigation allocations are expected to become more frequent, however, particularly during the dry season and near the urban areas, a detailed review of water balance will be needed, as well as a more integrated approach to the "real time" management of water resources. GOI is aware of the need to manage its resources on an integrated river basin basis, and is currently assessing the regulatory and institutional changes that this would require. As noted below, it will be especially important to ensure the coordination of groundwater as well as surface water use.

### Issues of Sustainability

2.70 The heavy reliance on groundwater to serve industrial and domestic needs in large urban areas cannot continue indefinitely. This is particularly true for the northern coastal cities of Java where groundwater is being abstracted at greater than replenishment rates, leading to saltwater intrusion and land subsidence—with attendant increases in floods and waterlogging which, in turn, aggravates groundwater pollution from septic tanks and leaching pits. Private abstractions of groundwater in Jakarta, for example, at more than 300 million cubic meters (MCM) per year, exceed the amounts supplied by the city's water supply authority. They are also far in excess of the estimated annual recharge capacity of Jakarta aquifers of about 114 MCM. This overdraft is causing land subsidence ranging from 4 to 9 cm a year, increasing the risks of flooding and threatening superstructure stability. Moreover, there is clear evidence that the overabstraction is causing salinization of the groundwater along the coast. In the northern parts of Jakarta, the salinized area is expanding rapidly (at a rate of 0.5 - 1.0 km/year), and now extends 15 km south from the coast.

2.71 In relation to industrial users, **pricing distortions** appear to be a major factor contributing to water use inefficiency and excessive groundwater abstraction. The present system of piped water tariffs in Indonesia is based on: (a) a block tariff structure, with higher rates charged beyond certain threshold levels; and (b) cross-subsidization, with tariffs for industry several times higher than those levied on residential consumers. This results in piped water tariffs for industry that average Rp 850/m<sup>3</sup>, as compared with groundwater abstraction charges leveled on deep wells averaging Rp 240/m<sup>3</sup>, with the higher prices for piped water not compensated for by differences in either quality or reliability. And, while industries using large amounts of water from deep wells may pay as much as Rp 1,200/m<sup>3</sup> in extraction fees, and an additional Rp 200/m<sup>3</sup> in pumping costs, the tariff for comparable levels of surface water use is Rp 2500/m<sup>3</sup>. With these price differentials, it is not surprising that 72% of the factories in Jakarta are estimated to be using groundwater sources.

2.72 Another contributing factor is the fact **incomplete registration of wells**. According to a recent estimate (IWACO, 1992), there approximately 2,700 deep wells are registered in Jakarta, contributing to recorded abstraction levels of about 31 million cubic meters (MCM)/year. Actual rates of abstraction, however, are believed to be considerably higher, possibly as much as 95 MCM/year. In addition, there are close to a million shallow wells, accounting for an estimated additional 200 plus MCM/year of withdrawals. As noted above, these levels of abstraction far exceed the estimated groundwater recharge capacity of about 114 MCM/year.

2.73 A further issue is that the relatively high piped water tariffs charged to small industries and businesses, typically three times those charged to households, is likely to be encouraging these customers to report as residential water users. This set of perverse incentives may account for the remarkable low number of small industries (44) registered as PAM Jaya customers in 1992. On this basis, a large share of the piped water supply subsidy may be benefitting small industries and businesses, for whom the subsidy was not intended.

2.74 The challenges of meeting the demand for water in the dry season are complicated by the growing volume of pollution from urban and industrial sources. As described in Chapter 3, most of the major rivers on Java are seriously polluted with a combination of urban and industrial waste, including increasing amounts of toxic and hazardous material. During the dry season, when river flows are greatly reduced, the concentration of pollution increases dramatically. Reducing over-extraction of groundwater aquifers in major urban centers will increase future demand for surface water. Many of these aquifers are also polluted, primarily by human waste but with increasing evidence of industrial waste as well. Fecal contamination of water supplies represents a serious threat to human health, which is compounded during the rainy season by the flooding of low-lying areas—in part due to the clogging of drains and canals by municipal solid waste. Toxic waste poses an even more serious threat to human health and welfare. Samples of groundwater in Jakarta, and marine life in Jakarta Bay, for example, already show evidence of contamination by toxic metals. In addition to the issues of water allocation during the dry season, therefore, much greater attention will be required to issues arising from the pollution of surface and groundwater from urban and industrial sources.

## F. THE MANAGEMENT OF ENERGY RESOURCES

### The Development and Use of Energy Resources

2.75 **Energy Demand.** The domestic demand for energy has grown rapidly over the past 25 years, averaging nearly 7% per annum in the 1980s. At the present stage of development, however, the energy intensity of GDP is still relatively low. (With 3% of the world's population, Indonesia consumes only about 0.3% of total energy.) The combination of rapid growth, the changing structure of production, and the backlog of demand from both industry and households means that energy demand will grow even faster in the decades ahead. Over the next 25 years, the demand for petroleum products is likely to expand by a factor of 9, mainly driven by growth in transportation, and the demand for electricity by a factor of 13, reflecting the growing share of electrification in manufacturing as it moves into higher technology products, and the rising standard of living of the population with attendant demand for additional lighting, electrical appliances and air conditioning.

2.76 **Availability of Energy Resources.** Indonesia is fortunate in having a large base of primary energy resources, including oil, natural gas, and coal, and considerable hydroelectric and geothermal potential. These resources are sufficient not only to meet domestic demand, but also to provide substantial export earnings. In the past, Indonesia has relied heavily on the development and use of its petroleum resources for power generation, transport and industrial sector needs, as well as a major source of foreign exchange. As a result of the rapid growth of domestic demand, however, combined with a gradual depletion of reserves, it now appears likely that the country will become a net oil importer as early as the year 2000. (Since 1978, exports of liquified natural gas have expanded significantly, but these still only account for about 8% of total exports.)

**2.77 Strategy for Energy Development.** In view of the value of petroleum in international markets, GOI has pursued a policy of prolonging the availability of an exportable petroleum surplus by promoting the supply of alternative energy resources where these can provide an economic substitute for oil. The power sector is playing a central role in this fuel substitution strategy. At present, in terms of primary energy, about 53% of power generation (in both the public and the private sector) is based on oil (fuel oil and diesel oil), 21% on coal, 7% on natural gas, 18% on hydro and 1% on geothermal. To meet the future demand for electricity, the power sector's expansion strategy is based on a reduction in the share of oil through expanding the use of natural gas, hydro and geothermal to the extent these resources are available and economical, with the remaining power needs to be met by coal. Based on this strategy, the power sector's primary fuel mix is expected shift, albeit very gradually. By 2020, the shares of oil and hydro are projected to decline to about 30% and 5%, and the shares of coal and natural gas are projected to increase to 56% and 8% respectively, with the share of geothermal remaining at about 1%.

### **Energy Conservation and Demand Side Management**

**2.78 The Potential for Energy Conservation.** Despite the projected rapid increase in energy consumption, and current efforts to improve the efficiency of production and distribution, relatively little attention has been devoted in the past to the enhancement of energy efficiency among the users of energy. The potential for improved efficiency in the transport sector of Indonesia, which accounts for about 35-40% of petroleum consumption, has never been studied. The potential for efficiency improvements in the industrial sector was reviewed most recently in the mid-1980s, when a survey of 67 industrial establishments identified a conservation potential of about 23% for all forms of energy used in various industrial processes. Of this amount, about 8% could be saved simply through "better housekeeping" measures and improved operating practices, at essentially no cost to the user, and another 15% could be saved through relatively modest plant improvements. The latter would require some additional investment, but these would have a relatively short payback period, after which the savings would represent a profit to the firm. The results of the survey are summarized in Table 2.4.

**2.79** Based on the results of this survey, GOI initiated an Industrial Energy Conservation Program under which KONEBA (an energy conservation company) was established. Since then, KONEBA has conducted a number of energy audits of public and private sector firms, and resulting changes have brought about substantial efficiency gains, most notably in the fertilizer sector. Its effectiveness, however, is constrained by a number of factors, including a lack of clear institutional objectives and the difficulty of selling its services to the private sector. The potential for energy efficiency, therefore, of the magnitude identified in the survey, remains to be achieved.

**2.80** A major obstacle to the improvement in energy efficiency is that the engineering, architectural, construction, operation and maintenance communities appear to lack both the requisite knowledge of energy efficient technology and the incentives to use this technology. The recent elimination of energy price subsidies (with the exception of the subsidy for kerosene) have moved the incentives in the right direction. The introduction of pollution-based fuel taxes, as illustrated in Chapter 4, would provide additional incentives and, at the same time, help to reduce urban vehicle emissions. A promotion program to facilitate the transfer and application of energy efficient technology and practices could be a useful complement to accelerate their adoption, but such a program would need to be designed with care, taking KONEBA's recent experience into account.

**Table 2.4: ENERGY CONSERVATION POTENTIAL IN SELECTED INDUSTRIES, 1985**

<u>Industry</u>	<u>Plants Surveyed</u>	<u>Energy Consumption ('000 boe/yr)</u>	<u>Potential Energy Savings</u>			
			<u>Total Potential</u>		<u>Without Investment</u>	
			<u>('000 boe/yr)</u>	<u>% of Cons.</u>	<u>('000 boe/yr)</u>	<u>% of Cons.</u>
Fertilizer	4	4,015	803	20	400	10
Basic Chemicals	4	145	36	25	17	12
Plywood	4	75	16	21	8	11
Cement	2	2,872	536	19	205	7
Sugar	10	1,500	435	29	75	5
Glass	3	340	119	35	34	10
Textiles	15	1,360	353	26	68	5
Paper	10	380	114	30	27	7
Tires	2	150	47	31	12	8
Food, beverage, tobacco	11	290	58	20	11	4
Ceramic	2	10	5	20	1	10
<b>TOTAL</b>	<b>67</b>	<b>11,137</b>	<b>2,519</b>	<b>23</b>	<b>858</b>	<b>8</b>

Source: Transenerg, Energy Conservation in Indonesia, Final Report, Paris, 1985.

2.81 **Demand Side Management in the Electricity Sector.** Analysis carried out for other developing countries suggests that the potential for Demand Side Management (DSM) in the use of electricity could, over the longer term, reduce generation requirements by about 20% on average, and peak demand requirements by about 30%. The achievement of actual savings will depend on a variety of factors, including the regulatory framework, the pricing of energy resources and the capacity of public and private institutions to support an effective program of DSM activities.

2.82 In Indonesia, the impact of a comprehensive set of DSM programs could be quite significant. The rapid rate of growth in energy demand combined with historically low energy prices, would tend to suggest that existing efficiencies in the consumption of electricity leave considerable scope for improvement. A 1992 study on development of DSM programs in Indonesia (RCG/Hagler Bailly, Inc.) concludes that a set of pilot programs covering only a portion of potential opportunities in Indonesia could save 1.4% of total generation requirements and 4.6% of peak load demand. The most important of the proposed measures, and the projected energy and capacity savings for the year 2000 are summarized in Table 2.5.

Table 2.5: PROJECTED SAVINGS FROM DEMAND SIDE MANAGEMENT PROGRAM<sup>2</sup>

	Capacity Saved (MW)	Energy Saved (Gwh)
<b>Industrial Sector Program</b>		
Improved Motors	17	138
High Efficiency Lighting	10	74
Time-of-Use Tariffs	176	214
Interruptible Tariffs	176	481
Energy Management Audits	1.5	204
<b>Commercial and Public Buildings Program</b>		
Improved Air-Conditioning	6.6	62
High Efficiency Lighting	9.8	66
Building Energy Performance Standards	32.9	271
<b>Residential Program</b>		
Improved Refrigerators	22.9	121
High Efficiency Lighting	50.7	206
<b>Total Savings</b>	<b>486</b>	<b>1716</b>

Source: RCG/Hagler, Bailly, Inc., 1992.

2.83 Examples of possibly significant savings exist throughout Indonesia. For example, new commercial buildings in Jakarta tend to use flat glass curtain walls, with no insulation or exterior sun shading and unitary air-cooled chilling systems. The trend appears to be towards the adoption of architecture that has been developed in industrialized countries with a temperate climate, with little application of the more traditional and energy-efficient tropical architecture with its sun-shaded exteriors. The preference for air-cooled unitary split systems, as opposed to water-cooled central chillers, is driven by the need to conserve water and the expense of ground and piped water use. An indication of the potential savings is suggested by a detailed assessment of potential energy savings in a single 15-story building complex, which concluded that electricity use could be reduced by about 40% through the use of energy efficient building design, centralized water-cooled air conditioning and improved lighting (Goldsmith, Deringer and Lewis. 1993).

2.84 It is important to recognize that energy conservation and DSM can only **reduce the rate of growth** of legitimate needs for energy in Indonesia over the coming years. It is equally important to note, however, that reducing the growth in demand, especially for electricity, will be increasingly important, since the shortage of supply could lead to a serious constraint to economic growth. GOI has initiated the preparation of a National Energy Master Plan and a National Energy Conservation Plan through the Ministry of Mines and Energy. The implementation of these plans should obviously be given a high priority--on economic, as well as environmental, grounds.

<sup>2</sup> The DSM pilot program is proposed to begin in 1993 and conclude in 1999, by which time the savings will be achieved.

### Prospects for "Exhaustible" Energy Resources

2.85 At the present rate of production (515 million barrels in 1991) Indonesia's proven and potential petroleum reserves of about 11 billion barrels would last about another 20 years. This reserve/production ratio is below the worldwide average of 34 years but is close to the non-OPEC average of 16 years. The main options for extending the depletion horizon is the enhancement of petroleum reserves involving additional exploration to discover new fields (there could be as much as 40-50 billion barrels of oil in as yet undiscovered fields) and improving the recovery ratios of known fields. Both approaches require substantial investments. At the current price of crude oil (ranging from \$16-18/barrel), there is little incentive for additional reserve enhancement or a major increase in petroleum exploration. Petroleum production is likely to decline, therefore, in the coming years.

2.86 For the long term, the sustainability of energy supplies will depend on the development of energy resources other than oil, with which Indonesia is abundantly endowed. The 104 trillion cubic feet (tcf) of proven and potential gas reserves, for example, would be sufficient for 40 years at the current rate of production (2.5 tcf in 1991), and the 25 billion tons of coal resources would suffice for several centuries at either the current rate of production (about five million tons in 1991) or the rate that could be envisaged for the year 2000 (of 30-40 million tons, including exports).

### Prospects for "Renewable" Energy Resources

2.87 The share of renewable energy sources in the total energy mix is not likely to increase significantly over the coming decades, for a variety of technical and economic reasons:

- o **hydropower** is already being developed where suitable sites have been identified. PLN is projecting its own hydroelectric capacity to increase from about 2,300 MW in 1992 to about 6,800 MW in 2004. The total hydropower potential of Indonesia has been estimated at about 75,000 MW, but a major constraint to further development is that the greatest potential (over 35%) is in Irian Jaya, which has less than 1% of total electricity demand, while Java, with about 80% of the demand, has less than 10% of the total potential, most of which has already been developed (Nippon Koei Co., Ltd and P.T. Indra Karya. 1993). Overall, hydropower generation is expected to increase from 9.3 Twh in 1990 to about 32 Twh in 2020, but its share of total power generation is likely to decline from 18% to 8% over this period.
- o **geothermal** resources are also being developed at a rapid pace, with potential resources approaching 10,000 MW: Java 5,500 MW; Sulawesi 1,400 MW; Sumatra 1,100 MW; other islands 2,000 MW. Economically feasible reserves, however, may be limited to about 1,000 MW (Geothermal Energy New Zealand, Ltd. 1987). Of these, 140 MW has already been developed and current plans envisage about 700 MW in use by 2004. Further expansion is possible, and new investments in their exploration and development could be stimulated through appropriate incentives. A key issue, however, is the competitiveness of geothermal on Java, where the electricity grid is well developed and the cost of geothermal has to be compared with large scale coal-fired or gas-fired combined cycle stations. Geothermal generation can be projected to increase from 0.8 Twh in 1990, accounting for 1.5% of total generation, to about 10 Twh in 2020, but the relative share would remain essentially unchanged (i.e., less than 2% of total generation).

- o **biomass-based** power generation represents a major option, based on the large amounts of waste materials generated in Indonesia's agriculture and forestry sectors. Its economic feasibility will vary depending on local circumstances, but tends to be highest when generation is undertaken as an add-on to an existing mill or, for stand-alone dedicated power plants, when scale is small (50-100 Kw) or operating hours are high.
- o **solar PV** technologies are well proven but they are expensive compared to diesel power and their economic viability is limited to remote communities where the cost of diesel is high and loads are small. GOI is currently assessing the feasibility of PV systems for rural electrification, and about 10,000 PV systems have already been installed. The analysis of its environmental benefits would have to take into account the fact that it mostly substitutes for kerosene used in lighting, rather than fossil fuel-based power generation, but there appears to be considerable scope for expanding its use in rural areas where households would otherwise not be connected to existing or planned grids.
- o **wind** energy conversion systems are competitive with diesel-based generation in areas with average wind speeds above 4 m/sec. In Indonesia such wind resources appear to exist in parts of Eastern Indonesia (e.g., East and West Nusa Tenggara), but the potential demand loads in these areas are relatively small due to the low population densities.

### **Environmental Implications of Energy Sector Development**

2.88 The expected rapid growth in production and consumption of energy will have important implications for the environment. The use of petroleum fuels, mostly by transport and industry, is concentrated in urban areas and constitutes a major factor in the deteriorating ambient air quality of Indonesia's major cities. The use of coal for power generation by PLN and industrial firms is also a concern in terms of both local emission of particulates and the contribution to global warming. Other concerns include the environmental effects of oil spills, coal mining, and effluents from power plants. As noted in Chapter 3, however, urban air pollution appears to be the most critical environmental issue arising from energy use in Indonesia. Vehicle emissions are the principal source of this pollution, and the greatest damage is caused by the health effects of particulates and lead.

## **CHAPTER 3**

# **THE GROWING THREAT OF ENVIRONMENTAL POLLUTION**

## CHAPTER 3

### THE GROWING THREAT OF ENVIRONMENTAL POLLUTION

#### CONTENTS

	<u>Page No.</u>
A. INTRODUCTION . . . . .	67
B. POLLUTION FROM URBAN SOURCES . . . . .	67
The Pace and Pattern of Urban Sector Growth . . . . .	67
The Availability of Safe Water . . . . .	68
Issues in Sanitation and the Disposal of Human Waste . . . . .	70
Challenges in the Management of Solid Waste . . . . .	71
The Growing Problem of Urban Air Pollution . . . . .	72
C. POLLUTION FROM INDUSTRIAL SOURCES . . . . .	74
The Pace and Pattern of Industrial Sector Growth . . . . .	74
The Nature of Industrial Pollution . . . . .	75
Pollution Intensities and Loads . . . . .	77
The Location and Concentration of Industrial Pollution . . . . .	79
From Pollution Loads to Population Exposure . . . . .	81
D. POLLUTION FROM OTHER SOURCES . . . . .	84
Environmental Implications of Energy Development . . . . .	84
The Hazards of Indoor Air Pollution . . . . .	85
The Special Case of Pesticides . . . . .	85
E. THE COSTS AND CONSEQUENCES OF ENVIRONMENTAL POLLUTION	87
The Health Costs of Pollution . . . . .	87
Other Costs and Risks . . . . .	90
Implications for Equity . . . . .	92
The Threat to Continued Rapid Growth . . . . .	93

## **THE GROWING THREAT OF ENVIRONMENTAL POLLUTION**

### **A. INTRODUCTION**

3.1 Continued rapid growth will be essential to meet Indonesia's development goals in the decades ahead. As noted in Chapters 1 and 2, this growth will rely extensively on the country's vast natural resources, but an increasing share will be concentrated in urban areas. While urbanization appears to be an inevitable result of the development process, the concentration of people in cities and towns simultaneously increases the concentration of pollution from human and economic activity and the number of people exposed to the health hazards of that pollution, with the urban poor least able to protect themselves from environmental degradation. Similarly, while rapid industrialization represents a vital economic transition, important for the growth of higher productivity jobs and non-oil exports, most industrial sector growth is also occurring in urban areas. Together, these trends are leading to increasing congestion and worsening environmental conditions in Indonesia's main urban centers, with important implications for the prospects of enhancing the efficiency of the "urban enterprise", improving the health and productivity of urban residents, and sustaining rapid economic growth.

3.2 The aim of this chapter is to examine the nature and consequences of environmental pollution. Pollution from urban sources is discussed in Section B, including human waste, solid waste and vehicle emissions. Past trends and projected future pollution loads from industry are explored in Section C, and pollution from energy, indoor air pollution and pesticides are described in Section D. A final section analyzes the costs and consequences of increasing levels of environmental pollution.

### **B. POLLUTION FROM URBAN SOURCES**

#### **The Pace and Pattern of Urban Sector Growth**

3.3 Urban development will play a key role in Indonesia's economic and social development as the country undergoes a major structural shift in the sources of growth and employment. Over the last two decades, the rapid increase in the manufacturing and services sectors have resulted in a significant increase in the rate of urban population growth such that about 55 million people (nearly a third of the total population) now live and work in urban areas. As noted in Chapter 1, by the year 2020, half the entire population may reside in urban areas. With a much larger total population, this would represent about 125 million people—or more than the entire population in 1970.

3.4 Census data indicate that population growth and rural-to-urban migration has been most rapid in areas where industrial concentration has taken place, particularly in medium and smaller sized towns (10,000-100,000 pop.) at the fringe of metropolitan centers. In DKI Jakarta, for example, the overall urban population grew by almost 7% per year between 1980 and 1990. However, in fringe areas where industrial output was expanding rapidly, population growth rates of over 17% per year were recorded (see Table 3.1). A similar situation exists for most large cities.

**Table 3.1: SPATIAL PERSPECTIVES OF URBAN POPULATION AND INDUSTRIAL GROWTH**

Geographic Area	% of national industrial output (excluding oil & gas)	1985 index of labor costs (Indonesia=100)	Annual Growth of Population (1980-1990)
Jakarta and surrounds	36.2	165	6.86 Surrounding area: 17.76
Surabaya and surrounds	11.1	98	5.88 Surrounding area: 8.68
Bandung and surrounds	6.7	72	5.80 Surrounding area: 7.30
Kediri	6.7	98	7.98
E.Coast Sumatra	3.9	95	8.78

Source: Hill, 1990, and Biro Pusat Statistic (BPS), 1990 Population Census.

3.5 As noted in Chapter 1, rapid urbanization in the years ahead will add substantially to the congestion and environmental pressures--already quite evident--in Indonesia's main urban centers. A review of the available evidence on current environmental conditions in major metropolitan areas, together with projected future trends in pollution loads and an assessment of the potential costs of further environmental degradation, clearly indicates the need to pay much greater attention to issues of human waste (sewerage and sanitation), solid waste (including both collection and disposal) and vehicle emissions (especially lead and particulates). These issues, which will be exacerbated by pollution from industrial sources, are discussed below.

### **The Availability of Safe Water**

3.6 Unsafe water is one of the major sources of disease in Indonesia, and the lack of adequate sanitation facilities is a primary cause of fecal contamination of urban water supplies. An important indication of the threat this poses to the urban population is the fact that, with the exception of bottled water, most sources of water are not safe to drink. In a survey of about 30 shallow wells, mostly in North and Central DKI Jakarta, for example, in the dry season of 1989, all but two showed some signs of fecal contamination, and 73% had traces of ammonia (NH<sub>3</sub>) (JICA, 1991). High levels of chemical contamination were also detected in most wells, and 13% of the samples located in southern Jakarta were found to contain traces of mercury. Tap water samples taken in Jakarta in 1992 reveal a 73% rate of coliform contamination, with a 55% rate in drinking water from wells (Surjadi, 1993). At the Ngagel treatment plant in Surabaya, the water quality was considered sub-standard (untreatable by conventional means) in 80% of samples taken at the intake in 1989-90.

**Box 3.1: Contamination of Urban Water Supply**

- **At the treatment plant.** In Surabaya, the water quality of Kali Surabaya (measured in terms of dissolved oxygen or DO) was considered sub-standard in 80 percent of the samples taken at the intake of the Ngagel water treatment plant in the period of 1989-90 (Crooks 1991). The low levels of DO registered can result in taste and odor problems, and may require costly aeration in the pre-treatment stage. The bacteriological quality, as measured at the water treatment plant inlets in Surabaya, was also sub-standard, and there is evidence of deterioration of quality since the 1978/84 period.
- **In the pipes.** Tap water samples taken in Jakarta in 1992 revealed a 73 percent rate of coliform contamination (Surjadi, 1993). In Surabaya, bacteriological surveys conducted in 1990 showed that 55 percent of the samples of tap water exceeded the total coliform standard for treated water supply (Crooks 1991).
- **In public hydrants and water terminals, and in water-carrying containers.** Samples of water hydrants taken in 1986 in the Tambora district of Western Jakarta showed that 58 percent of the hydrants were contaminated with fecal coliform. About a quarter of the hydrant basins were used for bathing and washing (Masulili, 1986), posing the risk of transmission of water-borne diseases. In 1989-90, nearly 20 percent of the public hydrant supply sampled in North Jakarta showed signs of fecal coliform contamination (YDD, 1990). This study also reported the building of sanitary facilities near the water hydrants, and the installation of live-in superstructures directly above the water reservoirs.
- **During transportation and household storage.** The large variety in sizes and types of water containers compounds the risk of poor hygiene: in Surabaya, for example, old paint containers (still coated on the inside) were being used to transport drinking water, a possible source of chemical contamination. The practice of installing private house tanks to counteract unreliability of supply is also risky: approximately 60 percent of home reservoirs sampled in Surabaya in 1979, for example, were found to be contaminated with fecal coliform (Kusumaatmadja, 1979).
- **Well water.** In DKI Jakarta, nearly 20 percent of the households owning wells in 1989 had septic tanks installed at less than 5 m distance (BPS 1990), and most shallow wells located in areas of high population density (over 100 persons/ha) were reportedly contaminated with fecal coliform (Budirahardjo and Surjadi, 1991). In a study conducted by JICA (1991) in the dry season of 1989, all but two of 30 shallow wells examined in different parts of the city presented signs of fecal contamination, especially in North and Central Jakarta, and 73 percent had traces of  $\text{NH}_4$ . High levels of chemical contamination were also detected in most wells, and 13 percent of the samples located in southern Jakarta were found to contain traces of mercury. The degree of contamination was found to be negatively correlated to the depth of the well. Pump wells, not surprisingly, present significantly lower levels of contamination than open wells (JICA 1991).
- **Alternative sources of water, such as rivers, ponds or rain,** are used relatively little for non-drinking water uses (such as bathing and doing laundry) in the major Indonesian cities. However, past studies have documented river bathing in localized areas of Jakarta (Lenz, 1988; Budiraharjo and Surjadi, 1991; JICA, 1991), and Crane (1992) documented the utilization of rain-collected water in North Jakarta during the rainy season. Most of the rivers in Java are considered seriously polluted with fecal coliform, and many present signs of significant chemical contamination (EX Corporation, 1992)<sup>1</sup>.

<sup>1</sup> For DKI Jakarta, for example, nearly all sampling stations of river water present levels of fecal coliform contamination of over  $10^6$  MPN (most probable number of cells) per 100 ml (JICA, 1991). The permissible standard for drinking water in Indonesia is 0 fecal coliform per 100 ml. The standard for raw water used for drinking after treatment (grade B) is 2,000 MPN/100 ml (Binnie and Partners, 1990).

3.7 A major reason for the poor quality of water supply in urban areas is that about two thirds of public water supplies are derived from increasingly polluted surface waters. Since ground-water supplies are already being over-extracted in many large coastal cities, surface water may be the only source of incremental supply for expanding public water systems. Although demand from municipal and industrial users will remain relatively small compared with the total resource base, the supply of surface water must have very high security and be used more effectively. Unfortunately, the lower reaches of most rivers are already polluted beyond the capacity of existing treatment plants. (The raw water entering the Jakarta treatment plant, for example, is reported to be worse than that entering many sewerage treatment works in other countries). A technically feasible option would be to upgrade the plants to handle more polluted inflows, but this would be an expensive solution and would only address the problem until pollution levels again exceed treatment capacity. The only sustainable solution, therefore, is to clean up pollution at the source (i.e., to address the growing challenge of urban and industrial pollution).

### **Issues in Sanitation and the Disposal of Human Waste**

3.8 The main issue associated with sanitation systems in Indonesia is that they are often operated with little regard to safe human waste disposal. Commonly, septic tanks are not emptied regularly and many public facilities, housing estates and private toilet owners by-pass effluent pipes directly to the drains to avoid the costs and inconvenience of desludging (Silver. 1990; Sawarto. 1987). Numerous toilets are built with little regard for guidelines specifying the types of on-site systems which are appropriate for local populations densities, water intakes, soil permeability, and depths of the groundwater table. Many kelurahans in Jakarta, for example, fall within the 150-500 people per hectare densities where the appropriateness of local conditions needs to be carefully weighted to safeguard the safety of the system. Individual households, however, have inadequate incentive to adhere to the guidelines when installing and maintaining their sanitation systems, since they can easily shift the effects of their overflowing systems to residents "downstream".

3.9 Unsafe human waste disposal is not only a result of private negligence, or poverty for those not owning private facilities. Often, desludging services discharge their waste directly into rivers and canals with little regard for public health hazards. In Jakarta, for example, public and private sludge collection amounts to well over 5,000 m<sup>3</sup>/day, but only 230 m<sup>3</sup> is disposed of at treatment facilities. (This may be due to the Rp 2,000/m<sup>3</sup> fee charged at the municipal treatment plant.) The remainder is disposed of into the city's waterways (Biller. 1992). In 1989, citywide septage discharges (including overflowing sanitation systems), were estimated at 202,400 m<sup>3</sup>/day, contributing to a pollution load of 93 tons of BOD (biological oxygen demand) a day. This was expected to increase, under present conditions, to 136 tons a day by the year 2010 (JICA. 1991).

3.10 The key issue of human waste management is the contamination of water supplies by fecal coliform. In addition to human waste, however, the separate disposal of domestic **sullage** into urban drainage systems also contributes significantly to water pollution. In the entire DKI Jakarta, for example, domestic sullage is equivalent to a pollution load of 152 tons/day of BOD, and is expected to increase, under present conditions, to 288 tons/day by the year 2010. Overall, domestic waste (sullage and septage) is estimated to contribute about 79% of the wastewater in DKI Jakarta, and 73% of the BOD load. BOD pollution generated by commercial and industrial establishments, on the other hand, generated 12% and 15% of the total load, respectively (JICA. 1991)

## Challenges in the Management of Solid Waste

3.11 The main issue associated with solid waste is the inability of the present management system to ensure safe disposal. In Jakarta, average daily quantities of solid waste produced are estimated at 21,900 m<sup>3</sup> (6,600 tons) for the 1990/91 period (P.T. Kartika Pradiptaprisma. 1992). Present solid waste generation in Surabaya is estimated at 5,100 m<sup>3</sup>/day (1,800 tons). While the collection rates are reportedly high for both cities, a large proportion of the waste is still disposed of in an uncontrolled way. Recent estimates for Surabaya indicate that as much as 280 tons of solid waste a day (15 percent of the total production) fails to be collected, and an additional 300 tons (16 percent of the total) are collected but disposed of in unidentified places (JICA. 1992). Estimates for Jakarta from 1986 also indicate that 40 percent of the waste produced ultimately finds its way into informal sites (JICA. 1987), and as much as 30 percent is believed to reach rivers and canals (Binnie & Partners. 1990). Random dumping is common and large quantities are burned.

3.12 Future estimates of solid waste production indicate that the present situation could get much worse unless a concerted effort is made to improve the collection and safe disposal of urban solid waste. Past trends indicate, for example, that waste generation has grown by 6 percent a year in Jakarta. Future growth in Surabaya has been estimate<sup>d</sup> at 5 percent a year (JICA. 1992), with the total increase resulting from a combination of population growth and the higher per capita waste (from 704 grams/day at present, to 910 in 2000, and 1,283 in 2010--an 82% increase over the next twenty years) that arises from improvements in income.

3.13 Unsafe solid waste disposal has the following major environmental impacts: (i) the creation of leachates, and consequent contamination of surface and groundwater; (ii) the blockage of drainage, inducing flooding; (iii) the proliferation of pests; (iv) air pollution caused by garbage burning and gaseous contamination; (v) health effects caused by any of the above impacts; (vi) traffic impacts caused by spillage; and (vii) impacts on land values. Many of the above impacts can occur at various stages of waste handling, transportation, and disposal.

3.14 **Leachates** are produced through the contact of solid waste with water, either in natural waterways where the waste is disposed, or through rainfall infiltration. Leachate infiltration is the preponderant form of surface and groundwater contamination by solid waste. This contamination can occur at home, when garbage containers are kept near wells and water tanks around neighborhoods, when solid waste finds its way into drains, and in temporary and final disposal sites, when solid waste is left exposed to rainfall or moisture. In the Sunter river of Jakarta, for example, solid waste is estimated to contribute to 7 tons of BOD per day (15 percent of the total organic pollution load), 300 kg of phosphate, and 60 kg of ammonia nitrogen (Binnie & Partners. 1990). The possibility of contamination of water bodies by toxic and inorganic wastes is particularly problematic in regions with high concentrations of home industries which do not use official means of garbage disposal.

3.15 Solid waste accumulation contributes to the proliferation of cockroaches, rats, mosquitoes, flies and scavenging animals such as cats and dogs. Besides from being a nuisance, *pests* can be important disease vectors. Random garbage dumping can also pose direct hazards to children playing outdoors, especially if the waste contains toxic or other hazardous materials.

3.16 The burning of garbage is a major contributor to urban **air pollution**, which is also increased by dust from collection trucks, and the decomposition of organic waste products. Burning is not only done by urban residents to reduce their waste, but is also performed by scavengers at final disposal sites as a method of separating out materials that can be recycled. Accidental fires can also start at waste disposal sites due to the ignition of methane gas generated by the process of decomposition. It is estimated that as much as 8% of total suspended particulates (TSP) and total hydrocarbons (HC) generated in Jakarta originates from solid waste.<sup>1</sup>

3.17 As most of the human waste is discharged into roadside drains and canals, the adequacy of **drainage systems** also becomes a concern in the environmental condition of urban areas. A combination of factors--including erosion in upland watersheds, increasingly built-up urban land, and land subsidence along the coast due to over-extraction of groundwater aquifers--has led to increasing problems of flooding in urban areas. The construction and maintenance of drainage systems has not kept up with the need. The accumulation of solid waste in the drains has aggravated these drainage problems, and is frequently a source of localized flooding, bringing contaminated drain water into contact with residential areas. Finally, random garbage dumping in waterways impedes drainage during the rainy season, and contributes to flow stagnation during the dry season.

3.18 **Health impacts** can result from direct contact with solid waste or can be indirectly caused by any of the above contamination paths. Direct health impacts include skin, respiratory and diarrheal diseases which tend to affect mostly scavengers and personnel involved in the direct handling of solid waste. These effects can be particularly harmful when the garbage includes fecal materials, or hospital and industrial waste. Indirect health effects occur mostly as a consequence of the ingestion of food and water contaminated by solid waste, air pollution impacts, and diseases occurring as a consequence of the proliferation of disease carrying vectors, such as insects and rats. With the exception of occupational hazards, however, the specific health impacts of solid waste contamination are generally difficult to isolate from those caused by poor hygiene, contaminated water, or unsafe human waste disposal.

### **The Growing Problem of Urban Air Pollution**

3.19 The available information indicates that Indonesia faces a serious and growing problem of air pollution in its major urban centers, with the concentration of several pollutants already exceeding the national ambient air quality standards at least some of the time. This is the case in relation to the level of total suspended particulates (TSP) and, in selected areas of heavy traffic in Jakarta, Bandung and Surabaya, also lead, sulphur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>). While direct measurements have been sparse, the observed results are consistent with specific economic, climatic and topographic conditions which lead to the emission and concentration of pollutants in certain areas. The impact of likely future trends in the growth of urban populations, vehicle use and traffic congestion are noted below, and air pollution from industry in the following section.

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<sup>1</sup> A 1991 emissions inventory prepared by BAPEDAL estimated the share of total air pollutants attributable to solid waste burning. The share of solid waste is highest for SPM and HC emissions. The estimated shares were: for Jakarta, 8% for SPM and 8% for HC; for Bandung, 20% and 17%, for Surabaya, 9% and 17%; and for Semarang, 8% and 8% (Kozak, 1992).

3.20 The greatest problem is in Jakarta, mainly due to its high population, and the attendant concentration of traffic and industries. Its topography is relatively flat and atmospheric inversions are infrequent. However, wind speeds are low and contribute to the build up of pollution, notably when stagnation occurs (i.e., when seasonal winds are counterbalanced by sea/land breezes). High rise buildings can cause canyon effects in highly built up areas and local inversion may occur. Already at present levels of emissions, the measurements of TSP, lead, and NO<sub>x</sub> indicate serious effects of air pollution on human health (see Section E, below). The material damage caused by the corrosive effects of air pollution appears to be far less a problem at present, since the ambient concentrations of SO<sub>2</sub> are relatively low. With continued economic growth, however, an expanding area around Jakarta will reach critical levels of air pollution, while air quality within the city will deteriorate dramatically unless immediate action is taken to reduce the growth of harmful emissions.

3.21 Other major cities in Indonesia, with similar weather and topography as Jakarta, can be expected to follow the same pattern of pollution, with the highest concentrations along the major traffic arteries, and the overall levels a function of population and traffic densities. The only major difference occurs in Bandung, whose location on a plateau surrounded by hills creates favorable conditions for the trapping of air. The few recent air quality measurements available for Bandung indicate relatively high concentrations of TSP and hydrocarbons.

3.22 The sources of air pollution are difficult to establish with accuracy. Man-made pollutants result from all kinds of economic activities, including transportation, industrial processes, power generation, the burning of household wastes, agricultural burning, forest fires, etc. However, in most large cities, vehicle emissions constitute the most important source of harmful pollutants. Recent emission inventories prepared by BAPEDAL (Kozak, 1992), for example, indicate that vehicle emissions account for 44% of TSP, 89% of HC, 100% of lead and 73% of NO<sub>x</sub> pollution in Jakarta. In Surabaya, the shares are 13%, 71%, 100% and 34%, respectively. Within vehicle classes, gasoline passenger cars, minibuses and trucks/pickups/jeeps account for about 85% of lead emissions, and trucks/pickups/jeeps account for about 55% of TSP.

3.23 While road vehicles constitute the most important source of several major air pollutants (TSP, lead, NO<sub>x</sub>, CO and HC), other sources also contribute significant shares. Specifically, on the basis of BAPEDAL's estimates, the industrial sector is the largest source of SO<sub>x</sub> (about 63% in Jakarta) and an important source of NO<sub>x</sub> (16%) and TSP (15%), and the residential sector is a major source of TSP (41% in Jakarta), largely due to the burning of solid waste by households themselves or by refuse recyclers after it is collected. A similar pattern of air pollution emissions has also been estimated for other large urban areas, including Bandung, Surabaya and Semarang.

3.24 For the future, as the transport sector continues to grow (projected at 6-8% per year), the attendant pollution loads are likely to increase quite substantially. Based on a recent Bank report (Indonesia: Energy and Environment, 1993), fuel use in road transport, and the attendant pollution, is projected to increase by twice the 1990 level by 2000, five times by 2010, and nine times by 2020. In line with projected economic growth, pollution from other sources, including industry (as described below) and households, will also expand rapidly in the coming years. Taking all of these sources into account, between 1990 and 2020, unless specific measures are taken to "delink" pollution from the growth of economic activity in urban areas, the emissions of particulates are projected to increase by a factor of 8, those of lead by a factor of 9, and of those of nitrogen oxides, by a factor of 14.

## C. POLLUTION FROM INDUSTRIAL SOURCES

### The Pace and Pattern of Industrial Sector Growth

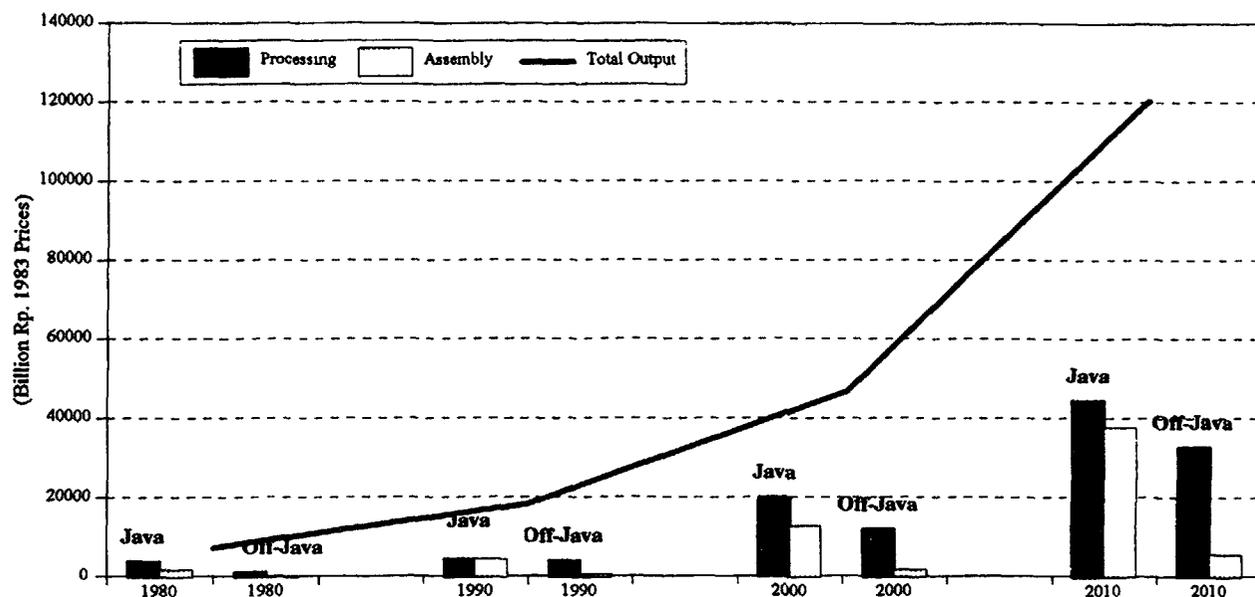
3.25 The industrial pollution issues faced by Indonesia are directly related to the pace and pattern of past industrial sector growth, and likely future trends. Although the potential level of industrial pollution rises with industrial growth, the characteristics of the pollution load depend on the sectoral composition of manufacturing output. The costs and consequences of this pollution depend on the concentration and location of industrial production. More highly concentrated industrialization imposes a greater burden on local ecosystems, and higher levels of pollution in urban areas increases human exposure and the corresponding health costs.

3.26 It is important to begin the assessment of pollution from industrial sources, therefore, with a review of basic trends in the manufacturing sector itself. The sectoral composition of industrial development in Indonesia has been evaluated by Bank staff based on Manufacturing Census data for the period 1975-1989, and projected into the future based on an analysis of the pattern of sectoral change which accompanied the process of economic development in a large sample of other industrialized and industrializing countries. Projections of the location of future manufacturing output are based on historical data on the rank and size of individual sectors by area, and projected changes in sectoral and regional output. The methodology is discussed in Annex C-3. For the purpose of this analysis it has been assumed that there will be no significant change in the industrial policies affecting production patterns or location in Indonesia (i.e., an "unchanged practices" scenario).

3.27 During the 1970s and 1980s, Indonesian *manufacturing output* doubled in volume every six to seven years. Thus, by 1990, manufacturing value added was approximately eight times its 1970 level in real terms. According to Bank staff estimates, it is likely to expand another 13-fold by the year 2020. This rate of growth exceeds that of the economy as a whole. Manufacturing, which contributed only about 13% of total GDP growth in the 1970s, and 23% in the 1980s, is expected to contribute more than 33% in the 1990s and nearly 45% in the following decade (see Figure 1.1). Industrial growth is expected to be faster in the outer islands than on Java, and the off-Java share of production is projected to increase from 25% in 1990 to about 35% by 2020.

3.28 The continued growth in manufacturing output will be accompanied by a gradual shift in **sectoral composition**. For the purpose of analyzing pollution from industrial sources, it is useful to make a distinction between the materials-processing sectors, and those primarily engaged in assembly (see Annex C-3). The pollution characteristics of these two broadly defined categories differ significantly, with processing sectors generally being more pollution-intensive, as discussed below. Our projections suggest that the share of basic processing industries in total industrial output will fall from today's figure of 72% to about 65% in 2010 and 60% in 2020. The pattern of structural change, however, will be quite different between Java and the outer islands, as shown in Figure 3.1. On Java, assembly industries will grow faster than the processing sectors, and may overtake processing in value of total output by the year 2020. In contrast, processing industries off-Java are projected to grow almost as fast as the assembly sectors. From an initial share of 85% in 1980, they are still expected to account for about 80% of off-Java industrial output by the year 2010. The expected concentration of new assembly industries on Java would be consistent with a number of factors, including the need for a more highly-trained, factory-experienced labor force, and greater availability and reliability of supportive infrastructure.

Figure 3.1: Manufacturing Sector Trend

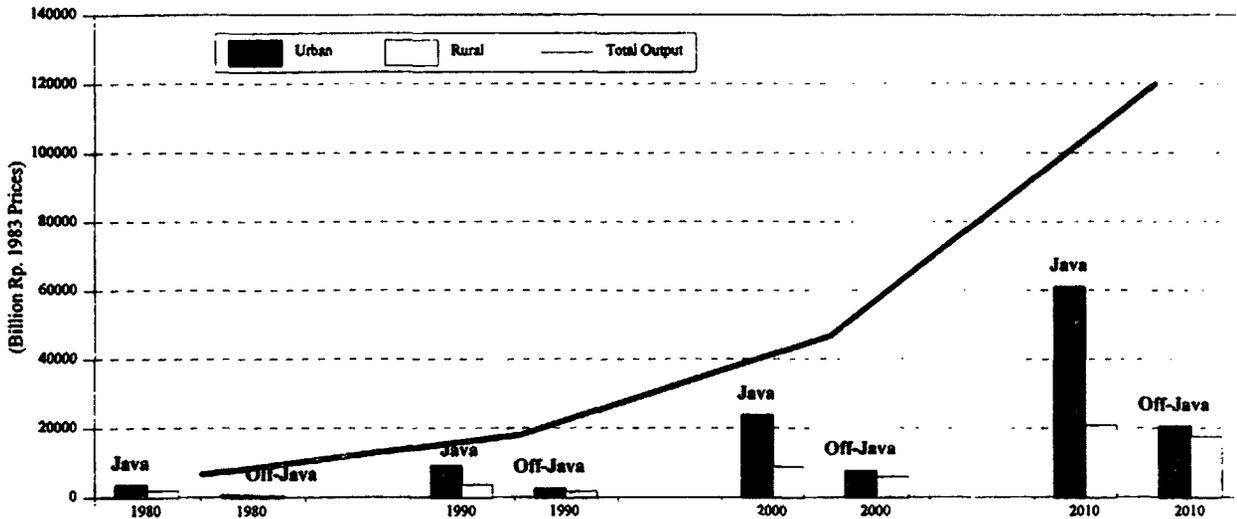


3.29 The different sectoral composition of industrial growth on Java compared to the outer islands is reflected in the **urban/rural distribution** of production. The rapid expansion of assembly operations on Java has led to an increasing concentration in and around Java's main urban centers, in part because many of these industries require a factory-trained labor force which is more readily available in urban areas. In the early 1970s, for example, about 55% of industry on Java was located in urban areas. Since then, the urban share has risen to 60%. Four cities alone (Jakarta, Surabaya, Bandung and Semarang) account for 36% of Java's--and 27% of Indonesia's--total industrial output. The urban concentration of industry on Java is likely to intensify. This is clearly seen in Figure 3.2, which shows the urban share of industrial production on Java rising to more than 70% by 2010. Off-Java, the projections indicate that the urban share of production is likely to fall continuously from 67% in 1980 to about 54% in 2010. This would be consistent with the continued dominance of processing industries in the outer islands, most of which need to be close to the supply of the relevant commodities, rather than urban areas.

### The Nature of Industrial Pollution

3.30 Indonesia's recent development has been led by rapid growth of manufacturing output. However, much of the industrial expansion has taken place without due regard to the environment, and has led to serious environmental degradation, particularly in Java where 75% of industry is located. As described below, this degradation has become increasingly evident in the form of contaminated water, air and land, adverse health impacts, and damage to both "downstream" activities, and coastal and marine ecosystems. In broad terms, these impacts can be traced back to industrial pollutants of three major types: Traditional water pollutants (e.g., biochemical oxygen demand (BOD) and suspended solids), traditional air pollutants (e.g., particulates, sulphur and nitrogen oxides, and carbon monoxide), and toxic and hazardous waste (e.g., bio-accumulative metals).

**Figure 3.2: Manufacturing Sector Trend**  
Urban/Rural Area



**3.31 Traditional Water Pollutants.** Results of recent monitoring of the discharge of large industries reveal that industrial pollution constitutes from 25% to 50% of the total pollution load in different rivers in Java. Monitoring results vary widely, but a 1989 survey in Surabaya estimated that industrial effluents accounted for 38 tons per day (tpd) of BOD in the Brantas River, out of a total load of 120 tpd.<sup>2</sup> Monitoring in the Jabotabek area indicates that industries account for 84 tpd of BOD out of a total of 171 tpd.

**3.32** The total amount of groundwater pollution attributable to industrial discharges is unknown. The presence of typical industrial effluents, such as phenol, detergents and nitrate has been observed in shallow aquifers in the Jabotabek area. Pollution of groundwater is also caused by mismanagement in the storage of hazardous material, such as the reported incident of a fertilizer firm in Lumajang. In this case, the chemicals of the fertilizer plant, which were kept in a careless manner, infused the soil and polluted the surrounding wells. Other incidents where groundwater on Java is no longer potable because of industrial wastes are anecdotal, but the number of cases reported seems to be rising.

**3.33 Air Pollution.** As discussed above, vehicle emissions constitute the most important source of air pollution in urban areas, but the industrial sector is also a major contributor. Recent emission inventories prepared by BAPEDAL indicate that in Jakarta, industrial sector emissions account for about 15% of total TSP, 16% of NO<sub>x</sub>, and 63% of SO<sub>x</sub> loadings (Kozak, 1992). In Surabaya, the industrial sector shares are about 28%, 43% and 88%, respectively. As noted below,

<sup>2</sup> Water Quality Monitoring and Pollution Control Program Report, Brantas River Basin Development Executive Office, 1989.

the health costs of air pollution are already high in Jakarta, and probably in other large cities. In the absence of effective measures to reduce such emissions from industry and other sources, these costs will rise substantially in the coming years.

**3.34 Hazardous and Toxic Wastes.** Hazardous wastes are defined as having one or more of the following characteristics: flammability, corrosivity, reactivity or capability to produce a hazardous leachate. Toxic wastes cause poisoning of humans and the environment, leading to death or serious illness. Most of Java's rivers undoubtedly contain a variety of hazardous and toxic substances, but the precise levels are difficult to establish. The monitoring that is carried out on a regular basis, for example, does not measure concentrations of mercury, copper or chromium. What is evident is that quantities of toxic and hazardous waste are now deposited in uncontrolled landfills, dumped in rivers along with other industrial wastes, and in some cases, spread to agricultural areas by irrigation water and wind. The discovery in the early 1980s of significant mercury contamination in sediments and marine biota of Jakarta Bay first brought the issue to public attention. Overall, while little reliable information is available, it is clear that a continuation of present practices can only mean the problems will worsen.

**3.35** A recent study of hazardous waste (Dames & Moore, Inc. 1993) estimated that about 2.2 million tons per year of such waste are currently being generated in West Java and DKI Jakarta. Toxic materials represent a particularly dangerous threat to human health, most especially the bio-accumulative metals that may build up in the sediments of inland and coastal waterways, and the food chain. As noted in Chapter 5, these can be prohibitively expensive to remove, which places a very high premium on minimizing their use in production processes wherever possible and ensuring proper treatment of contaminated waste wherever that is not possible.

### **Pollution Intensities and Loads**

**3.36** Total pollution depends on a combination of pollution intensities per unit of output and the scale of output produced. If the pollution intensity is known, then the total load of a particular pollutant from a given sector may be estimated from manufacturing activity data. Similarly, the pollution intensity of the industrial sector as a whole defines the pollution load generated per unit of industrial output, and is largely dependent on the mix of manufacturing activities. Bank staff estimates of sectoral pollution intensities (see Annex C-4) have been used to analyze trends in the pollution intensity of Indonesian manufacturing output, and the impact of changes in sectoral composition on total pollution loads. It is important to note that this analysis represents an "unchanged practices" scenario, and the results, therefore, are by no means inevitable.

**3.37** The **pollution intensity** of an industrial sector varies according to the manufacturing process involved and the pollutant in question. This is shown in aggregate terms in Table 3.2, which portrays the relative pollution intensities of processing and assembly industries for three major forms of pollution. The sectoral composition of processing and assembly is based on the structure of Indonesian manufacturing in 1989. The table reveals that for all the pollutants listed, except volatile organic compounds and biochemical oxygen demand, the processing industries are significantly more pollution intensive than the assembly sectors. This is particularly true for the emission of particulates, nitrogen dioxide and lead to the atmosphere, and the discharge of suspended solids in liquid effluent.

**Table 3.2: POLLUTION INTENSITIES: PROCESSING VERSUS ASSEMBLY**  
(in lbs. per Rp million of output value - 1989)

Pollutants	Assembly	Processing	Ratio Processing/Assembly
<b>"New" Pollutants</b>			
Volatile Organic Compounds (Air)	9.609	9.495	1.0
Lead (Air)	0.00048	0.00289	6.0
Toxic Release (All Media)	4.806	13.085	2.7
Bio-accumulative Metal (All Media)	0.254	0.987	3.9
<b>"Traditional" Air Pollutants</b>			
Fine Particulates (Air)	0.679	3.037	4.5
Sulphur Dioxide (Air)	7.394	24.03	3.3
Total Particulates (Air)	2.518	15.39	6.1
Nitrogen Dioxide (Air)	4.138	17.50	4.2
Carbon Monoxide (Air)	7.193	17.39	2.4
<b>"Traditional" Water Pollutants</b>			
Biochemical Oxygen Demand (Water)	7.006	5.458	0.8
Suspended Solids (Water)	2.632	36.27	13.8

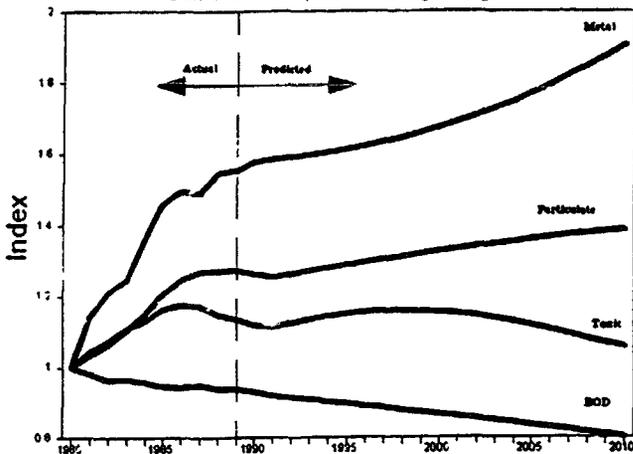
Source: World Bank, Industrial Pollution Projection Project.

3.38 As the **sectoral composition** of industry changes, so does the aggregate pollution intensity of total manufacturing. As noted above, Bank staff estimates suggest that the share of processing industries in total industrial output will fall over the next several decades. Since "processing" tends to be more pollution intensive than "assembly", the pollution intensity of the industrial sector as a whole is likely to fall. Figure 3.3 supports this general conclusion, but indicates that it may not hold for all pollutants. Although the intensity of pollution from particulates, toxics and biochemical oxygen demand are projected to decline from a peak in 1990, the intensity of bio-accumulative metal pollution is expected to increase throughout the period. This is because the structural composition of processing is expected to shift towards a more bio-accumulative metal intensive configuration.

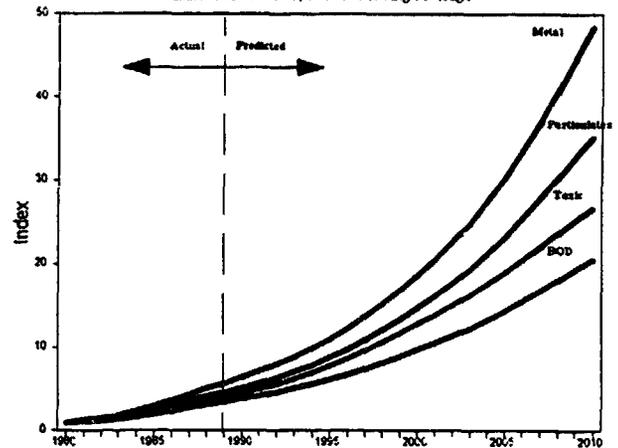
3.39 It is only by reducing pollution intensity that the **total pollution load** can be reduced while maintaining industrial sector growth. This can be achieved either by reducing the pollution intensity of individual sectors, or by altering the sectoral composition of production. Figure 3.3 suggests that shifts in sectoral composition will reduce the aggregate pollution intensity of manufacturing, at least for some pollutants. Unfortunately this effect will be off-set by the rapid growth of industrial output. Figure 3.4 indicates that even for particulates, toxics and BOD, for which declining pollution intensities are projected, the total pollution load will continue to grow at an accelerating rate, up to 2010. The combination of increased pollution intensity and higher levels of production, means that the total release of bio-accumulative metals is expected to grow faster than the other three pollutants illustrated, with an expected release in 2010 almost fifty times greater than in 1980. Despite the fact that four of the eleven pollutants are projected to have lower pollution

intensities in 2020 than 1990, the annual emission of each of the eleven is expected to be at least ten times greater, assuming no changes are made to environmental policies or industrial practices.

**Figure 3.3: Pollution Intensity Trends**  
Base Year 1980=1, 5-Year Moving Average



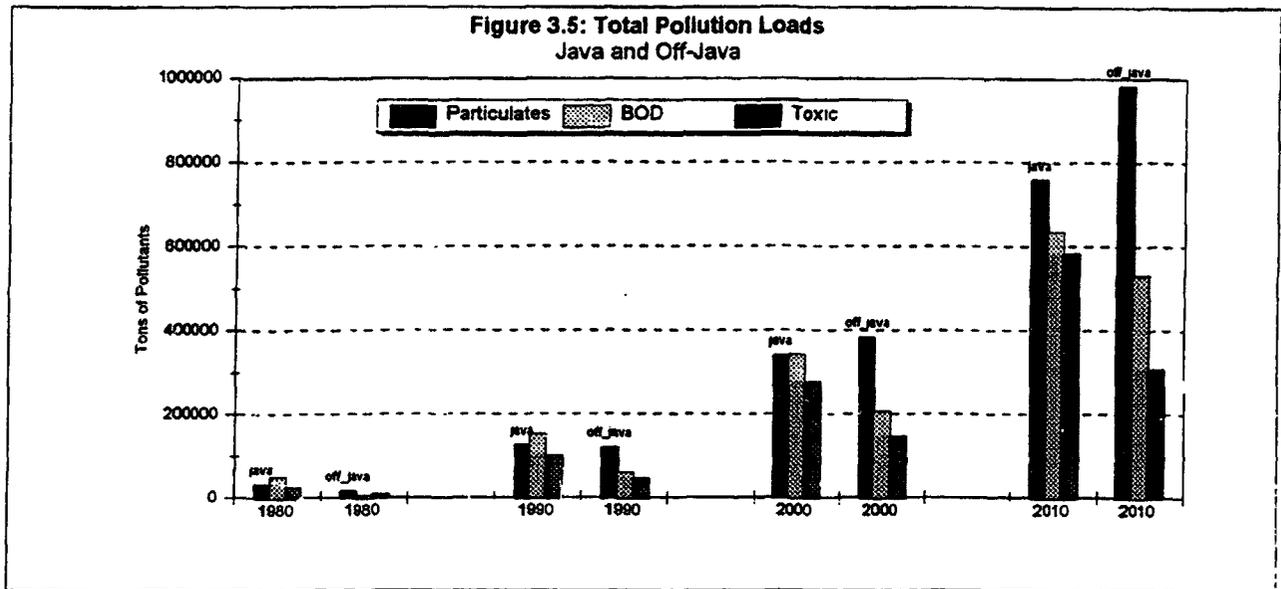
**Figure 3.4: Pollution Load Trends**  
Base Year 1980=1, 5-Year Moving Average



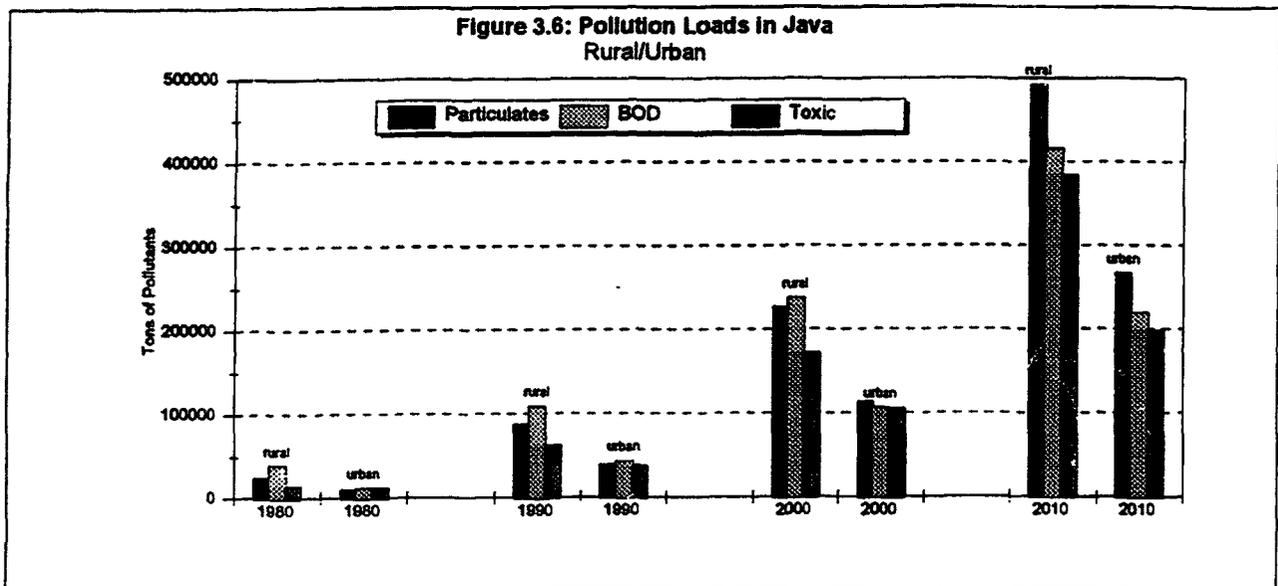
### The Location and Concentration of Industrial Pollution

3.40 The costs and risks of industrial pollution are heightened to the extent that they are concentrated in provinces with high population densities (predominantly those on Java), and in urban areas. By combining pollution intensity data with the locational estimates of industrial sector growth, it is possible to generate geographic-specific projections of future pollution loads, including trends in the Java/off-Java, and urban/rural distribution of industrial pollution.

3.41 **Java/off-Java distribution.** As noted earlier, the share of total industrial output produced in the outer islands is expected to rise from 25% in 1990 to about 35% in 2020. Further, off-Java production is likely to remain predominantly based on process industries. The majority of the less-pollution-intensive assembly industries will be attracted to sites within Java. With a larger and more pollution-intensive share of manufacturing output, the total pollution load in the outer islands is expected to rise faster than on Java. This is illustrated in Figure 3.5, which indicates that by the turn of the century the total emission of particulates off-Java will exceed the particulate load on Java, and that by 2010 the biochemical oxygen demand from pollution in the two regions will be almost equal. By 2020, Java's share in the total load of traditional water and air pollutants will decline to under 45%, from 60% in 1990. Nevertheless, Figure 3.5 also highlights the fact that, in the absence of changes to policies and practices, the total emissions of these pollutants on Java will increase about six-fold by 2010. Java's share of the toxic pollutant load will remain roughly constant, at about two-thirds of the national total from manufacturing, and this load will also be about six times greater than current levels by 2010.



**3.42 Urban/rural distribution.** Nationally, the share of industrial pollution in urban areas will decline from 70% today to about 60% in 2020. However, these national figures hide significant differences between Java and the outer islands. As can be seen in Figure 3.6, the pollution load in urban areas on Java is expected to remain below that in rural areas, despite the expectation that industrial growth on Java will be largely urban (see Figure 3.2). This is because the urban industrial growth will be predominantly in assembly sectors, which are relatively "cleaner" than the processing sector growth that will occur in rural areas. Regardless of the relative growth rates, Figure 3.6 also indicates that by 2010, pollution loads in urban areas on Java may be more than ten times greater than they are today. Off-Java industrial growth in both rural and urban areas will be largely in processing industries, which will grow faster than total national manufacturing output (see Figure 3.2).



Consequently the pollution load in urban centers will continue to be higher than in rural areas, and by 2010 the total pollution load in urban areas off-Java will be more than twelve times greater than the current burden.

### **From Pollution Loads to Population Exposure**

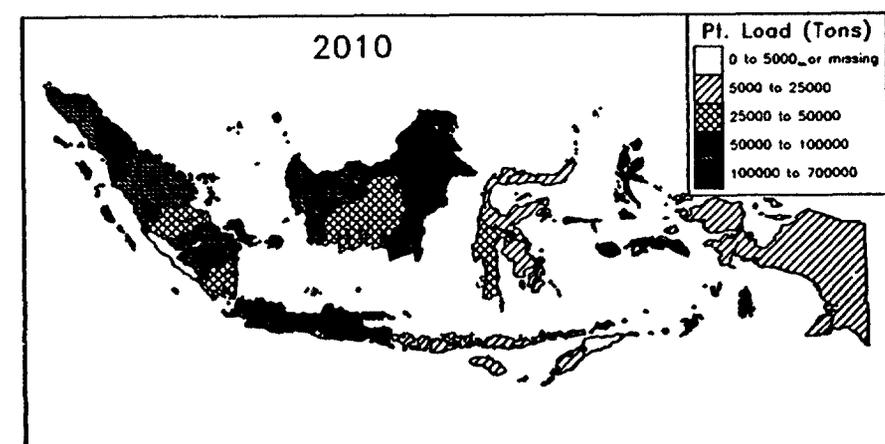
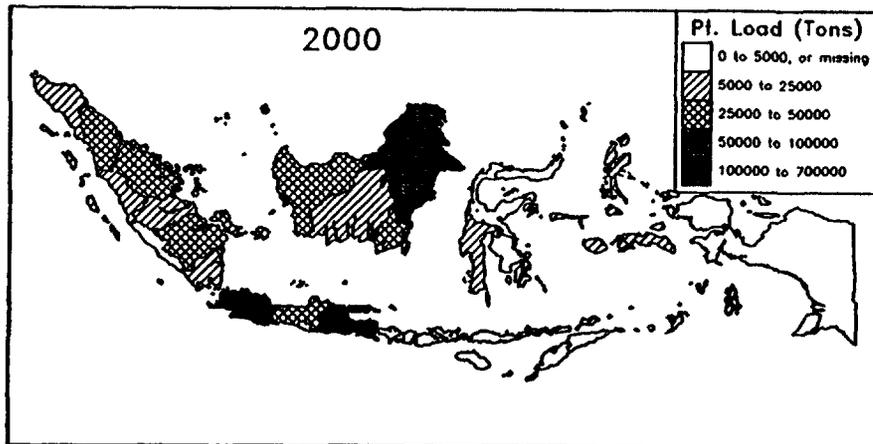
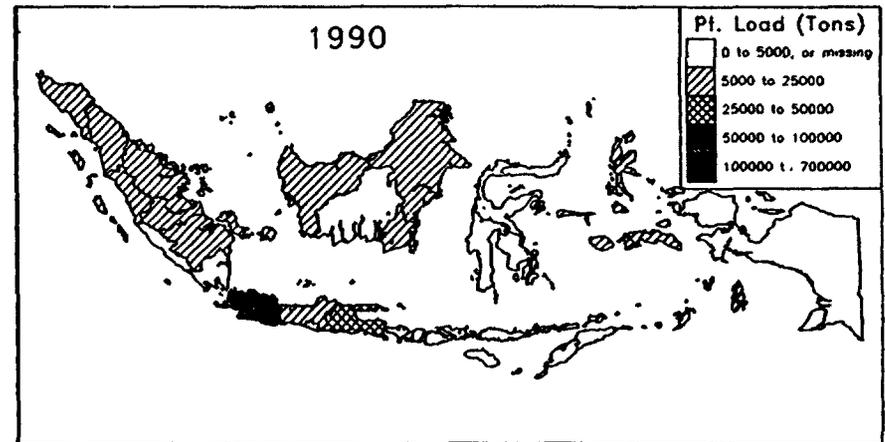
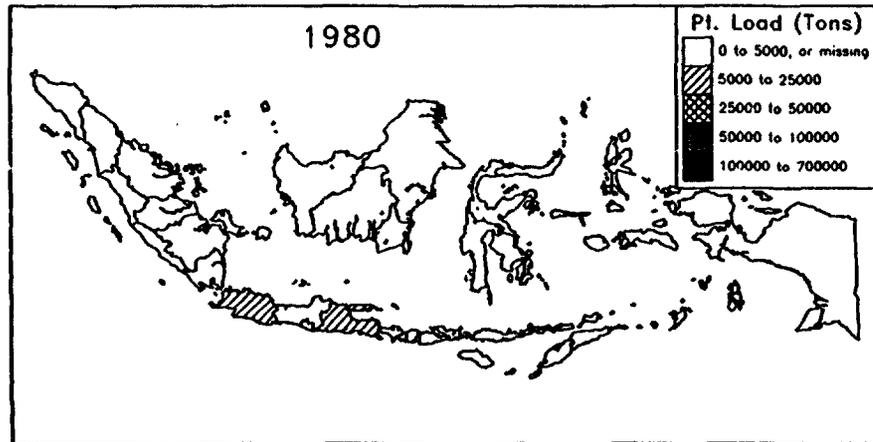
**3.43 Pollution Loads.** The locational analysis suggests that the projected pattern of deconcentration of output and the attendant pollution to rural areas and to the outer islands will provide little relief from the growing costs and risks of industrial pollution in urban areas, particularly in the densely populated provinces on Java. This is reflected in Figure 3.7, which maps the total particulate load from industrial sources by province for the period 1980 to 2010. A broadly similar pattern will be followed by industrial emissions of other pollutants. Although higher pollution loads can be seen spreading to the outer islands, the emissions on Java increase throughout the period. By 2010, the total load of particulates released on Java will be more than ten times the current level.

**3.44 Ambient Concentrations.** Figure 3.7 maps estimated total loads of particulates, which are related to aggregate levels of industrial activity in each province. To understand the extent to which the total loads of industrial pollution represent a serious problem requires that these estimates be divided by the total area of the province in order to arrive at an estimate of average concentration levels. East Kalimantan, for example, appears highly polluted in terms of load, but the actual average pollutant concentrations are relatively low due to the large size of the province. Figure 3.8 shows the effect of this adjustment, highlighting those provinces where rising particulate concentrations achieve a level equal to—or greater than—the estimated 1990 concentration for Jakarta and West Java. Although the whole of Java is projected to exceed this threshold by 2010, the only non-Java provinces where this occurs are North Sumatra, Bali and South Kalimantan. Further disaggregation at the Kabupaten level reveals the reality that, off Java, the critical concentrations are limited to just a few key areas—mostly urban centers with a high concentration of industrial sector growth.

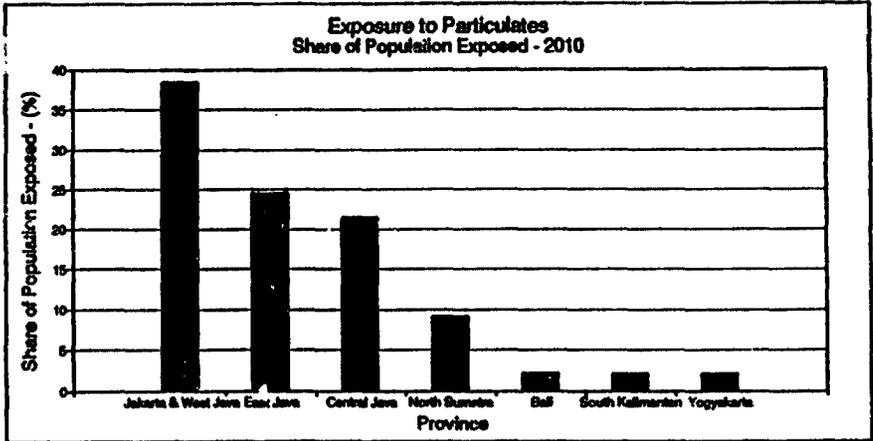
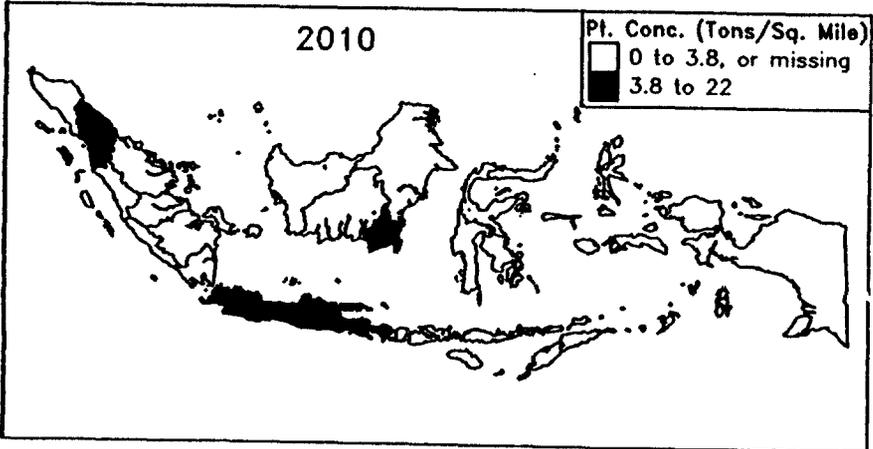
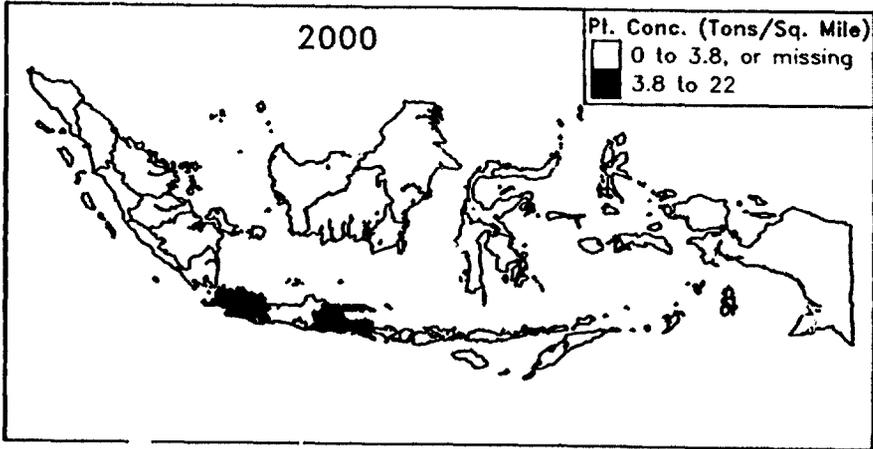
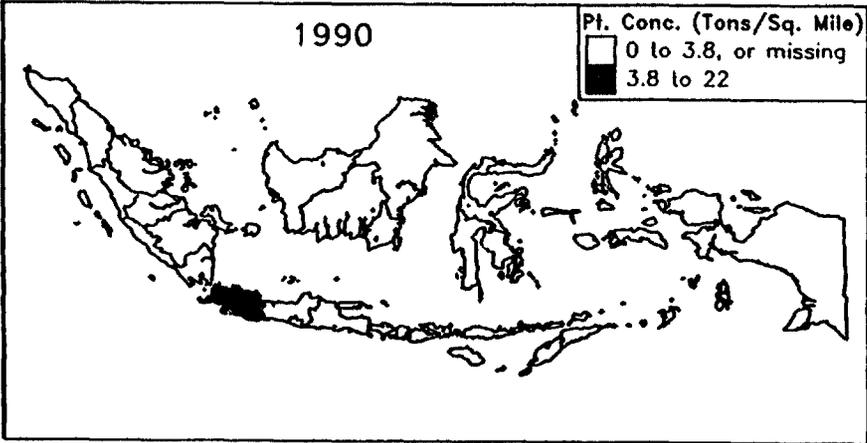
**3.45 Exposure to Pollution.** Currently, measured concentrations of particulates in Jakarta are at least twice the level of (draft) ambient standards. This level of pollution is associated with relatively high levels of respiratory disease recorded in the city. Inflammation of the respiratory tract, for example, accounts for 12.6% of mortality in DKI Jakarta, which is more than twice the national average (Ministry of Health, Health Ecology Research Center, 1991). While the estimated average concentration of particulates shown in Figure 3.8 can only be taken as a very rough indicator of local ambient conditions, it is important to note that—by 2010—six other provinces are projected to experience particulate concentrations at or above the 1990 level estimated for Jakarta and West Java. The geographic distribution of the health risk associated with this hazard is indicated by comparing the projected concentration level with the size of the affected population in the highlighted provinces. As shown in the bar-chart in Figure 3.8, in 2010 about 85% of the affected population will be located on Java, and only about 15% off Java—specifically, in North Sumatra, South Kalimantan and Bali.

**3.46 Overall,** while the total pollution load may increase more rapidly in the outer islands than on Java, concern should focus on areas where the largest number of people are exposed to excessive levels of harmful pollutants. These will be predominantly key urban centers on Java and a relatively few mostly urban "hot-spots" of exposure off-Java, as noted above. This confirms the virtues of the PROKASIH Program in targeting pollution control efforts to the most critical areas.

**Figure 3.7: Total Load of Particulates (Tons)  
1980-2010**



**Figure 3.8: Particulate Concentrations (per unit area)  
and Exposed Population (% of total)  
1990-2010**



## D. POLLUTION FROM OTHER SOURCES

### Environmental Implications of Energy Development

3.47 In parallel with Indonesia's expanding economy, the consumption of energy is projected to grow to a multiple of current levels. Based on a recent estimate, over the next 25 years the demand for petroleum products is expected to grow by a factor of 9, mainly driven by the growing demand for transportation, for which alternative fuels are far more expensive. The demand for electricity is expected to increase 13-fold, as a result of the growing share of electrification in manufacturing, as it moves into higher technology products and production processes, together with population increases and a rising standard of living--with attendant growth in demand for additional lighting, electrical appliances and the comforts of air conditioning. To meet the demand for electricity, the supply of natural gas is projected to grow to the limits of available reserves, from about 300 bcf (billion cubic feet) in 1990 to 1,200 in 2005. Further growth beyond that will depend on the identification of additional reserves, for which prospects are reasonable but by no means certain. As part of Indonesia's least-cost strategy for energy sector development, most of the remaining growth in power generation is expected to be met by coal, the consumption of which could grow from about 5 million tons per annum at present to over 15 million tons by the year 2000, and about 150 million tons by the year 2020 (World Bank, Indonesia: Energy and Environment. 1993).

3.48 The growing consumption and production of energy is associated with an increasing environmental impact. Of the major effects, those associated with the use of fuels in transport and industry in urban areas are the most critical (see Section E, below). The local impacts of power generation are far less significant, since most major power plants are sited in rural areas and their local effects are expected to be limited by appropriate abatement technology. Most other concerns associated with energy production, such as effluents from coal mines and power plants, including geothermal plants, are also manageable locally and should be addressed through the AMDAL process.

3.49 In addition to essentially local effects, air pollution may also have regional effects. The most important of these is **acid rain**, which results from SO<sub>2</sub> and Nox emissions that can be carried by winds far beyond the point of origin. At present, there are no observed signs of acid rain damage within Indonesia, and no evidence that Indonesia contributes to acid rain in any of its neighboring countries. The few available measurements indicate that rainwater acidity is very close to the neutral level. The most important sources of precursor emissions appear to be of natural origin, including sea spray emissions and volcanoes, with no significant influence from man-made emissions. In the longer term, however, given the expected rapid growth in energy consumption, the possibility of acid rain cannot be ignored. The immediate priority, therefore, should be to improve the monitoring of precursor conditions, especially in those areas most vulnerable to the potential effects.

3.50 Finally, the large increase in energy use and the growing share of coal in total energy supply raises a legitimate concern about Indonesia's potential role in **global warming**. A recent analysis indicates that Indonesia accounted for only about 1.6-1.7% of global man-made "green house gas" (GHG) emissions in 1989. Of total GHG emissions, however, about 75% was attributable to land use change (deforestation and forest fires), 12% to energy use (including gas flaring), 9% to methane emissions (mainly from irrigated rice), and 4% to chlorofluorocarbons (CFC) use. Over the coming decades the rate of deforestation is not likely to increase significantly, the area devoted to

irrigated rice will grow only slowly, and the use of CFCs is expected to be completely phased out. CO<sub>2</sub> emissions from energy use, however, could rise by a factor of 6 by 2010 and 13 by 2020. By then the structure of GHG emissions will become similar to that of the world as a whole.

3.51 Indonesia has joined the Climate Change Convention, and is committed to limiting the growth of its greenhouse gas emissions (see Box 4.1). As noted above, controlling the growth of energy-related GHG emission should be the key focus of this strategy. On the basis of a recent Bank study, however, it would appear that efforts to mitigate local pollution damage effects of energy production and use, even when combined with the introduction of a carbon tax at a level commensurate with the expected damage from global warming, would result in only modest declines in the growth of CO<sub>2</sub> emissions--20% and 23%, respectively (World Bank, 1993a). A more concerted effort would require the resolution of "financial burdensharing" issues under the Climate Change Convention, since more stringent carbon taxes would otherwise lead to an imbalance in addressing Indonesia's priorities for sustainable growth on a national basis (see Annex D).

### **The Hazards of Indoor Air Pollution**

3.52 The use of biomass fuels (firewood, charcoal, agricultural residues) in open cookstoves generates smoke containing significant amounts of several important pollutants, including particulates, carbon monoxide, hydrocarbons and, to a lesser extent, nitrogen oxides. Available evidence from studies carried out in India, Nepal, and elsewhere in the developing world indicate that indoor air pollution from such open cookstoves is a risk factor for chronic lung disease in adults, particularly women, and acute respiratory disease in young children (Chen, et.al. 1990). This could be a problem in Indonesia, where an estimated 88% of the rural households cook with wood or charcoal, frequently indoors, in stoves without flues and in poorly ventilated kitchens. In urban areas like Jakarta, wood and charcoal use is limited to less than 2% of households, with the rest using kerosene (83%) and LPG (15%) (Surjadi. 1993).

3.53 The extent of the health hazard in Indonesia is difficult to determine. Given the country's tropical climate, most housing is likely to have relatively high ventilation rates, which would tend to reduce indoor pollutant concentrations. Preliminary results from recent measurements of indoor air pollution in Jakarta households indicate that while most kitchens (83%) had ventilation, more than a quarter (28%) of homemakers suffered from respiratory disease. There was also some correlation between respiratory disease and factors such as lack of ventilation, dampness in the house, and low socioeconomic status. For children, 28% of their respiratory diseases resulted from dampness (leading to molds and mildew) and garbage problems (Surjadi. 1993).

### **The Special Case of Pesticides**

3.54 In the mid-1980s it was recognized that the intensive use of pesticides represented a growing threat to sustaining Indonesia's self-sufficiency in the production of rice. The targeted pests always appeared to be able to develop pesticide resistance, while the pesticides simultaneously reduced the effectiveness of natural controls. As a result, in 1986, GOI banned the application of 57 broad-gage insecticides on rice, phased out pesticide subsidies and developed a highly successful pilot program for the introduction of Integrated Pest Management (IPM) methods (see Box 6.7). Since then the consumption of pesticides has declined substantially, from 60,000 tons in 1987 to 20,000

tons in 1990. Nevertheless, most of Indonesia's 15 million farmers continue to use pesticides, with important risks to their health, and associated risks to their households, livestock and the surrounding environment. A recent assessment of the risks associated with pesticides used for rice crop protection concluded that their production and use constitutes a major environmental hazard (Tarrant, 1992).

3.55 The main issue associated with pesticides is that they constitute toxic substances whose safe production and use is extremely difficult to achieve under Indonesian conditions. Key factors include: (i) the fact that the overwhelming majority of users have incomes near or below the poverty line, which makes it difficult or impossible for them to hire or purchase the protective clothing and other safety gear needed to handle pesticides safely; (ii) the intense tropical heat in Indonesia's rice growing areas militates against using such stifling protection; and (iii) it is simply not feasible to provide adequate training and supervision over pesticide use in actual daily working conditions.

3.56 Given the above difficulties, as well as shortcomings in the existing regulations and practices in the manufacturing, distribution, storage, packaging and use of pesticides, it is not surprising that serious risks have been identified at every step. At the manufacturing level, several plants were identified with inadequate safety procedures and deficient effluent control practices. (In one of the plants, workers were found cleaning up spills with their bare hands.) In distribution, pesticides are often sold (illegally) in plastic bags which carry no more than the name of the product on the label, without information on proper mixing and application ratios, user-handling warnings and other vital information. By far the greatest risks, in terms of severity and sheer numbers, accrue to farmers, who routinely mix pesticides with their bare hands, spray with exposed eyes, noses and mouths, and have their clothes wetted by pesticides, all of which allow the pesticides to infiltrate their body.<sup>3</sup>

3.57 Another health risk associated with the use of pesticides for the production of crops results from pesticide residues in foodstuffs. Residue amounts depend upon the type of food products and their susceptibility to pesticide uptake and retention, as well as the type, amount, and frequency of pesticides used. An Indonesian Agricultural Product Research Office survey found that 50% of sample cabbages and mustard greens were contaminated with several pesticide residues at levels above WHO or FAO standards. The National Nuclear Energy Board (BATAN) found fish, shrimp and crabs in West Java contaminated by traces of DDT derivatives (Tarrant, 1992).

3.58 The total pesticide exposure levels and resulting health impacts in Indonesia are difficult to estimate. For 1984-89, the Department of Health reported 1,614 cases of pesticide poisoning, of which 161 (or 10%) resulted in death. Another study found that as many as 10% of all visits to a PUSKESMAS in Bali were for pesticide-compatible signs and symptoms (Tarrant, 1992). These data are undoubtedly only a small fraction of actual poisonings, which either go unreported or are misreported/diagnosed. WHO estimates, for example, that 3 million acute pesticide poisonings and 220,000 deaths occur each year worldwide, of which nearly all (90-99%) occur in developing countries. By assuming the worldwide average pesticide mortality rate of 0.00005 for Indonesia, one would expect the actual mortality to be about 9,000 per year.

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<sup>3</sup> Preliminary findings of the National IPM Program's health study (reported in Tarrant, 1992).

## E. THE COSTS AND CONSEQUENCES OF ENVIRONMENTAL POLLUTION

3.59 The costs of environmental pollution are commonly underestimated and often invisible to key government policy-makers. As discussed in Chapter 6, the lack of information about actual environmental conditions and trends, combined with a lack of understanding of the impact of pollution on ecological systems and human health and welfare, has been a major impediment to decisive action in favor of environmental protection in nearly every country of the world. The aim of this section is to explore the nature and magnitude of the economic costs of pollution in Indonesia. There are two main reasons for attempting to quantify these costs. First, given all of the competing claims for attention and resources from other important social and economic goals, an "order of magnitude" sense of the externalities of environmental pollution is needed simply to establish rational priorities for action. Second, efforts to reduce the level of urban and industrial pollution will involve sizable capital investments by both the public and private sectors, with a high "opportunity cost" in a relatively low-income country such as Indonesia. Since the economic costs of pollution represent the potential economic benefits of pollution control, quantifying these costs will be essential for deciding how far to go in setting environmental standards and how much to invest in environmental protection.

3.60 There are also important implications for equity, since the poor are more vulnerable to, and least able to protect themselves from, the physical impacts and health effects of pollution. If the experience of other countries is any guide, the uncontrolled growth of urban and industrial pollution also represents a potential threat to further industrial expansion in key urban centers--with serious implications for the prospects of continued rapid growth of the economy as a whole. These topics are discussed below, beginning with an assessment of the health costs of air and water pollution.

### The Health Costs of Pollution

3.61 A complete analysis of the economic costs of pollution would require an understanding of the complex inter-relationships between the sources and magnitude of specific pollutants and their impact on human and ecological systems, and more detailed and accurate data on pollution emissions and current ambient environmental conditions in Indonesia than is presently available--and is thus beyond the scope of this study. To illustrate the sort of methodology that might be used, however, and to provide at least an "order of magnitude" sense of potential economic costs, an effort was made in connection with this study to estimate the health costs of air and water pollution for DKI Jakarta.

3.62 The methodology used is described in Annex C-5. To start with, computer models were employed to predict air pollution loads, their geographic dispersion, and the corresponding effects on ambient pollution concentrations. This was combined with dose/response measures developed mostly in the U.S. to assess the potential impact of pollution on morbidity and mortality. These estimates involve considerable uncertainty, heightened by the fact that the underlying conditions in Indonesia are quite different from those in the U.S.--including predisposing factors such as general health conditions, access to medical care, and behavioral patterns (such as smoking rates). Since most of these predisposing factors are likely to be less favorable in Indonesia, however, the resulting estimates of morbidity and mortality are probably quite conservative. Estimates of the costs of these health impacts were then made, using local values for medical costs and lost wages due to illness. "Willingness to pay" measures developed in the West--adjusted for Indonesian wage rates and other factors--were used to estimate mortality costs, which are subject to an even wider range of uncertainty.

**3.63 The Health Costs of Air Pollution.** Separate estimates were made for the health impacts of TSP (total suspended particulates), lead and NO<sub>x</sub> (Nitrogen Oxides). The effects of other pollutants such as ozone, sulfur dioxide and carbon monoxide were not included because they are not monitored (O<sub>3</sub>), do not have well-developed dose-response functions (CO), or are at concentrations below the ambient air quality standards (SO<sub>2</sub>). The primary health effect of TSP arises from its relationship to acute respiratory infections and chronic respiratory disease, both of which are responsible for a significant share of mortality and morbidity in Indonesia. According to the 1990 Census, for example, acute respiratory infections account for nearly 15% of all mortality among children under age five, making it the second leading cause of death within this age group after diarrheal disease. For the population as a whole, inflammation of the respiratory tract was the sixth leading cause of death, accounting for 6.2% of deaths. In Jakarta, however, it accounts for 12.6% of all mortality. The health effects of excessive levels of lead in the air include hypertension, coronary heart disease and a decline in I.Q. levels of children, who are particularly susceptible to its effects. Concern with NO<sub>x</sub> arises from the increased likelihood of respiratory problems, but Nitrogen Dioxide is also a precursor of ozone, nitrates, nitric acid, and potentially carcinogenic nitrogen compounds.

**3.64** The total economic cost of the health effects of TSP, lead and NO<sub>x</sub> were calculated using local estimates for health care and lost wages, together with a range of assumptions about mortality costs. The results are summarized in Table 3.3 below. For 1990, these range from low of US\$97 million to a high of US\$425 million, with a central value of about US\$220 million.

**3.65 The Health Costs of Water Pollution.** The health effects of water pollution arise mainly from the contamination of water supplies by fecal coliform. Water-borne diseases such as cholera, dysentery, gastroenteritis, typhoid, paratyphoid, hepatitis A, and parasitic intestinal infections, are transmitted through the ingestion of water contaminated with human faeces. The vast majority of these diseases are also transmitted by a variety of fecal-oral routes, including the ingestion of contaminated food and accidental ingestion of contaminated water. Thus, the transmission of these diseases is also dependent on personal hygiene habits which are frequently related to availability of safe water. In fact, a recent review of 84 studies on water quality and quantity, hygiene and sanitation from 30 different countries indicates that improved water and sanitation can be expected to reduce diarrheal mortality by 55% to 60%, and morbidity by 25% (Esrey, et.al. 1990).

**3.66** Applying the 1986 Household Health Survey finding that 12% of mortality is due to diarrhea to Jakarta's population of 8.2 million and crude mortality rate of 0.007, yields a diarrhea-related mortality estimate of about 7,000 per year. Using the same cost estimates noted above for the case of air pollution, the economic value of reducing this mortality by 55-60% (3,800-4,200 avoided deaths per year) would be about \$285-315 million in 1990, not counting the additional costs of health care and lost wages arising from the effects on morbidity.

**3.67** Taken together, the central values of the estimated avoidable health costs of air and water pollution in Jakarta in 1990 total more than US\$500 million. The uncertainty surrounding these estimates is illustrated by the wide range of results, which also reflect the importance of further research and the development of more accurate Indonesia-specific data. Despite the uncertainties, however, these estimates help to make a rather important point: clean air, and access to safe water and sanitation, are not just about "environmental amenity" values; they entail very real and substantial costs in terms of the health, longevity and overall welfare of Indonesia's urban citizens.

Table 3.3: AVOIDABLE HEALTH COSTS OF POLLUTION IN JAKARTA, 1990

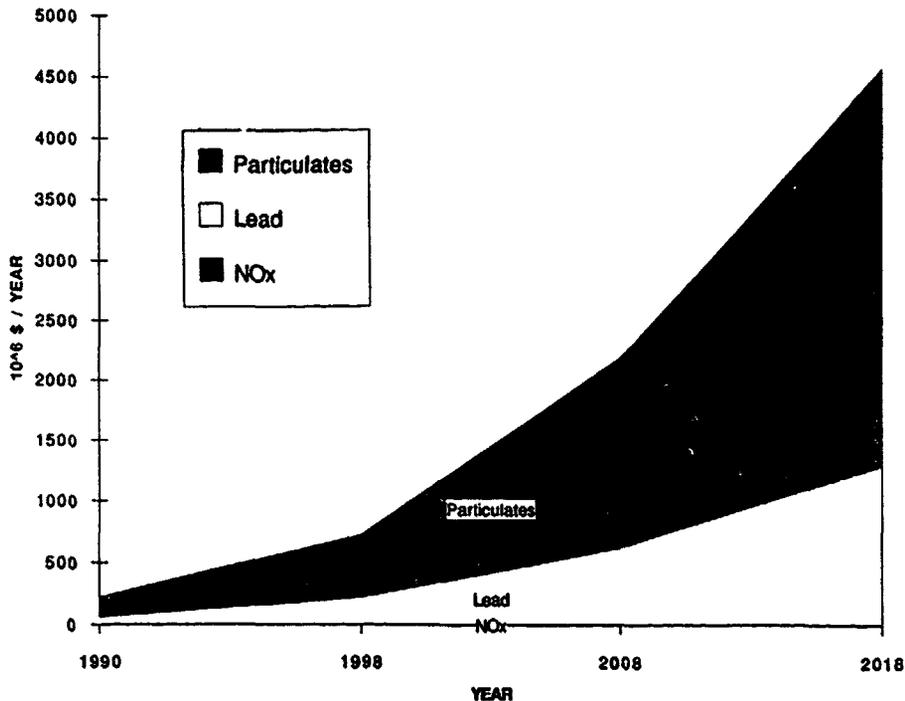
Pollutant	Total Value (US\$ millions)		
	Low	Central	High
<b><u>AIR POLLUTION</u></b>			
<b><u>Suspended Particulate Matter:</u></b>			
Avoidable Mortality	15	113	262
Avoidable Illness	41	44	65
subtotal	56	157	327
<b><u>Lead:</u></b>			
Avoidable Mortality	3	25	60
Avoidable Illness	37	37	37
subtotal	40	62	97
<b><u>Nitrogen Dioxide:</u></b>			
Avoidable Illness	1	1	1
<b>TOTAL AIR POLLUTION</b>	<b>97</b>	<b>220</b>	<b>425</b>
<b><u>WATER POLLUTION</u></b>			
<b><u>Fecal Contamination:</u></b>			
Avoidable Mortality	40	300	700
Avoidable Illness	1	3	6
<b>TOTAL WATER POLLUTION</b>	<b>41</b>	<b>303</b>	<b>706</b>
<b>TOTAL AIR AND WATER POLLUTION</b>	<b>138</b>	<b>523</b>	<b>1,131</b>

Source: Bank Staff Estimates (see Annex C-5).

3.68 There is reason to believe that these estimates may not be too far off the mark, and could even be rather conservative. A recent study of the annual health costs of air pollution alone in Mexico City, for example, estimated the costs there to exceed US\$1.5 billion (World Bank, 1993b). Whatever their current level in Jakarta, however, over time, as the number and density of both pollution sources and the exposed population increases, the attendant health-related costs will rise at an even faster pace. Assuming no change in current policies and practices, for example, tentative Bank staff estimates indicate that, over the next 25 years, while the population of Jakarta is projected

to increase by a factor of 1.8, air pollution from energy use (vehicles and industry) will increase by a factor of 6, and the corresponding health damages will rise by a factor of 21--as shown in Figure 3.9, below (see also Figures 4.1 and 4.2). There can be little doubt, therefore, that unless appropriate action is taken to control the growth of urban and industrial pollution, the magnitude of the health costs will escalate quite substantially in the years ahead.

**Figure 3.9: The Rising Health Costs of Air Pollution in Jakarta**



3.69 Policy-makers in every country respond to issues of public health and safety in accordance with their perceptions of risk and potential consequences. Following a train accident near Jakarta five years ago, for example, that claimed over 200 lives, Government officials took immediate action to enhance the safety of railway operations. Underlying the calculation of health costs shown in Table 3.3 are relatively conservative estimates of the number of lives that might be saved if the quality of water and air in Jakarta could be improved significantly--currently about 6,000 lives a year. In a city of nearly nine million people, losses of that magnitude occurring individually over a year's time are simply not very visible to the municipal authorities. In total, however, they are fully the equivalent of a train wreck--comparable to the one noted above--occurring about every two weeks.

### Other Costs and Risks

3.70 There are other costs and risks of pollution beyond the health effects noted above. Most of these relate to the "down-stream" effects of water pollution. While little is known about the precise environmental impacts of air pollution in Indonesia, in comparison with their health effects they do not appear at present to represent major economic costs or risks (see Annex C-5 for details).

3.71 **Environmental Effects of Urban and Industrial Water Pollution.** The flow of large quantities of inadequately treated domestic and industrial waste into inland waterways contributes to adverse biological changes impacting the flora and fauna of estuarine and coastal waters. The main effect of domestic waste is to increase the biological oxygen demand (BOD) and reduce the dissolved oxygen (DO) in the water. As a consequence, localized or generalized anaerobic conditions can prevail, whereby aerobic organisms are gradually substituted by anaerobic algae and bacteria. These conditions, while having the largest impact on bottom organisms (benthos), can also have significant downstream impacts on species which are dependent on estuary and river organisms for survival. Coastal fisheries can also be affected. Organic pollution, for example, has contributed to the disappearance of coral reefs within 30 km of Jakarta Bay.

3.72 Much of the water pollution from industrial sources also involves a high level of BOD, particularly from the food processing, non-basic chemicals and pulp and paper industries (as shown in Figure 4.3). The disposal of industrial effluents, however, also involves a large and growing amount of toxic and hazardous waste. An analysis of the Angke estuary in Jakarta Bay, for example, indicated a mercury content in the water ranging from 7 to 18 ppb (parts per billion), which exceeds the 6 ppb allowable limit for sea water used for aquaculture (Hutagalung, 1987). A concurrent analysis of marine organisms also indicated that the mercury content in commercial fish species showed higher mercury levels than those permitted by WHO for human consumption (0.5 ppm).

3.73 **Potential Economic Costs and Risks.** In addition to the health costs and risks, urban and industrial pollution can raise the operating costs of downstream economic activities--and even put them out of business. Brackish water aquaculture on the north coast of Java, for example, is increasingly threatened by pollution, and could have to be relocated (World Bank, 1992). The potential costs and risks of water pollution for aquaculture is illustrated by the early 1992 incident in which reports of antibiotics residues found in Indonesian black tiger prawns by Japanese importers caused a minor scare and induced some importers to look for alternative suppliers (INFOFISH Trade News, June 1, 1992). Without proper action to prevent the recurrence of such events in the future, such contamination and other pollution-related diseases could lead to irrevocable loss of production and markets. Indonesia's shrimp exports, for example, which earned over US\$700 million of foreign exchange in 1990/91, are vulnerable to the same forces that led to the collapse of shrimp production in Taiwan (China) and, more recently, Thailand (see Annex F). These effects are not limited to Java. While precise data is lacking, there is increasing anecdotal evidence of pollution-related losses to aquaculture in the outer islands as well due to the rapid growth of processing industries.

3.74 The "flushing" of key rivers on Java during the dry season, in order to move excessive concentrations of human and industrial waste away from major coastal cities, involves a high opportunity cost in terms of foregone agricultural output. The need to build special canals and enhance the capacity of municipal water treatment plants to ensure the availability of clean water for urban consumers also raises the cost to both industry and households. To compensate for heavy pollution in the rivers supplying water to the Jakarta treatment plants, for example, it was necessary to construct the West Tarum Canal to bring less polluted water from the Tarum River basin in West Java--at a cost of \$400 million. In many areas of Jakarta and Surabaya, the advance of salinization and increasing levels of pollution have rendered groundwater unusable for drinking, forcing household to rely on alternative and higher-cost sources.

3.75 Finally, as with other forms of environmental degradation, the growing volume of water pollution also has an aesthetic impact. With human waste pollution contributing to the fouling of rivers and canals, it is hardly surprising to see river banks occupied by the poorest of the poor. This situation is in stark contrast to many developed country cities, where river front property tends to command premium prices. These aesthetic impacts are also felt in recreational and tourist areas. Kuta Beach (Bali) is an example of an area which, as a consequence of rapid population growth and inadequate management of human and solid waste, is suffering rapid deterioration of its beaches, the main tourist attraction. As demonstrated by the experience of other tourist destinations around the world, increasing levels of pollution can lead to a rapid decline in tourism revenues--at US\$3 billion, one of the largest and most rapidly growing sources of non-oil foreign exchange in Indonesia today.

### Implications for Equity

3.76 The available evidence also suggests that the burdens of pollution falls disproportionately on the poor. In relation to airborne pollution, for example, studies have shown that slum dwellers had the highest measured levels of lead in their blood, followed by street vendors and *bemo* drivers (Achmadi). A recent survey of household-level environmental problems in Jakarta found that respiratory disease was present in 33% of "low" socioeconomic status households, as compared to 25% of "middle" and 22% of "high" socioeconomic status households (Surjadi. 1993).

3.77 Throughout urban Indonesia, household piped water connections remain strongly correlated with household income: in 1992, less than 10% of households with monthly expenditures below Rp 100,000/month had running water, as compared with 91% of the households spending over Rp 700,000/month. The poor, therefore, rely more on wells, water vendors, and public hydrants. As groundwater is becoming increasingly polluted and, in some areas, saline, the only choice for households unconnected to piped water is to buy drinking water from private street vendors at a relatively high price. In DKI Jakarta, for example, 32% of the population bought water from vendors in 1988. While a household with a connection only paid between Rp 170 to Rp 285 per cubic meter to the municipal water company, a household without a connection paid between Rp 2500 to Rp 8840 per cubic meter, depending on location and season. Thus, a household purchasing water from vendors paid as much a 50 times more per unit of water than a household connected to the municipal system (Lovei and Whittington. 1991).

3.78 In relation to toxic and hazardous waste pollution, the available information also suggests that the poor may be unusually vulnerable. When mercury was found in Jakarta Bay, for example, the highest levels were identified in the children of coastal settlements, whose residents generally have the lowest incomes (Ohno, et.al. 1984). When oily wastes from petroleum operations were found in Sungai Sagu, it was the poorer of the riverine villagers, who draw their drinking water from the river, that reported itches and intestinal problems (Tempo, January 30, 1993). When effluents from a plywood mill damaged the fisheries of Sungai Siak, it was the local fishermen who reported that their incomes had declined from about Rp 15,000 per month to Rp 3,000 per month (Tempo, September 19, 1992). Similar incidents have been reported elsewhere (see Box 6.10, for example, which describes a case of polluted shrimp ponds in Aceh), with the loss of incomes from aquaculture sometimes accompanied by serious health effects as well. Indeed, the impact of pollution-related diseases may be felt most acutely in the loss of labor productivity and income, which the poor can least afford to bear.

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### The Threat to Continued Rapid Growth

3.79 Since the early 1980s, and especially since 1986, Indonesia has been replacing its dependence on oil for foreign exchange revenues, and its dependence on agriculture for the absorption of the rapidly growing labor force, with an increasing reliance on the industrial sector for growth in GDP, exports and employment. As noted in Chapter 1, this trend is likely to continue well into the future: manufacturing is expected to contribute more than 33% of GDP growth in the 1990s, and nearly 45% in the following decade; its contribution to the growth of exports is expected to increase from 47% in the 1980s to more than 80% over the next two decades; its contribution to employment growth, an expected 23% in the 1990s, is lower--reflecting the large absolute share of employment in agriculture and services--but critical for increasing the productivity of labor. In short, GOI's goals for the Second Long-Term Plan are highly dependent on the rapid expansion of the industrial sector.

3.80 There are two main concerns about the implications of urban and industrial pollution for the prospects of continued rapid growth of industry. The first relates to the need to attract increasing amounts of direct foreign investment, both for the capital itself and for the industrial technology that comes with it. The second, and more serious, concern is likely to come from within Indonesia in the form of growing community resistance to ever-increasing levels of pollution--particularly, but not exclusively, in the larger metropolitan areas where so many industrial firms are already located.

3.81 **Implications for Attracting Direct Foreign Investment.** To increase the productivity of Indonesia's labor force will require continued rapid growth of higher-technology ("assembly-type") manufacturing, a significant share of which is expected to come from direct foreign investment. As noted above, assembly-type firms will generally be less polluting, but will mostly want to locate in urban areas to take advantage of the availability of supportive infrastructure and factory-experienced labor. In the coming years, however, Indonesia will face increasing competition for direct foreign investment from other countries in the region where labor costs are also relatively low. There is at least anecdotal evidence to suggest that the location decisions of foreign firms are beginning to take into account the potential future costs of local environmental degradation for both their company and their prospective employees. The degree of congestion and pollution in Indonesia's key urban centers, therefore, can either be a drawing card or a constraint to attracting foreign investment.

3.82 A recent survey of large multi-national companies, for example, ranked various cities according to their desirability as a potential location for corporate headquarters.<sup>4</sup> Singapore was rated one of the most desirable locations in the world. Warsaw came in last, and Mexico City, Manila and Bangkok were near the bottom of the list. Jakarta was not mentioned, but would presumably fall somewhere below Singapore and--for the moment at least--ahead of Bangkok and Manila. In the absence of a concerted effort to reduce traffic congestion and the pollution of water and air, however, it is obvious that Jakarta and other key cities in Indonesia will become increasingly less attractive to foreign investors. (The failure to enforce environmental standards could be used as part of a deliberate strategy to attract foreign investment but such an approach, as discussed in Chapter 5, would be shortsighted, costly in terms of both health impacts and subsequent clean-up costs, and quite possibly--for the reasons noted above--self-defeating.)

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<sup>4</sup> Survey by P. Fantus, relocation consultant, the Washington Post, September 4, 1992, p.F2.

3.83 **Community Resistance to Industrial Sector Expansion.** As noted above, the costs of environmental pollution are commonly underestimated and often invisible to key government policy makers--especially those at the national level. At the local level, however, they are all too visible to those who suffer from the effects of water that is unsafe to drink and air that is unfit to breathe. While the burdens generally fall hardest on the poor, it is the growing middle class that is likely to become the most vocal in pressuring municipal authorities to reduce environmental pollution.

3.84 The pattern of experience in the industrialized countries is clear, with resistance growing roughly in proportion to industrial expansion and the growth of per capita income. Governments in the developed countries have responded by putting in place increasingly stringent environmental standards and regulations. Even in the absence of official industrial pollution control efforts, however, there is increasing evidence from developing countries that local communities have been able to exert considerable pressure on highly polluting industrial firms (see Huq and Wheeler, 1992). Recent incidents in the rapidly industrializing countries of East Asia (e.g., Korea, Thailand, and Malaysia) demonstrate the power of local communities to force such firms to either clean up or close down. Such pressures were responsible, for example, for the decision by the Environmental Protection Agency in Taiwan (China) to crack down on firms recycling auto batteries in an unsafe manner (often in residential neighborhoods, and sometimes very near schools), which has since been extended to other toxic and hazardous waste-producing operations (see Box 4.9). With the urban population in Indonesia expected to more than double over the next twenty five years, and a potential 10-fold increase in industrial pollution in urban areas (19-fold in the case of bio-accumulative metals), it is simply inconceivable that the pressure to slow the expansion of industrial firms--in those areas of Indonesia where the growth of industrial output is mostly likely to occur--will not increase.

3.85 The NIMBY ("Not In My Back Yard") phenomenon is, in some cases, an unavoidable response by municipal authorities to the overwhelming consequences of urban and industrial pollution. Mexico city, for example, has had to close down several thousand firms during recent peak pollution episodes, and some have been forced to close permanently or to relocate. Similarly, Bombay has recently passed legislation banning further industrial expansion within the municipal boundaries. This phenomenon has already begun in Indonesia. In Surabaya, during the dry season of 1987, despite a two year effort to force the most highly polluting firms to reduce their effluents, the river on which the city depends for its water became so polluted that the municipal water treatment plant could not handle the load. It was necessary to close down all of the local industries for two weeks and "flush" the river by releasing impounded water from an upstream dam. Within two weeks, however, water quality had again deteriorated to about the previous level. Since then, Surabaya has restricted the growth of industry within the city limits, and other cities are likely to follow suit in due course.

3.86 In all too many countries of the world, serious attention to issues of environmental degradation, and especially the health risks of urban and industrial pollution, came only after a catastrophic event galvanized government action: the London fog in England, Minimata Bay in Japan, the Love Canal in the U.S., etc. Indonesia has not yet experienced such an event, but many of the ingredients either are, or soon will be, in place. GOI has an opportunity to avoid such experiences, but only if action is taken sooner rather than later. Improvements in urban environmental quality involve a long lead time, and the rapid growth of the industrial sector means that further delay will increase the costs as well as the risks. What to do about these issues, and how to improve the management of natural resources, is the subject of the remaining Chapters of this report.

## **CHAPTER 4**

# **INFLUENCING ENVIRONMENTAL OUTCOMES: POLICIES AND INSTRUMENTS**

## CHAPTER 4

### INFLUENCING ENVIRONMENTAL OUTCOMES: POLICIES AND INSTRUMENTS

#### CONTENTS

	<u>Page No.</u>
A. INTRODUCTION .....	97
B. ESTABLISHING PRIORITIES .....	97
Complementarity and the Positive Linkages .....	98
Market Failures and the Need for Government Intervention .....	98
The Question of Affordability .....	99
Establishing Rational Priorities .....	100
C. CHOOSING THE RIGHT APPROACH .....	102
Environmental Effects of Macroeconomic Policies .....	104
Sectoral Policies: Alternative Approaches .....	104
Selecting the Right Policies and Instruments .....	107
D. IMPROVING THE MANAGEMENT OF NATURAL RESOURCES .....	108
Land Resources Management .....	109
Parks and Protected Areas .....	111
The Management of Forest Resources .....	112
Water Resources Management .....	114
The Management of Energy Resources .....	115
Complementarities in the Management of Natural Resources .....	116
Moving Beyond the Identification of Issues .....	116
E. PROTECTING THE URBAN ENVIRONMENT .....	117
The Challenges of Urban Environmental Management .....	117
Improving the Availability of Safe Water .....	120
Sanitation, Drainage and Solid Waste Management .....	122
Urban Transport and the Control of Vehicle Emissions .....	123
Caveats and Complementarity in Policy Design .....	125
F. CONTROLLING INDUSTRIAL POLLUTION .....	127
Policies and Approaches: Experience in OECD Countries .....	127
Constraints and Opportunities in Indonesia .....	130
Cleaning Up Existing Pollution .....	131
Controlling the Growth of Future Industrial Pollution .....	136

## **INFLUENCING ENVIRONMENTAL OUTCOMES: POLICIES AND INSTRUMENTS**

### **A. INTRODUCTION**

4.1 The emergence of the environmental issues described in Chapters 2 and 3 has led to a growing awareness within Indonesia of the need to improve the management of natural resources and reduce the level of urban and industrial pollution. To deal with these issues will not be easy. The main challenge will be to integrate environmental concerns into the process of economic growth and development. This will require a combination of efforts, including more effective policies and incentives for environmentally responsible behavior, increased investments by the public sector, firms and households, and significant improvements in the institutional capacity for implementing a more sustainable development strategy. The costs and financing of environmental protection are dealt with in Chapter 5, and the challenges of institutional strengthening are discussed in Chapter 6.

4.2 The aim of this chapter is to examine the policies and instruments that can be used to influence environmental outcomes. Choosing the right approach, however, must begin with a careful assessment of what exactly needs to be done, and why. The challenges of establishing the right priorities are discussed in Section B. There are several different approaches available for encouraging more responsible environmental behavior (regulatory, "market-based", etc.), and these are described in Section C. In most cases, a combination of approaches will be required, with a complementary set of policies and instruments working together to achieve the desired results. GOI can benefit from the experience of other countries with what works--and what doesn't--but policy design and the selection of specific instruments will need to be carefully tailored to existing conditions in Indonesia. Choosing the right approach will determine not only the success or failure of the effort, but also the costs. These points are illustrated in Sections D, E and F, which describe the measures needed to improve the management of natural resources, protect the urban environment, and control industrial pollution.

### **B. ESTABLISHING PRIORITIES**

4.3 While GOI is committed to achieving sustainable development, environmental issues and concerns must compete for attention and resources with all of the other priorities for social and economic development. Establishing environmental priorities, therefore, should be based on a clear understanding of the complementarities and tradeoffs involved. There is enormous complementarity, for example, between good environmental policies and sound economic policies, especially in the removal of "market distortions". But most environmental issues also involve a cost, and thus the question of affordability needs to be addressed. Dealing effectively with the tradeoffs will require the weighing of costs and benefits, many of which are hard to quantify. Establishing the right priorities will be further complicated by a variety of uncertainties, and by the need to balance national priorities with increasing pressures to address issues of global sustainability.

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### **Complementarity and the Positive Linkages**

4.4 As noted in Chapter 1, economic growth and changes in the structure of production are an integral part of the development process. While rapid growth is closely associated with increasing pressure on natural resources and increasing volumes of waste, efficient and equitable growth is a necessary condition for improving environmental quality: the demand for a cleaner environment is clearly linked to income levels, with the wealthier countries best able to afford the investments needed to meet that demand; equitable growth is necessary for the reduction of poverty, which in turn will reduce some of the environmentally damaging practices used by the poor to obtain a livelihood; rising levels of income, together with investments in health and education, are closely related to the adoption of family planning techniques that can reduce the overall growth of the population, and thus reduce future pressures on the natural environment.

4.5 To stimulate rapid growth, reduce poverty and achieve other important social objectives, most countries have adopted policies that interfere with the normal functions of the market place--e.g., subsidized prices for natural resources to encourage their exploitation and use, tariffs and non-tariff barriers to protect domestic producers, and the provision of public services (especially water and electricity) at rates below the cost of production. In nearly every case, these interventions have had the unintended effect of encouraging inefficient growth, unsustainable use of natural resources, and excessive levels of pollution.<sup>1</sup> Removing such distortions will have the opposite effect. Moving to market prices for land, forests, water, and energy, for example, will simultaneously reduce wasteful consumption (thus conserving resources and reducing pollution), improve the efficiency of production (and hence competitiveness), and enhance Government revenues (by the elimination of subsidies).

### **Market Failures and the Need for Government Intervention**

4.6 Moving to market prices is a necessary, but not sufficient, condition for environmentally sustainable growth. In addition to policy distortions, environmental problems are also caused by the failure of markets to take into account potential "externalities". Industrial pollution is the classic case of a "negative externality". Because the effects of pollution on the environment are not valued by normal market forces, they are not reflected in the financial costs of polluting firms--even though, as noted in Chapter 3, the social and economic costs for those affected may be quite substantial. But markets also fail to take into account the positive benefits of natural ecosystems, such as the hydrological effects of forested areas in the uplands of a watershed and the many ecological and economic benefits of mangrove forests and coral reefs (as described, for example, in Box 2.3). As a result, government interventions will be needed to correct for these market failures. In the case of pollution from industrial sources, this has led to the well known "polluters pay" principle, adopted by the OECD countries, which is intended to force private sector firms to "internalize" the costs of pollution. Government intervention will also be required, however, to protect key natural resources and critical ecosystems, especial when the incentives for individual behavior in the short run conflict with societal interests in the long run--including the interests of future generations and the continued existence of species other than our own.

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<sup>1</sup> The health effects and environmental consequences of market distortions designed to encourage industrialization in Eastern Europe and the former Soviet Union are noted in Chapter 6.

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### The Question of Affordability

4.7 Government interventions in favor of the environment, however, rarely come without a cost. Pollution standards and fees designed to implement the "polluters pay" principle, may lead to lower growth of output and employment.<sup>2</sup> The protection of biodiversity means that land, forests and marine resources that could be used to generate income for local communities must be set aside. Investments in urban infrastructure (sewerage systems and public transport) will generate economic as well as environmental benefits, but financing them from limited fiscal resources means that less is available for other important needs such as health care and education. Even the removal of subsidies on natural resources--the classic "win-win" scenario of environmental management--is not without a cost, at least in terms of the "political capital" that may be used up in the process of implementation.

4.8 The fact that tradeoffs are required between economic growth and environmental protection has led some to argue that the developing countries cannot afford to adopt the kinds of policies that have emerged in the wealthier, industrialized countries of the world. Businessmen, for example, often claim that the imposition of pollution control measures will put them out of business, and Government authorities in the developing countries--almost without exception--have concluded that the creation of employment and incomes for the poor must have precedence over "environmental amenities". More recently, however, as a result of accumulating experience in both industrialized and developing countries, the issue of affordability is being reassessed--on several grounds.

4.9 **First**, there is growing recognition that poor people in rural areas suffer the most from the degradation of forests, land and water, while the poor in urban areas have less access to clean water and sanitation and are particularly vulnerable to the effects of environmental pollution. **Second**, there is mounting evidence that adverse health effects in the newly industrializing countries--from urban water and air pollution and the uncontrolled disposal of hazardous waste--are occurring much earlier in the process of industrialization than they did in the West (see Box 4.6). As noted in Chapter 3, the health costs of pollution in Indonesia, and thus the benefits of pollution control, are already quite substantial. **Third**, as noted in Chapter 5, the costs of pollution abatement are lower than is often assumed, and are relatively modest when compared with the benefits, while the costs of clean-up may be enormous. The adoption of "clean technology" can enhance competitiveness, as well as reduce pollution, and controlling congestion and pollution in urban centers may be essential for attracting foreign investment--especially in the higher-technology, less polluting industries.

4.10 **Finally**, the failure to account for unsustainable management of natural resources and uncontrolled environmental degradation in the conventional measures of economic growth provides a false sense of progress. Estimated GDP growth in Indonesia from 1971-1984, for example, adjusted for the depletion of petroleum resources, unsustainable extraction of timber, and soil erosion on Java, would decline--by one estimate--from 7.1% to only 4.0% (Repetto, 1989). Adjusting for the social costs of pollution would further reduce the growth rate, but would provide a more accurate measure of progress in improving human welfare--which is, of course, the ultimate goal of economic growth.

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<sup>2</sup> The output and employment of polluting industries may (but will not necessarily) decline, while that of other industries may or may not increase--depending in part on whether they benefit from reduced costs as a result of the decline in pollution levels.

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### **Establishing Rational Priorities**

4.11 With limited financial and administrative resources, it will obviously not be possible for GOI to take on every environmental issue with the same degree of urgency. And not every issue is equally important. The establishment of rational priorities for action, therefore, should be based on a careful assessment of costs and benefits, taking into account the tradeoffs noted above, the opportunity costs of expenditures on environmental protection, and whatever risks and uncertainties may exist about the longer-term implications of continued environmental degradation.

4.12 **Valuing Costs and Benefits.** In an ideal world GOI could establish its priorities simply by comparing the costs and benefits of measures to protect the environment with similar calculations for investments in other areas. Unfortunately, many of these costs and benefits are extremely difficult to quantify and, even where quantification might be possible, the data may not exist. (The challenges of data collection and analysis in Indonesia are described in Chapter 6.) Ecosystems, for example, provide a variety of social and economic benefits. Some, such as timber and non-timber forest products, can be valued at market prices. Others, such as the role of mangrove forests in preventing coastal erosion, must be valued indirectly—e.g., from lost agricultural production. The value of future options and "existence value" for biodiversity, however, can only be inferred from "willingness to pay" indicators that are subject to wide variations and interpretations, as noted in Chapter 2.

4.13 Tradeoffs between socio-economic activities and the multiple functions of an ecosystem may also be difficult to quantify (e.g., the sometimes conflicting use of rivers, lakes and estuaries for irrigation, fisheries, industry and other productive purposes, the assimilation and carrying away of wastes, human consumption and recreation). In some cases, the value of "substitutes" can be used. To compensate for heavy pollution in the rivers supplying water to Jakarta treatment plants, for example, it was necessary to construct a major canal to bring less polluted water from further upstream—at a cost of US\$400 million. Quantifying the tradeoffs between development activities and human health is more challenging due to uncertainties in the "dose/response" rate, data constraints, and methodological issues in valuing human life, as noted in Chapter 3. Here, the experience of other countries may provide a useful guide. Environmental degradation may also impair the "socio-cultural support" functions of an ecosystem (e.g., the effects of deforestation on indigenous forest dwellers), or reduce important "amenity values" (e.g., the loss of open spaces in urban areas). As in the case of endangered species and other benefits of interest to future generations, value judgements will sometimes have to be substituted for strict cost/benefit considerations. Wherever possible, however, priorities should be based on the careful assessment of costs and benefits.

4.14 **Dealing with Risks and Uncertainties.** Unfortunately, there is also a great deal of uncertainty about many of the key issues of environmental sustainability. The ability of ecosystems, for example, to cope with the cumulative effects of depletion or degradation is not fully understood (e.g., the effect of changes in water temperature on coral reefs), but there appear to be "threshold" limits beyond which they cannot survive. The long-term effects of ecological change may depend on highly complex relationships which make them extremely difficult to predict (e.g., the accumulation of greenhouse gases in the atmosphere and the implications for global warming). Similarly, the effect of specific pollutants on human health (e.g., the role of industrial pollution or vehicle emissions in the increasing incidence of cancer, respiratory illness and heart disease) may be difficult to distinguish from other contributing factors (e.g., cigarette smoking and in-door air pollution).

4.15 Wherever the penalties for "guessing wrong" are high, a bias in favor of environmental protection will be appropriate. This is clearly demonstrated by the past experience in other countries with the uncontrolled disposal of toxic and hazardous waste--such as the discovery of mercury accumulation in the food chain at Minimata Bay in Japan, with devastating consequences for the local population. Where the costs of concerted action are high, however, and the benefits are distant or uncertain, a more conservative approach would be justified--as in the case of global warming. (See, for example, the analysis and recommendations in Annex D and the World Bank's WDR 1992.)

4.16 **Indonesia's National Priorities.** Despite all of these challenges and uncertainties, decisions must be made about which problems to address and in what order, how far to go in setting environmental standards, and how much to invest in environmental protection. Existing "order of magnitude" data is sufficient to identify the most critical problems. As a part of this study, for example, a simple ranking exercise was undertaken which compared the issues discussed in this report with the priorities of Indonesia's long-run development strategy (see Annex C-6). This assessment identifies five issues that appear to have the highest priority: **water supply and sanitation, solid waste management and vehicle emissions in Indonesia's major urban centers, industrial pollution control--primarily on Java, and the management of forest concessions in the outer islands.** In each case there are serious implications for the achievement of GOI's development objectives.

4.17 Other issues with a high, but less critical, rating involve the protection of upland watersheds, coastal zones and fishery resources, and improvements in the management and sustainable use of forest lands, including greater efficiency in the wood processing industries and the development of forest plantations. It should be noted that these rankings represent national priorities and would apply, in the first instance, to the allocation of Government resources at the central level. Obviously, other priorities may apply at the provincial and local level, and the attention given to the highest priority issues by senior policy-makers need not detract from the attention given to other issues by the relevant Government agencies, local communities and other interested groups (see Chapter 5).

4.18 **National Versus Global Concerns.** GOI has a long-standing commitment to issues of global sustainability. This is reflected in the positions Indonesia has taken, and the commitments it has made, in each of the most critical areas--from destruction of the ozone layer and global warming to the protection of biodiversity and the conservation of its tropical rainforest (see Box 4.1). The main challenge, as described in this report, is one of implementing its commitments effectively. There are also, however, important issues of "financial burdensharing" that remain to be resolved between the developed and developing countries, and an urgent need in most of these areas for technical expertise and assistance, as well as incremental financial resources.

4.19 Some of these issues have become increasingly contentious (and politicized) in recent years, reflecting the dichotomy of interests between the industrialized West and the developing world--not only in the relative priority of environmental protection versus growth and poverty alleviation, but also in the sharp differences of interest in specific issues of environmental sustainability (global versus national and local). The relatively high priority rankings noted above for forestry-related issues, for example, reflect the importance to Indonesia of managing its remaining forest resources sustainably, including the role of forest products in the growth of employment and non-oil exports. But they also reflect the growing threat of consumer boycotts and proposals from NGOs in some of the industrialized countries for import restrictions on products made from tropical timber.

4.20 Some of the pressure from external sources is clearly misguided. The effect of bans or boycotts on tropical wood, for example, would be to reduce the value to Indonesia of standing timber, and thus increase the incentives for converting natural forests to other uses. The possibility of "green labeling" (or restricting the import of tropical timber unless it is certified as coming from "sustainably managed" forests) could have the opposite effect--including the possibility of higher prices for such products. The introduction of sustainable management practices in all of Indonesia's 500 concessions, however, will require a number of years to achieve. Taking the pressure off Indonesia's natural forests will also require alternative sources of income for the growing population in the outer islands. The expansion of labor-intensive, export-oriented industries in urban centers would simultaneously provide additional employment opportunities, and draw people out of the rural areas, while reducing the need for growth in forest product exports. Given Indonesia's comparative advantage in textiles, garments, and footwear, therefore, a more open global trade regime would help to protect the forest.

4.21 Similar pressures and criticisms from abroad have arisen in the development of Indonesia's energy resources. Some would argue that Indonesia should give highest priority to energy conservation and "renewable" energy sources to meet its future needs, and are opposed to hydro-electric projects (because of resettlement issues), the use of coal (due to its effect on global warming) and nuclear power (also for environmental reasons). The reality, as noted in Chapter 2, is that rapidly increasing energy consumption will be critical for economic growth and the reduction of poverty over the next several decades. Energy efficiency and conservation is important, but would only reduce the growth of legitimate needs by about 20%. For technical and economic reasons, renewable energy sources will be able to provide only a small proportion (less than 10%) of total supply. Even with increasing reliance on gas, the use of coal will be essential for the "least cost" development of the power sector. Currently, Indonesia contributes less than 2% of the world's greenhouse gases, of which only 12% is due to energy use--including coal (see Box 4.1).

4.22 Such pressures are likely to increase in the coming years and, if the past is any guide, will focus almost exclusively on issues of global sustainability. There is a risk that these pressures will distract from the attention needed to issues of local sustainability--including the rapidly growing health threats of urban and industrial pollution faced by millions of Indonesian citizens. Clearly what is needed, as noted by President Soeharto at the 1993 UNCED meetings in Rio, is less confrontation, greater understanding on all sides, and the development of more effective global partnerships.

### C. CHOOSING THE RIGHT APPROACH

4.23 GOI's emphasis on growth, poverty reduction and human resource development in the past has contributed significantly to the prospects for more sustainable growth in the years ahead. A concerted effort will be required, however, to reduce environmental pollution and to manage natural resources more effectively. There are a variety of policies and instruments available to achieve those objectives--direct and indirect, regulatory, "market-based", and others. Choosing the right approach will be important--but not always easy. While Indonesia can benefit from the lessons learned in other countries, much of that experience demonstrates "what not to do". And what has worked in other countries may not work in Indonesia. What is clear is that choosing the right policies and instruments will determine not only the success or failure of the effort, but also the costs.

**Box 4.1: Global Environmental Concerns: Indonesia's Role and Commitments**

**Acid Rain:** While the available data is incomplete, there is currently no evidence of the impact of acid rain in Indonesia. On Java, where acid rain-related pollutants are most concentrated, the chemical characteristics of the soil would buffer the effect of acidification. Due to its location and the prevailing winds, there is also no evidence that Indonesia contributes to acid rain in any of its neighboring countries.

**Ozone Depletion:** Indonesia currently consumes about 4,000 tons of Ozone Depleting Substances (ODS) annually, all of which are imported since it does not produce them. This represents less than 1% of total world consumption. Indonesia has ratified the Montreal Protocol (MP), and is committed to phasing out all ODS consumption by 2005 at the latest. A National Committee has been established to oversee this process. A first ODS Phase-Out Project is under preparation and will be submitted to the MP in 1994.

**Global Warming:** A recent analysis indicates that Indonesia contributes less than 2% of the world's Greenhouse Gas (GHG) emissions. Of this amount, about 75% is due to changes in land use (mainly from deforestation--including forest fires), 12% from energy use, 9% due to methane emissions (mainly from wet-rice agriculture), and 4% from Chlorofluorocarbons (CFC). For the future, wet-rice agriculture will grow only slowly, and CFCs will be phased out under the Montreal Protocol initiative. Carbon dioxide emissions from energy use may increase as much as 14-fold over the next twenty five years as a result of growing demand for electricity in manufacturing and in residential use, combined with growing energy consumption for transportation. GHG emissions in the Asia Region (excluding Japan) are growing very rapidly, and could exceed those of Europe and the U.S. within the next two decades. Compared with China and India, however, who together produce 75% of the Asian total, Indonesia's share is relatively small--about 5%. Indonesia has joined the Climate Change Convention, and is committed to limiting the growth of its GHG emissions.

**Protection of Biodiversity:** Indonesia has the second largest remaining tropical rainforest in the world which, together with the rich diversity of its marine resources, makes it one of ten "mega-diversity" countries. GOI fully recognizes that these biological treasures are a global asset, and is committed to protecting them for the benefit of future generations. It has recently completed a National Biodiversity Action Plan which establishes specific geographic areas to receive priority attention. Indonesia has set aside nearly 10% of the country's total land area (about 19 million hectares) as parks and reserves, covering all of the major zones of interest for biodiversity protection. It was one of the early contributing members to the Global Environment Facility (GEF), and is currently preparing an "Integrated Conservation and Development" Project in the Kerinci-Seblat National Park area for submission to the GEF.

**Conserving the Tropical Rainforest:** Nearly 70% of the land in Indonesia is classified as "forest land" by the Ministry of Forests--about 144 million hectares. Approximately 110 million hectares are currently estimated to contain closed canopy forest. In addition to the 19 million hectares (13% of forest land) set aside for conservation purposes, 30 million hectares (21%) are designated as "protected areas"--mainly for watershed protection. To meet the needs of its population, and reduce poverty in the outer islands, another 21% is expected to be converted to agricultural use (including tree crops). The remaining forest land (about 45%, or 65 million ha.) is designated for limited or full production under Indonesia's "selective cutting" approach to forestry management. GOI has expressed its commitment to the sustainable use of these production areas in the form of a Tropical Forest Action Plan. In this area also, support (and understanding) from the donor community will be needed to implement this commitment effectively.

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### **Environmental Effects of Macroeconomic Policies**

4.24 Macroeconomic policies are primarily used to maintain economic stability and promote growth. These include monetary and fiscal policy, trade policy and the management of external debt. In general, they focus on aggregate balances in the economy (savings and the demand for credit, fiscal revenues and expenditures, trade and "current account" balances, etc.), and on absolute, rather than relative, prices--e.g., controlling inflation in the overall level of prices. (Influencing the relative prices of goods and services is generally the concern of sectoral--or microeconomic--policy.)

4.25 Such policies are rarely intended to influence environmental outcomes, but--directly or indirectly--they sometimes do. Fiscal policy, for example, is used to balance the Government's budget, but this may involve changes in taxes (such as "stumpage fees" in the forestry sector) and expenditures (including investments in water supply and sanitation, and subsidies for fuels and electricity). Trade policies help to balance the current account, but movements in the exchange rate will effect the demand for exportable natural resources, and changes in tariffs and non-tariff barriers will influence the structure of domestic production, with potential consequences for the level of industrial pollution. The precise nature of these unintended effects, however, is often hard to predict, and the analysis may lead to ambiguous--and sometimes misleading--results (see Box 4.2).

4.26 As noted earlier, policies that promote efficient and equitable growth are essential for improving environmental quality, and macroeconomic stability is essential for encouraging such growth. In broad terms, therefore, Indonesia's macroeconomic policies have been increasingly supportive of environmental sustainability, especially the structural adjustment initiatives designed to improve the efficiency and competitiveness of domestic production and to encourage foreign investment. Policy initiatives designed to restore and maintain macroeconomic stability have been especially important for growth and, together with GOI's emphasis on poverty reduction and efforts to control the rate of growth of the population, have clearly been "environmentally friendly".

4.27 Given the possibility of "unintended effects", significant changes in macroeconomic policies should be carefully reviewed for potential environmental impacts. Most environmental problems, however, arise from sectoral policies that distort market prices, or the failure of relative prices to properly reflect market "externalities". In most cases, therefore, a sector-specific approach will be needed. Often this will involve fiscal policy such as changes in taxes or subsidies (see, for example, Ahmed, 1991). Some environmental problems, of course, arise from cross-sectoral issues, such as those affecting land and water resources. Here, the development of institutions that can coordinate policy initiatives among and between the relevant sectors will be required (see Chapter 6).

### **Sectoral Policies: Alternative Approaches**

4.28 Influencing environmental outcomes in a specific sector will sometimes require direct intervention in the form of public sector investment (e.g., sewerage and sanitation in urban areas). The primary challenge, however, is to encourage environmentally responsible behavior by others: getting private sector firms to invest in pollution abatement equipment, households to dispose of their solid waste properly, individuals to use public transportation rather than private vehicles, etc.. The policies and instruments available to meet this challenge fall broadly into three categories: regulatory; "market-based" and "other". These are described briefly below.

**Box 4.2: Macroeconomic Policies and the Environment: Myths and Realities**

**Debt and the Environment:** Many have argued that a high debt level forces developing countries to exploit their natural resources at unsustainable rates--contributing, for example, to deforestation. While Indonesia has a relatively high external debt burden, it has used these resources to supplement domestic savings, and channeled them to productive purposes, thus contributing to growth and the reduction of poverty. From the early 1970s to the mid-1980s, oil and gas exports provided the means to repay such borrowings, but "non-oil" exports have since taken the lead. Forest products have been one of the fastest growing non-oil exports, and now contribute 20% of the total. Deforestation in Indonesia, however, is caused by a variety of factors, some of which have nothing to do with the level of external debt--such as increasing population pressures and the absence of alternative sources of income for local people. The introduction of export bans on raw logs and sawnwood in Indonesia has undoubtedly contributed to unsustainable rates of timber extraction, but their purpose was to promote employment growth and higher "value added" from the export of forest resources--both of which have occurred. In reality, as GOI is well aware, the need for continued growth in exports over the longer term, to ensure the repayment of its external debt, provides a powerful incentive for Indonesia to manage its natural forests more sustainably.

**Environmental Effects of Structural Adjustment:** Some have suggested that "structural adjustment" programs may have serious (unintended) negative effects on the environment. Since the early 1980s, GOI has undertaken a number of policy reforms designed to restructure the economy and reduce the reliance on oil and gas, including the deregulation of industry, financial sector reforms and a series of trade policy reforms--including two major devaluations and a significant reduction in tariffs and non-tariff barriers. The impact of these reforms on the environment is difficult to assess. Environmental effects of financial sector reform are probably not significant. The net effect of trade policy reforms is somewhat ambiguous: devaluations increase the demand for exportable natural resources, but a recent review of the "effective rates of protection" for Indonesian industry indicates that tariff reforms were environmentally friendly--or at worst, neutral--since they generally favored less-polluting industries. Together with industrial deregulation and the encouragement of foreign investment, these reforms have led to a high rate of growth and investment, mainly in labor-intensive export industries where efficient production is needed for global competitiveness. Resulting changes in the structure of industrial production have led to lower pollution intensities (per unit of output), with additional environmental benefits likely from greater efficiency in the consumption of natural resources--especially from the adoption of newer technologies.

**Foreign Investment and "Pollution Havens":** Since environmental standards in most developing countries are poorly enforced--if at all--conventional wisdom would suggest that the encouragement of foreign investment runs the risk of creating a haven for polluting firms eager to escape such enforcement in their home countries. The available evidence, however, points to a rather different conclusion. While exceptions no doubt exist, most multinational firms--in response to liability concerns and close scrutiny by shareholders, customers and NGOs--have adopted standard environmental policies wherever their factories are located. In many cases, technology designed to meet strict environmental standards in the West is not easily "unbundled" when used elsewhere. Studies of firms that have moved to another country reveal that the savings in labor costs (the major reason for many such moves) vastly exceed the savings in pollution control costs, compared to what they would have faced in their home countries. There is also anecdotal evidence that foreign firms are beginning to press developing country authorities to adopt and enforce more stringent environmental standards for domestic firms, simply to obtain a "level playing field".

**4.29 The Regulatory Approach.** Sometimes referred to as "command and control", this approach is designed to achieve environmentally responsible behavior by replacing market forces with non-market controls. Examples include pollution effluent/emission standards for industries and motor vehicles, urban land use plans and zoning controls, and environmental impact assessments ("EIAs") for investment projects. The virtue of this approach is that it focuses directly on the desired outcome, and--assuming the regulations are met--the environmental impact is quite straightforward.

**4.30** Compliance rates will vary, however, depending on the enforcement capacity of the regulating agency, the number of firms or individuals involved, and other factors that influence voluntary compliance (e.g., economic conditions and socio-cultural traditions.) The main drawback is that the costs of complying with the regulations are not usually known. Such costs may vary quite significantly from one firm or individual to another and, unless the number of affected firms and individuals is small, the total costs cannot be determined. A small number will make enforcement easier, but if the numbers involved are high, enforcement capacity is low, and motivations for voluntary compliance are weak, regulatory policies may simply result in an increase in "transaction costs", with no noticeable effect on environmental outcomes.

**4.31 "Market-based" Instruments.** Other instruments attempt to influence environmental outcomes by relying on market forces--together with changes in relative prices--to correct for "externalities". Examples include explicit charges on pollution emissions by industry, "reforestation" fees on logging companies, differential pricing of fuels (e.g., higher prices for "leaded" gasoline), and subsidies for public transport. The principal virtue of this approach is that firms and individuals can respond flexibly and independently, motivated by self-interest, to change their behavior in line with the change in market prices. In the case of industrial pollution, for example, the regulatory approach requires all firms to achieve the same environmental standard, regardless of the cost. A system based on pollution charges would allow firms with low abatement costs to reduce their pollution, and firms with a high cost to pay the charge. Assuming that the level of charges is sufficient to achieve the desired reduction in total pollution loads, the fact that lower-cost firms contribute most of the reduction would result in a savings in total costs compared to the regulatory approach.

**4.32** With market-based instruments, the costs of compliance can be determined, but the precise impact on the environment will not be known. Setting the right level of pollution charges for industrial emissions, for example, would require either detailed knowledge of the costs of abatement (at different levels of abatement) and current abatement practices, or the use of "presumptive" charges based on estimates of industry-specific abatement costs and average discharge levels. The use of subsidies may sometimes be appropriate, and will generally be more acceptable to those affected than fees and charges, but this will also impose a burden on Government budgets.

**4.33 Other Approaches to Influencing Environmental Outcomes.** Some market failures result simply from a lack of information and poorly-defined or enforced property rights. In the absence of information about the nature and level of pollution emissions by firms, for example, local communities will be unaware of potential hazards and ill-equipped to establish damages in the event of excessive pollution or accidental "spills". Making such information publicly available can be a powerful force in reducing industrial pollution (see Box 4.8). Public information campaigns can also be helpful in generating a stronger consensus in favor of environmental protection and encouraging more environmentally responsible behavior by the general public.

4.34 The threat of financial liability (and especially jail terms) is an even more powerful force in limiting environmental damage. This requires a legal system, however, which is capable of dealing effectively with environmental cases involving criminal violations and civil damages. Educational programs for prosecutors, judges and attorneys can help to strengthen this threat. Similarly, conflicts over land and access to natural resources can be reduced by clarifying and registering property rights, provided these can be legally enforced. Improving land tenure, by itself, can lead to more sustainable management practices by farmers in rural areas and households in urban areas.

4.35 Community participation is another means of influencing environmental behavior for the better. (Issues of participation and community involvement in environmental management are discussed in Chapter 6.) In Japan, for example, community representatives are invited by local governments to participate in negotiations with firms on the pollution standards to be applied. In Indonesia, the involvement of forest-dwelling communities in the management of parks and reserves would be an effective way of supplementing Government enforcement efforts, relying on established local practices and institutions for the sustainable management of these important natural resources.

### Selecting the Right Policies and Instruments

4.36 There are four principal criteria that should guide the design of policies and the selection of specific instruments: environmental effectiveness; cost effectiveness; administrative feasibility; and equity. **Environmental effectiveness** requires that policies and instruments be targeted to the highest priority concerns, and contribute effectively to resolving them. Pollution control efforts, for example, should be targeted to the worst polluters and the most damaging pollutants in the most threatened areas. Biodiversity projects will need to include a focus on finding alternative sources of income for local people, as well as encouraging their participation in the management of parks and reserves, as an essential complement to the enforcement of restrictions on access to protected areas.

4.37 **Cost effective** policies and instruments are those that achieve the desired outcome at the least possible cost, and with a total cost that does not exceed the expected benefits. In theory, market-based policies offer the "least-cost" solution to environmental problems, but—at least in the case of pollution charges on industry—there is relatively little experience in their use. Regardless of whether regulatory standards or market-based instruments are used, cost effectiveness requires that they be tailored to local ambient conditions and the size of the affected population: heavy emissions of particulates from a cement factory in suburban Jakarta, for example, will result in very different "damage costs" than a similar plant located on a sparsely populated hillside in Sumatra. Similarly, removing lead from gasoline in major urban centers will be cost effective, but expensive abatement of sulfur dioxide emissions from coal-fired power plants—especially those in remote areas—may not be.

4.38 **Administrative feasibility** requires the selection of policies and instruments that are consistent with existing institutional capacities, and minimize the need for scarce skills, information and other resources in short supply. In most developing countries, initiatives that require either strong enforcement capacity or high rates of voluntary compliance are difficult to implement. In the case of industrial pollution control, the power of community pressure can be mobilized to supplement enforcement capacity. Programs such as vehicle emissions inspection, however, are more likely to lead to "informal payments" for approvals, and resentment of inequitable enforcement, with little actual compliance with the environmental standards and regulations themselves.

4.39 **Equity** requires appropriate burden-sharing in the costs and benefits of environmental protection, with particular attention to impacts on the poor. Requiring industrial firms to absorb the costs of pollution abatement, for example, shifts the burden from those who would otherwise suffer from environmental degradation (most often the poor) to those who cause it. As noted above, subsidies may sometimes be appropriate, for poverty as well as environmental reasons, but they should be carefully designed to ensure (inter alia) that they are received by the intended beneficiaries. In the case of urban water supply, for example, middle-income households receiving piped water benefit from subsidies, while the poor—who often buy from vendors—pay several times as much.

4.40 In most cases, no single policy or instrument, used alone, can achieve the desired result. Simply building more roads in urban areas, for example, will provide temporary relief from traffic congestion, but—in the absence of incentives to discourage private vehicle use and the availability of adequate public transportation—will end up increasing pollution in the longer term. There is, in fact, enormous potential for complementarity and synergy in the design of policy packages that combine regulatory measures with market-based incentives, increased public information and greater community involvement. As noted below, the development of lead-free and low-lead gasoline, combined with a major shift to compressed natural gas as a vehicle fuel, would help tremendously to reduce the growth of vehicle emissions (and the related health costs) in Jakarta. Related investments (e.g., in a natural gas pipeline) can be justified on purely economic grounds, but the introduction of a modest pollution tax on gasoline and diesel fuel would help to mobilize the domestic resources needed to finance them and, at the same time, provide incentives to reduce private vehicle use. A public information campaign could explain the rationale and help to overcome consumer resistance.

4.41 **The Need for Policy Analysis.** As in the case of macroeconomic policies, sectoral policies may also have unintended effects. The low water rates for residential users, for example, are "cross-subsidized" by high rates for industry. This makes the use of less expensive groundwater for industrial production more attractive, leading to excessive extraction, while the low rate for residential users encourages wasteful consumption of piped water. The design of sound environmental policies and the selection of appropriate instruments obviously requires the careful assessment of costs and benefits, environmental impacts, administrative feasibility and equity. At the moment, however, the capacity within GOI to design environmental policies, and to review other proposed policies for their environmental impacts, is relatively weak. Proposals for strengthening it are discussed in Chapter 6.

#### **D. IMPROVING THE MANAGEMENT OF NATURAL RESOURCES**

4.42 A recent review of the lessons of development experience over the past forty years provides compelling evidence that a "market friendly" approach is the best way to encourage **economically sustainable** growth (see World Development Report, 1991). Success in promoting growth and reducing poverty is more likely when governments allow markets to function well, and concentrate their interventions on areas where markets prove inadequate. These lessons are also applicable to **environmentally** sustainable growth, especially in the management of natural resources. As noted in Chapter 2, for example, there is an urgent need to improve the efficiency with which Indonesia allocates and uses its land, forests, water and energy. As illustrated in the discussion below, there is considerable evidence that a more "market friendly" approach would improve GOI's chances for success in that endeavor.

4.43 Helping markets to work better, and relying on market forces, will help to ensure more sustainable use of scarce natural resources--in a "commodities" sense. But there also a need for greater attention to the protection of critical ecosystems, and growing concern about the economic and social impacts of development on local communities. Government interventions, therefore, will also be required. Given the complexity of the underlying relationships, however, poorly designed interventions--even with the best of intentions--are likely to fail. In some cases, they may also have perverse effects on efficiency, ecological sustainability and equity. These points are perhaps best exemplified in the challenges of improving the management of land in Indonesia.

### **Land Resources Management**

4.44 **Relying on Market Forces.** As noted in Chapter 2, land markets in Indonesia are not well developed. The legal and institutional framework is highly complex, property rights are poorly defined and enforced, and land titling and registration procedures are cumbersome and expensive. State-owned land is transferred to private developers at below-market rates, while permits for the acquisition of private land for development projects often result in large blocks of land being tied up for several years prior to actual development. The costs and complexity of land transactions act as a deterrent to business investment, constrain the allocation of land to its highest and best use, and result in inappropriate land-use densities and increased costs of infrastructure development in urban areas. Improving on this situation will require a major effort to strengthen market forces--by reducing and simplifying land regulations, expediting land titling and registration, improving the availability of land information, and relying on competitive auctions (wherever feasible) to allocate public land.

4.45 "Deregulating" the land market will help to ensure that changes in land use lead to greater efficiency. Increasing population pressures, however, especially in urban areas, and rapid growth of commercial and industrial activity, will inevitably lead to higher prices for land. Rising land prices can prove frustrating for Government authorities responsible for the acquisition of land for development projects. The availability of land at a reasonable price for housing in urban areas, especially for the poor, is another frequently cited concern. Interventions to control increases in land prices, however, or to set aside land for housing and other purposes, will generally be self-defeating. Government-sponsored "land banks", for example, have rarely been successful (see Box 4.3). In fact, any market intervention that involves "taking land off the market"--including the development permits noted above--will simply result in higher prices for the shrinking amount of land still available on the open market--increasing the prospects for land hoarding and speculation.<sup>3</sup>

4.46 Other market interventions may have equally perverse effects. In many developing countries, for example, efforts to set minimum standard lot sizes for low-income housing involves a larger size lot than the poor can actually afford. Priced out of the formal market for properly planned housing lots, they are forced to construct "temporary" housing on much smaller plots in areas not intended for housing at all. Subsequent attempts to provide infrastructure and urban services are either impossible or made more expensive by the haphazard layout of such settlements.

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<sup>3</sup> Much of the land area in some of Indonesia's main urban centers is already covered by previously-granted development permits, thus limiting the availability of land for new development initiatives by either the public or private sector.

**Box 4.3: Land Banking: Experience in Other Asian Countries**

The desire to ensure that urban land is available at a reasonable cost for development purposes (including housing), and to limit speculative increases in land prices, has led many governments in the Asia region to establish public sector "land development agencies" (e.g., Pakistan, India, Thailand, Philippines, and Korea). Such agencies are often authorized to acquire both public and private land, the latter through a combination of voluntary sales by private owners and the expropriation of land in excess of legally defined limits on private holdings. The intention is to increase the supply of serviced urban land, reduce the market price of such land, improve the access of low-income families to serviced land, and facilitate the work of private sector developers.

The record of experience, however, is not very encouraging. The most common outcomes include: low compensation rates for land obtained from private owners; a tendency to serve the middle and upper income markets with subsidized land and subsidized credit for housing; prices for developed housing plots that exclude 90% or more of the poor (largely due to unaffordable standards on lot size); operating policies and procedures that lead to inefficient and financially unsustainable operations; and a failure to improve the supply of land available to private sector developers. Illustrative examples include:

**Pakistan:** Beginning in the 1960s, when Karachi's total population was only about 1 million, the Provincial government established what amounted to a land bank in a largely deserted and barren area surrounding the city. This land was developed as housing sites and sold at subsidized prices to private individuals, many of whom purchased the lots with repatriated capital as an investment for the future. Today, the city has grown to 10 million people. While some 200,000 of these developed plots sit vacant, an estimated 4 million low-income citizens are living in informal subdivisions and dwellings, occupying less than 10% of Karachi's total land area. (United Nations, 1988.)

**India:** Under the 1976 Urban Land Ceiling and Regulation Act, state governments were empowered to acquire private land held in excess of specified amounts at significantly less than market prices. The Act froze the land market. By the late 1980s, some 100,000 hectares of urban land had effectively been taken out of the market in 73 cities, often as a result of lengthy court cases with landowners. Prices of land still privately traded increased sharply--between 10% and 100% annually in some of those cities. (World Bank, 1991.)

**Korea:** Beginning in 1975, a government agency was established to create a land bank, using public sector funds and capital market bonds to acquire both public and private land. In 1979, this agency was replaced by a land development agency, which has continued to acquire land by voluntary sales and expropriation procedures, but has generally been able to develop and sell serviced plots within 3-5 years. These interventions, however, have not contributed to stabilizing the price of privately held land. In fact, the price of privately held land has continued to increase--at a particularly fast pace in 1988-89. (Hyun-Sik Kim, 1992)

In a number of countries in the region, the speculative increase in land values has contributed to distortions in capital markets, and--to the extent that land purchases have been based on borrowed funds--increasing risk for the financial sector. Wherever rapid economic growth and increasing demand for urban land is pushing up prices, Government interventions such as "land banking" are likely to exacerbate the problem and--judging from experience elsewhere--will be of little real help to the poor.

4.47 **Government Interventions.** Protecting critical ecosystems (e.g., watersheds, coastal zones and aquifers), and other important ecological assets (e.g., terrestrial and marine nature reserves) will require market interventions. GOI has recently approved legislation that provides a framework for spatial planning, including the protection of certain areas and improved planning for the economic use of the remaining areas. As noted below, the use of "strategic structural plans" can play an important role in guiding the development of urban centers and improving efficiency and sustainability in urban land use. The adoption of detailed zoning plans, however, is likely to result in increased transaction costs and reduced flexibility in responding to changing market conditions.

4.48 Greater recognition of property rights and improvements in the security of land tenure can lead to more sustainable farming practices in rural areas. As noted in Chapter 2, however, many traditional communities have developed local systems of communal property rights for managing their natural resources. Land titling and registration based on individual property rights, therefore, will negate these practices, and thus reduce the prospects for continued sustainable management.

4.49 Rapid growth and development over the past several decades has led to increasing conflicts over the use of land and access to other natural resources. A major concern is the loss of land and livelihoods for those displaced by development projects. Here, Government intervention should take the form of a clearly articulated and carefully implemented policy on compensation for lost property rights and the resettlement of affected people, with particular attention to restoring their livelihoods. There is also increasing evidence of unintended negative effects of development projects on natural resource-dependent communities, especially in the outer islands (see Box 6.8), and growing concern about the uncontrolled effects of environmental pollution by industrial firms on the health and welfare of "downstream" communities (see Box 6.10). Improvements in the consultation process prior to project approval, constructive participation in project design and implementation, and improved mechanisms and Government support for "dispute resolution" in the case of damages to the environment and to local communities would go a long way toward ensuring more harmonious and equitable development. (These topics are discussed in Chapter 6.)

### **Parks and Protected Areas**

4.50 Until fairly recently, Government efforts to manage parks, reserves, and watershed protection areas have focused primarily on the enforcement of restrictions on entry. Given the vast extent of these land areas, the large number of people living near (or within) their boundaries, and the limited number of forest department staff, such efforts cannot be expected to succeed. Encroachment of poor and landless farmers in the uplands of Java, for example, has led to soil erosion from land clearing on steep slopes. Initial efforts to reduce erosion, based on terracing and step dams, were not successful. Recent efforts to support the adoption of more sustainable agricultural practices appear to have greater promise, providing the institutional arrangements for extension services and supportive infrastructure can be improved (see Box 2.2). Pilot programs of "social forestry" have also been attempted in the upland areas of Java, but with somewhat mixed results thus far.<sup>4</sup>

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<sup>4</sup> Village women seem more interested than men in participating in such schemes, but the rights to harvest are typically granted only to "heads of households". When husbands lose interest, their wives may lose the right to continue participating in the program.

4.51 In the longer term, as noted in Chapter 1, the lure of higher paying jobs in Java's rapidly growing cities and towns will help to reduce the pressure on threatened ecosystems. In the outer islands, however, keeping people out of the parks and protected areas will be far more difficult to achieve--especially in those areas where the boundaries fail to take into account the existence of long-standing forest-dwelling communities. GOI's success in protecting these areas will ultimately depend on the cooperation and support of local communities. Government interventions, therefore, will have to combine conservation activities within protected areas with income-generating activities outside their boundaries, with a major emphasis on community participation.

4.52 Recent initiatives include the design of integrated conservation and development projects (ICDPs), such as the one currently under preparation for Kerinci-Seblat National Park (see Box 2.4). Past projects include the Dumoga-Bone National Park, which was established to protect the forest cover in the upland area of rivers supplying irrigation water for several thousand rice farmers, and a 70 square kilometer area of rainforest in Irian Jaya, where an agreement was reached with indigenous people on joint decision-making about reserve boundaries, regulations and management plans, with local communities acting as a "guard force" to prevent illegal forest cutting while maintaining their traditional forest activities. Projects such as these, however, are still in the experimental stage and are not yet fully proven. Implementation on a large scale would be expensive and time-consuming. It would also require a degree of inter-agency coordination by central and local Government authorities that will be hard to achieve. The protection of biodiversity will also require foreign expertise, and both international and local NGOs can play a helpful role in project design and implementation. (Prospects for grant funding from donor countries is discussed in Chapter 5).

### **The Management of Forest Resources**

4.53 In addition to parks and protected areas, plans for the remaining forest land in Indonesia include the conversion of some to agriculture use--including tree crops--mostly through Government-sponsored development programs. As noted in Chapter 2, it will be important to ensure that these initiatives lead to sustainable use of the converted land. This will require improvements in agricultural research and extension, and the design of farming systems tailored to local ecological conditions. Highest priority should be given to improving existing schemes (e.g., replanting of tree crops using better seedlings, and better design and implementation of drainage schemes in swampland reclamation areas), and the use of already degraded forest lands (along grass areas) for both agricultural expansion and (especially) the development of timber plantations (as noted below).

4.54 Perhaps the most contentious issue of forestry management today, however, is the management of production forests. The introduction of bans and prohibitive export taxes on logs and sawn wood has resulted in domestic log prices that are significantly lower than international levels. This outcome greatly undervalues the remaining natural forest, and has led to inefficiencies in the wood processing industries. Combined with poor logging practices, the amount wasted is equivalent to a third of the total harvest. Current extraction rates have been estimated to be as high as 36-40 million cubic meters per annum. While there is considerable uncertainty about the regeneration rate, the limits of sustainability on an annual basis may already have been exceeded--thus raising the possibility of a shortage of supply in the longer-term and the gradual disappearance of this valuable resource. In the near term, as noted above, Indonesia's exports of wood products (plywood, furniture and others) are threatened by the prospect of import restrictions and consumer-led boycotts.

**4.55 Moving to Market Prices.** In response to these issues, GOI has committed itself to achieving sustainable management of its production forests by the year 2000. To achieve this goal will require a combination of reliance on market forces and direct Government interventions. Issues of efficiency and global competitiveness for the wood processing industries, for example, and sustainable use of the natural forest have converged on the issue of prices for raw logs. To improve both efficiency and sustainability, it will be necessary to raise domestic prices to international levels. A sudden opening of the domestic market to foreign buyers would price some processing firms out of the market, with the loss of jobs and invested capital, and is unlikely to be politically feasible. Log prices could be raised over time, however, according to a pre-announced schedule, and--combined with regular increases in Government fees on standing timber--would move the processing industries in the right direction. It would also improve the share of forestry "rents" collected by the public sector, and avoid the experience of other countries (e.g., the Philippines) where excessive rates of logging by the private sector essentially eliminated the natural forest and the benefits of watershed protection and other ecological services, with little gain to public revenues or local communities.

**4.56 Improving Concession Management.** Pricing alone, however, will not resolve the problem of poor logging practices and other shortcomings in the current system of concession management. The duration of concession agreements, for example, should be changed from the current 20 year period to one of indefinite length, renewable every five years--subject to satisfactory performance. The definition of sustainable management practices, however, will require some further research. Technical assistance to concessionaires for the development of better management plans will also be needed. Proper enforcement of forest regulations will become increasingly important, especially since higher log prices will raise the incentives for illegal logging and reduce the incentives for careful logging. This will require the devolution of responsibility and authority to provincial and local agencies, and considerable strengthening of institutional capacities--including a review of the mandates and organization of forest agencies and investments in human resources development.

**4.57** One solution to some of these challenges would be to contract out for an independent inspection service. Properly conceived and implemented, this service could provide advice and guidance to concessionaires on sustainable management practices while, at the same time, reporting to forest authorities on the adequacy of their current practices. Penalties for failure to perform could be based on a "performance bond" approach, but the more powerful incentive--assuming the advent of "green labeling"--would be the authority of the inspection service to certify whether or not the management practices in a given concession comply with international standards of sustainability. In that context, failure to achieve certification would greatly reduce the value of the concession.

**4.58 The Development of Forest Plantations.** Higher prices for raw logs would improve the profitability of forest plantations, thus stimulating investment by the processing industries in their development, and current subsidies could more easily be removed. The most critical need, however, is to ensure that they are established on already degraded lands and do not cause further deforestation.

**4.59 Ensuring Equity for Forest-Dwelling Communities.** Incentives for ensuring equitable treatment of forest-dwelling and forest-adjacent communities should also be improved. A major effort is needed to improve the delineation of concession boundaries and to better recognize existing *adat* rights. New approaches will be required to ensure community participation in decision-making on forest management, and a more equitable sharing in the benefits to be derived from forest resources.

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## Water Resources Management

4.60 The development of water resources in Indonesia over the past 25 years has played a critical role in stimulating rapid growth and reducing widespread poverty. Public sector investment--in irrigation systems, urban water supply systems, and hydro-electric facilities--has been the primary instrument for developing water resources, complemented by positive incentives (e.g., subsidies for fertilizer, seeds and pesticides to encourage agricultural development) and institutional support (such as agricultural extension services). Because of rapid economic growth, however, Indonesia is beginning to encounter water shortages, primarily on Java, and increasingly serious problems of water pollution in key river basins. As a result, GOI policy-makers have begun to think differently about the role of water as a natural resource. In the past, for example, water was seen a "gift of nature", and charging for its use inappropriate. With growing scarcity and deteriorating quality, however, it is increasingly viewed as a resource for development that involves economic costs as well as benefits.

4.61 **Relying on Market Forces.** Recent discussions in Indonesia have focused on the design of a more integrated strategy for water resources management, including policies and incentives to reduce the demand for water, and institutional development focused on "real time" management of water resources within an entire watershed--including the conjunctive use of surface and groundwater. GOI is already assessing the institutional and regulatory changes that this will require (see Chapter 6). Market pricing and cost recovery policies will be especially important for demand side management, but are also needed to finance additional investments (e.g., in urban water supply) and to ensure the sustainability of past and future investments (e.g., the recent introduction--on a pilot basis--of "service charges" for irrigation water, which will be used by local "water users groups" to fund "O&M").

4.62 **Government Interventions.** The coordination of water pricing among different uses, and different users, will also be needed to ensure environmental sustainability. As noted in Chapter 2, for example, current pricing policies for piped water and for groundwater used by industry contribute to the excessive use of groundwater in Jakarta and other coastal cities on Java. Protecting the quality of water from excessive pollution will require a mix of policy interventions, as noted in the sections below. Focusing on entire watersheds will be important, not just for dealing with the allocation issue but also for reducing the level of pollution from various sources. The provision of clean water in Surabaya and Jakarta, for example, has been increasingly frustrated by pollution from rapidly growing cities, towns and industrial complexes "upstream".

4.63 Few things are more important for human health and welfare than access to an adequate supply of water. Improving the availability of water for both urban and rural households, therefore, should be a key element in targeted interventions to reduce poverty. The willingness of even the poorest households to pay for water is generally high, but access may be constrained by their ability to pay the "up-front" costs (e.g., of connections to piped water in urban areas). In rural areas, better-off villages, almost without exception, have adequate supplies of water. Poorer villages in isolated areas may have adequate water, but there is a high correlation between the lack of water and a low level of income. Poverty-oriented programs to improve the availability of water supply (and sanitation) in rural areas will require additional investments and Government support. As noted in Chapter 6, however, policies on cost recovery (especially for "O&M"), and the participation of local people (especially women's groups) in project design and implementation, will be critical for success. The private sector, and NGOs, can also play an important role (see Box 6.5).

## The Management of Energy Resources

4.64 Like water, Indonesia's abundant energy resources have played a critical role in supporting economic growth. As noted in Chapter 1, revenues from oil have been used to finance massive investments in social and economic infrastructure. Subsidized prices for energy have been seen as a way of "sharing the wealth" of this gift of nature, as well as encouraging more rapid growth. Here also, however, recent events have led to a reassessment of the role of energy as a resource for development. Recognizing that Indonesia may soon become a net importer of oil, President Soeharto has announced the elimination of nearly all of the remaining budgetary subsidies on fuels. This will have important effects on efficiency, sustainability and equity (see Box 4.4).

### Box 4.4: Complementarities in the Adjustment of Fuel Prices

In a landmark decision announced by President Soeharto in his 1993/94 Budget Speech, GOI substantially raised domestic fuel prices with the aim of eliminating budgetary subsidies for all fuel products, except for a reduced and temporary kerosene subsidy. The rationale: "We have to treat energy as an ordinary commodity with the going price at the international market". Retail prices for nearly all fuels were raised to world market levels, with an average increase of 24%. Savings will amount to about Rp 3 trillion, switching a budget subsidy of Rp 1 trillion to a surplus of Rp 2 trillion. Other effects:

**growth and efficiency:** Higher prices will lead to improved efficiency in use and encourage substitution by economically cheaper fuels. Slower growth in domestic consumption will improve the availability of surplus oil for export, while the additional public savings will help to finance investments in infrastructure and human resources to support sustained private sector growth.

**environmental sustainability:** the more efficient use of petroleum products will help to conserve a non-renewable resource and encourage the substitution of less polluting alternatives: gas in industry and transport; central power generation instead of diesel-based "captive" power generation; and LPG in household and industrial uses.

**equity:** Savings on automotive diesel fuel subsidies, which did not benefit the poor, will amount to Rp 1.3 trillion per year. Such savings can now be reallocated to programs that clearly benefit the poor, such as primary education, basic health care, and village water supply and sanitation.

4.65 Similar opportunities exist in the power sector, where low electricity prices for industry, and lower still for residential use, have encouraged the rapid growth of demand and weakened incentives for conservation. They also constrain the ability of the national power company (PLN) to finance the expansion of supply. One result has been the need for industry to invest in "captive" generating capacity, which is not only a less efficient source of power but also results in higher levels of air pollution in urban areas where most industries are located. While the intention of subsidized rates for residential use is to make electricity more available to the poor, most of the subsidy (amounting to about US\$500,000 per year) goes to relatively better-off households, with only about 4% reaching the poor—who consume little or no electricity. Reducing this subsidy would encourage more efficient use of electricity, and the savings could be channeled into more targeted interventions for the poor.

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## Complementarities in the Management of Natural Resources

4.66 There is obviously a substantial complementarity between improving the management of natural resources and promoting sustainable economic growth: enhancing the efficiency and global competitiveness of domestic firms (e.g., in the wood processing industries), ensuring the optimal use of renewable and exhaustible resources (land, water and energy), and maintaining the long-term viability of ecosystem-dependent production and trade (e.g., plywood, furniture, shrimp and other important exports). But there are also significant complementarities between the "green" issues of natural resources management and the "brown" issues of environmental pollution.

4.67 GOI's highly successful IPM (Integrated Pest Management) Program, for example, which was initiated in response to a threat to the rice harvest, eliminated subsidies on all pesticides and banned the use of some. Under the IPM program, agricultural yields have risen while pesticide use has been significantly reduced. Higher log prices, and the resulting efficiency gains in the wood processing industries, would simultaneously reduce the volume of waste created and motivate the search for additional uses--such as the recent investment by a plywood manufacturer in equipment to make particle board. Allowing the prices of water and energy to reflect their true scarcity value would encourage firms and individuals to economize in their use, and provide an important stimulus to industry for the adoption of "clean technology". Equally important, however, is the "revenue effect" of removing subsidies and moving to "market prices" for natural resources. Savings from the elimination of pesticide subsidies amount to US\$150 million per year, and the revenue potential of forestry sector "rents" is a multiple of that amount. The recent fuel price increases will yield budget revenues of US\$1.5 billion in FY93/94 alone--about 1.1% of GDP. Revenues such as these are urgently needed to deal with increasing congestion and pollution in Indonesia's key urban centers.

## Moving Beyond the Identification of Issues

4.68 Identifying environmental problems and establishing priorities is really the easy part. The hard part is figuring out what exactly to do about them, and then doing it. In the case of natural resources management, the general approach is reasonably straightforward, and the primary challenge is one of implementation--moving ahead with the agenda for policy reform and putting in place the institutional framework needed to support those reforms. The payoffs, in terms of complementarity with other important social and economic goals, are also straightforward, and this will help in overcoming vested interests and other constraints to implementation.

4.69 In the case of environmental pollution, however, the approach to take is far less straightforward, and efforts to impose the "polluters pay" principle will encounter significant resistance. Dealing with issues of urban environmental management and industrial pollution control involve major investments--for both the public and private sectors--with a high opportunity cost in a low-income country such as Indonesia, while the benefits are extremely difficult to quantify. Some of the key issues (e.g. vehicle emissions) have only been tackled in the developed countries within the past two decades. In many cases, the approaches adopted in wealthier countries will not be feasible in Indonesia due to differences in income (e.g., willingness and ability to pay) or institutional capacity (e.g. enforcement requirements and the prospects for voluntary compliance). As a result, "second best" approaches will often be needed. As noted below, however, allowing market forces to determine the price of key natural resources may be essential for even those solutions to work.

## E. PROTECTING THE URBAN ENVIRONMENT

4.70 Urban populations throughout Indonesia have been growing rapidly--exceeding 5% per annum in the 1980s. This trend is likely to continue for the next several decades. To accommodate this growth, and to meet the existing backlog of demand for urban services, will require a substantial increase in public sector investment. More effective policies for pricing and cost recovery will be essential, both for "demand management" and to help finance the necessary investments and their operating and maintenance costs. Other policies and instruments will be needed to improve urban land use, ensure that the development of urban services is targeted to high priority areas and needs, improve the coordination of urban infrastructure investments, and minimize their costs.

4.71 The design of more effective policies and incentives and improved coordination of investments across the relevant infrastructure sectors will require a substantial strengthening of the institutional capacity of municipal governments. It will also require changes in central and local government relationships, especially in the planning and financing of urban investments, and greater reliance on community participation in project design and implementation. (Revenue sources and the prospects for cost-recovery are discussed in Chapter 5, institutional strengthening and participation issues in Chapters 6.) The main challenge, however, is to define a strategy for the management of urban areas that accommodates the need for growth while protecting the quality of the environment. At stake is not only the efficiency of the "urban enterprise"--with significant implications for overall economic growth--but also the health and welfare of Indonesia's urban citizens.

### The Challenges of Urban Environmental Management

4.72 Urban development in general has been a growing concern for Indonesia over the past decade, particularly in its larger cities.<sup>5</sup> The focus of attention has been on improving the availability of urban services, especially for the poor, and ensuring the efficiency of the "urban enterprise" as an increasingly important source of economic growth. While the demand for urban services has increased rapidly, however, investments in urban infrastructure--in real per capita terms--have fallen in recent years. Other factors have compounded the problem of keeping up with demand:

- o inefficiencies and distortions in the urban land market have led to low-density development in the older areas of many cities, and thus encouraged urban sprawl. Growth on the periphery of these cities is occurring at a rapid rate (nearly 18% per annum around Jakarta), in areas that are least well-served by urban infrastructure and often at the expense of prime agricultural land and ecologically sensitive areas.
- o private sector development of urban land for industrial, commercial and residential purposes is occurring in an uncoordinated fashion, with municipal governments then expected to provide supportive infrastructure and other urban services. By lagging behind, the costs of infrastructure are higher, since it is then necessary to disrupt already built-up areas to improve roads, lay water mains, and construct drainage systems.

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<sup>5</sup> Much of the discussion in this section is based on data for Jakarta and Surabaya, but the broader issues are likely to be relevant for most other large and rapidly growing cities.

4.73 The failure of infrastructure to keep up with demand has led to growing congestion and pollution, and the degradation of critical ecosystems--including groundwater aquifers upon which industry and households depend for water. Private sector development is occurring in ecologically fragile areas, and often fails to take into account potential impacts on the surrounding community. Efficiency losses are increasing due to traffic congestion, and human health and welfare is threatened by water pollution from human and industrial waste, air pollution from vehicles, industry and the burning of trash, and the clogging of canals and drainage systems by municipal solid waste.

4.74 To deal with the increasing challenges of urban sector growth will require more effective strategies for both the provision of urban services and the protection of the urban environment. The integration of environmental concerns into the urban agenda, however, is a fairly recent phenomenon, not only in developing countries like Indonesia but also in most donor agencies--including the Bank. As a result, there are relatively few "cook book"-type recipes for success. At the same time, the challenges of environmental management may be vastly different from one urban area to another, and it will be necessary, therefore, to develop city-specific plans and approaches. There are a number of emerging lessons of experience from other developing countries, however, that should be useful in the design of strategies for urban environmental management in Indonesia:

- o **first**, such strategies must begin with the recognition that natural resources (especially water, land and air) are the basic foundation upon which cities grow, and their limits must be respected. The starting point, therefore, should be an analysis of the carrying capacity of local ecosystems in relation to both existing and potential future demand, to ensure that the expansion of human and economic activity does not exceed that capacity.
- o **second**, new approaches are needed to influence the spatial dimensions of urban sector growth that recognize the dynamics of the development process, such as GOI's proposed "strategic structural plans", but these will need to be supported by a range of complementary policies and instruments--both regulatory and "market-based".
- o **third**, governments cannot--and need not--do it all. In fact, the chances of success are greatly enhanced by the encouragement of constructive partnerships between government agencies, private sector firms and individual communities within each city. In addition, the "politics" of urban environmental management require a strong consensus on the key issues and the establishment of priorities for action that reflect local values and concerns.

4.75 Experience to date in Indonesia would seem to confirm these principals, as reflected in the discussion below on specific issues of urban environmental management: water supply; sanitation, drainage, and the management of solid waste; and the control of vehicle emissions and other sources of urban air pollution. Before turning to these issues, however, it is important to note the policies and instruments that are needed for influencing the spatial dimensions of urban sector growth--since they will have a bearing on the solutions to these issues. As noted in Section D, deregulating land markets, expediting land titling and registration, and improving the availability of land information will be critical for ensuring that scarce urban land is allocated to its highest and best use. But Government intervention, in the form of a well-prepared and properly implemented spatial plan, will also be needed. This should be supported by other policies and instruments that can help to influence the location decisions of firms and individuals, including the "full cost" pricing of urban services.

**4.76 Prospects for Spatial Planning.** GOI has long recognized the need for better planning and coordination of urban sector investments but, until recently, such plans have not taken into account the spatial dimensions or the environmental limits of future urban growth. In 1992, a new law on "spatial planning" was passed which establishes the legal foundation for improving on current practices. This law provides for the identification of environmentally sensitive areas, where development activities would be restricted, and improved planning for the location and support of significant "activity centers" (e.g., industrial and commercial developments, government complexes, and other sources of employment). In the latter, the intention is to ensure the provision of adequate public services and to minimize adverse affects on surrounding communities and ecosystems. The implementing regulations for this law are now being drafted, and this should be given a high priority.

**4.77** The preparation of "Strategic Structural Plans", as they are called in the new law, provides an important opportunity for municipal governments to anticipate future needs instead of simply responding "after the fact" to private sector initiatives. They also offer the potential of guiding the future directions of development through the planned expansion of infrastructure, including "main trunks" and secondary and tertiary links for roads, electricity, water supply and (where appropriate) sewerage systems. Given the increasingly common phenomenon on Java of "metropolitan areas"--such as Jabotabek--such plans may need to be coordinated with other local governments. Planned use of surface and ground water would also need to be reviewed by the agencies that will be responsible for the management of water on an "integrated watershed" basis.

**4.78** To achieve the necessary political support within the urban community, preparation of such plans should be a highly participatory exercise. This will help to ensure that the priorities for action represent a local consensus on the key issues, and that the final product represents a "shared vision" of what the city should look like two-three decades into the future. It should also be updated regularly, to reflect the dynamics of urban sector growth, and be carefully linked to the capital budget. The temptation to expand the identification of development areas into a detailed and rigid zoning plan, however, should be resisted, since that would only lead to further distortions in the urban land market, add to the cost of land transactions and discourage job-creating investments.

**4.79 The Importance of "Full Cost" Pricing.** As noted below, it will be increasingly desirable for larger and medium-size firms to locate in industrial estates, outside the boundaries of Indonesia's main urban centers, and GOI is encouraging this for new industrial investments. The mandatory relocation of existing firms could be an expensive proposition, but both existing and expanding firms located in urban areas should at least pay the full economic costs of urban services. For new real estate developments in urban areas, consideration should be given to requiring that project sponsors contribute to the cost of the off-site infrastructure investments needed to provide basic services--including trunk lines for roads, water supply, electricity, and other utilities.

**4.80** Wherever the provision of urban infrastructure improves the value of privately held land, and direct contributions and "user fees" are not feasible, the recovery of public sector investments can be achieved through increases in the land tax. At the moment, land taxes are relatively low in Indonesia compared to other developing countries in the region. The more immediate opportunity, however, is to improve the collection of existing taxes and this should have the highest priority. Such an effort--which is already underway--will help to ensure appropriate land-use densities and will also influence the future location decisions of private sector investors.

4.81 Ideally, in addition to pricing urban services at their full economic cost, municipal governments would charge for any negative environmental "externalities" caused by businesses, households and individuals. As noted below, however, this may be neither possible nor desirable--for reasons of equity (e.g., the ability of the poor to pay) or because the social benefits exceed the willingness of private citizens to pay (e.g, in the case of investments in sewerage trunk lines and treatment systems). In other cases, such as the location of polluting industries in urban areas, pricing and market-based instruments alone will not be sufficient, and thus a more regulatory approach will be needed, as noted in Section F, below.

### **Improving the Availability of Safe Water**

4.82 Unsafe water is one of the major sources of disease in Indonesia, and the lack of adequate sanitation facilities is a primary cause of fecal contamination of water supplies. The solution to this problem, of course, is to tackle it at its source--through the provision of adequate sewerage and sanitation services. As noted below, however, this is a long-term challenge, and will not be resolved any time soon. In the interim, a range of policies and instruments is needed to improve at least the availability of "clean" water<sup>6</sup> for the growing number of urban citizens. In most cases, this will involve the provision of piped water by municipal authorities. GOI has set ambitious targets for the number of urban households with piped water connections, and much has been achieved over the past decade. Unfortunately, as with most urban services, growth in demand has outpaced supply.

4.83 While increased investments in urban water supply will clearly be needed, a review of the "demand side" issues carried out as a part of this study concludes that other factors will be equally important. In particular, the strategy for improving on current conditions must take into account the availability and pricing of alternative sources of water (including surface water in rivers and canals, shallow wells, public standpipes, water from vendors, and commercially bottled water). It also concludes that quality and reliability may be even more important than price, and that efforts to expand the availability of piped water (and to enhance equity) should be based on "revealed demand" by households at different levels of income (Whitehead and Bettencourt. 1992).

4.84 **Expanding the Supply of Piped Water.** Expansion of the distribution network will be important in all major cities, but most of the local water agencies could achieve a significant increase in the basic supply of water simply by reducing the proportion that is currently "unaccounted for" (which is often as high as 35-40%). Reducing such losses would allow continued growth in the number of household connections without the need for additional treatment capacity. In some cities, including Jakarta, there is already excess capacity in the treatment facilities, and a high priority should be given to increasing the number and density of household connections. Increasing the number of connections is constrained by a number of factors, but one of the most important is the high "up-front" cost of the connection itself. One proposal to overcome this difficulty is to include part of the connection fee in the monthly charges for water. While this would initially require increased capital for the water authority itself, it would be covered over time by consumers and the revenue from additional connections would improve the overall financial returns for the water agency.

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<sup>6</sup> "Clean" water is defined in Indonesia as water that is free of industrial chemicals and other potentially harmful wastes, but does not preclude the possibility of fecal contamination.

**4.85 Improving Quality and Reliability.** Nearly all urban residents are aware of the need to boil water for human consumption from almost any source. The demand for quality, however, is revealed by the explosive growth in demand for commercially bottled drinking water (43% in 1991), with total sales throughout Indonesia exceeding the daily piped water consumption of DKI Jakarta. Issues of water quality affect the rich as well as the poor. A recent consumer survey (SRI, 1992) found that 70% of the highest income households consider water pollution problems to be "serious to very serious", a larger proportion than those in the lower income households. Supply interruptions and low pressure in the pipes force many households to install home reservoirs to store water, to use pumps applied directly to the pipes, or rely on other sources of supply (e.g., shallow wells). Not surprisingly, a second recent survey found that piped water customers in Jakarta would be willing to pay as much as 30% more than their current water bill for a significant improvement in the level of service (IWACO, 1992).

**4.86** Given the deteriorating condition of many large urban water supply networks, low water pressure, combined with fecal contamination of the relatively high groundwater tables, leads to contamination of piped water through infiltration and the effects of consumers pumps. To ensure the quality and reliability of piped water would require a major effort to improve the quality of initial construction and increased attention to operations and maintenance. This would also help to reduce the amount of unaccounted for water, and thus improve the reliability of the system. The reliability of piped water supply will also be important for reducing the consumption of groundwater in cities where excessive extraction is a major problem. Reliability is especially important for industrial users. Since they also pay much higher rates for piped water than households, increasing reliability for industry would yield high returns for the municipal water agency.

**4.87 Pricing and "Demand Management".** The tariff schedule for piped water includes a relatively low rate for residential use, which is "cross-subsidized" by high rates for industrial use. This encourages wasteful consumption by households connected to piped water, and the excessive use of groundwater by industry. In some urban areas, absolute restrictions on groundwater extraction by industry may be needed, but as long as the price of piped water is higher they will seek alternative sources of supply. Both industries and households are sensitive to the price of water and will respond to an increase in price by reducing demand. In Bogor, for example, domestic consumption declined 30% when prices were increased (by 200-300% in different consumption blocks). Subsequently, a public relations campaign focused on "wasteful practices", including the importance of repairing household leaks. This campaign reduced consumption by 29%, with the cost of repairing household leaks was offset by savings in customer's water bills in about three months time (Cestti, 1993).

**4.88 Pricing and Equity.** While subsidized prices for piped water are intended to help the poor, less than 10% of households with monthly expenditures below Rp 100,000 have piped water, and end up paying 30-50 times more through water vendors. (Over 90% of those with expenditures above Rp 700,000 are connected.) More importantly, the lack of an adequate quantity of water at a reasonable price leads poorer households to use a minimum amount of water from vendors for human consumption, and to use more highly polluted (and thus riskier) sources of water (from rivers and canals) for washing, bathing and cleaning. These practices lead to a high rate of exposure to fecal contamination and a higher incidence of diarrhea and other diseases. Households dependent entirely on vendors for their water also limit their overall water consumption to levels that restrict proper hygiene practices, thereby increasing their risks of water-based diseases.

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## Sanitation, Drainage and Solid Waste Management

4.89 As noted in Chapter 2, issues of sanitation, drainage and solid waste management are closely linked. With growing population density, traditional solutions to the management of human waste are no longer adequate and, as a result, urban water supplies are increasingly polluted. A combination of factors--including erosion in upland watersheds, increasingly built-up urban land, and land subsidence along the coast due to over-extraction of ground water aquifers--has led to increasing problems of flooding in urban areas. The construction and maintenance of drainage systems has not kept up with the need, and the systems that do exist are all too frequently clogged by the uncontrolled disposal of municipal solid waste. Municipal waste that is collected is often disposed of in unplanned and unsafe landfills, which leads to the contamination of aquifers with toxic and hazardous waste. What isn't collected is burned, adding to the problems of urban air pollution. The health impacts fall hardest on the poor, who are least able to protect themselves from this environmental degradation.

4.90 Long-term solutions will require a major increase in Government expenditures, but the prospects for recovering the full cost of public sector investment (especially in sewerage and drainage systems) are limited by the relatively low incomes of most urban households and a low "willingness to pay" among private citizens for investments in "public goods" needed to protect the environment. There is, however, a willingness of households to pay for the more immediate benefits of removing human and solid waste from their own property, and often a strong spirit of cooperation on the part of local community groups to improve environmental conditions within in their own neighborhoods. For industrial and commercial developments, the principle of "full cost" recovery should apply--in part to influence private sector decisions on where to locate.

4.91 While sewerage and drainage systems are likely to remain the responsibility of the public sector, there is scope for private sector participation in solid waste collection and possibly also in its disposal. The overall approach should begin with a careful assessment of demand against the collective social benefits of a clean and healthy urban environment. The design of public sector investments and services should encompass a range of technical options, tailored to specific areas of the city and the "willingness to pay" of those most likely to benefit from their use. While municipal authorities will have to provide the "trunk" elements of sewerage and drainage, for example, private sector firms, individual households and community groups should be involved in the expansion of secondary and tertiary systems, and pay at least a part--if not all--of the cost.

4.92 **Sewerage and Sanitation.** Many parts of most Indonesian cities can continue to rely on "private sector" sanitation approaches (pit latrines and septic tanks), but efforts will be needed to improve the conditions of their use (e.g., the proper removal and disposal of septic tank sludge). Water-borne sewerage collection systems are unlikely to be economically justifiable for any but the most wealthy residential areas for the foreseeable future. The intensive development of core commercial areas, however, may justify the investment costs needed in trunk lines, and could be cost-effective for high-rise buildings that would otherwise have to invest in their own treatment plant to meet local environmental standards. GOI has already initiated a planning exercise covering up to 25 cities to assess their sanitation needs. Preliminary indications are that up to 60% of the urban areas can continue to rely on-site solutions, but the rest will need to be connected to a sewerage system. The "least cost" technical options will need to be defined and issues of financing and cost-recovery and the institutional arrangements for managing the system within each city will need to be resolved.

4.93 **The Management of Solid Waste.** Improvements are clearly needed in both the collection and disposal of urban solid waste. Even in the poorest neighborhoods, waste removal is a high priority. Primary waste collection is often managed by local residents. Greater involvement of private operators in waste collection should be encouraged, including the design, construction and operation of "transfer stations" in larger cities. Waste recycling is already a thriving activity, and efforts are underway by NGOs to support this effort in several cities (see para. 6.35). Long-term planning is needed for the siting of future landfills, and improved management of existing landfills should be a high priority--especially those located in environmentally vulnerable areas.

4.94 As noted in Chapter 6, improvements in the design and implementation of sanitation, drainage and solid waste management initiatives would benefit enormously from greater community involvement. In some cases, particularly Kampung Improvement Projects, participation will be critical for effective design and implementation, as well as the sustainable use of project components. While this will require a change in the approach of some municipal and central government agencies, the limits of public sector resources would clearly suggest the importance of relying on the untapped potential for community "self-help" wherever possible (see Box 4.5).

**Box 4.5: Managing the Urban Environment--the Allocation of Responsibilities**

In a recent exercise carried out in Surabaya, a study team consulted with local residents in several Kampung (urban villages) on the identification of local environmental problems and what could be done about them (see Box 6.6). While residents noted a number of actions already undertaken by the community to improve footpaths and drainage within the Kampung, they described several factors external to their neighborhoods that had frustrated local efforts--particularly the blockage of larger drainage canals by "upstream" businesses and households--and felt powerless to deal with such issues.

Some problems they felt could be **managed within the community**: primary waste collection; overall cleaning of the neighborhood; micro-drainage cleaning; on-site sanitation installation; and the control of pests and mosquitos. Other problems **require government assistance**: installation of main water pipes; macro-drainage improvements requiring coordination with other localities, compensation and resettlement (for the acquisition of rights of way); and land tenure problems requiring legal decisions.

**Urban Transport and the Control of Vehicle Emissions**

4.95 The number of motorized vehicles in Indonesia more than doubled during the 1980s, to 9 million vehicles, about a third of which are in urban areas. With continued rapid growth of urban populations and increases in income, this trend is likely to continue. Expansion of the urban road network, however, has lagged behind, leading to growing traffic congestion in several of Indonesia's larger cities. Unless effective solutions are found to this problem, the loss of economic efficiency and the pollution of urban air from vehicle emissions will continue to grow. In Bangkok, for example, nearly a third of the city's potential GDP is lost because of congestion-induced travel delays. This could rise to 60% if remedial measures are not taken.<sup>7</sup> Reducing traffic congestion and vehicle

<sup>7</sup> See Toward Environmental Strategies for the Cities, World Bank (forthcoming, 1993).

emissions will not be easy. Even in the wealthiest countries (e.g., the United States and Japan), this problem has proven nearly intractable in major metropolitan areas. **Reducing the rate of growth of congestion and air pollution in Indonesia's key urban centers, however, will be critical for minimizing efficiency losses and for protecting the health and welfare of the urban population.**

4.96 While much can be accomplished in the near and medium term through a combination of public sector investments and policy reform, longer-term solutions will require a comprehensive and integrated approach. An effective strategy would need to include the following key elements:

- o **Land Use Planning.** The development of urban spatial plans that anticipate future growth provides an important opportunity to coordinate the development of transport networks, employment centers and residential areas so as to reduce the need for long-distance commuting and encourage pedestrian traffic and non-motorized transport.
- o **Improving the Communications Network.** Expanding the urban road network should receive a high priority, but improvements in other forms of communication (including telephone systems and mail service) can also help to reduce vehicular traffic.<sup>8</sup>
- o **Traffic Management and Engineering.** Improvements are also needed in the design of roads and the management of traffic flows, including (inter alia) bus lanes, improved traffic signals and intersections, provisions for pedestrians and non-motorized vehicles, and the facilitation of inter-modal transfers for commuters.
- o **Technical Options for Vehicles and Fuels.** Higher standards for new vehicles will be needed (e.g., engine design and pollution control features for cars), and emissions inspections (at least for "fleet" vehicles) should be introduced wherever feasible. The highly polluting two-stroke engines on motorcycles (70% of the motorized vehicle fleet) should be phased out. Unleaded and low-lead gasoline, and CNG (compressed natural gas) for buses, taxis, and private cars, should be introduced in the larger and more congested cities--particularly Jakarta--as early as possible, as noted below.
- o **Improved Public Transport.** Alternatives to the use of private vehicles will be critical for slowing the growth of vehicle emissions, and this will require major improvements in public transportation. "Mass transit" systems are unlikely to be financially viable or economically justified outside of Jakarta. Improvements in bus service, however, will be essential in most urban centers, and this is likely to require increased private sector participation--directly as bus owners and operators or through management contracts.

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<sup>8</sup> Improving reliability and reducing the long waiting-list for telephone service, for example, would reduce the need for business meetings; in Jakarta, where cellular car phones are easier to obtain, businessmen sometimes have to use their car phone in the parking lot, with the engine running to power the air conditioner. Improved mail service would lessen the need for drivers to deliver letters, and allowing utility bills to be paid at local banks would reduce the number of trips. For similar reasons, the number of cars in San Paulo, Brazil now exceeds the number of telephones, with predictable effects on vehicle emissions in the city.

- o **Demand Management.** Some cities, including Singapore, have successfully introduced "congestion pricing"--involving special stickers for entering downtown core areas during business hours--and other means to reduce private vehicle use--such as higher prices for (or reduced numbers of) parking spaces in congested areas. Increased road user charges and pollution taxes on fuels would help to recover the costs of improving the road network, and would also provide market-based incentives to reduce the reliance on private vehicles, and thus encourage the use of public transportation.

### **Caveats and Complementarity in Policy Design**

4.97 As noted earlier, environmental problems vary by city, and the same solutions may not be appropriate in every case. In approaching urban environmental problems, however, "the best can be the enemy of the good", and effective action should not await the full elaboration of a detailed policy framework for each and every problem. On the other hand, the unintended effects of environmental policies can lead to perverse outcomes, and careful attention is needed, therefore, to the principles described in Section C. This will be especially important in the design of policies for the control of vehicle emissions, as noted in the paragraphs below.

4.98 **Environmental effectiveness.** In Mexico City, efforts to reduce vehicle emissions included a limit on the number of days a particular car could be driven into the city; as a result, those who could bought a second car--older and more highly polluting--and the level of emissions went up. In Jakarta, restricting traffic on one major road (to buses and cars with three or more passengers) improved the flow of traffic there, but greatly increased congestion and delays on surrounding roads.

4.99 **Cost effectiveness.** Because of the small initial capital cost involved, which is more than offset by fuel savings, the installation of vapor recovery equipment in fuel systems can reduce evaporative hydrocarbon emissions in a cost effective manner. "Mass transit" systems in some cities, however, have proven to be financially unsustainable and a major drain on public sector resources.

4.100 **Administrative feasibility.** Emissions inspections for high-use vehicles can contribute to reducing vehicle emissions, but experience in other developing countries (e.g., Mexico and Thailand) clearly suggests that broader application to all private vehicles is not likely to succeed, but would greatly increase the potential for "informal fees" which are likely to be resented.

4.101 **Equity.** The banning of pollution-free becaks in Jakarta, often used as a low-cost form of local transport (e.g., for shopping trips), eliminated the income of the operators and increased the number of motorized trips, as well as inconveniencing local residents. A sudden ban on two-stroke motor-cycle engines, as opposed to a carefully planned and gradual phase-out program, would have equally serious consequences for the majority of urban commuters in Jakarta and other large cities.

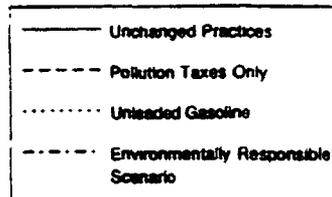
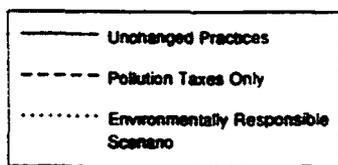
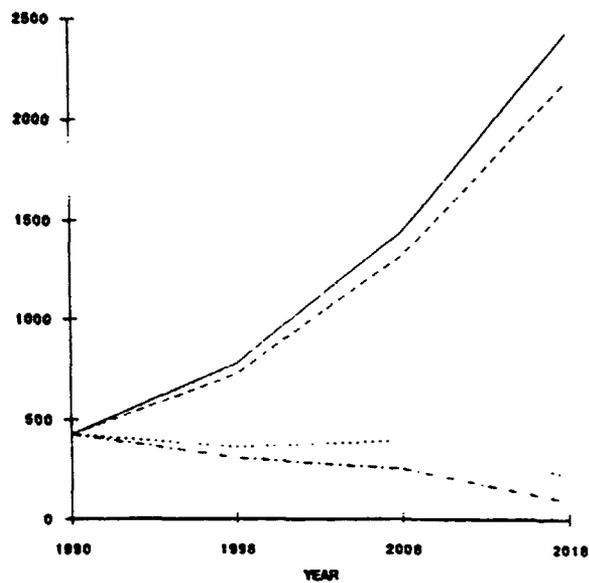
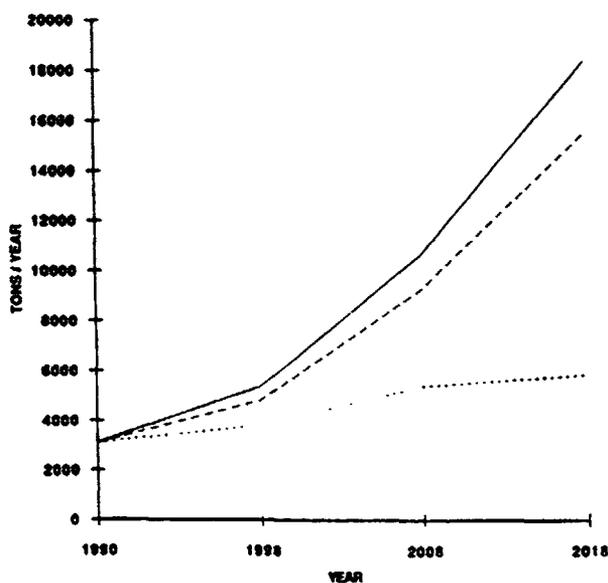
4.102 Despite these caveats, there are a number of steps that could be taken immediately to reduce vehicle emissions in Indonesia's key urban centers. The potential for reducing energy-related air pollution through a combination of market-based incentives and investments in cleaner fuels, for example, was examined in a recent Bank study (Indonesia: Energy and the Environment, 1993). Three scenarios were developed for the future growth of emissions from motor vehicles and industry in DKI Jakarta: an "Unchanged Practices" scenario; a scenario based on the introduction of pollution-

based fuel taxes; and an "Environmentally Responsible scenario" which combined fuel taxes with the introduction of cleaner fuels (CNG and Unleaded Gasoline). A computer model was used to predict the effect of these measures on the use of various fuels, and thus the rate of growth of energy-related pollutants. The results, for total suspended particulates (TSP) and lead are shown in Figures 4.1 and 4.2, respectively.

4.103 While these measures would not reduce the growth of emissions from other sources (e.g., non-energy-related industrial emissions and the burning of trash), they would obviously pay significant dividends in terms of reduced emissions from energy use. Under the "Environmentally Responsible" scenario, suspended particulate matter would increase by only about 90% over the next 25 years, as compared with a six-fold increase in the "Unchanged Practices" scenario, and lead emissions would decline by 80%. The economic benefits in terms of reduced health costs from urban air pollution would also be significant. Health damages from energy use would be reduced by 84%, and total health damages from TSP and lead would be reduced by over 50%. As these results suggest, however, without complementary measures to control the emission of non-energy-related pollutants, the health costs of air pollution will continue to increase.

Figure 4.1: Energy-Related TSP in Jakarta

Figure 4.2: Lead Emissions in Jakarta



## F. CONTROLLING INDUSTRIAL POLLUTION

4.104 Indonesia's development strategy for the Second Long-Term Plan will rely heavily on the industrial sector for the creation of jobs for the expanding labor force and for continued rapid growth of non-oil exports. As noted in earlier chapters, this will have important implications for the environmental sustainability of future growth and development. The expansion of the commodities processing industries, for example, will add to the pressure on natural resources and ecosystems. The most critical environmental issues of industrial sector growth, however, involve the rapidly increasing social and economic costs of industrial waste, especially in urban areas where most of industry is located. These costs represent the potential benefits to Indonesia of industrial pollution control.

4.105 To obtain these benefits, it will be necessary for GOI to influence the behavior of polluting firms who, according to the "polluters pay" principle, should bear the costs of pollution control and cleanup. The aim of this section is to define the essential elements of a cost-effective strategy for doing so. Unfortunately, as in the case of urban environmental management, there are few readily available answers to some of the most important questions. This should not be too surprising since industrial pollution itself is a relatively recent phenomenon (see Box 4.6), and it is only in the past twenty to twenty-five years that even the wealthiest industrialized countries have made a serious effort to control it. As noted below, much of their experience represents "what not to do". GOI is fortunate in being in a position to learn from the efforts of other countries and avoid their worst mistakes. What has worked elsewhere, however, will not necessarily work in Indonesia--for a variety of reasons noted below. Social, political and cultural factors have had an important influence on the design of pollution control strategies in other countries--and the extent to which they have been successful--and these factors will no doubt play a role in Indonesia as well.

### Policies and Approaches: Experience in OECD Countries

4.106 The response to growing industrial pollution in OECD countries has followed a fairly common pattern (Wheeler, 1992): As a first step, enabling legislation is approved and ambient standards for water and air pollution are defined. Environmental agencies are then established, though the mandate for pollution control remains diffused. Political support is generally weak and, in the absence of enforcement, there is relatively little response from the private sector. Eventually, information requirements are introduced for new investments, in the form of environmental impact assessments. And, finally, because of the continued absence of an effective response from the private sector, and growing concern about the damage occurring to the environment, the environmental protection agency's mandate is clarified and strengthened, its resources are increased, and the monitoring and enforcement of environmental standards begins in earnest.

4.107 Unfortunately, in all too many countries of the world, serious attention to environmental protection has come only after a catastrophic event galvanized government action, and popular support--often times based on the fear of toxic and hazardous waste--was finally able to overcome the resistance of the business community and the political bias in favor of jobs and economic growth. At the same time, while economists have long argued for "market-based" policies and instruments to ensure a least-cost approach to pollution control, the popular predisposition for concrete results in reducing pollution levels, combined with the extraordinary political difficulties of introducing new forms of taxation, has led to the adoption of a predominantly "regulatory" approach.

**Box 4.6: An Historical Perspective on Industrial Pollution Control**

Issues of industrial pollution control are a relatively recent phenomenon in human history--dating only from the industrial revolution of the mid-1700s. For most of the 250 years since then, pollution issues related mainly to particulates in the air (especially from the use of coal as a source of energy), and waste products disposed of into local waterways (mostly from the processing of basic commodities). Until the present century, the effects of industrial pollution were entirely local--though often with high levels of pollution in cities and towns where industry was concentrated, predominantly in Europe and North America. Over the past several decades, however, a number of factors have led to growing attention to issues of industrial pollution control at the national, regional and global level:

- o The process of industrialization has generally (but not always) led to rising per capita income, particularly in urban areas. While industrial pollution was earlier assumed to be "the price of progress", and workers in factory towns with no alternative source of employment were unable to influence that outcome, rising incomes eventually led to a growing demand for a cleaner environment in the wealthier countries of the world.
- o Since World War II, industrial waste has included increasing amounts of newly invented chemicals which may be highly toxic in even minute quantities, many of which persist for long periods of time, and some of which accumulate in the atmosphere or the food chain, with potentially disastrous consequences for human health and welfare. As a result of a number of catastrophic events--particularly in the late 1960s and early 1970s--governments in the industrialized countries began a serious effort to reduce industrial pollution of water and air, with particular attention to the control of toxic and hazardous waste.
- o More recently, additional attention has been given to industrial pollution control issues as a result of the discovery of impacts that transcend national boundaries (e.g., acid rain, destruction of the ozone shield, and global warming). With the world's population still rising, and the likelihood of continued rapid growth of energy-intensive sectors (especially among the developing countries), issues of global sustainability have now come to the fore.

Over the past several decades, increasing numbers of developing countries have begun the push for industrialization, relying mainly on technology imported from the West. Rapid industrialization, and high population growth--increasingly concentrated in urban areas--has meant that the traditional problems of localized pollution are growing even more quickly than they did in the West. The concentration of the industrialization process into a much shorter time span, combined with the introduction of toxic and hazardous waste-producing industries, means that the developing countries are encountering many of the same health impacts that have occurred in the industrialized countries, but at an earlier stage in the development process and at a much lower level of per capita income.

While the awareness of these issues is high, successful (and cost effective) experience in the control of industrial pollution is still quite limited. Efforts in the wealthier industrialized countries have relied mainly on relatively expensive regulatory approaches, focused primarily on end-of-pipe abatement. Most developing countries are at a distinct disadvantage, since they generally lack the financial resources, institutional capacity and technical skills to mount an equivalent effort on their own. Creative interim solutions will be required, therefore, with a primary emphasis on preventing pollution before it occurs.

4.108 In most OECD countries, water quality has improved significantly and particulates, sulfur dioxide and lead in urban air have been reduced, with obvious benefits for society. While this progress might not have been achieved without stringent regulations, the approaches used in the past are increasingly being questioned--not just by the business community, but by local governments, individual citizens, and even the regulators themselves (see U.S.EPA. 1993). The key issues include:

- o **Constraints to innovation:** regulations that mandate standards, especially those that specify control technologies (as is common in Europe and the U.S.), provide no incentive for firms to reduce pollution below the level of the standard. They also "lock in" existing technology and reduce the incentives to design cleaner production methods and more effective controls, or to adopt any that may become available.
- o **Lack of flexibility:** Standards and specified control technologies are generally applied to all firms, when greater flexibility could reduce both pollution and abatement costs. A recent EPA study in the U.S. (undertaken jointly with a major oil company) revealed that, while US\$41 million has been spent on mandated technical controls on one part of the refinery process, five times as much pollution is being emitted by a related process not covered by any existing standard--which could be dealt with at a cost of only US\$6 million. EPA insisted on the former, and the firm has no incentive to tackle the latter, so it hasn't (reported in the Wall Street Journal, March 29, 1993).<sup>9</sup>
- o **Excessive costs:** studies in various parts of the U.S. indicate that the ratio of the costs of regulatory policies to those of other, less-costly, approaches ranges from 110 for sulfates control in Los Angeles, California to 2,200 for hydrocarbons control for all of the plants of a domestic chemical manufacturer (World Bank WDR. 1992).
- o **Excessive standards:** in the case of toxic and hazardous waste, standards in the U.S. have been based on the results of "maximum tolerable dose" experiments with mice, an increasing number of which have since been questioned on methodological grounds. Stringent regulations based on relatively weak scientific assumptions have, on occasion, led to rather costly mistakes (e.g., the Times Beach, Missouri dioxin case in the U.S.).
- o **Neglect of pollution prevention measures:** Regulatory strategies have focused almost exclusively on "end-of-pipe" abatement standards. The "pollution prevention" concept was formally adopted in the U.S., for example, only in 1991. As a result, the potential of this idea remains largely untapped (see Chapter 5).

4.109 Some environmental regulations have imposed very high costs with little regard for the benefits obtained. A study of the cost effectiveness of health and safety regulations in the U.S., for example, found that the cost for each premature death averted by various regulations ranged from US\$100,000 to US\$100 million. Perhaps not surprisingly, there is now a growing resistance in the U.S. to environmental standards and regulations (see New York Times series, March 21-24, 1993).

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<sup>9</sup> In another case reported recently, the U.S. Air Force, at the insistence of the EPA, will be retrofitting its nuclear missiles with cooling systems that do not use ozone depleting substances.

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## Constraints and Opportunities in Indonesia

**4.110 Constraints.** Influencing the behavior of private sector firms represents a special challenge at this stage of the development process in Indonesia. The use of regulatory measures will be essential in some cases to achieve the desired level of pollution reduction from major "point-sources" of pollution. In general, however, weaknesses in monitoring and enforcement capacity and low rates of voluntary compliance will limit the effectiveness of a "command and control" approach—especially for the large number of small and micro enterprises that account for a substantial amount of total pollution loads. The legal system is essentially not equipped as yet to deal with pollution cases and, judging from the attempts thus far to bring polluters to court, the quality of laboratory results will also have to be improved.<sup>10</sup>

**4.111** The institutional capacity for pollution monitoring and the enforcement of pollution standards is at a very early stage of development. BAPEDAL, GOI's environmental protection agency, was only established in 1990, and has fewer than 100 professional staff (see Chapter 6). This compares with about 18,000 in the U.S. EPA. The number of qualified staff at the provincial level is also quite limited, and even within the private sector there is a serious shortage of expertise in the technical aspects of industrial pollution control. In contrast to Indonesia, local governments in Japan have traditionally benefitted from a strong and highly qualified civil service. With salary levels comparable to those of both central government and private sector jobs, they are able to attract the level of expertise needed. There is also a high level of expertise within the private sector in Japan. Under a 1971 law, factories with pollution above a certain level must have qualified pollution control professionals on board; as a result, there are now 23,000 government-certified pollution control supervisors, and another 40,000 certified pollution control managers (EX Corporation, 1992).

**4.112 Opportunities.** Coming late to the challenges of industrial pollution control carries with it enormous advantage—not least of which is the opportunity to learn from the mistakes of others. Indonesia has other advantages as well: the rapid growth of investment carries with it the opportunity to replace aging, less efficient and more highly polluting industrial plant, to guide the location of new industrial firms, and to take advantage of "clean technology" designed to meet the more rigorous environmental standards of the industrialized countries; there is no entrenched bureaucracy committed to one approach over another, and thus ample opportunity for experimentation and innovation. There are also opportunities for more effective partnerships with the private sector, as noted in Chapter 5.

**4.113** There are actually two key issues of industrial pollution control facing Indonesia today: (a) what to do about the pollution from existing firms; and (b) how to "delink" future pollution loads, and the damage they may cause, from the rapid expansion of industrial output. The first is important, given the current levels of pollution from industry, but the second is the more critical issue: by the year 2010, assuming continued rapid growth, existing firms will represent only about 15% of total industrial output and, by the year 2020, less than 8%. A major issue in both cases is how to achieve the optimal level of pollution control at the least cost. The choice of policies and instruments, and how they are used, will determine not only the success or failure of the effort, but also the costs.

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<sup>10</sup> In one of the few cases prosecuted thus far, the results of laboratory analysis presented as a part of the Government's case were successfully challenged by lawyers for the firm.

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### Cleaning Up Existing Pollution

4.114 Taking into account the experience of other countries and the constraints and opportunities in Indonesia, the recommended strategy for reducing pollution from existing firms is comprised of six key elements, summarized below and described in the following paragraphs.

- o **Continue to improve the incentives framework for private sector development**, with particular attention to policies that encourage greater efficiency--including increased domestic competition, market-based prices for natural resources, and "full-price" cost recovery for investments in supportive infrastructure, particularly urban services.
- o **Carefully target the pollution control effort--by area, by pollutant, and by industry**, taking into account the significant differences that exist in area-specific ambient environmental quality (for specific watersheds and urban centers), the size of the exposed population, and the corresponding estimate of potential damage costs--focusing on the worst polluters and most damaging pollutants in the most threatened areas.
- o **Develop a balanced mix of policies and instruments**, including market-based as well as command and control, carefully tailored to conditions in Indonesia, and **integrate environmental concerns into industrial sector policy**, rather than treating them as separate and distinct objectives.
- o **Give highest priority to the prevention of pollution** before it occurs, through the encouragement of waste minimization and "clean technology" approaches, including industry-specific technical assistance, to simultaneously reduce pollution loads at the least cost while enhancing industrial efficiency and competitiveness.
- o **Rely extensively on the power of publicly available information--**about trends in ambient environmental quality, firm-specific pollution practices, and both positive and negative examples of the response of individual firms--to build consensus, capture the attention of industry leaders, and bring community pressure to bear on unresponsive firms.
- o **further develop the existing plans and procedures for dealing with toxic and hazardous waste**, including storage and transport issues as well as the management of planned treatment facilities, giving special attention to the role of smaller firms.

4.115 **Incentives for Growth and Efficiency.** Improving the policy and incentives framework for private sector development is necessary for both efficient growth and environmental improvement (see Box 4.2). Encouraging direct foreign investment will be important for obtaining new technology and higher-value added jobs--an increasing share of which will be in less-polluting "assembly-type" industries. Improving the efficiency of domestic production will contribute to reducing the rate of consumption of natural resources and the resulting waste products that otherwise pollute local ecosystems. Pricing natural resources and urban services at their full economic cost encourages conservation and helps to influence the location decisions of firms.

**4.116 The Need for Targeting.** Given its limited technical, financial and administrative resources, GOI will need to carefully target its pollution monitoring and enforcement efforts. As noted below, a limited number of industries contribute the majority of any given pollutant, and not all pollutants are equally damaging. The suggested approach to targeting has, in fact, already been adopted in the PROKASIH ("Clean Rivers") Program (see Box 4.7). A similar program has recently been announced for improving air quality. The main risks to these programs is the possibility that they may promise too much too soon, and lose credibility if the results are not forthcoming, and that they may be extended to more provinces before the institutional capacity is in place to support them. BAPEDAL is aware of these risks, but the pressures to expand too rapidly are likely to increase.

**4.117 Designing a Balanced Mix of Policies and Instruments.** GOI has already developed ambient quality standards for water and air. With the help of outside experts, BAPEDAL is working to define a broad range of policies and instruments to help meet those standards. Current and ongoing work includes: a review of its legal mandate for industrial pollution control; the specification of effluent standards for existing industries (in addition to the ones already issued); the design of a pollution control permit system; the strengthening of pollution control laboratories and other agencies at the provincial level; and improvements in the implementation of Indonesia's environmental impact assessment (AMDAL) procedures. It is also reviewing the options for market-based incentives, including such possibilities as "tradeable permits", direct charges on industrial effluents, and financial (as well as technical) assistance to small-scale firms (e.g., for joint waste-water treatment facilities).

**4.118** Going beyond regulatory and market-based approaches, BAPEDAL staff are also working with various donors on waste minimization and "clean technology" approaches to reduce pollution through efficiency-enhancing changes in technology and improvements in industrial practices (including pilot approaches to environmental and energy audits of individual firms). Substantial progress in this area is likely to require close collaboration between BAPEDAL and the Ministry of Industry, as well as greater involvement of trade and industrial associations (see Chapter 5). They are also reviewing the options for resolving pollution control disputes between firms and local communities (e.g., through direct negotiations and "alternative dispute resolution" techniques)

**4.119 The Need to Consider Market-Based Instruments.** While the PROKASIH Program has had a number of successes to date, it relies essentially on a regulatory approach and is only able to target a limited number of firms for effective follow-up. In the absence of a credible threat of enforcement (including legally imposed fines and other penalties on those who ignore their "voluntary" letters of agreement), this approach has a number of obvious limitations. It is not able to reach the large number of smaller firms, even today, and the total number of firms is likely to grow substantially over time. The potential for early adoption of market-based instruments, therefore (such as direct charges on industrial effluents), should be explored as a matter of some priority.

**4.120** Experience with pollution charges in other countries is still quite limited. Where they have been introduced, the level of charges is relatively low. The proceeds, however, are often used to fund the pollution control agency and to provide grants and subsidized credit to firms for the adoption of pollution reduction and abatement techniques (see Box 5.1 for a description of pollution charges and revolving funds in China). While there are a number of unanswered questions about the legal and institutional framework that would be needed to introduce such charges in Indonesia, they could prove to be an important addition to the pollution control arsenal over the medium term.

#### Box 4.7: Overview of the PROKASIH Program

The PROKASIH (Clean Rivers) Program in Indonesia was initiated in response to growing pollution loads in critical watersheds, and was designed to overcome the previously fragmented and uncoordinated efforts to control such pollution, especially from rapidly expanding industries. It was inaugurated in 1989 by KLH, in collaboration with the Ministry of Home Affairs and senior officials from the eight most industrialized provinces: East Java, Central Java, West Java, DKI Jakarta, North Sumatra, South Sumatra, Lampung and East Kalimantan. In 1990, Riau, Aceh and West Kalimantan also joined. The initial focus was on the worst industrial polluters in the 24 most highly polluted rivers, with a stated goal of reducing their pollution loads by 50% within two years.

At the central Government level, **technical coordination** has been provided by KLH and (since 1990) BAPEDAL, and **administrative coordination** has been provided by the Ministry of Home Affairs. **Implementation** is carried out by provincial authorities, with support from central agencies as needed. Prokasih Teams in the provinces are coordinated by the Vice Governor, and include representatives from BKLH, BAPPEDA, PSLs, research laboratories, local offices of the Ministry of Industry, police and prosecutors, and other relevant sectoral agencies. The mass media is encouraged to report on environmental damage caused by pollution and on significant clean-up efforts. NGOs are encouraged to facilitate the participation of community groups in related environmental activities.

The process has involved five key steps: (a) **establishing the local Prokasih Teams**; (b) **identifying specific firms** in highly polluting industries; (c) getting these firms to **sign voluntary "Letters of Commitment"** to reduce pollution loads by 50% within an agreed time frame; (d) **monitoring subsequent results**, and (e) **applying increasing pressure** on those not making a good faith effort to comply with their commitment. While it is still a relatively new program, there have been some notable successes. Prokasih Teams are now in place in each of the eleven provinces, and voluntary agreements have been signed by some 2,000 firms. Pollution loads appear to have been reduced in some provinces, particularly those with the strongest technical capacity to pursue the objectives of the Program.

There are still major shortcomings in the government's capacity to monitor actual industrial effluents, and in the private sector's capacity to design and operate pollution abatement systems. The political commitment to enforce environmental standards, however, has been greatly enhanced by the favorable publicity surrounding the Prokasih Program, which in turn has increased the credibility of the national and provincial authorities in their enforcement efforts with individual firms. In short, Prokasih is an effective and collaborative effort not only to reduce pollution, but to send a clear signal that GOI is getting serious about the enforcement of its policies for a cleaner environment.

4.121 **The Virtues of "Clean Technology"**. The concept of "clean technology" encompasses a wide range of initiatives, all focused essentially on reducing the amount of industrial inputs that end up as "end-of-pipe" waste. It begins with a review of product design and the possibilities for input substitution to reduce the need for harmful pollutants in the production process, and may involve process changes to increase the efficiency of input use, thus reducing the waste stream. It also focuses on the recovery of wastes and either reusing them within the production process or recycling them to other firms. When all of these possibilities have been exhausted, what is left as waste is then treated in an efficient and environmentally sound manner.

4.122 A surprising amount of waste can be eliminated, at a profit to the firm, simply through "improved housekeeping" (ranging from keeping the plant clean and well-maintained to simple measures such as insulating hot water pipes). This applies to inputs such as energy, as well. As noted in Chapter 2, a survey of industrial plants in Indonesia revealed potential energy savings from better housekeeping of 8%, with another 15% possible through modest plant improvements. The prospects for offsetting the costs of mandatory "end-of-pipe" abatement through the adoption of such techniques is examined further in Chapter 5. The motivation to adopt a clean technology approach, however, depends in large part on the costs of various inputs. When water is free, for example, and electricity is highly subsidized, there is little incentive to conserve, and little or no pay-back for investments that may be needed to achieve a higher level of efficiency in their use.

4.123 **The Power of Information.** Information made available to the public can be a powerful tool for reducing industrial pollution. In the U.S., for example, a "community right to know" law has made available to the public reports from individual firms on their toxic chemical emissions (see Box 4.8). This information has had several important effects. Community groups have used the reports to negotiate with local firms on the reduction of toxic emissions, often with highly positive results. University researchers and other public interest groups have used the information to support more effective state and national legislation for the management and control of hazardous waste.

4.124 The most interesting result, however, has been the attention that senior corporate executives suddenly began to give to the use and disposal of toxic chemicals, once they realized that the information they provided to the government was going to be made public. In many cases, the preparation of their toxic release inventories led to a search for waste minimization and improvements in waste management. The publicity surrounding the reports also led to more open discussions with local community groups, and a willingness to negotiate voluntary "good neighbor" agreements.

4.125 In one case, a major chemical company, with 41 plants putting ten thousand tons of toxic chemicals into the air each year, pledged to reduce its emissions by 90% over the next five years. Several industrial associations have found the TRI information, and the subsequent efforts by their members to reduce toxic pollution, to be helpful in enhancing public perceptions of their industries. The Chemical Manufacturers Association, for example, launched a "Responsible Care Program" in 1989, and is using TRI reports both to track the performance of its members and to assist in identifying and disseminating "best practice" techniques for wider adoption.

4.126 **Dealing with Hazardous and Toxic Waste.** Detailed regulations for the management of toxic and hazardous waste in Indonesia are still in draft, and have not been issued. BAPEDAL has announced, however, that such pollutants should be stored "on-site" until treatment facilities are established. An agreement has recently been reached with a joint venture firm for the construction of a first such facility—to be located near Jakarta, which will serve all of West Java. Nine additional facilities are expected to be built as and when the level of demand would make them financially feasible, with a second facility likely to be located in the Surabaya area of East Java.

4.127 Even the temporary storage of toxic waste poses a risk if not managed carefully, and the transport of such wastes will need to be carefully regulated. In addition, given the potential for traffic accidents and other unforeseen events, an emergency response capacity should be developed as quickly as possible through the training of local police, fire departments and emergency rescue teams.

**Box 4.8: Toxic Release Inventories in the U.S.**

In 1986, the U.S. Congress passed the **Emergency Planning and Community Right to Know Act**. This law required the U.S. Environmental Protection Agency (EPA) to establish an annual inventory of toxic chemicals produced by individual industrial firms, and to make this information available to the general public. Beginning in 1989, manufacturing firms employing 10 or more people, and using 25,000 pounds or more of any of 302 specified chemicals, were required to file reports with EPA covering the release and transfer of those chemicals. The reports include six topics:

- o **Facility information**, including name and address, people to contact, parent company, and receiving bodies of water;
- o **Activity and use information**, the identity, use and maximum quantity on site of the chemical(s) being reported;
- o **Chemical releases and transfers**, including annual quantities of the chemical(s) released **on-site** to air, water, land or underground, and quantities **transferred off-site**;
- o **Off-site transfer information**, including the identity of the off-site facility and the type of treatment, storage or disposal employed;
- o **Waste treatment**, including information on the method and efficiency of any on-site treatment used to remove TRI chemicals from the wastestream; and
- o **Waste Minimization**, an optional section for information on activities that reduce the generation of TRI chemical wastes.

In producing these reports, firms are not required to undertake additional monitoring of their processes, so the quality of the data is subject to some degree of error from estimation. It is not comprehensive, since non-manufacturing firms are exempt, as are firms with fewer than 10 employees and those using less than 25,000 pounds a year. These limitations were seen as an acceptable tradeoff between the desire for comprehensive and accurate data and the additional costs to firms of producing the reports. The fact that the system relies on self-reporting by firms also minimizes the additional work-load for the EPA, which simply publishes the results.

Source: Paul Martin, Community Right-to-Know: the Impact of Toxic Release Inventory Reporting in the USA, a paper prepared for the Environment Department, World Bank, February 1992.

4.128 Encouraging the participation of small-scale and micro enterprises in a program of toxic and hazardous waste management will be a special challenge. While it is difficult to identify and register them, the cumulative effects of their production activities often poses a serious health risk at the local level (e.g., small-scale tanneries and "back-yard" enterprises involved in recycling lead/acid auto batteries). Large firms producing significant amounts of toxic and hazardous waste, with either a strong sense of social responsibility or a fear of legal liability, will be inclined to transport their waste to a treatment facility and pay the required fees. Small firms will probably have to be reached

through a collection service, but may be quite unwilling (or unable) to pay. Attempting to collect a fee may simply generate widespread avoidance of the service, and little improvement in the amount of such wastes being disposed of in an unsafe manner. The socially optimal solution, therefore, may be to subsidize their participation--possibly to the full extent of the costs of collection and treatment.

4.129 In theory, a tax on the relevant chemical inputs could be used to recover the costs of treating toxic and hazardous waste. Experience in other countries with such an approach, however, has not been very encouraging. A recent Government proposal in Hong Kong, for example, to recover the costs of their new facility through a tax of 0.75% on chemical imports, was strongly opposed by the chemical importers and manufacturing industries, and the proposal was dropped.

### **Controlling the Growth of Future Industrial Pollution**

4.130 To minimize pollution loads--and damage costs--from newly established and expanding firms, the obvious place to start is with the investment approval. The suggested strategy involves four key elements, summarized below and discussed in the following paragraphs:

- o **Use existing procedures for prior review of potential environmental effects**, but target the effort and ensure professional and expeditious reviews--possibly by "contracting out" with a reputable and experienced firm.
- o **Expand the review to include issues of technology choice**. Wherever there are significantly different options available, require further justification for adopting older/inefficient and more highly polluting technologies.
- o **Ensure that provisions are made for appropriate "end-of-pipe" pollution abatement** in new and expanding firms, to avoid more expensive "retro-fitting" later on, and that site selection is consistent with the implementation of abatement equipment and procedures.
- o **Improve local government input on location issues**, especially for major projects but also for any that are highly polluting, and encourage the location of medium- and larger-scale firms in private sector-initiated industrial estates.

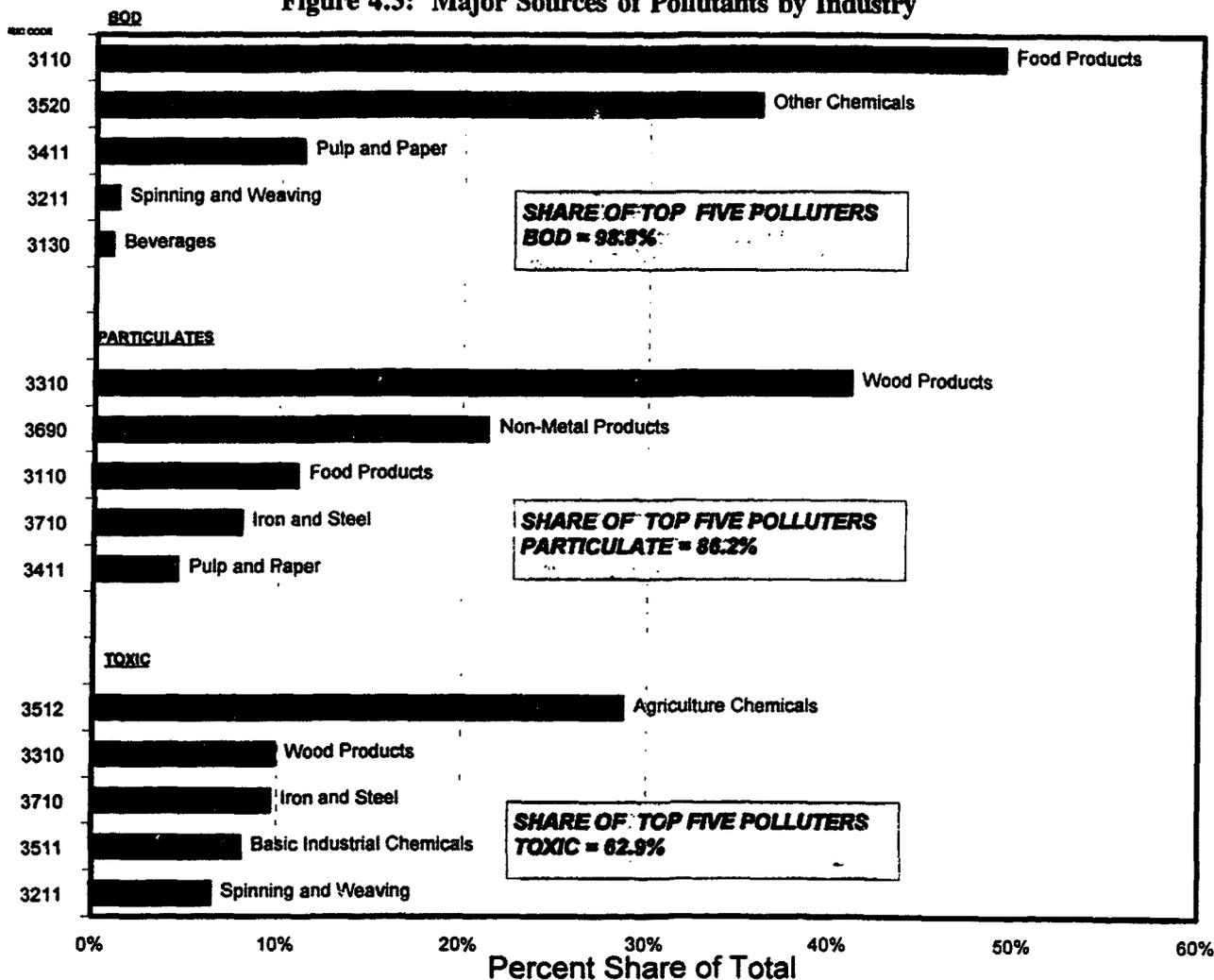
4.131 **Investment Approvals: Use of EIAs.** Indonesia's environmental impact assessment procedures (AMDAL) provide an appropriate mechanism for reviewing new investment proposals, and completion of this process is supposed to be a prerequisite for granting the necessary licenses and location permits. As noted in Chapter 6, however, this is a relatively new process and it does not yet provide adequate assurance that investment proposals are consistent with the objectives and standards of sound environmental management. Key shortcomings include (inter alia) the lack of expertise to prepare and review EIAs. Various documents are submitted in sequence, with review periods of up to 90 days each. Combined with the lack of staff and expertise within the review commissions, this leads to either long delays in approval, or shorter turn-around times with a less thorough review. One result is that investment approvals and location permits are sometimes issued before the AMDAL process has been completed. GOI is aware of these shortcomings and BAPEDAL staff are currently reviewing ways in which the process can be made more efficient and effective (see Annex E).

4.132 Consistent with on-going efforts to "deregulate" industry, GOI officials responsible for encouraging more rapid growth of private sector investment are looking for ways to further streamline investment approval procedures. This will obviously place even greater demands on the AMDAL process. On an interim basis, it should be possible to accommodate these demands through a special program focused on major investments in the most highly polluting industries. The suggested approach would involve three key elements:

- o **Targeting:** Focus on larger investment proposals, approved at the national level by the AMDAL Commission of the sponsoring agency (e.g., Ministry of Industry for iron, steel and chemical projects, Minister of Agriculture for tree crops processing projects, or the Investment Coordinating Board for foreign investments and those requesting import duty rebates). Target a select number of industrial sub-sectors, specifically those that are the most highly-polluting. These are relatively easy to identify: for BOD, particulates and toxic chemicals, for example, the top five industrial sub-sectors account for 99%, 86%, and 63%, respectively, of total pollutant loads (see Figure 4.1).
- o **Ensure quick turn-around time:** In Thailand, EIA documents submitted for approval must receive a response within 30 days, or they are automatically considered to be approved. If additional information is needed, it must be requested within 15 days of the original submission. If the submission, or additional information, raises serious issues, approval can be delayed for up to another 30 days to allow for consideration by a special review committee. Even for those proposals involving serious issues, therefore, the project sponsor will have approval or rejection within a maximum of 75 days. Similar standards in Indonesia would go a long way toward avoiding the complaint that environmental concerns are impeding the pace of development.
- o **"Contract Out":** To overcome the current shortage of expertise within the existing AMDAL commissions, while still meeting short turn-around times, consideration should be given to "contracting out" for the initial reviews with a reputable and experienced firm. This would ensure both speed and objectivity in the review, with those proposals identified as requiring further attention referred to a special session of the standing AMDAL Commission in the relevant Government agency.

4.133 **The Choice of Technology.** As noted above, the rapid pace of industrial sector growth provides an opportunity for Indonesia to replace aging plant and equipment far more quickly than is possible in the more mature industrialized economies. Experience elsewhere, particularly in Eastern Europe, demonstrates the economic and environmental costs of out-dated technology. Until the recent political upheavals, for example, Poland continued to rely on technologies originating in the 1950s and 1960s that were far more wasteful in their use of energy and other natural resources than the equipment developed in OECD countries to meet the needs of firms coping with higher energy prices and stricter environmental controls. The result was an increasing erosion of international competitiveness as the efficiency of domestic production fell further and further behind the performance of comparable plants in the market-based economies of the West (World Bank, 1992d). Japan, on the other hand, experienced continued rapid growth, and further gains in global competitiveness, during the 1970s and 1980s when increasingly stringent pollution standards were being introduced.

Figure 4.3: Major Sources of Pollutants by Industry



4.134 There are a variety of tradeoffs in the choice of industrial technology, affecting the use and productivity of various factors of production—labor and capital especially, but also the use of material inputs and, in some cases, some rather serious social and environmental costs (see Box 4.9). While there are strong arguments against adopting a regulatory approach to influencing technology choice on environmental grounds, we would suggest that the choice of technology be included in the targeted EIA reviews recommended above. Where alternative "clean" technologies are available, and the ones proposed are especially polluting or inefficient in the use of natural resources, project sponsors may simply not be aware of the alternatives. At a minimum, the sponsors should be asked to provide additional justification and, if the difference in investment costs is small, or the additional pollution (and potential damage costs) high, the project should be subject to further examination. Given the experience noted earlier in OECD countries, and the enormous cost of cleanup—especially for toxic waste—preventing pollution should receive the highest priority in GOI's strategy for pollution control. And, as noted further in Chapter 5, the choice of technology will have a major impact on the pollution intensity of industrial production in Indonesia in the years ahead.

**Box 4.9: Choice of Technology--The Case of Caustic Soda Production**

The production of chemicals is one of the faster growing segments of the industrial sector in Indonesia (16% per annum over the past six years). Technology options in the production of caustic soda illustrate some of the key issues of social versus private costs in dealing with the environmental tradeoffs of industrial sector growth:

There are three main processes used to produce caustic soda, the oldest of which is based on "mercury cells". This process produces highly toxic waste, including mercury-contaminated sludge and air-borne mercury that contaminates both the factory site and--in the absence of protective measures--the surrounding neighborhood. There are a number of major plants producing caustic soda in Indonesia, most of which are in Java, many of which are older plants using "mercury-cell" technology. One is a 35-year old Government-owned plant near Surabaya. A recent study revealed that the site itself was heavily contaminated, and that fugitive mercury dust has led to higher than desirable levels of mercury in the surrounding area, including local fish ponds.

GOI is considering the possibility of constructing a new factory, using "clean technology" developed in the West (based on "membrane transfer") which would produce attractive financial returns and would cost US\$10-15 million to build. The old factory and site, however, cannot simply be abandoned. Contamination of the building, and the prevailing winds, would result in a continued problem for the surrounding area. The accumulated sludge on the site will also have to be removed and disposed of, once the proposed hazardous waste facility is built. The costs of clean-up have been estimated at US\$10-15 million.

In Taiwan (China), in response to growing community pressure and fears about toxic and hazardous waste, the Government's environmental protection agency has begun to force the closure of caustic soda factories using the older mercury-based technology. The owners of one of these factories, with 10 times the capacity of GOI's Surabaya plant, offered its equipment for sale at a price only about a quarter of the cost of what would be needed for new equipment using "clean technology". The equipment was bought by a private sector Indonesian firm, and relocated to West Java, where it is operating today. Shortly after this experience, GOI prohibited new investments in Indonesia using the mercury-cell technology. As this case clearly illustrates, however, technology choice based exclusively on private sector considerations of financial returns can lead to significant additional costs to the rest of society.

**4.135 Ensure Provisions for Pollution Abatement.** At a minimum, EIA reviews of proposed investment projects should ensure that there has been adequate provision for "end-of-pipe" abatement equipment and procedures, since it is far more expensive to "retro-fit" subsequently. Where this would require sufficient land area for abatement facilities, such as water treatment lagoons, approval of location permits should be consistent with the siting of such facilities. This should include both the space requirements and the potential impact on neighboring and downstream activities.

**4.136 Influencing Industrial Location.** As noted earlier, the development of "strategic structural plans" for urban areas provides an opportunity both to protect critical ecosystems and to guide the development of urban sector growth, with a least-cost provision of supportive infrastructure. Unfortunately, the implementing regulations are not yet in place for the recently approved legislation,

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and it will take time to prepare adequate plans once those regulations have been issued. In the meantime, AMDAL reviews represent an opportunity for local government input at the investment approval stage regarding guidance to project sponsors and other relevant agencies on any particular concerns about location and site plans. Unfortunately, as noted in Chapter 6, local government input in the review of EIAs at the national level is mostly honored in the breach. This problem will require longer-term solutions but, on an interim basis, the special targeted program suggested above should include a provision for more timely and effective input by local government authorities.

4.137 Pricing urban services properly will help to influence the location decisions of private sector firms, but pricing alone is unlikely to deter industrial firms from locating in key urban centers. Too often, simply the availability of key urban services is enough to overcome higher prices if the alternative is to do without or to invest in "in house" capacity (such as diesel generators if electricity is not available). The development of well-planned industrial estates in areas outside the main urban centers provides a conceptually attractive alternative. They offer significant potential for economies of scale in the provision of services and may be quite appealing for industries that benefit from being located in the same area as other related firms. They would also be helpful to those responsible for industrial pollution control, given the prospects for cost-effective abatement procedures (e.g., through shared waste-water treatment facilities), and they would reduce the regulatory burdens of monitoring a much larger number of single plant sites. GOI has already begun to encourage the development of industrial estates by the private sector, though with relatively little success to date.

4.138 Governments in a number of other countries have attempted to influence the location of industry by investing directly in the required infrastructure for industrial estates and/or heavily subsidizing the relocation of individual firms to such estates. In most cases the results have not been successful, or have only generated satisfactory results after considerable delay and at a very high cost. Forcing smaller firms into estates has proven particularly unsuccessful, since they often need to be closer to their suppliers and customers to survive than is possible in the outer-lying areas where most industrial estates are located.

4.139 Over the medium and longer term, as noted in Chapter 3, it is likely that an increasing number of large cities will join Surabaya in deciding that they can no longer accommodate the growth of industry within their municipal boundaries, and new firms will simply be excluded. This could provide a major impetus to the development of industrial estates on a "demand-driven" basis, and would be greatly preferred to the random location of individual firms on the still-expanding periphery of those cities.<sup>11</sup> If the development of such estates is left to the private sector, competition between them should help to ensure that the amenities and services provided (including shared arrangements for the treatment of industrial waste) are efficient and cost effective. It will be all the more important, however, to ensure that these estates actually install and use their abatement equipment and processes effectively, and that they are not located in environmentally sensitive areas. Here, the development of "strategic structural plans" for the province as a whole can help to ensure appropriate location decisions by the private sector developers of industrial estates.

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<sup>11</sup> In the case of Surabaya, for example, banning new industries within the city has not led to a reduction in pollution levels in the Brantas River because new and expanding industrial firms have simply located further "upstream".

## **CHAPTER 5**

# **THE COSTS AND FINANCING OF ENVIRONMENTAL PROTECTION**

## CHAPTER 5

### THE COSTS AND FINANCING OF ENVIRONMENTAL PROTECTION

#### CONTENTS

	<u>Page No.</u>
A. INTRODUCTION . . . . .	143
B. PUBLIC SECTOR EXPENDITURES AND INVESTMENTS . . . . .	143
Strengthening Environmental Management . . . . .	144
Improving the Management of Natural Resources . . . . .	144
Protecting the Urban Environment . . . . .	145
Other Priorities for Public Sector Investment . . . . .	148
C. SOURCES OF PUBLIC SECTOR FINANCE . . . . .	149
Improving Domestic Resource Mobilization . . . . .	149
Potential Role of the Private Sector . . . . .	150
Prospects for Cost Recovery . . . . .	150
Natural Resource Pricing and Subsidies . . . . .	151
External Financing . . . . .	152
D. PRIVATE SECTOR COSTS AND FINANCING ISSUES . . . . .	152
The Costs of Pollution Abatement . . . . .	153
Environmental Standards, Growth and Competitiveness . . . . .	154
The Choice of Policy Instruments . . . . .	156
The Role of Subsidies in Pollution Control . . . . .	158
E. THE PRIVATE SECTOR RESPONSE: ATTITUDES AND INNOVATION . . . . .	159
Pollution Prevention Pays . . . . .	159
The Need for Government Incentives . . . . .	161
Constraints and Opportunities . . . . .	161
Attitudes and Innovation . . . . .	162
F. COSTS, TRADEOFFS AND PRIORITIES . . . . .	163
The "Least-Cost" Growth Path . . . . .	163
The Nature and Magnitude of the Tradeoffs . . . . .	164
Establishing Environmental Priorities: A Focus on the Process . . . . .	166

## THE COSTS AND FINANCING OF ENVIRONMENTAL PROTECTION

### A. INTRODUCTION

5.1 As noted in Chapter 4, Government interventions in favor of the environment rarely come without a cost. Some of these costs will be incurred by GOI itself in the form of direct public sector expenditures and investments in environmental protection, some by private sector firms in response to environmental standards and regulations, and some by households and individuals as they, too, respond to changing incentives for more responsible environmental behavior. Given the issue of "affordability" discussed earlier, it is important to have a sense of the "order of magnitude" of these costs, how they might be financed, and the extent to which they may conflict with the achievement of other important social and economic goals.

5.2 The aim of this Chapter is to explore these issues as they relate to public and private sector investments. The order of magnitude increases needed in public sector expenditures are described in Section B, and potential sources of finance are discussed in Section C. The costs of pollution abatement for private sector firms are assessed in Section D, including issues of standards and competitiveness, the prospects for less-costly "market-based" instruments, and the potential role of subsidies. Section E focuses on the prospects for recouping end-of-pipe abatement costs through the adoption of money-saving waste-minimizing innovations by existing firms. Pricing and regulatory incentives will help to stimulate such innovations, but direct Government support also offers an valuable opportunity to collaborate with the private sector in reducing industrial pollution. A final section considers the nature and magnitude of the tradeoffs between growth and the environment. It concludes that preventing environmental degradation is far cheaper than cleaning up pollution and restoring natural ecosystems, and that this principle should feature prominently in GOI's development strategy. It also notes the virtues of a more participatory process for establishing environmental goals, including a broader consensus and the mobilization of additional resources to achieve them.

### B. PUBLIC SECTOR EXPENDITURES AND INVESTMENTS

5.3 In assessing the need for increased Government expenditures, it is important to distinguish between the larger capital-intensive investments to be funded from the "development budget" and allocations from the "recurrent cost budget" for institutional strengthening and "O&M", both of which will need to be increased. It is also important to specify the benefits to be gained from these expenditures, some of which reflect the need for complementary improvements in efficiency (e.g., urban transport) and health (e.g., water supply and sanitation). In some cases, the level of expenditures that might be desirable will not be feasible due to a lack of implementation capacity, a lack of ability (or willingness) to pay, or financing constraints. These points are illustrated below in the case of expenditure increases needed for strengthening environmental management in general, improving the management of natural resources, and protecting the urban environment.

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## **Strengthening Environmental Management**

5.4 The agenda for institutional strengthening in support of more effective environmental management is described in Chapter 6. The key elements include increased staffing and staff training and development for central, provincial and local Government agencies (e.g., MLH, BAPEDAL and BPN at the national level, the BAPPEDAs, river basin water boards, and environmental laboratories at the provincial level, and corresponding agencies at the municipal government level), improvements in data collection, analysis and dissemination, and environmental education and awareness programs (including university-based PSLs), as well as support for specific environmental initiatives (such as central and provincial AMDAL Commissions, land titling and registration, and spatial planning).

5.5 Unfortunately, information on the current level of budgetary expenditures on these items is not readily available, and it not possible in this study, therefore, to estimate the level of future allocations that may be needed. In projecting those needs, however, it will be important to ensure that adequate budgetary provisions are made not only for the "soft-ware" elements of institutional strengthening (e.g., staff training and development) but also the "hardware" (e.g., vehicles, computers and other equipment, as well as their operating and maintenance costs) without which staff cannot function effectively. Even small budget items, if lacking, can severely limit program effectiveness. "Real-time" management of water supply in a river basin, for example, requires accurate historical (as well as timely current) data on river flows. Some of the existing gaps in the historical data base for key riversheds reflect simply the lack of paper supplies for monitoring equipment.

5.6 It will also be important to recognize the limits that exist to the pace of institutional strengthening, particularly the shortage of skills and experience in Indonesia in many of the key specialties of environmental management, and the difficulty of competing with the private sector as a result of relatively low Government salaries. As suggested in Chapter 4, "contracting out" can be used to meet environmental management objectives despite these constraints--such as for targeted AMDAL reviews and the development of an independent inspection service for forest concessions.

## **Improving the Management of Natural Resources**

5.7 Compared with the costs of dealing with pollution issues in urban areas, public sector investments for improving the management of natural resources are relatively modest. The primary need is for policy reform, including the removal of subsidies for key natural resources. In fact, the revenue effects of such reforms would go a long way toward financing the increased costs of urban environmental management. Some additional investments will be needed, however, in specific areas.

5.8 **Conservation and the Protection of Biodiversity.** Strengthening the conservation department (PHPA) in the Ministry of Forestry should have a high priority. This effort is already underway, but could be accelerated. Given the potential funding from donor sources for conservation initiatives, improvements in aid coordination should be given particular attention--including the prospects for "twinning" (or "adopt a park") arrangements between high-priority parks and reserves and counter-part forestry departments in some of the developed countries. As noted in Chapter 2, the ICDP concept provides another model for improving the management of protected areas, by involving local communities in conservation and resource management activities as well as providing alternative income-generating opportunities that minimize future encroachment into protected areas.

5.9 Estimated expenditures for effective management of parks and reserves vary widely, from US\$1.80 per hectare to US\$8.00, depending on the level of management complexity involved. A benchmark estimate has been made in a recent study (UNDP/KLH. 1992) which suggests that the successful management of 17 high-priority areas would cost about US\$190 million a year. Since current expenditures represent only a fraction of that amount, and implementation capacity is still rather limited compared with the need, the amount actually budgeted for in REPELITA VI should reflect a gradual "ratcheting up" of annual expenditures, perhaps reaching the desired level on an annual basis by the end of the plan period. (As noted below, this would also imply a significant increase in grant funding from the donor community since GOI, understandably, is reluctant to add to its already sizable external debt for this purpose.) Implementation constraints also apply in the case of ICDP activities outside park boundaries, where the study noted above estimates a need for to spend about US\$90 million a year. Since these investments support income-generating activities by local communities, it is appropriate to include them in the development budget, rather than relying on grant funding, but here also there will be a need for gradual increases in the budget in line with gradually improving implementation capacity at the provincial and local level.

5.10 **Protection and Production Forests.** Successful management of watershed protection and production forest lands will require a combination of investment and recurrent cost expenditures. Current expenditures on GOI's "regreening" program amount to an estimated US\$50 million a year, and monitoring and management of production forests is estimated to cost about US\$45 million a year. The appropriate level of future expenditures in these areas will need to take into account the improvements required in the effectiveness of the underlying programs. As noted in Chapter 2, for example, further strengthening is needed in the institutional framework and the quality of extension services under the "regreening" program. There is also an urgent need to expand the research effort on issues of sustainable forest management, to improve data collection and analysis, and to strengthen the oversight of forest concessions. Institutional changes in both of these areas will also need to include further decentralization of authority to provincial and local agencies, and this will require increased recurrent cost budgets for institutional strengthening at those levels.

### **Protecting the Urban Environment**

5.11 Protecting the urban environment calls for a sustained effort to strengthen the institutional capacity of municipal governments, and this will require an increase in recurrent costs at the local level. Improving the availability of safe water and the management of human and solid waste, and reducing the growth of vehicle emissions, however, will require a substantial increase in public sector investments. The Government's growing concern for improving urban services is reflected in the planned increase in investments during REPELITA V—up from 3.4% of budget expenditures in the previous plan to 6.1%, with a rising share expected to be directed to urban water supply, sanitation and solid waste management. REPELITA V has also emphasized improved O&M, increased local government responsibility for investment planning and implementation, and a greater role for the private sector in the provision of public services. Actual public sector investments, however, have declined in both nominal and real terms, and the envisaged increase in private sector participation has not yet materialized. With the rapid growth of the urban population, this has led to an increase in the backlog of unmet demand. At the same time, while important progress has been made over the past several years in improving the implementation capacity of local government agencies, weaknesses in implementation capacity remain a serious constraint in virtually every sector.

5.12 The estimates shown below of budget expenditures needed during REPELITA VI to improve the quality of the urban environment reflect an assessment of overall investment needs in the relevant sectors. They also take into account the availability of financial resources, implementation constraints, and the potential role of the private sector.

5.13 **Urban Water Supply.** Public investments in piped urban water supply reflect a number of important social and economic objectives, including improving the health of Indonesia's urban citizens, enhancing equity for the poor, and reducing the unsustainable use of groundwater resources. Despite rather ambitious plans for the number of households connected to piped water supply during REPELITA V, expenditures in this sector have declined in recent years--from Rp 300 billion a year (in 1989 prices) in 1987/88 to about Rp 175 billion in 1990/91. As a result, in 1990, only about 15% of urban households were served, and most others continued to rely on either private wells or more expensive sources such as vendors. Among commercial users, only a small fraction are connected to piped water, with most relying on groundwater.

5.14 A significant expansion in the number of households served by piped water during REPELITA VI will require a substantial increase in public sector investment--to about Rp 500 billion a year (in 1989 prices). Improvements will also be needed in supply-side efficiency (e.g., through reductions in unaccounted-for water), in the quality and reliability of service (e.g., consistency in water line pressure), and in demand-side management (e.g., through changes in the level and structure of water tariffs). If these investments and improvements are made, it should be possible to extend service to 8 million new households by the end of the period, more than doubling the percentage of households served, while improving public health and reducing excessive extraction of groundwater.

5.15 **Sewerage, Sanitation and Solid Waste.** Investments in sewerage, sanitation and solid waste management are intended primarily to improve human health and welfare, but may also have an important influence on the overall appeal and competitiveness of Indonesia's main urban centers in attracting job-creating foreign investment. Improvements in these areas have received relatively little public sector attention in the development of urban services in the past. The existing sanitation system in most cities, for example, is essentially private sector-oriented, and relies primarily on septic tanks (or the use of open spaces). With the expected rapid growth of urban populations, however, the provision of water-borne (piped) sewerage systems will need to become an increasingly common component of public sector investment--at least in the core areas of the larger Indonesian cities.

5.16 In 1990/91, only about Rp 50 billion was spent on human and solid waste management, and this included investments in drainage systems. This contrasts with the estimated Rp 500 billion a year that would be needed to provide conventional sewerage systems in high density inner cities by the year 2000. Assuming that least-cost technology options are selected, that institutional issues for the implementation and operation of such systems are addressed, and that adequate measures are taken to achieve an appropriate level of cost recovery, it should be possible to increase public sector investments in these areas to about the level needed by the end of the REPELITA VI period.

5.17 In the case of solid waste management, there is considerable scope for increasing the role of the private sector, especially in the provision of collection and transportation services, and this would relieve some of the pressure on already stretched municipal budgets. A number of cities have already begun to expand private sector participation in this area, but much more could be done.

5.18 **Hazardous Waste Management.** Construction is expected to begin shortly on a first treatment facility for toxic and hazardous waste in Indonesia, at a site near Jakarta which will serve all of West Java. Current plans envisage as many as 10 such facilities in various parts of the country. A preliminary feasibility study has been completed for a plant near Surabaya to serve East Java. The initial stage of a basic minimum facility is likely to cost about \$20 million, and subsequent stages (depending on the level of demand and the nature of treatment required) could bring the total to as much as US\$100 million. As noted in Section F, below, the cost of cleaning up such wastes if they are not treated properly would be a multiple of the investments needed in treatment facilities. Given the potential cost of treatment, however, the preferred option will be to work with the private sector on ways to reduce the volume of toxic and hazardous waste that is generated in the first place.

5.19 **Urban Transport and the Reduction of Vehicle Emissions.** As noted in Chapter 4, controlling the growth of vehicle emissions will require a combination of policies and instruments, including increased public sector investments in urban roads, demand-side management incentives to discourage the use of private motor vehicles, investments by both the public and private sectors in transport systems, and the provision of cleaner fuels (especially unleaded gasoline and CNG). These efforts will be needed in part to reduce the rapidly growing health costs of vehicle emissions in Indonesia's main urban centers, but many of them will also be needed to avoid the substantial losses in economic efficiency (and potential GDP) that arise from increasing traffic congestion. As noted in Chapter 3, the failure to control such congestion and pollution can seriously reduce the competitiveness of key urban centers in attracting much-needed direct foreign investment.

5.20 Both public and private sector investments in the transport sector as a whole have increased quite substantially, quadrupling in the past five years. Much of GOI's investment has gone toward reducing the backlog of maintenance, and betterment, of national and provincial roads. While the overall level of transport sector investment should grow less rapidly during REPELITA VI, investments in urban roads and related transport infrastructure will need to increase substantially. Additional capacity and improvements in the road network will be required in all of the larger cities to reduce current levels of congestion and to open up new peripheral areas for development. In some cases, by-pass routes will be needed to channel intra-urban traffic around the urban core. For the Jabotabek area, investments envisaged include the development of a basic network of light-rail-based mass transit systems in existing major corridors. Recent estimates suggest that the public sector costs of such systems could be as much as US\$1.6 billion, and the rolling stock (some of which might be financed by the private sector) another US\$1.5 billion, or a total of about US\$3.1 billion for the entire system. This would obviously have to be phased in over a long period of time, but increased investments by the public sector during REPELITA VI would probably be on the order of Rp 400 billion a year. In other cities, mass-transit systems are unlikely to be economically justified or financially feasible, but in most of the larger cities--including Jakarta--there is a need for substantial improvements in the quality of bus systems to provide an attractive and competitive alternative to private vehicles. Private sector participation in this area should be encouraged.

5.21 Investments in cleaner fuels (unleaded gasoline and CNG) will also be needed. These investments can be justified on economic grounds alone, but their contribution to reducing the health costs of urban air pollution would suggest that they should have a high priority. Estimates of refinery costs are not available, but total costs for natural gas infrastructure would be about Rp 1.2 trillion over the next 10 years, of which the public sector share would be about Rp 560 billion a year.

### Other Priorities for Public Sector Investment

5.22 The recommended increases in public sector investments for environmental protection need to be seen in the light of changing relative priorities for Government expenditures as a whole, as reflected in Table 5.1 below. The shift in relative priorities reflects the changing role of the public sector, as noted in Chapter 1, with GOI focusing its resources on infrastructure and human resources development, including targeted interventions to reduce poverty and protect the environment, and reducing its role in directly productive investments in favor of the private sector.

5.23 Investments in infrastructure include power, transport, communications, irrigation and municipal water supply and sanitation. In order to support the rapid growth of private sector investment, and thus the creation of jobs and non-oil exports, infrastructure investments should increase significantly (by nearly 50% in comparison with expenditures under REPELITA IV). Investments in human resources development and poverty reduction, including health, education, basic agriculture, population and family planning and other related programs, should also absorb a higher share of a growing public sector budget. (Investments in human resources development, which have benefitted from massive investments in physical capacity in the past, will emphasize increasing quality, while poverty-related programs will emphasize a more targeted approach to the remaining pockets of poverty on Java and in the outer islands.) Other investments, particularly in state-owned enterprises, have declined markedly, and--consistent with the role of the private sector as the new "engine of growth--this trend is expected to continue.

**Table 5.1: Priorities for Public Sector Investment**

	Actual (%) 1984/85-1988/89 (REPELITA IV)	Estimated (%) 1989/90-1993/94 (REPELITA V)	Indicative Projection (%) 1994/95-1998/99
Infrastructure	43.0	59.0	61.0
HRD/Poverty Sectors	25.0	25.0	27.0
Others	32.0	16.0	12.0
Percent of GDP	8.8	9.4	10.2

5.24 Investments in urban water supply and drainage, sewerage and sanitation (including related investments under the Kampung Improvement Program), and solid waste management should rise substantially, from Rp 2.0 trillion in REPELITA IV, and an estimated Rp 1.3 trillion in REPELITA V, to about Rp 5.9 trillion during REPELITA VI (all in 1989 prices). The share of these expenditures as a percentage of GDP would rise from 0.2% to 0.4%. Similarly, within the growing allocation for road transport, investments in urban roads and other transport-related infrastructure are expected to expand substantially in order to deal with the challenges of congestion and vehicle emissions arising from the rapid pace of urbanization and the increasing number of motorized vehicles. Urban transport investments, therefore, would represent roughly 0.5% of GDP (excluding investments in natural gas/CNG development under the power sector).

5.25 Allocations for "O&M" related to these investments will also need to increase. Order of magnitude expenditures would be 3-5% of the incremental investments in water supply, 2-3% for (relatively newer) investments in sewerage systems, and 5-6% for urban roads. In rough terms, other recurrent account expenditures on environmental protection (including institutional strengthening and support for improved management of natural resource.) could amount to about 1% of total public sector expenditures, or 0.1% of GDP. On the basis of these estimates, Indonesia's public sector expenditures on environmental protection under REPELITA VI would represent about 1% of GDP.

5.26 **Comparisons with Other Countries.** Cross-country comparisons of public sector expenditures on environmental protection are extremely difficult, in part due to the problem of defining the relevant categories, and in part because of a lack of firm data from different levels of government--since national government expenditures may be only a fraction of what is spent from local government budgets. A recent OECD report<sup>1</sup> focusing on pollution control experience in East Asian countries notes that central and local governments in Japan spend an estimated US\$36 billion (1.2 percent of Japan's GDP) in 1991 on environmental protection, of which nearly US\$11 billion was spent at the national level and another US\$25 billion at the local level. The largest share went for pollution-related infrastructure--about 83% at the national level and 90% at the local level--of which 73% and 80%, respectively, went for conventional sewerage collection and treatment systems.

5.27 In Taiwan (China), the budget for pollution control in 1991 was US\$1.1 billion (0.7% of GDP), of which the central government accounted for a third. Solid waste management consumed the largest share (56%), but future plans call for a substantial increase in investments in sewerage systems--an expected US\$3.5 billion in its 1990-95 six-year plan. In Korea, expenditures on environmental protection amounted to US\$660 million in 1991. Like Japan, most went for pollution control infrastructure, with 82% (about 0.2% of GDP) going for urban water supply, sewerage and sanitation and solid waste management. Data on environmental protection expenditures in Thailand are not available, but according to one estimate investments in pollution control infrastructure amount to about 0.4% of GDP (about US\$350-500 million a year). Future plans include a sewerage treatment system for Bangkok (US\$800-1,200 million), hazardous waste treatment facilities (US\$200 million) and additional investments in solid waste disposal. (Even larger investments are likely to be needed to deal with the growing problems of traffic congestion in the Bangkok metropolitan area.)

## C. SOURCES OF PUBLIC SECTOR FINANCE

### Improving Domestic Resource Mobilization

5.28 To achieve the envisaged (50%) increase in public sector spending on priority sectors over the coming years will require a major effort to improve resource mobilization and cost recovery in the relevant sectors, as noted below. Financial constraints, together with weaknesses in implementation capacity, suggest the need for greater private sector participation in the provision of public services.

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<sup>1</sup> See David O'Connor, Managing the Environment with Rapid Industrialization: Lessons from the East Asian Experience, OECD, 1993, which contains cross-country comparisons based on country-specific reports prepared by various authors as a part of OECD's study.

### **Potential Role of the Private Sector**

5.29 Private sector participation, bringing with it managerial talent and expertise, can help to improve efficiency as well as provide additional financial resources. For private participation to be successful, however, and to ensure that the expected gains actually materialize, will require a carefully designed and transparent framework for the award of contracts and effective regulatory oversight on pricing and the quality and availability of services.

5.30 GOI has recently begun to encourage private sector participation in bulk water supply and distribution. During REPELITA VI private sector investments in water, sewerage and sanitation, and solid waste management are envisaged as being quite substantial--as much as Rp 2.6 trillion (in constant 1989 prices), or about Rp 520 billion per annum. Recent experience in negotiating with the private sector on bulk water supply, however, has revealed a number of difficulties that will need to be ironed out if private participation in water supply is to be successful. These include a clarification of the applicable laws, a strengthening of the structure of municipal water authorities (PDAMs) to provide for greater managerial autonomy, and the formulation of an appropriate regulatory framework for this sector.

5.31 Similarly in the power sector, private participation has been slower to develop than was originally expected--in part due to the complexities of contracting for BOO (build/operate/own) and BOT (build/operate/transfer) schemes. Over the coming years, assuming these difficulties can be resolved, private participation in the power sector could amount to as much as a third of the total investments required. Opportunities in the transport sector would also appear to be quite substantial, particularly in the provision of urban bus services and, potentially at least, in the proposed mass-transit system for Jabotabek. Where existing bus systems are publicly owned and operated, and divestiture is not immediately possible, the use of management contracts could lead to greater efficiency and quality of service on an interim basis.

### **Prospects for Cost Recovery**

5.32 As noted in Chapter 4, pricing public services at their full economic cost, wherever feasible, will be important for demand management. Increased revenue, however, will be critical for strengthening the financial condition of the enterprises providing those services and for greater self-financing of future investment programs. Substantially reducing the existing subsidies in electricity rates, for example, would allow PLN to nearly double its self-financing ratio.

5.33 In the case of urban water supply, assuming that the quality and reliability of service can be improved, it should be possible to raise the level of cost recovery from past rates of about 10% of investments to 20% or more over the next several years. The potential for cost recovery in sewerage and sanitation is likely to be less than for piped water, given lower willingness to pay among private households. Accordingly, a level of 10% is probably a more realistic estimate for REPELITA VI. In the case of urban roads, with planned increases in road user charges, it should be possible to achieve a rate of about 20%. Judging from the experience of other countries, it is unlikely that cost recovery will be able to contribute any significant amount toward financing the costs of mass-transit systems. In the case of GOI investments in its national parks, however, a higher level of fees collected from tourists could contribute significantly to funding the costs of operation.

### Natural Resource Pricing and Subsidies

5.34 Savings from the elimination of pesticide subsidies, as noted earlier, have amounted to about US\$150 million a year. Eliminating the remaining subsidies on fertilizers, which would also reduce pollution from agricultural sources, would generate additional savings of about US\$350 million a year (in 1989 prices). The recent decision to remove almost all of the subsidies on petroleum products will, by itself, result in budget savings of about US\$1.5 billion a year--or 1.1% of GDP, which is roughly equivalent to the recommended annual budget expenditures for environmental protection during REPELITA VI.

5.35 As noted in a number of recent studies, GOI efforts to collect a higher proportion of the economic "rent" from the forestry sector would also add substantially to public sector revenues. Most of these studies conclude that current levies on standing timber and royalties on logs capture only about 20-30% of potential rents. Government revenues from the logging industry have averaged about US\$385 million per annum in recent years, making forestry the second largest revenue-earning natural resource (after oil and gas) for the Indonesian public sector. Assuming a substantial improvement in the share of forestry sector rents collected, however (moving to about 75% by the year 2000), a simultaneous rise in domestic log prices (achieving parity with international prices during the same period), and improved collection of existing fees, potential revenues for GOI could be as high as US\$1.5 billion a year--a nearly four-fold increase. This would represent close to 10% of all central Government revenues by that time, and would amount to about fifteen times the current level of annual Government expenditures on the management of forest resources in Indonesia.

5.36 The two main fees on the logging industry have been the "reforestation" levy, recently raised from US\$10 per cubic meter to US\$15, and the forest products "royalty" payments, which amount to about 6% of the delivered price of logs. Funds from the reforestation levy are earmarked for, and managed by, the Ministry of Forestry. As noted in earlier Chapters, this fund has been used to support the "regreening" program for critical watershed areas and the reforestation of logged-over land where the concession owner has not properly carried out a replanting program. Recently, in an effort to take some of the pressure off the natural forest while also meeting the needs of the wood processing industries, this fund has also been used to provide concessional financing for investments in pulpwood plantations. This program involves a substantial subsidy for private investors, including an interest free loan for about a third of the cost of the project. An analysis of the economics of such plantations would suggest that this level of subsidy, particularly for relatively short-rotation pulpwood species, may not be needed even at current domestic prices for logs. A significant increase in the price of logs over the next several years, as envisaged above, would clearly eliminate the need for such a subsidy under any but the most extreme circumstances (e.g., in particularly difficult terrain where replanting of degraded forest land would generate substantial environmental benefits).

5.37 Since reforestation fees have recently been increased, and the funds available from those fees are already quite large, additional revenue should probably be collected under the royalty tax, which goes to the Ministry of Finance. The earmarking of forestry revenues, however, within the Forestry Ministry itself or for those funds going to the Ministry of Finance, should be carefully reviewed--especially given the potential for a substantial rise in such revenues and the urgent need to increase spending in other high-priority areas--including health, education and other poverty-related programs, as well as urban water supply and sanitation, solid waste disposal and public transportation.

## External Financing

5.38 To sustain rapid economic growth, and to supplement domestic savings, Indonesia's external financing requirements will continue to increase during REPELITA VI. Due to the already relatively high level of external debt, however, GOI will need to rely increasingly on the mobilization of domestic resources to support the expansion of public sector investments and expenditures. While concessional loans from the donor community will remain an important source of finance, commercial loans and direct foreign investment will have to play a significantly larger role than in the past. Given projected increases in debt service payments, however, GOI is intent on limiting the growth of external debt and the use of external financing for any but the highest priority investments.

5.39 It is within this context that GOI has been reluctant to add to its external debt to fund the management of parks and reserves, preferring to rely on domestic resources and grant funding from the donor community for this purpose. Given the global benefits of protecting biodiversity, it would be entirely legitimate for Indonesia to expect that additional resources will be made available from developed countries to support its conservation efforts, as well as other programs where there are substantial global benefits (e.g., the phasing out of ozone depleting substances, the reduction of "greenhouse" gases, and measures to reduce pollution in international waters). The prospects for a sizable increase in the availability of such resources, however, appear somewhat uncertain.

5.40 Hopes were raised in anticipation of the 1992 UNCED meetings for real and substantial progress on global partnerships for sustainable development, including a sizable increase in funding, but actual progress has been rather disappointing to date. Economic recessions in the main donor countries, expanding needs for traditional aid, especially for Eastern Europe and the former Soviet Union, and continued debate over the details of some of the specific conventions, have prevented the resolution of "burden sharing" issues. These factors are understandable, and hopefully will be overcome. Until then, however, the availability of external funding on a grant basis could limit Indonesia's ability to contribute more effectively to resolving issues of global sustainability.

## D. PRIVATE SECTOR COSTS AND FINANCING ISSUES

5.41 The costs of pollution abatement in the industrial sector will depend primarily on the level of abatement desired and the policies and instruments used to achieve it. Ideally, pollution standards would be set so as to equate the marginal costs of abatement with the marginal social benefits of a cleaner environment. As noted elsewhere in this report, however, it is extremely difficult to quantify the savings in health costs and other economic benefits of pollution control. At the same time, while the demand for a cleaner environment is clearly related to the level of income, and thus can be expected to rise over time, there is a legitimate concern among GOI policy-makers about the tradeoffs in the near term between industrial pollution control and the competitiveness of Indonesian industry--in terms of the impact of more stringent regulations on the prospects for growth in jobs and non-oil exports. The aim of this section is to explore the nature and extent of these tradeoffs, beginning with an estimate of the potential costs of pollution abatement for the Indonesian manufacturing sector. Other topics considered include the issue of standard setting, experience in other countries with competitiveness issues, the effect on costs of alternative policies and instruments, and the potential role of subsidies in an optimal strategy for controlling industrial pollution.

### The Costs of Pollution Abatement

5.42 There is very little information available on the actual costs of pollution abatement in Indonesia's manufacturing sector. Experience in the industrialized countries, however, can provide at least an order of magnitude sense of the required investments in "end-of-pipe" abatement. In the OECD countries, total costs varied from 3-5%, and averaged about 4%, of total investment in the 1970s and early 1980s. Data for selected industries in the U.S. is shown in Table 5.2, below.

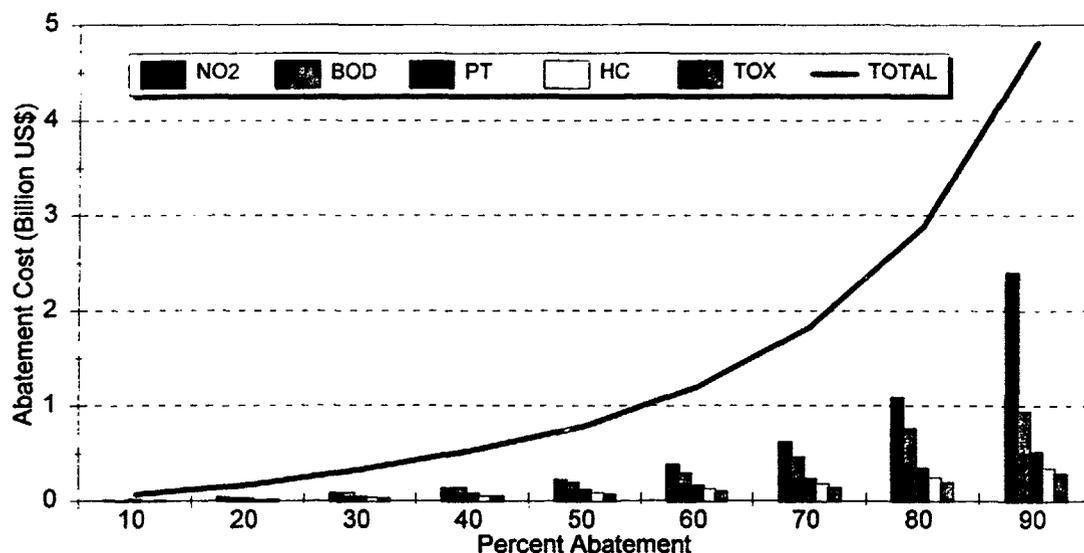
**Table 5.2: COST OF POLLUTION ABATEMENT, UNITED STATES, 1989**

Sector	Total investment in new plant and equipment			
	Billions of dollars	Share for Pollution Abatement (%)	Type of Abatement (%)	
			Air	Water
Food and beverages	8.3	3	20%	70%
Textiles	2.3	1	33	56
Paper	10.1	8	49	32
Chemicals	13.5	9	32	50
Petroleum	3.3	13	35	55
Rubber	4.6	2	64	20
Stone, clay, glass	2.9	3	75	18
Primary metals	5.7	7	53	34
Fabricated metals	4.6	3	33	47
Machinery	8.1	2	59	32
Electrical equipment	8.7	2	35	50
Transport equipment	10.0	3	54	29
All manufacturing	97.2	4	42	42

Source: U.S. Bureau of the Census 1990 and 1991. Cited in World Development Report 1992.

5.43 To examine the potential impact of abatement costs on Indonesian industries, an effort was made in this study to estimate these costs--using a combination of U.S. data on the unit costs of pollution control and BPS data on the level of output from existing Indonesian firms. The results are shown in Figure 5.1, below. One of the most important features of the estimated "abatement cost curve" is that unit costs rise with the proportion of total pollution eliminated, increasing rapidly in the higher ranges. According to our estimates, for example, abatement costs range from about US\$275 million at the 30% level, to US\$1.9 billion at the 70% level, and US\$4.8 billion at the 90% level.

**Figure 5.1: Industrial Pollution Abatement Costs  
Total and Composition**



Source: World Bank Staff estimates based on BPS and US Census Bureau data.

**5.44** Abatement costs also vary quite significantly between pollutants, which reflects differences in the nature of the abatement technology that is available, and between industries since, as noted in Chapter 3, different industries have quite different pollution intensities per unit of output. To further complicate matters, pollution intensity—and thus the costs of abatement—will also vary significantly between different firms within the same industry, depending on the age and type of production technology employed and the efficiency with which it is used.

#### **Environmental Standards, Growth and Competitiveness**

**5.45** The costs of pollution abatement actually imposed on Indonesian industry, of course, will depend on the standards that are set and the extent to which individual firms comply with those standards. Applying the goals of the PROKASIH Program (i.e., a 50% reduction standard), total (capitalized) costs would amount to about US\$700 million for existing firms. Amortized over 10 years, this would imply an annual cost of about US\$70 million—which would be equivalent to about 0.6% of GDP, but less than 0.5% of total industrial sector sales—and only about 1% of value added.

**5.46** Larger reductions, of course, would result in higher costs, and that fact will need to be taken into account in setting pollution control standards. In deciding on the appropriate level of standards, the first consideration should be the social and economic benefits associated with a cleaner environment. As noted in Chapter 3, it is extremely difficult to come up with precise estimates of these benefits. Based on the qualified estimate of the health costs of water and air pollution in Jakarta, however (approximately US\$500 million a year), it is clear that they are not negligible.

5.47 Given the importance of job creation and continued rapid growth of non-oil exports, a second factor to consider is the impact of pollution abatement costs on the global competitiveness of domestic production. Here also, it is difficult to be precise. Given the differences that exist between industries and for different firms within the same industry, generalizations may be quite misleading. There are grounds for believing, however, that a reasonable level of pollution abatement need not impose a substantial burden in terms of either growth or competitiveness.

5.48 The first is the experience of other countries. As noted in Chapter 4, for example, Japan experienced continued rapid growth and increasing global competitiveness during the 1970s and 1980s when increasingly stringent pollution standards were being introduced. At the other end of the spectrum, Poland suffered a continued erosion of international competitiveness during the same period of time despite paying little or no attention to pollution control in its rapidly growing industrial sector.

5.49 The second relates to the need to improve the efficiency of industrial sector investment. As noted in Chapter 1, GOI's structural adjustment program of the 1980s included a range of policy reforms intended to free up the private sector--including industrial deregulation, trade reforms and the encouragement of direct foreign investment. Despite the progress achieved thus far, however, the level of protection in the manufacturing sector remains relatively high. (The "effective rate of protection" has been estimated to be as high as 58% in Indonesia, as compared with 33% for the Philippines, 23% for Malaysia, and 28% for Korea.) Continued progress in policy reform is implicit in the projected rate of future economic growth, which includes the assumption of efficiency gains in private sector investment of 15-20%. This would be a multiple of the investment costs required for pollution abatement--which are only likely to be in the range of 3-5% of total investment costs.

5.50 At the same time, as noted elsewhere in this report, the rapid pace of new investment stimulated by those reforms, and the continued rapid turnover of capital, will allow Indonesia to take advantage of "clean" technology developed in the West, where the introduction of environmental standards has resulted in production processes that are both more efficient in their use of natural resources and significantly less polluting. A recent analysis of cross-country experience in the diffusion of such technology in the wood pulp and steel industries confirms the potential for major environmental benefits to developing countries from the adoption of new technology (Wheeler, Huq and Martin. 1992). The pattern of "process diffusion" for clean technology outside the OECD was strongly influenced by national economic policies: newer technology replaced the old fairly quickly in "outward-oriented" developing economies, more slowly in the closed ones, and hardly at all in the COMECON economies of Eastern Europe and the former Soviet Union. In fact, the more "open" developing countries achieved an average 8-year lead time in the adoption of these newer technologies over the less-open countries. Since newer processes tend to reflect general technological progress, incorporating superior engineering efficiency and/or improvements in product quality, it is likely that they also increased their competitive advantage, though the study did not focus on that possibility.

5.51 While national environmental standards were lacking or not enforced in nearly all of the countries studied, the more open developing countries succeeded in reducing the pollution intensity of their steel industries by an average of 52%, and the less open ones by 35%. The COMECON countries experienced a near-total absence of process succession in their economies. As noted in Chapter 6, however, the loss of competitiveness they suffered has since been overshadowed by the devastating impact of industrial pollution on the health and welfare of the affected populations.

5.52 The lack of environmental standards—or the failure to enforce them—could be used by developing countries as part of a deliberate effort to attract foreign investment. For a variety of reasons, however, such an approach would be shortsighted, costly in terms of both environmental damage and health impacts, and quite possibly self-defeating. As noted in Chapter 4 (Box 4.2), most multinational firms have adopted standard environmental policies wherever their factories are located, and some are beginning to press developing country authorities to adopt and enforce more stringent environmental standards for domestic firms in order to obtain a "level playing field". They may also prefer to know precisely what the standards are, or will be, so as to avoid expensive retrofitting of their investments. Pressures to adopt a common set of environmental standards have also emerged in the context of negotiations over regional trade agreements, where the intention is to avoid unfair competitive advantage among trading partners on the basis of differences in environmental standards.

5.53 More importantly, as a number of recent studies indicate, firms that have moved their operations to another country most often do so for the savings in labor costs, which vastly exceed any possible savings in pollution abatement costs in their home country. As noted in Chapter 3, while Indonesia continues to enjoy a comparative advantage in labor costs, the competition for direct foreign investment from other labor-surplus countries in the region is likely to increase in the coming years. Given the preference of higher-technology/less polluting "assembly-type" industries to locate in Java's main urban centers, the failure to control the potentially large increase in the level of pollution in and around those centers could cost Indonesia its competitive edge within a fairly short period of time.

### **The Choice of Policy Instruments**

5.54 As noted in Chapter 4, the costs of pollution abatement will depend in part on the policy instruments used to encourage such investments. Economists frequently argue for "market-based" instruments, such as tradeable permits and direct charges on pollution emissions, since the flexibility they offer in comparison with the "command and control" approach would—in theory at least—reduce the total cost of pollution abatement. A recent study on policies for water demand management and pollution control in the Jabotabek region, for example, concludes (on the basis of a relatively small sample of firms) that such savings could be as much as 30% of total abatement costs (Cestti. 1993). Obviously, the potential for using such instruments in Indonesia should be pursued. There are two important caveats, however, to the assumption that market-based instruments represent a significant alternative to the regulatory approach in the near—and perhaps even the medium—term.

5.55 First, the reality is that Indonesia does not yet have in place the monitoring and enforcement capacity that would be required for either approach to work very effectively, which is why the PROKASIH Program has had to rely primarily on moral suasion and publicity to achieve results. Second, direct charges on the pollution generated by industrial firms, or even "second best" instruments such as pollution-based taxes on energy and water, represent a new form of taxation—which will be strongly resisted. This second reality is borne out by the experience of other countries with market-based instruments, which is not exactly extensive. Where pollution charges and similar initiatives (e.g., deposit/refund schemes) have been introduced, the initial level of charges has been relatively low—an inevitable requirement for overcoming resistance to introducing them at all. Given the same resistance to raising such fees subsequently, they tend to suffer a decline in real terms and, as a consequence, may have little direct impact on environmental outcomes. This pattern is clearly reflected in the experience of East Asian countries (OECD. 1992).

5.56 Despite these difficulties, market-based instruments have a number of potential advantages that may be more important than their direct effect on reducing pollution. Among other things, they send a signal to firms that pollution is something that cannot be ignored. More importantly, in most of the countries that have introduced such charges, they are used to strengthen monitoring and enforcement capacity. The revenue from such charges can be an especially important source of funding for local pollution control agencies, which typically have small (and sometimes unreliable) budgets. Over time, with wider application and gradual increases in the charges, they may also be used to support "revolving funds" that provide loans and grants to local firms for the purchase of abatement equipment and the introduction of waste minimizing "clean" technology (see Box 5.1).

#### **Box 5.1 Revolving Loan Funds: Experience in China**

China is taking a variety of measures to bring industrial pollution under control. One element in their strategy involves revolving loan funds that provide below-market financing for pollution control efforts by local--mostly small and medium-size--firms.

**The Operation of the Funds.** The loans are financed by proceeds from waste discharge fees. These fees are levied under national and provincial legislation established in the mid-1980s, which allow the imposition of fees for release of pollutants. A basic fee is charged for releases up to a specified concentration, above which a penalty fee is imposed. The funds are administered by the provincial or municipal environmental protection bureau, and directed by a board of representatives from the local economic planning bureau, finance bureau and environment bureau. To qualify, the industrial enterprise and target pollutants must be listed as part of the area's pollution control strategy. Waste reduction is the favored control option, with selection based on meeting environmental standards at least cost.

**Revolving Loans versus 100% Grants.** Loans are extended for 50% to 80% of project cost, and grants for 10% to 30% of costs. This structure has developed from the initial years of the scheme, when the revenues from pollution fees were returned to enterprises as 100% grants for pollution control. In the early 1990s it was recognized that the levies did not generate sufficient funds to provide large enough grants for meaningful environmental improvements. Under the revolving loan system larger projects can be undertaken, and the available capital may be allowed to accumulate with the addition of annual waste discharge fees. Typical projects range from \$0.1-2.0 million. Loans are made at commercial rates, presently 8%-10%, with maturity in three to seven years. The availability of funds earmarked for environmental improvements provides a significant incentive for such projects, because of the difficulty of obtaining credit with current rapid economic growth, but the grant element increases the incentive.

**Institutional Prerequisites.** Experience under China's revolving loan funds suggest three key factors needed to establish such a system. First, Government commitment to the "polluter pays" principle allows pollution fees to be levied. Second, effluent and ambient quality standards provide the basis for an overall pollution control strategy, against which project proposals may be tested. Third, financial support for the operation of the system is generated by the pollution fees, 20% of which fund provincial and municipal environmental protection bureau activities. As a result of these factors, a sound institutional structure is in place with the capacity to administer, monitor and enforce the pollution control program.

## The Role of Subsidies in Pollution Control

**5.57** Virtually all OECD countries, and increasing numbers of Asian countries (Korea, Singapore, Philippines, and India) rely on subsidies to help meet their environmental objectives. Given the normal arguments against government subsidies, it is important to consider why they may be appropriate and how they should be introduced. The theoretical and practical rationale, and guidelines on how to do it, are set out in Box 5.2, below. The possibility of achieving "budget neutrality" through the use of pollution charges and pollution-based taxes suggests that they should be carefully considered. Given the large number of small enterprises, many of which generate sizable amounts of toxic waste, and the impossibility of monitoring their activities, a targeted program of subsidies (e.g., for centralized waste-water treatment) for such firms could pay large dividends.

### Box 5.2: Subsidies for Industrial Pollution Control: Why and How?

**Why - The Theoretical Foundation.** Industrial pollution occurs as an externality to production because the private cost of pollution-related damage is below the public cost. If environmental "property rights" could be enforced, pollution would be reduced to an efficient level by transactions between polluters and the affected public. The nature of such transactions would depend on whether producers are assigned the right to pollute, or the public is granted the right to a clean environment. A market failure is likely to arise if a right to pollute is given, because of the transaction costs of fully reflecting the public's willingness to pay for a clean environment. This theoretical observation, and the political difficulty of assigning a right to pollute, have helped to promote the "polluter pays" principle.

**Polluter Pays or Pay the Polluter - The Need for a Balanced Approach.** Obviously, the "polluter pays" principle would not support the use of subsidies for pollution control. In addition to the potential for market distortions, they may also raise equity issues for those who are taxed in order to provide them. There are a number of difficulties, however, in actually getting producers to bear the cost of reducing pollution. Most developing countries are at a distinct disadvantage, since they generally lack the financial resources, institutional capacity and technical skills to enforce environmental standards and regulations. The alternative to subsidies, therefore, may be even less equitable, since the burden of pollution falls disproportionately on the poor. In contrast to an ineffective enforcement effort, well-targeted subsidies for pollution abatement, aimed particularly at waste minimization and "clean technology", can achieve substantial emission reductions at a relatively low administrative cost. A balanced mix of policies and instruments--including standards and regulations--can help to maintain pressure for end-of-pipe controls while ensuring that opportunities for waste minimization are not missed.

**How - Guidelines for Pollution Control Subsidies.** To avoid imposing a budgetary burden, subsidies for pollution abatement may be funded from revenues raised by charging for pollution. Well-designed schemes of this form, which provide both a carrot and a stick for pollution abatement, gain political acceptance by being revenue neutral and setting relatively low pollution charges. Careful targeting of subsidies is required to ensure that they are not used for industrial capacity expansion with no environmental rationale, and "least cost" solutions must be sought to achieve maximum benefit from the available resources. The prerequisites for the success of such schemes are discussed in more detail in Box 5.1, which examines a revolving loan program for pollution control in China.

## E. THE PRIVATE SECTOR RESPONSE: ATTITUDES AND INNOVATION

5.58 The actions recommended in this report would raise the cost of doing business for most industrial firms in Indonesia. That could lead to a lower rate of economic growth, and hence fewer jobs, as well as a slower rate of growth for non-oil exports. As Japan has demonstrated, however, that doesn't have to happen. The outcome will depend on a variety of factors related to the process of innovation. As noted above, the adoption and diffusion of newer, cleaner production technologies will occur almost automatically through the expanded use of technology imported from the West. But much will also depend on the response of existing firms to the higher costs imposed by higher prices for natural resources and especially the cost of "end-of-pipe" abatement investments that add nothing of value to the production process. The aim of this section is to explore the possibility of offsetting such costs through a "clean technology" approach to innovation within existing firms, the incentives needed to encourage such an effort, and the opportunity it represents for a more constructive partnership between the Government and the business community in Indonesia.

### Pollution Prevention Pays

5.59 As noted in Chapter 4, as a result of regulatory processes in the West focusing almost exclusively on "end-of-pipe" pollution abatement, the prospects for reducing pollution at the source remain largely untapped. Most governments in the OECD countries, however, are giving increasing attention to the prospects for pollution prevention. At the same time, the business community is coming to recognize that the search for waste-minimizing innovations can add significantly to the profitability of the firm. There is now a growing body of evidence that relatively simple and inexpensive changes in products, inputs and production processes can generate major savings. "Pollution Prevention Pays" campaigns, pioneered by the 3M corporation in the mid-1970s have resulted in total savings to date for 3M of more than US\$600 million. This same approach has since been adopted by a growing number of more progressive--and competitive--multinational firms.

5.60 A survey of over 500 companies in the U.S. found that those who adopted cleaner production processes were able to reduce some pollutants by over 80%, and eliminate others altogether, with investment payback periods ranging from only one month to three years, after which the savings represent additional profit. These benefits accrued to firms using older and simple technologies as well as to those using new and higher-technology processes. Changes included the incorporation of advanced technologies; the replacement of toxic inputs with alternative, less-polluting material; and the switch from chemical-intensive and to more mechanical-intensive processes. The most dramatic case was that of a photographic firm, shown in Table 5.3, below. The initial cost of \$120,000 for the process modification was paid back in a few months by annual savings in the cost of developing solutions (\$1.2 million) and silver recovery (\$1.4 million)--a total of \$2.6 million a year.

5.61 A similar study of firms in the U.S. chemical industry examined 181 source reduction activities in 22 firms. Major findings included: (a) even simple changes in production techniques can save substantial amounts of pollution, and money--with 20% of the activities saving from US\$350,000 to US\$3.0 million a year; (b) a quarter of these activities required no capital investment at all; (c) of those that did require an investment, the payback period ranged from six to 18 months, with two-thirds having a payback period of six months or less (Dorfman, 1992).

**Table 5.3: Cost-Effective Clean Technology Investments in the U.S.**

INDUSTRY	METHOD	REDUCTION OF WASTE	PAYBACK PERIOD
Pharmaceutic production	Water-based solvent replaced organic solvent	100%	< 1 year
Equipment manufacture	Ultrafiltration	100% of solvent and oil; 98% of paint	2 years
Farm equipment manufacture	Proprietary process	80% of sludge	2.5 years
Automotive manufacture	Pneumatic cleaning process replaced caustic process	100% of sludge	2 years
Micro-electronics	Vibratory cleaning replaced caustic process	100% of sludge	3 years
Organic chemicals production	Absorption, scrap condenser, conservation vent, floating roof	95% of cumene	1 month
Photographic film processing	Electrolytic recovery ion exchange	85% of developer; 95% of fixer, silver and solvent	< 1 year

Source: Huisingsh, 1989.

5.62 In addition to their financial advantages, such programs can help to reduce the longer-terms risks of failing to respond to the growing public demand for more environmentally responsible behavior by industrial enterprises. A U.S. chemical company has summarized the risks it sees as: more restrictive regulations, tougher punitive actions, product bans and boycotts, loss of market share, and an inability to recruit the best and brightest people. In the longer term, these same risks are likely to apply to domestic firms in the developing countries. In some cases, they already apply to their export markets in the form of product standards in the importing countries (e.g., restrictions on products using CFCs). The more important lesson, however, may be the possibility of achieving a comparative advantage in the market place. Those firms that have integrated environmental concerns into their corporate philosophy and business strategies are likely to be able to respond more quickly, and adjust more competitively, to future environmental challenges--whether increased costs, new regulations, or changes in market opportunities. This approach helps to explain the competitiveness of the Japanese auto industry, for example, which is ahead of many others in preparing to meet higher fuel efficiency and other environment-related standards that will apply soon in the large and increasingly regulated California auto market.

### **The Need for Government Incentives**

5.63 There is ample reason to believe that the same (or even greater) potential exists in Indonesia for cost-saving waste minimization innovations. Experience in other countries, however, clearly indicates the need for governments to provide the right incentives. As noted in Chapter 4, pricing natural resources such as water, energy and timber at market levels would help to stimulate conservation efforts. Pricing alone, however, will not be enough. In countries where CFC's are being phased out, for example, most firms only initiated a serious effort when regulations and/or quotas were introduced, and only then did they discover that the replacement of CFCs with other substances actually save on their operating costs (O'Connor. 1991).

5.64 This phenomenon has also been confirmed in Indonesia under the PROKASIH Program. In one of its more successful case histories, a glucose factory near Jakarta was able to reduce its consumption of water by two-thirds--from 300 cubic meters a day to less than 100 (at a savings of Rp 650/cum)--and the volume of its waste water from 120 cubic meters a day to only about 20 cubic meters. These savings were accomplished through a combination of relatively simple "housekeeping" improvements, together with the recycling of water within the production process. By recycling water from its condenser (which contained significant amounts of glucose and previously had been considered as waste water) back into the production process as a sweetener, for example, it was able to reduce raw material inputs--and thus their costs--by about 10%. It also added a waste-water treatment facility to deal with the remaining effluents. The operating costs of this facility are expected to average 0.5-1.0% of total operating costs. The savings resulting from its waste minimization efforts, however, will not only cover these additional operating costs, but will also pay back the investment in the water treatment facility within about five years time. The fact remains, however, that these initiatives came only after the firm had been publicly cited by BAPEDAL as one of the worst polluters in the area, and the firm was prohibited from disposing of its waste effluents into the local river until it had installed an effective waste-water treatment facility.

### **Constraints and Opportunities**

5.65 The weaknesses of the monitoring and enforcement capacity in Indonesia represents a serious constraint to the prospects for rapid adoption of a "clean technology" approach to reducing pollution at the source. Other constraints will also apply, reflecting the current stage of development. Efficiency improvements, for example, may require a level of managerial skills and labor discipline that will be more difficult to achieve in Indonesia than in most developed countries. Information about new process changes within an industry may not be readily available, and the quality of expertise in the local consulting industry is relatively weak when it comes to the design of waste-treatment facilities and advice on waste-minimizing changes in the production process.

5.66 These constraints, however, should not be overemphasized. The ability of workers to contribute to waste minimization was clearly demonstrated in the glucose factory case noted above. In response to Government sanctions, the first decision considered by the firm's owners was whether or not to simply close the 20-year old plant. Faced with the prospect of losing their jobs, the staff were highly motivated to find ways of reducing waste, and were responsible for much of the savings achieved. Trade associations can help to collect and disseminate information on "best practice" technology, and foreign consultants can be used if needed to conduct environmental audits.

5.67 More importantly, the search for waste minimization techniques that can save on operating costs represents a potentially fruitful area of collaboration between Government and the private sector. In the West, the regulatory approach is generally seen by both businessmen and the regulators as an adversarial (and often contentious) process. Most firms will be far more receptive to Government interventions in the form of support for money-saving waste minimization programs, and this can provide the foundation for moving beyond a purely adversarial relationship to one of constructive partnerships in achieving more sustainable (and profitable) growth.

5.68 Initiatives designed to stimulate such programs are now underway in several countries in the Asia region, supported by the Bank's UNDP-funded Metropolitan Environmental Improvement Program, and the initial response from trade associations and individual firms has been surprisingly enthusiastic. Support is also available from a number of bilateral donors, and from non-governmental organizations. BAPEDAL, with support from U.S.AID and others, has already made a start in this direction. Given the potential benefits, this concept should be vigorously pursued.

### **Attitudes and Innovation**

5.69 In the absence of strong economic and regulatory incentives, the question that arises for Indonesia is whether the Indonesian business community will be sufficiently interested in the search for money-saving waste minimization opportunities for such programs to have an impact on the level of industrial pollution. The evidence from other countries would suggest that attitudes among businessmen--and especially among senior executives in individual firms--will play a decisive role.

5.70 Despite the prospects for increasing company profits, for example, the improvements noted in the studies cited above only came about when senior management took a direct interest in the process and the outcomes, and when the incentives for subordinate managers and staff reinforced the priority to be given to waste-minimizing innovation. It was generally not sufficient for the advisory staff responsible for environmental affairs in these firms to advocate such initiatives. Indeed, the most dramatic results were achieved when managers and staff from "operations" took the lead in making things happen. This rarely occurred without clear and unequivocal signals from the top, or--as in the case of the Indonesian glucose manufacturer described above--an equally clear signal from external environmental regulators that senior management could no longer afford to ignore.

5.71 Attitudes among senior business executives in the West have changed markedly over the past twenty-five years. The initial response was one of denial--first of the problem, and then of their company's role in it; followed by "lip-service" to the idea of environmental protection, but little effective action; and, finally, grudging acceptance of the need to do something--but essentially still "business as usual, plus a treatment plant". More recently, a growing number of business leaders have come to recognize that public pressure for environmentally responsible behavior is not going to go away, and that waste minimization can help improve their public image as well as increase profits. An increasing number of companies, therefore, especially among the more progressive multi-national firms, have sought comparative advantage in the market place by attempting to anticipate future environmental trends and by building environmental issues and concerns into their basic business strategy for the longer term. The issue for Indonesia is whether its business community could find a way to move from the "denial and resistance" stage directly to the more progressive (and socially responsible) stage. This topic would appear to deserve some further thought and analysis.

## F. COSTS, TRADEOFFS AND PRIORITIES

5.72 As noted in Chapter 4, there is substantial complementarity between economic growth and improvements in environmental quality over the longer term. But there are tradeoffs as well, especially in terms of the costs of urban and industrial pollution and the corresponding investments that are needed to protect the environment. The aim of this final section is to summarize what is known--and what isn't--about the nature and magnitude of those tradeoffs. Additional thoughts are offered on the virtues of a more open and inclusive process for establishing environmental priorities and goals, including the mobilization of additional resources needed to achieve those goals.

### The "Least-Cost" Growth Path

5.73 Investments in environmental protection, especially the capital-intensive public sector investments needed in urban infrastructure and private sector investments in pollution abatement, have a high opportunity cost in a low income country such as Indonesia. It is legitimate to ask, therefore, whether GOI should adopt the approach implicitly followed by other industrializing countries over the past two-hundred years--essentially, "muddle through, and clean up later". The answer is no. While there are obvious limits to how much Indonesia can invest in environmental protection in the near and medium term, the long-run costs of environmental pollution are simply too high. Similarly, the over-exploitation of natural resources and the potential loss of critical ecosystems poses a threat to the sustainability of even current levels of income for many local communities.

5.74 **Future Clean-up Costs.** Part of the evidence lies in the enormous costs of cleaning up pollution after it has occurred, particularly toxic and other hazardous wastes that accumulate in the atmosphere, in soils, in the sediments of water courses, and often in the food chain, posing an increasing health risk for the current population, and an even greater one for future generations:

- o The National Institute of Public Health and Environmental Protection in the Netherlands estimates the costs of restoring damage caused by improper disposal of toxic and hazardous waste in that country at US\$0.9 billion.
- o Authorizations under the "Superfund" for toxic and hazardous waste clean up in the United States have already exceeded US\$10 billion, and are still rising.
- o Estimates for the clean up of toxic and hazardous waste in Poland range from US\$25 billion to more than US\$100 billion, and this does not include the damage already done to human health and the productivity of the country's land and water resources.
- o In Japan, the costs of dealing with Minamata and other sites contaminated by toxic waste have been estimated to be between 10 and 100 times more expensive than the cost of the pollution control measures that might have prevented them from occurring.
- o In Eastern Europe, efforts to sell off inefficient, money-losing state-owned enterprises to Western investors, with the hope that this will save the jobs of their employees, have been seriously constrained by the fear of future legal liability for the clean-up costs arising from past practices of these firms in the disposal of toxic and hazardous waste.

5.75 In some cases, the cost of cleaning up past mistakes is simply prohibitive, and the only economically sensible thing to do is to "write them off". "Put up a red flag and a fence around the site, and just keep people out", as one U.S. Governor suggested recently. He was responding to an estimated cost of US\$10 million an acre to dig up tons of top soil, truck it hundreds of miles to a treatment facility, remove the toxic waste, and dispose of the treated soil (see New York Times series on environmental issues in the U.S., March 21-24, 1992). Given the fact that Java's population density is already one of the highest in the world (815 people per square kilometer), and is projected to grow still higher (to an estimated 1,100 by the year 2020), Indonesia would not appear to have the luxury of "writing off" significant parts of its land and water resources--particularly on Java, and especially if such an outcome could be prevented. Even in the wealthiest countries in the world, however, if they had it all to do over again, they would most assuredly do it differently.

5.76 Indeed, the most important lesson of the past twenty-five years of experience with industrial pollution control in the West can be summed up in three words: **pollution prevention pays**. This applies not only to individual firms--in terms of operating cost savings and/or subsequent liability for clean-up costs) but, more importantly, to the society as a whole--and especially to those citizens who will otherwise bear the costs of environmental degradation. It is for this reason that efforts to support the adoption of "clean technology", including waste minimizing innovations among existing firms, should be given the highest priority in Indonesia's strategy for the control of industrial pollution. This responsibility, however, should not be that of BAPEDAL alone. The "pollution prevention pays" principle should feature prominently in GOI's overall strategy for the development of the industrial sector in Indonesia over the next twenty-five years.

5.77 **Irreversible Loss of Critical Ecosystems.** Essentially the same lesson--that prevention is cheaper than cure--also applies to the protection of critical ecosystems. The costs of restoring the groundwater aquifers in Jakarta, for example, by pumping in sufficient quantities of surface water to reverse the intrusion of seawater, would be prohibitively expensive. In the case of coastal and marine ecosystems, it may be possible to replant mangrove forests, and to restore some coastal wetlands, but coral reefs destroyed by siltation from uncontrolled logging or by pollution from urban and industrial sources, may never be restored. The same applies to the loss of potentially valuable biodiversity, where species extinction can only be prevented through the effective protection of increasingly threatened natural habits--particularly in designated areas of Indonesia's tropical rainforest. In fact, as noted in Chapter 2, the continued over-exploitation of natural resources and the degradation of critical ecosystems calls into question not only the prospects for continued rapid growth, but the sustainability of current levels of economic activity in a number of key sectors and for some entire communities.

### **The Nature and Magnitude of the Tradeoffs**

5.78 As in the case of other rapidly industrializing countries of East Asia, Indonesia has given highest priority in the past to achieving rapid economic growth. More recently, the bias in favor of growth over environmental protection in most of these countries is being reassessed--in part due to growing community resistance to the health risks and other costs of urban and industrial pollution. It also reflects, however, an increasing level of concern about the effects of congestion and pollution in major metropolitan areas on the efficiency of public and private sector investments. Given the increasing share of total GDP expected to be generated in these urban centers, such efficiency losses will inevitably be translated into slower growth for the economy as a whole.

5.79 While the costs of environmental degradation have been too often under-estimated in the past, there is relatively little hard information on the costs of environmental protection, especially the costs of pollution abatement for the private sector, and the implications of those costs for the tradeoff between growth and environmental quality. There is reason to believe that this tradeoff may have been exaggerated in the past, especially when the health and welfare effects of pollution are taken into account. As noted in Section D, for example, the estimated abatement costs for existing Indonesian firms (assuming reasonable standards) are relatively modest, particularly in comparison with the health cost estimates of water and air pollution noted in Chapter 3. Fortunately, for countries coming late to the process of industrialization, these tradeoffs are becoming less severe (see O'Connor, 1993). The main reason is that the costs of controlling pollution are coming down:

- o As noted above, new production technologies developed in the OECD countries in response to increasingly stringent environmental standards are both more efficient in their use of natural resources and less polluting. Most of these advances are embodied in the design of capital equipment and are available in the form of imported technology.
- o Additional technical advances have occurred in the design of abatement processes and equipment, with second- and third-generation technologies resulting in lower costs per unit of pollutant abated, and these advances are also readily available.
- o Based on a review of the data on industrial patents for environment-related technology in both developed and developing countries, one recent study (Lanjouw and Mody, 1993) suggests that there is significant additional scope for the developing countries to adapt imported technology to local conditions, presumably obtaining further efficiency gains in the use of inputs, lower pollution intensity per unit of output, or both.

5.80 Unfortunately, there is still a great deal that is not known about the magnitude of the growth/environment tradeoff in Indonesia. As noted in Section D, for example, the costs of pollution abatement for individual firms may vary widely, making generalizations even on an industry-specific basis hazardous, while the scope for off-setting mandated abatement costs through waste-minimizing innovations remains largely unexplored. An accurate assessment of the health costs of pollution will require additional research on Indonesia-specific dose/response rates and "willingness to pay" indicators (see Chapter 3). Similar shortcomings exist in the available information about key natural resources and ecosystems. There is considerable uncertainty, for example, about the current rate of deforestation (and its causes), and relatively little is known about the conditions and trends of vital coastal and marine ecosystems, such as wetlands and coral reefs (see Chapter 2).

5.81 Existing Indonesia data on both pollution and natural resources management issues, combined with the experience of other countries with these same issues, is sufficient to identify the highest priority environmental concerns requiring immediate attention. To evaluate relative priorities, however, and to ensure the optimal allocation of budgetary resources over time, will require a significant improvement in the quality and timeliness of data on actual environmental conditions and trends in Indonesia. The design of specific policies and instruments to deal with these issues, including the establishment of environmental standards and the evaluation of specific investment proposals, will also require greater accuracy in the costs and benefits of environmental protection. (The need to strengthen environmental information systems is discussed further in Chapter 6.)

### **Establishing Environmental Priorities: A Focus on the Process**

5.82 Some environmental issues are more important than others for achieving Indonesia's development objectives for the medium and longer term. At the national level, the highest priority concerns include: water supply and sanitation, solid waste management and vehicle emissions in Indonesia's main urban centers, industrial pollution control--primarily on Java, and the management of forest concessions in the outer islands. The resolution of these issues will require the attention of senior GOI policy makers and, as noted above, they should also be reflected in the allocation of budget resources during REPELITA VI. It is important to recognize, however, that environmental issues and concerns will vary by province, within provinces in terms of rural and urban issues, and even within communities at the municipal and village level. There will also be legitimate differences of opinion about environmental priorities among and between different constituencies at each level: Government agencies (many of which have quite different mandates), trade associations and individual firms, communities and households, and non-governmental organizations--including local, national and international environmental interest groups.

5.83 As noted in Chapter 4, some environmental issues have become increasingly contentious in recent years--especially those involving the sustainability of global ecosystems and the protection of biodiversity. Within Indonesia, however, issues of sustainability at the local level are also becoming more contentious: population pressures combined with continued rapid growth is leading to increasing conflicts over the use of land and access to other natural resources, and more and more people are exposed to the health risks and other costs of urban and industrial pollution. To resolve the issues of global sustainability, President Soeharto has called for less confrontation, greater understanding on all sides, and the development of more effective global partnerships. These same principles will also be applicable to issues of local sustainability.

5.84 While GOI has the primary responsibility for establishing Indonesia's environmental priorities and goals, it does so, in effect, as the agent of the Indonesian people--including both present and future generations. To the extent that global issues are at stake, it is also the agent of the world's population--present and future. Recent experience in Indonesia confirms that a more open and inclusive process of establishing environmental priorities can help not only to ensure that those priorities are the right ones, but also to broaden and strengthen the consensus among the various constituencies in favor of those priorities. This was reflected, for example, in the preparation of Indonesia's National Biodiversity Action Plan, which involved representatives from both Government agencies and non-governmental organizations, with the later including both national and international NGOs (such as WALHI, an "umbrella" organization representing hundreds of Indonesian environmental interest groups, and the World Wildlife Foundation, which contributed its technical expertise to the preparation of the Action Plan).

5.85 GOI also has primary responsibility for the implementation of development plans, including those to protect the environment. As noted in Chapter 6, however, Government cannot--and need not--do it all. The spirit of cooperation engendered by wider participation in the process of establishing environmental priorities and goals will also provide the foundation for more effective collaboration among and between the stakeholders concerned, and thus help to mobilize the additional talents, energy, skills and financial resources needed to achieve those goals. The challenges and opportunities of a more participatory approach are discussed further in Chapter 6.

## **CHAPTER 6**

### **THE CHALLENGES OF IMPLEMENTATION**

## CHAPTER 6

### THE CHALLENGES OF IMPLEMENTATION

#### CONTENTS

	<u>Page No.</u>
A. INTRODUCTION .....	169
B. THE POLITICS OF ENVIRONMENTAL MANAGEMENT .....	169
Barriers to Effective Action .....	170
Experience in Other Countries .....	170
Prospects in Indonesia .....	172
The Challenges of Political Leadership .....	173
C. THE CRITICAL ROLE OF INFORMATION .....	174
Establishing Clear and Rational Priorities .....	174
Designing Cost-Effective Approaches .....	176
Ensuring Effective Implementation .....	178
Evaluating Progress and Results .....	178
D. THE IMPORTANCE OF INSTITUTIONAL STRENGTHENING .....	179
Environmental Management at the National Level .....	179
Environmental Management in the Provinces .....	186
Institutional Issues in the Management of Key Natural Resources .....	189
The Search for Creative Solutions .....	190
E. THE NEED FOR CONSTRUCTIVE PARTICIPATION .....	192
The Rationale for Participation .....	192
Development Effectiveness and Sustainability .....	193
Sustainability and Burdensharing .....	197
Growth, Equity and Stability: Striking a New Balance .....	203

## **THE CHALLENGES OF IMPLEMENTATION**

### **A. INTRODUCTION**

6.1 Previous chapters have described the major environmental risks and costs facing Indonesia, the changes in policies and incentives that would lead to more sustainable development, and the investments in environmental protection that need to be made by both the public and private sectors. In many respects Indonesia has been a leader, particularly among developing countries, in articulating a sustainable development strategy and in putting in place the essential elements of a legal and institutional framework to support that strategy. As in most other countries, however, there remains a sizable gap between official statements of policy and the realities of implementation--between what is being done and what needs to be done.

6.2 The aim of this chapter is to explore the opportunities that exist, and the challenges to be overcome, in strengthening Indonesia's capacity to implement a sustainable development strategy. The discussion focuses on four key aspects of implementation. Section B examines the political aspects of environmental protection, including the challenges of overcoming vested interests and other mutually reinforcing barriers to effective action. Section C deals with the critical role of information in environmental planning and management, including the establishment of priorities, the design of cost-effective policies and instruments, ensuring effective implementation and monitoring progress and results. Section D focuses on the importance of strengthening the institutional capacity of the relevant government agencies at the central, regional and local levels, and the need for "creative interim solutions" to overcome existing institutional constraints. A final section explores the need for wider participation in the process of development planning and implementation, and suggests that there is considerable scope for improving the effectiveness, sustainability and equity of development efforts. This will require greater attention to consultations between project sponsors and affected communities, and a new balance between the sometimes conflicting goals of growth, equity and stability.

### **B. THE POLITICS OF ENVIRONMENTAL MANAGEMENT**

6.3 Public awareness of environmental issues, especially in the West, has grown exponentially over the past twenty five years, fueled by increasing evidence of the threats to human health, wildlife species and critical ecosystems from uncontrolled environmental degradation. This explosion of interest and concern has led to unprecedented political attention at the highest levels, as reflected in the June 1992 U.N. Conference on Environment and Development in Brazil attended by President Soeharto and more than 100 other heads of state. Despite all of this attention and concern, progress in addressing the underlying causes of environmental degradation on a national basis has been painfully slow in nearly every country in the world. With a few notable exceptions, issues of regional and global concern have only begun to be addressed. What are the factors that have prevented so many governments from moving more forcefully to deal with these issues?

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## Barriers to Effective Action

6.4 There are at least four main reasons for the continuing gap between rhetoric and reality, and each is particularly relevant for Indonesia:

- o Inertia - often based on a lack of information about actual environmental conditions and trends, especially those less "visible" to policy-makers and the public;
- o Uncertainty - about ecological processes and their reversibility, the implications for human health, productivity and growth, and the potential costs and benefits of effective environmental protection;
- o Public sector trade-offs - where government action in favor of environmental protection must compete for limited administrative and financial resources with other important social and economic goals, and where the attention of policy-makers is frequently focused on more immediate issues of macroeconomic management; and
- o Private sector costs - where the free or subsidized use of natural resources and uncontrolled pollution of the natural environment are treated as existing "rights", whose holders have a vested interest in maintaining the "status quo", and who frequently argue that environmental protection will have dire economic consequences.

## Experience in Other Countries

6.5 The prospects for overcoming these barriers depend on a variety of social, economic and political conditions. Before turning to the Indonesian prospects, it may be useful to illustrate how these factors have influenced environmental outcomes under different conditions elsewhere.

6.6 **The experience of Eastern Europe** represents one extreme of the spectrum. Until the recent political upheaval, the governments of Eastern Europe and the former Soviet Union followed a distinctly "non-market" approach to economic growth, with disastrous environmental consequences. Distortions in the price system, intended to encourage industrial output and other social objectives, had the unintended effect of encouraging pollution: "Material input prices were kept well below marginal production costs, thereby encouraging wasteful consumption and reducing incentives for recycling. Water and electricity prices were kept artificially low to stimulate industrial development and promote consumer welfare, again promoting wasteful consumption and extra pollution. State investment policy was explicitly directed toward the encouragement of heavy industries such as metals and chemicals..."<sup>1</sup> industries under heaviest cleanup pressure in the EEC and U.S. over the past twenty years. One outcome of these policies was inefficiency in the production of goods and services. In 1985, for example, the median energy intensity in production for six East European economies was 300% higher than for eight EEC economies.

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<sup>1</sup> David Wheeler, The Economics of Industrial Pollution Control - An International Perspective, World Bank Working Paper (draft), June 1991, p.53.

6.7 The extent of the environmental damage caused by these policies, however, has been far more devastating in terms of their effects on human health and ecological conditions in the region. In Poland, for example, high rates of mental retardation in certain regions have been attributed to high concentrations of heavy metals in the environment, especially lead, with one region declared an "ecological disaster area"; deaths due to pollution are said by some researchers to have contributed, at least in part, to the reduction of life expectancy for Polish males aged 40-60 back to 1952 levels; forest resources have been highly degraded by acid rain, and 96% of the rivers are unfit for municipal use (38% are unfit for industrial use); estimates of pollution-related losses to the economy range from 3-10% of GDP annually, while the cleanup cost is estimated at US\$25-100 billion.

6.8 **Experience in Western Europe and North America** has been markedly better, in part due to the more "market-friendly" approach to economic management, and in part due to the growing influence of environmental interest groups. While generalizations are difficult, it is fair to say that none of these countries has fully implemented the "polluter pays" principle, and most have relied almost exclusively on "command and control" rather than "market-based" approaches to the control of industrial pollution. The relative political strength of environmental interests groups varies widely, with considerable influence in Europe, especially Germany, and rather less in North America, especially the U.S.—where private sector interests and "competitiveness" concerns more often prevail. These differences account for much of the variation that exists between countries in the attention given to waste minimization and recycling, energy conservation and pricing, the enforcement of effluent standards for water and air, and the protection of natural habitats.

6.9 As a result of increasingly stringent regulations, water quality has improved significantly, and considerable progress has been made in reducing particulates, sulfur dioxide and lead in urban air. The volume of municipal waste, however, has continued to escalate, as have emissions of carbon dioxide from the burning of fossil fuels. The management of toxic and hazardous waste remains a serious issue, with only marginal progress to date in reducing aggregate emissions. In the U.S. alone, there are more than ten thousand sites that may eventually be eligible for cleanup under the "Superfund" initiative, at a cost of more than US\$10 billion.

6.10 **The experience of Japan** represents a further variation, in both approach and results. Throughout the postwar period, the Government of Japan has followed a more interventionist approach to the private sector, with remarkable success in stimulating rapid economic growth. The social costs of urban and industrial pollution were recognized earlier than in many other countries, with environmental regulations introduced beginning in 1967. The responsibility for environmental protection was allocated to the lowest effective level of government and, while there were relatively few active environmental interest groups, neighborhood communities were invited to participate in negotiations between industrial firms and local authorities on the environmental standards to be applied. Japanese firms are particularly sensitive to community concerns, often agreeing to standards far more strict than national regulations require. As a result of rigorous abatement efforts, a surprising number of normally highly polluting firms continue to operate in residential areas without objection from the surrounding community.

6.11 Expenditures on pollution abatement and environmental protection expanded rapidly during the 1970s, with a simultaneous increase in the competitiveness of Japanese exports and continued rapid growth. While solid waste disposal and vehicle emissions remain a serious problem,

pollution of water and air have been reduced significantly. In response to oil price shocks in the 1970s, energy conservation has been strongly encouraged, and per capita consumption of energy is now less than half that of the U.S. There have been major improvements in technology for waste minimization, recycling, and waste treatment, including the management of toxic and hazardous waste. Many firms have integrated environmental concerns into their international business strategies. Japanese auto firms, for example, have anticipated the tightening of emission standards in the U.S. by designing more efficient, less polluting engines, while U.S. firms continue to propose delays in their implementation, arguing that the standards cannot be met in the time allowed.

### Prospects in Indonesia

6.12 Conditions in Indonesia include a number of constraints to effective environmental management. There are an equal number of positive features, however, that provide ample opportunity for political leadership, building on the well-established tradition of "doing the right thing". These constraints and opportunities arise from the current stage of economic development, the prospects for rapid growth, and the unique characteristics of the Indonesian political environment.

6.13 Indonesia today is still a low income country, with many competing demands for the Government's limited fiscal and administrative resources and a serious shortage of the skills needed for effective environmental management. The lack of data on environmental conditions and trends is a major handicap. "Coming late" to the development process, however, has enormous advantage--not least of which is the opportunity to learn from the experience of other countries, and to avoid their worst mistakes. The most important lesson is to prevent environmental degradation before it occurs, rather than clean it up later. The experience of other countries with alternative approaches is quite important, but--as noted further below--Indonesia will need to define solutions that take into account the country's unique political, social and cultural circumstances. The prospects for continued rapid growth represent a challenge and an opportunity. While growth will be essential for improving environmental conditions in the longer term, the pace of development also implies a narrow window of opportunity for influencing longer-term outcomes.

6.14 In the period following Independence in 1945, Indonesia experimented with the "parliamentary democracy" approach common in the West, and found them wanting.<sup>2</sup> To avoid political instability and a paralysis of leadership, the Government adopted a policy of "Guided Democracy". Under the New Order Government, the philosophy of Pancasila has provided the guiding principals.<sup>3</sup> In line with both Pancasila and strongly held cultural values, political conflicts are expected to be resolved through deliberation and consensus. This applies even in the parliament, where the resolution of specific issues is decided by discussions aimed at achieving a "meeting of the minds" rather than by voting.

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<sup>2</sup> In 1951, there were 13 different political parties, the largest of which controlled 25% of the vote; from 1945 to 1958, there were 17 different cabinets.

<sup>3</sup> Pancasila is the official expression of the five core national principles incorporated in the Preamble to the Constitution: belief in one god, humanitarianism, national unity, democracy arising out of deliberation, and social justice.

6.15 Development planning and implementation in the past have been highly centralized, with succeeding Five Year Plans (Repelita) founded on the "trilogy" of development goals: growth, equity and stability. To encourage the growth of output, employment and social welfare, many of the key inputs for development (e.g., water, seeds, fertilizer, and electricity) have been subsidized, with large scale development programs driven by quantified targets both for the provision of inputs and for expected results. The emphasis on political stability has greatly facilitated rapid growth, while the emphasis on growth in rural areas has contributed to a major reduction in poverty, and thus to a more equitably sharing in the gains of development.

6.16 In the interests of collective gain and national security, however, "popular movements" have been discouraged, and development objectives are often given a higher priority than the rights of individual citizens and community groups. Under these conditions, environmental interest groups, though growing in number and influence, have had relatively little voice in political decision-making. At the same time, a number of private sector entrepreneurs have been able to develop sizable "conglomerates" engaged in a wide range of business activity, including manufacturing, finance, forestry concessions and agro-processing. Their political influence arises in part from the contributions they make to economic growth, employment and exports, and in part--as in many other countries--from their political connections.

### **The Challenges of Political Leadership**

6.17 Under these circumstances, it will be imperative for Indonesia's political leaders to strengthen the national consensus for environmental protection, and to foster more effective relationships among and between the three main constituencies: Government, the business community, and the general public. Government policy-makers will continue to have primary responsibility for establishing priorities, improving the policy framework, and strengthening the institutional capacity for environmental management. Well-informed popular support and community involvement will be necessary to ensure effective implementation of sustainable development policies and programs. The private sector, however, is the engine of growth in Indonesia and it will be especially critical to develop more effective relationships between business and government, and between individual firms and the surrounding communities. This will be necessary not only to overcome vested interests and the natural resistance to change, but--more importantly--to mobilize the financial and technical resources and to harness the energy and innovative talents of the entire business community in favor of more sustainable growth.

6.18 The Government has demonstrated its capacity for strong political leadership and bold action many times in the past, whenever justified by the national interests. Examples include: the initiation of family planning efforts early in the development process, one of the most successful programs in the world; the achievement of self-sufficiency in rice production, from a position as the world's largest importer; the subsequent introduction of an innovative system for "integrated pest management", and the elimination of subsidies on pesticides; and the major structural reforms achieved over the past decade in the face of strongly entrenched vested interests, within Government itself as well as in the business community. There are grounds for optimism, therefore, that GOI's policy-makers will seize the present moment of opportunity to close the gap between the rhetoric and reality of environmental protection. The remainder of this chapter describes what needs to be done.

### C. THE CRITICAL ROLE OF INFORMATION

6.19 There are four key steps to effective environmental management, and the collection, analysis and dissemination of information has a critical role to play in each of them: establishing clear and rational priorities; designing cost-effective policies, procedures and investments; ensuring effective implementation "on the ground"; and monitoring progress and results.

#### Establishing Clear and Rational Priorities

6.20 "Doing the right thing" must begin with an understanding of what exactly needs to be done, and why. Many of the worst environmental crises in the world have occurred because neither the public nor government policy-makers were aware of the extent and consequences of environmental degradation. While the conservation of nature is an established movement in the U.S., for example, the modern environmental protection movement began with the publication of Rachael Carson's book (*Silent Spring*), which revealed the growing danger to wildlife from the uncontrolled use of DDT, and gained considerable momentum from the infamous "Love Canal" toxic waste dump; in Japan it began with the discovery of the devastating human consequences of mercury accumulation in the food chain at Minimata Bay; the current global concern with CFCs began when scientists documented the growing threat to human health from ozone depletion. The starting point for environmental protection, therefore, is the collection and analysis of data on environmental conditions and trends.

6.21 When this analysis leads to the identification of potentially serious problems, further information will be required to understand the underlying causes and the potential consequences. Most environmental problems arise from a combination of increasing population densities and changes in the nature or intensity of economic activity. Environmental change, however, is an inherent feature of the development process, and trade-offs are inevitable. To establish rational priorities, therefore, the costs and benefits of environmental protection must be carefully weighed. This will require additional information about both "market" and "non-market" values.

6.22 Accurate and precise data on environmental conditions and trends in Indonesia is not readily available. Water pollution in rivers, streams and aquifers, and air pollution in urban centers, for example, is poorly monitored in virtually all developing countries, and Indonesia is no exception. Data on land use patterns and the utilization of forestry resources is generally outdated and unreliable for decision-making purposes. Information on the condition of critical ecosystems (watersheds and coastal zones in particular) is nearly non-existent. The problems in coverage and quality of environmental data in Indonesia are generally well recognized (see Barbier, 1988). The need to strengthen the institutional framework for environmental data collection and analysis is noted in the following section, and should obviously be given a high priority.

6.23 The two main sources of published environmental data are MLH (the Ministry of Environment) and BPS (the Central Bureau of Statistics). MLH publishes an annual report of data submitted by provincial environment bureaus (BKLHs). These reports include wide-ranging information on population characteristics and trends and socio-economic activity, and some data on environmental conditions and trends. The main sources of data, however, are those readily available from other provincial offices, and there are major differences in coverage, quality and consistency between provinces.

6.24 Since 1982, BPS has produced an annual report of environment-related statistics, including data on population trends, health conditions, water supply and sanitation, and other socio-economic factors. BPS data, however, is limited to that which can be collected by survey questionnaires, supplemented by information obtained from sectoral agencies. As in the case of MLH reports, the available data is organized on the basis of government administrative units (provinces, kabupatens, etc.), and is not easily related to ecosystem boundaries (e.g., watersheds).

6.25 Other sources of data include the sectoral ministries (Agriculture, Forestry, Industry, Public Works, Mines and Energy, etc.), BPN (the land agency) and BAKOSURTANAL (the agency responsible for mapping and remote sensing). There are three main problems with these sources. First, data coverage is biased by the strong orientation to development programs based on inputs and outputs. In agriculture, for example, there is considerable data on the use of inputs, output per hectare and commodity prices, but little on soil conditions, productivity and erosion. Second, given their strong sector orientations, the impact of development activity in one sector on the development of other sectors (or on ecosystems outside of program boundaries) are largely ignored. Third, the accessibility to other departments of data produced by any given department is often limited by bureaucratic factors; the availability of digitized maps and results of remote sensing by BAKOSURTANAL, for example, has been a particular problem--due largely to security concerns.

6.26 The direct collection of field data on environmental conditions is still quite limited. Only about 0.2% of forest land, for example, has been intensively surveyed on the ground. The regular monitoring of water quality is carried out in relatively few areas, and measurements of air quality even in major urban centers have been sporadic at best, leading to problems of consistency in time-series data. This problem is compounded by a general lack of quality control in both data collection and laboratory analysis due to a combination of outdated and inadequate equipment, a shortage of well-trained staff, and the lack of standardized protocols and reference materials in most government laboratories (see, for example, Aertgepts, 1988). The computerization of data storage, retrieval and analysis, outside of BPS at least, is at an early stage of development. Even the data that does exist, therefore, is not easily accessible to policy-makers and economic planners, and much less so to the general public.

6.27 In addition to weaknesses in the data base on ambient environmental conditions, very little research has been carried out on the relationship between environmental conditions and human health--including--as noted in Chapter 3--the "dose/response" rates which are needed to estimate the impact of pollutant concentrations on morbidity and mortality. Additional work is also needed on "willingness to pay" surveys that will be required for accurate measurement of the health costs of pollution for individual communities.

6.28 These shortcomings represent a major handicap not only to understanding the underlying causes of environmental degradation and the potential consequences, but also to the design of specific policies and instruments needed to resolve such issues. As noted in Chapter 4, however, existing "order of magnitude" data is sufficient to identify the most critical problems. While working to improve the institutional capacity for data collection and analysis, policy-makers should rely on "rapid appraisal" techniques, targeted research studies and experience from other countries to refine the priorities for environmental protection and sustainable management of natural resources.

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### **Designing Cost-Effective Approaches**

6.29 The cost of environmental protection depends on the approach that is taken. As noted in Chapter 5, for example, the choice of instruments for the control of industrial pollution may have a significant effect on the cost of compliance with environmental standards. A least-cost strategy for sustainable development, however, will also require the formulation of sectoral development programs and the design of individual projects that fully reflect environmental "externalities". Area-specific planning, and the provision of ecosystem-specific environmental information, will be needed to guide the design and location of development projects so as to minimize their environmental costs.

6.30 As noted above, most sectoral departments focus their attention almost exclusively on the achievement of development goals within their own sector, and ignore potential impacts on other sectors and on environmental conditions outside the physical boundaries of their projects. As a result, projects with significant environmental effects may have unacceptably low rates of return when their full economic costs are taken into account (See, for example, Ascher, 1991).

6.31 In 1982, Indonesia established the legal basis for requiring that development projects be subjected to a detailed "environmental impact assessment", with the results to be incorporated in subsequent project design, approval processes, mitigation efforts, and the monitoring of results. Detailed regulations to guide this process (the AMDAL program) were issued in 1986. Progress in implementing this program has been slow, and the results somewhat disappointing. This is due partly to the high expectations at the start of the program, but mostly to the lack of effective institutional support and the scarcity of environmental skills in both the public and private sectors. The nature of these difficulties are described in the following section. In addition, however, greater attention should be given to sectoral EIAs by the respective line Ministries, including an assessment of cross-sectoral and "downstream" effects arising from potential environmental impacts.

6.32 Equally important is the need to improve area-specific development planning, especially for rapidly growing urban areas and for critical or threatened ecosystems, such as watersheds and coastal and marine resources. What is needed is not the sort of detailed zoning plans that have failed so often in the past, but broad "structural" plans that can guide development projects and other socio-economic activity in line with the productive and assimilative capacity of local and regional ecosystems. A law on spatial planning has recently been passed by the parliament. The development of implementing regulations, and specific plans for critical areas, should now be given a high priority. The information provided by such plans can be used for influencing locational decisions and for guiding the terms of reference for project EIAs, as well as the subsequent design of projects and mitigation plans, and the monitoring of actual environmental outcomes.

### **Ensuring Effective Implementation**

6.33 Information and analysis is required for rational decision-making on environmental priorities and for cost-effective policies and development plans. But action at the "grass-roots" level is needed to ensure that those policies and plans are implemented effectively. Here, information plays an even more critical role: in helping to build a consensus necessary for the introduction of specific policies; in changing the habits of individuals and firms; and in ensuring compliance with environmental policies and regulations.

6.34 There is no need to convince people that environmental problems exist; they live with and suffer from the effects of environmental degradation every day. In a recent survey of adults in four major cities, for example, 84% felt that Indonesia faces serious environmental problems (Survey Research Indonesia, 1992). They ranked the removal of rubbish, safe water and sanitation as their highest priorities. Doing something about environmental problems, however, will involve costs and inconvenience for individual citizens, as well as firms. Education and awareness campaigns can help to lay the groundwork for the introduction of specific new policies and regulations, including convincing the public that such initiatives will be enforced fairly and effectively. The need for such an approach was illustrated recently when the introduction of a new traffic law had to be delayed for a year due to widespread resistance. As one leading newspaper noted in an editorial commending the delay: "Without the support of the public, any new law will fail to fulfill its purpose."

6.35 The introduction of Indonesia's "integrated pest management" system provides another example of the need for sometimes quite intensive education and training to achieve desired changes in behavior at the grass-roots level. Government agencies, however, cannot--and need not--do it all. NGOs can play an especially helpful role in education and awareness campaigns, and in mobilizing public support. A leading environmentalist active in consumer protection, for example, recently initiated a program to support waste recycling in several cities in Java. Called *Peduli* ("we care"), this program encourages housewives to separate their wet waste from used plastic and paper products, and has helped to organize and support some 30,000 scavengers who collect this material and channel it to junk dealers and recycling plants. The Government-owned television network (TVRI) is providing national-level publicity. A number of private firms have agreed to serve as sponsors, and several banks are providing needed credit to scavengers and other middlemen.

6.36 Information, especially if it is available to the public, can also be a powerful force in reducing industrial pollution. In the U.S., for example, a "community right to know" law has made available to the public reports from individual firms on their toxic chemical emissions (see Box 4.8), with some rather dramatic results in some cases. Recent experience in Indonesia reinforces the potential of publicity for capturing the attention of corporate executives. Under GOI's ProkasiH Program, initiated in 1989, voluntary agreements to reduce water pollution were signed by 2,000 firms along the most highly polluted rivers in eleven provinces. Many firms followed up on these agreements conscientiously, but others were generally uncooperative, despite increasing pressure from PROKASIH Teams. In October 1991, the Minister of MLH warned that those firms ignoring their agreements would be taken to court. He also publicly named the worst offenders. Subsequently, action was taken by the Jakarta ProkasiH Team against a joint-venture firm, which included a halt to all dumping of its wastes into the river until a waste water treatment plant was in operation (described in para. 5.64). This initiative was also widely publicized in the local press.

6.37 These actions, together with the attendant publicity, were instrumental in convincing hundreds of other firms that GOI was indeed getting serious about the control of industrial pollution in Indonesia's rivers. As in most other countries, public perceptions about a company are considered important by managers and shareholders alike. Making information on the polluting activities of individual firms publicly available, therefore, can play a vital role in encouraging compliance with environmental regulations, both directly through the negative effect of adverse publicity, and indirectly through a subsequent process of negotiations between firms and local community groups, as noted in the final section of this chapter.

## Evaluating Progress and Results

6.38 To know whether or not their efforts to protect the environment and to manage natural resources more effectively are succeeding, Government policy-makers need to keep score. It would be useful, therefore, to develop some "key indicators" that measure progress and results in the most critical areas. Surprisingly, the development of such indicators is a relatively recent phenomenon even in the more developed countries. Since 1989, OECD has been working on a set of 18 policy-oriented indicators that would help to integrate environment and economic decision-making in OECD countries, although a number of important factors (e.g., toxic releases) are not included due to a lack of reliable data (See Hammond, Rodenburg and Tunstall, 1991). Canada was committed to developing a preliminary set of environmental indicators in 1991, but the draft results are not yet available to the public. The World Resources Institute, in cooperation with UNEP and UNDP, has published a series of statistical reports on environment-related measures of natural resources, and recently attempted a composite index on greenhouse gas emissions, though the latter has been criticized on both technical and political grounds.

6.39 In short, while the development of environmental indicators would seem to be a good idea, the process is not necessarily easy. For a developing country like Indonesia, with limited resources to devote to such an effort, it should be confined to the most important issues, focused on policy-related concerns, and designed to improve accountability in both the public and private sector. Most indicators would fall into one of two categories: the management of natural resources, and the control of environmental pollution.

6.40 In the area of **natural resources management**, MLH has been working for several years on "natural resources accounting", to develop adjustments to Indonesia's national income accounts. The intention is to adjust the estimated growth of GDP (Gross Domestic Product) to reflect reductions in the stock of natural resources (e.g., forestry and energy) which should not be counted as "income". It might be useful to extend this effort to include measures of efficiency in the use of key natural resources, as an indicator of progress in improving efficiency through changes in pricing policy and other incentives. Obvious examples would include: energy efficiency in manufacturing; efficiency of water use in irrigation; productive efficiency of timber utilization in the wood-processing industry; etc. These indices could be produced by the relevant sectoral agencies, and could eventually be used both for setting reasonable targets for improvement and, by making the results public, for stimulating accountability in achieving those targets.

6.41 In the area of **environmental pollution**, there are three type of indices that might be useful. The **first** relates to public sector efforts in environmental protection, particularly in urban areas, and could include such things as access to safe water and sanitation, volumes of solid waste collected (and recycled), and measures of public transport availability and use. A **second** would involve urban and industrial sector pollution control efforts, and could focus on a combination of aggregate (reported and/or estimated) emissions of hazardous and non-hazardous waste (including vehicle emissions), and measures of compliance with GOI's emission standards. The **third** would focus on actual conditions and trends in the ambient quality of surface and ground water, and of air quality in selected urban centers. The development of such indicators would contribute to strengthening the national and local consensus for environmental protection and the influence of MLH, BAPEDAL and other government agencies in carrying out their mandates.

## D. THE IMPORTANCE OF INSTITUTIONAL STRENGTHENING

6.42 Indonesia has had a long-standing commitment to the basic concepts of sustainable development and environmental protection, and has already established a legal framework and regulatory procedures designed to implement those concepts. As in most developing countries, however, the institutions responsible for environmental management face a variety of constraints in carrying out their mandate. As a result, environmental issues and concerns are not yet effectively integrated in development planning and implementation. The evolving institutional framework for environmental management in Indonesia is described below, along with an assessment of the key constraints and areas for improvement. Institutional development, however, is a long-term process, and--if the experience of the industrialized countries is any guide--substantial progress may require a generation or more. Some problems can't wait. In the interim, therefore, it will be necessary to find creative solutions for tackling these problems in spite of the existing institutional shortcomings.

### Environmental Management at the National Level

6.43 There are a large number of institutions in Indonesia that have an important role to play in environmental protection and the sustainable management of natural resources, at both the national and provincial levels (see Box 6.1). Most are in the public sector, but non-governmental institutions, including universities and NGOs, will be increasingly important in the coming years. At the national level, the key agencies include the State Ministry for Environment--MLH and the Environmental Impact Management Agency--BAPEDAL, central agencies responsible for the management and use of natural resources (Forestry, Agriculture, Industry, etc.) and others responsible for key aspects of development planning and coordination (e.g. the State Planning Agency--BAPPENAS, and the Ministry of Home Affairs--responsible for administration of provincial and local governments).

6.44 **The State Ministry of Environment.** The origins of MLH can be traced to the preparations made by GOI for the UN-sponsored "Conference on the Living Environment" held in Stockholm in 1972. As a follow-up to that work, a "Committee for the Formulation of Environmental Policies" was set up under the leadership of the Vice Chairman of BAPPENAS, reporting directly to the President. In 1978, a Minister of State for Development Supervision and Environment (PPLH) was created, out of which grew the State Ministry for Population and Environment (KLH) in 1983. The last major reorganization of KLH occurred in 1988, and resulted in the formulation of a "priorities and planning committee" (to be assisted by a Policy Analysis Unit) directly under the Minister, and four divisions, each headed by an Assistant Minister. With the recent cabinet changes, however, the population responsibilities of KLH were combined with Indonesia's Family Planning Program activities to form a new Ministry, and KLH became MLH.

6.45 As a State Ministry, MLH does not have direct implementation responsibilities, but is charged with policy formulation and the coordination and oversight of sustainable development efforts by other line ministries and agencies. During the late 1970s, and for much of the 1980s, the main focus of MLH's work was on raising the awareness within Indonesia of environmental issues and concerns, and putting in place the essential elements of a strategy for sustainable growth, including laws and regulations, information systems, environmental skills and a "support network" of environmental organizations.

**Box 6.1: The Institutional Framework for Environmental Management**

<b>National Level Institutions</b>		
<u>Central Ministries</u>	<u>Environmental Agencies</u>	<u>Other Key Agencies</u>
Industry	State Ministry for Environment (MLH)	State Planning Agency (BAPPENAS)
Agriculture	Environmental Impact Management Agency (BAPEDAL)	Central Bureau of Statistics (BPS)
Forestry		Mapping Agency (BAKOSURTANAL)
Mines and Energy	Environmental Studies Centers Network (BKPSL)	Land Management Agency (BPN)
Public Works		Technology Assessment Agency (BPPT)
Communications & Transportation	Government-sponsored and Non-Profit Research Orgs.	
Ministry of Home Affairs	Private Sector/Non-Govt. Organizations (NGOs)	
Health, etc.		
<b>Regional Level Institutions</b>		
<u>Offices of Central Ministries</u>	<u>Environmental Agencies</u>	<u>Key Government Agencies</u>
Industry	Bureaus of Population and Environment (BKLHs)	Office of the Governor and Staff
Agriculture	Government Laboratories	Planning Agency (BAPEDAs)
Forestry		University Environmental Studies Centers (PSLs)
Mines and Energy	EIA Commissions (Komisi Daerah AMDAL)	Industry
Public Works		Prokash Teams
Communications & Transportation	Private Sector/Non-Govt. Organizations (NGOs)	Forestry
Health		
etc.		Police, Prosecutors and the Courts

6.46 There have been major accomplishments in each of these areas over the past decade. These include the passage of Law No. 4 in 1982 ("Basic Provisions for the Management of the Living Environment"), which provides the legal foundation for environmental management in Indonesia; the issuance of Regulation No. 29 in 1986, which provides implementation guidelines for the Indonesia EIA process; the initiation in 1989 of the Prokasih (Clean Rivers) program, a collaborative effort with regional governments for the control of industrial pollution in critical watersheds; the establishment in 1990 of a separate environmental protection agency (BAPEDAL) reporting directly to the President, and headed by the Minister of MLH; and the recent passage of basic laws on population and spatial planning. Other achievements include the setting up of a system of 54 university-based environmental studies centers, and support for the development of environment-related NGOs. A start was also made in developing the rudiments of an information system, with annual reports on socio-economic and environmental developments prepared in each of the 27 provinces, and effluent standards for water have now been established for existing enterprises in 14 industrial sub-sectors.

6.47 In the absence of direct implementation responsibilities, MLH's main objective has been to ensure that the key line agencies take environmental considerations into account in carrying out their sectoral mandates. Thus far, however, MLH's success in this area has been rather limited. A major constraint is the lack of official authority over the environment-related activities of other ministries, but this is compounded by its relatively small budget, and by the shortage of full-time, technically trained and experienced staff. There are a number of options for improving on this situation, including a strengthening of MLH's role in the development of macroeconomic and sectoral policies for more sustainable development, as discussed farther below

6.48 **The Environmental Impact Management Agency.** By the late 1980s, there was growing recognition of the need for a stronger effort to develop and enforce environmental standards and ensure the effective implementation of Indonesia's EIA procedures. MLH, with support from a number of donor agencies, began the preparation of a development plan for an environmental protection agency. BAPEDAL was officially created in June, 1990. The original staff came mostly from MLH, but have been supplemented since then by an active recruitment program. BAPEDAL is chaired by the Minister of MLH, and has two deputy chairmen, one responsible for environmental pollution control and the other for development (including the AMDAL Program, technical guidance to regional governments, and establishment of a reference laboratory and data processing center).

6.49 As a new agency, expectations are high. On the positive side, the establishment of this agency is a clear signal of GOI's intention to enforce environmental standards and regulations. In addition, BAPEDAL has inherited from MLH two high priority programs already well under way-- Prokasih and AMDAL. Initially, however, BAPEDAL faces the same constraint as MLH in attracting well-trained and experienced staff. It will be important, therefore, to maintain clearly defined priorities and to phase in additional programs only when the capacity to implement them is in hand. There are other constraints that will also need to be overcome. The most important is the need to clarify the legal mandate of BAPEDAL and other agencies at the national and provincial level for establishing an integrated regulatory and compliance system. This is a prerequisite for development of legally enforceable standards, the design of a pollution permit system, the initiation of effective monitoring (and laboratory analysis) to detect cases of non-compliance, and the implementation of enforcement procedures that will result in appropriate legal sanctions. To overcome these constraints will require a concerted effort and continued close cooperation with other relevant agencies.

6.50 Consideration is being given to the establishment of BAPEDAL offices at the regional level (BAPEDALDAs), although a final agreement on the nature and timing of such an expansion has not yet been reached. Here again, staffing considerations are likely to be a major factor in determining the extent to which such an expansion is feasible in the near term. At the moment, the headquarters staff of BAPEDAL consists of less than 100 full-time professionals, not all of whom are fully experienced in the implementation of pollution control policies and procedures. By way of contrast, the U.S. Environmental Protection Agency now has about 18,000 staff in its national and regional offices.

6.51 It has taken twenty years, however, for the U.S. EPA to reach this level of staffing, and to develop its policies and operating procedures. In terms of effectiveness, it is also worth noting that EPA's enforcement capacity was slow to develop, with 70% of all fines and penalties over the past 20 years having been generated in the just the past four years. Development of BAPEDAL into an effective agency for environmental protection, therefore, is likely to take at least as long, and possibly longer given the relatively greater scarcity of the relevant skills in Indonesia, and the constraints that low government salaries pose in the recruitment of needed skills. Interim proposals for dealing with this challenge are noted below.

6.52 **The Environmental Support Network (PSLs and NGOs).** A part of MLH's mandate is to develop environmental skills, encourage greater awareness of environmental issues, and enhance the opportunities for wider participation in the process of environmental management. A major initiative supporting these objectives has been the development of university-based **Environmental Studies Centers (PSLs)**. A primary objective of the PSLs (see Box 6.2) has been to enhance the availability of environmental expertise to GOI officials responsible for environmental planning and policy analysis. The demand for sound economic analysis of environmental issues, however, has greatly exceeded the supply of well-trained university graduates. Despite its best efforts, therefore, MLH has not been able to establish its planned Policy Analysis Unit, and has had to rely on (mostly expatriate) consultants to carry out policy-related studies. Government-sponsored and non-profit research organizations (e.g., CPIS, the Center for Policy and Implementation Studies, sponsored by EKUIN, the State Ministry for Coordination of Economic Affairs) are beginning to get involved in issues related to natural resource management and environmental protection. Here also, however, the capacity is quite limited in relation to the demand for their services from other clients, and MLH, with its limited budget, has had little direct influence on their research priorities.

6.53 A second initiative has been to encourage the development of environmental NGOs (non-governmental organizations). There are literally hundreds in Indonesia, at the national, provincial and local level. Many focus their activities on issues of sustainable growth and environmental protection. They are quite diverse, and their roles are continuing to evolve. Many, such as the National Consumers Union (YKB), have sponsored education and awareness campaigns; others, such as the Government-sponsored Family Welfare Movement (PKK), have worked directly with local communities in trying to improve environmental conditions; and still others, such as the Legal Aid Society (LBH) have taken on an advocacy role--for improved environmental policies at the national level, and for more equitable implementation of those policies at the local level. More recently, NGOs with links to the business community (such as the Business Council for Sustainable Development, which includes a number of leading Indonesian businessmen) are beginning to emerge.

**Box 6.2: Indonesia's Environmental Studies Centers**

University-based Environmental Studies Centers (PSLs), have been prominent throughout the twenty-year history of the environment movement in Indonesia. The first center was founded at Padjadjaran University in 1972. Today there are 54 centers located in universities in each of the 27 Provinces. A formal network of PSLs (BKPSL) was created in 1985, which holds annual conferences and publishes a journal and newsletter.

The PSLs have been established to provide technical expertise for environmental research, training in environmental sciences and management, and policy advice at the national, regional and local levels. Originally sponsored by KLH, and relying wholly on annual budget allocations of that Ministry (plus donor support), the PSLs have since been absorbed into the structure of each university, with funding now provided by the Ministry of Education and Culture. This provides for long-term stability and better integration into the university communities. Substantive guidance, and assistance with coordination, continues to be provided by KLH and BKPSL.

Individual PSLs perform a wide variety of functions for both the public and private sectors. They carry out basic and applied research under their own budgets, as well as under contract with government agencies and both public and private sector enterprises. Many specialize in carrying out environmental impact assessments required under the AMDAL Program (Box 6.5).

The PSLs are also active in environmental education and training. They have already trained several thousand government staff, private consultants and community leaders in AMDAL preparation procedures, as well as several hundred specialists in AMDAL evaluation. They also conduct courses on population and the environment, and other environmental management concerns. Some PSLs have also been involved in formal undergraduate and graduate degree programs related to environmental sciences and management. These programs will expand with absorption of the PSLs into the university system.

In some cases, PSLs play a significant advisory role as a member of central and provincial AMDAL commissions, as consultants to government and private agencies, and as members of international agencies and commissions.

The quality of research, training and advisory contributions of PSLs, however, varies considerably. Some are comprised of only one or two faculty members, with a very small budget and little real expertise. Others have been created to carry out a specific project, and their sustainability over the longer-term is uncertain. Fewer than half can be regarded as having both a sound professional reputation and a secure institutional base, and only about 12 are able to make a significant advisory contribution to national and provincial government agencies. These 12 PSLs are receiving support from a number of donors (including the Bank), and are expected to serve as training centers to strengthen the weaker PSLs.

6.54 A few NGO's have managed to grow in both size and sophistication, and their views are increasingly represented in public discussion of emerging environmental issues. Many of these NGOs belong to WALHI, the umbrella network of environmental NGOs, which was established in 1980. In most cases, however, environmental NGOs are relatively small organizations characterized by voluntary (or low-paid) staff and a shortage of professional expertise and administrative skills. While official Government policy encourages the involvement of community and self-help

organizations in development planning and implementation, the reality is that many government agencies are reluctant to involve NGOs in policy development and project design, or are ill-equipped by habit and culture to encourage their effective participation. In some cases, the advocacy role of environmental NGOs has been seen by GOI as exceeding the bounds of "constructive criticism", which inhibits debate and limits effective collaboration. The importance of improving the relationship between NGOs and Government agencies is discussed further in the final section of this chapter.

**6.55 The Role of Central Government Agencies.** Within GOI, the management of natural resources is primarily the role of central ministries, such as Agriculture, Forestry and Industry. For most of the past 25 years, these ministries have been primarily concerned with the exploitation of natural resources in support of economic growth and the reduction of poverty, and most have been quite successful in carrying out their mandate. In view of the importance of poverty reduction for sustainable development, the use of natural resources to improve incomes has had many positive environmental effects. In general, however, these agencies have carried out their mandates without much attention to environmental impacts. With the growing concern about the sustainable use of Indonesia's natural resources, and increasing evidence that past development approaches have led to avoidable environmental degradation, most Government agencies have begun the process of reassessing their mandate with a view to incorporating issues of sustainable development.

**6.56** The integration of environmental issues and concerns into the formulation of sectoral policies and the design of development programs, however, is constrained by a number of factors. Common themes include the need for a devolution of authority and responsibility (and corresponding expertise) from the national to regional levels, and the development of more effective mechanisms for inter-agency coordination at all levels of government. This will require a redefinition of the legal mandate for a number of agencies, the creation of a few new agencies, and significant changes in the financial relationships between levels of government. It will also require a concerted effort to involve local community groups and the private sector in the development process, as described below.

**6.57** Many of these challenges are illustrated by experience to date with the AMDAL program. Expectations for AMDAL have been high, since the process was conceived of as an effective tool for the integration of environmental concerns into the development process (see Box 6.3). There are many positive aspects in the design of AMDAL, including the fact that it covers social and cultural as well as environmental impacts, provides for inter-agency commissions for the review of individual project documents, and--while not required--allows for public participation. The establishment of AMDAL commissions in each agency, with a high level of representation from within the agency, was seen as a means of gaining the attention of senior officials. Linking the AMDAL process with the approval of project permits was considered vital for the enforcement of environmental standards and regulations.

**6.58** In comparison with its original expectations, however, experience to date with the AMDAL program has been disappointing. In part this is due to unrealistic expectations. The requirement, for example, that all existing projects, as well as all new projects, be subject to EIAs did not take into account the shortage of expertise to prepare EIAs, or the capacity of the AMDAL commissions to review them. Even for new projects, however, there are a number of weaknesses in the current AMDAL process that will take considerable time and effort to overcome (See Dick and Bailey, 1992).

6.59 In response to these shortcomings, GOI has recently issued a revision of the implementing regulations with the intention of simplifying and strengthening the process. Key areas needing improvement, and the changes recently introduced, are summarized in Annex E.

**Box 6.3: Essential Elements of the AMDAL Program**

The requirement for environmental impact assessments (EIA) in Indonesia (the AMDAL program) is defined in Law No. 4 (Article 16) of 1982, which stipulates that an EIA should be carried out for proposed activities which are expected to have significant environmental effects. Regulation No. 29, issued by KLH in 1986, sets out the general procedures for carrying out an EIA. The essential elements of the AMDAL program, as originally established and as recently amended, are as follows:

- o **Scope.** Regulation 29 requires that both new and already operating should be subject to the EIA process. Assessments are to include social and cultural, as well as environmental, impacts;

- o **Documents.** The original AMDAL regulations defined five separate documents: a PIL (or PEL for existing projects) which sets out a preliminary assessment of environmental impacts and how they might be mitigated; a KA ANDAL, (or KA SEL) which defines the Terms of Reference for carrying out the assessment; the ANDAL (or SEL) which provides the actual assessment of environmental and socio-cultural impacts; the RKL which specifies the design and operating plans for mitigating potentially negative impacts; and the RPL which sets out the plans for monitoring and reporting on actual environmental impacts. Under the recent revisions, PILs (and PELs) were dropped in favor of screening criteria to be provided by BAPEDAL for each sector.

- o **Process.** AMDAL begins with a screening process, previously based on the PIL or PEL (in future to be based on screening criteria), at which point the project may be exempted from further evaluation if no significant impacts are expected, or rejected if clearly unacceptable. For projects with potentially significant impacts, terms of reference for the EIA must be submitted for approval, followed by the actual assessment itself, which must then be approved or rejected as unacceptable. Earlier, the RKL and RPL were submitted for review and approval separately; this has now been combined with submission of the EIA. This process is expected to be closely linked to project feasibility and design studies, and investment, location and other permits cannot be issued until the AMDAL process has been successfully completed. Maximum time periods have been established for the review of documents by the AMDAL Commissions--previously, up to 90 days for review of the EIA itself. Under the revised procedures, only 45 days are allowed for the EIA, RKL and RPL together).

- o **Institutions.** Responsibility for overseeing the implementation of AMDAL, originally with KLH, is now with BAPEDAL. The authority for implementing the process lies with central line agencies and with provincial governments, both of which are expected to establish inter-agency AMDAL Commissions to review documents submitted by project proponents. Central agency commissions, Komisi Pusat, are chaired by the Secretary General of the relevant agency, and deal with most large-scale projects in their sector. Permanent members include representatives from BAPEDAL, Ministry of Home Affairs, university or other experts, and the agency itself, supported by a Technical Committee and a Secretariat. At the Provincial level, Komisi Daerah are chaired by the head of the Development Planning Board (BAPPEDA). Members include representatives from the provincial Population and Environment Bureau (BKLH), and university experts from the local Environmental Studies Centers (PSLs).

6.60 There is, of course, considerable variation among line ministries in the extent to which they have adopted the spirit and intent of the AMDAL program. The first to establish and operationalize its AMDAL commission was Mines and Energy, which has also issued screening guidelines for projects. It was also the first to engage in local consultations with affected people, in connection with a World Bank-financed power project. Other ministries with active AMDAL commissions include Public Works, Industry and Forestry. Preliminary (somewhat rough) data from central agency commissions indicates that, by mid-1991, nearly 1,600 AMDAL documents had been reviewed, and that about 235 projects had completed the full AMDAL cycle. Mines and Energy accounted for about 40% of the documents reviewed, and Public Works, Industry and Forestry for another 50%, or 90% for just these four departments alone (out of 14 central ministries and non-ministerial agencies).

6.61 Many line ministries and agencies are working to develop screening procedures and training programs for their staff, establish project tracking systems, and compile rosters of consultants with expertise in the relevant sectors. Some are also beginning work on the development of sectoral EIAs which take into account cross-sectoral and "downstream" environmental effects. Despite the current shortcomings of the AMDAL program, therefore, there is still considerable hope that the AMDAL commissions will play a key role in the integration of environmental issues more directly into the design of sectoral policies and development programs by the central line agencies.

### **Environmental Management in the Provinces**

6.62 The Provincial government is responsible for environmental management at the regional level. In principle, the authority vested in the provincial government is wide-ranging: to coordinate the implementation of development plans; to set environmental standards; to approve location permits and other licenses for new projects; to monitor adherence to environmental laws and regulations; and to enforce those laws. The institutional capacity for environmental management at the provincial level, however, is still quite weak. This shortcoming is compounded by a number of other factors, including the strongly hierarchical administrative structure of the national government, the fact that development planning is largely sectorally-oriented and centrally-driven, and the rather severe shortage of environment-related skills available to provincial and local government agencies.

6.63 Government administration in Indonesia is highly structured and is guided, in most aspects, by central government agencies in Jakarta. There are twenty seven provinces, divided into districts (*kabupaten*) and municipalities (*kotamadyas*), and further divided into sub-districts (*kecamatan*), and villages (*desa* in rural areas, and *kelurahan* in cities and towns). Administrative support is provided by the Ministry of Home Affairs. The provinces are headed by Governors, who are selected by the President. They, in turn, appoint the heads of districts (the *bupati*) and municipalities (the *walikota*). In rural areas, the village heads (*kepala desa*) are elected, while in urban areas the sub-municipal leaders (*lurah*) are appointed by the walikotas.

6.64 Development planning is guided by Five-Year Plans which describe the general development policies and aims for each sector, and are then translated into specific development programs funded through annual budgets. The design and implementation of development programs over the past twenty five years has been mainly carried out by sectoral ministries and other central government agencies, most of which have regional offices (*kanwil*) in each province.

6.65 Technically, these offices report to the governor, as well as to their own ministry, but their primary role is to implement the development programs of the respective central agencies. The role of regional and local governments in resource mobilization is quite limited, with the majority of development expenditures funded through a combination of central government subsidies and the project budgets of central line ministries and agencies.

6.66 At the regional level, the provincial governor is assisted by a planning agency (BAPPEDA) that is responsible for the coordination of sectoral development plans. They also have their own technical staff corresponding to the central line ministries, organized in sectoral offices (*dinas*), who attempt to coordinate provincial programs with national programs through their counterparts in the *kanwils*. There is a Bureau of Population and Environment (BKLH) in each province, essentially low-level, non-operational units whose primary responsibility is to prepare the annual environment reports required by MLH.

6.67 Since 1987, each province has set up an AMDAL commission to review environmental impact assessments for existing and proposed investment projects. The institutional and other constraints on environmental management in the provinces are reflected in their experience to date with the AMDAL program, in the challenges of cross-sectoral planning and coordination, and in their efforts to enforce pollution control laws and regulations.

6.68 **Experience with the AMDAL Program.** The operation of Amdal at the provincial level has encountered all of the same problems as those noted above at the national level. The Komisi Daerah have primary responsibility for reviewing only those projects funded directly out of the provincial budget, and those with an investment cost under Rps 600 million (US\$300,000). AMDAL regulations also stipulate, however, that Komisi Daerah have an opportunity to participate in the review of larger projects by the Komisi Pusat. In the absence of area-specific development plans, such participation may be critical for ensuring a proper review of projects against local environmental concerns. Project sponsors are supposed to send copies of AMDAL documents to the Komisi Daerah two weeks before submitting them to the Komisi Pusat; provincial representatives are supposed to attend the review meeting in Jakarta or, at a minimum, to send written comments. In practice, however, they often fail to receive the copies in time, if at all, and are rarely invited to attend meetings of the Komisi Pusat.

6.69 The scarcity of expertise in many provinces is an even more serious constraint even when AMDAL documents are received in time. For smaller projects where the Komisi Daerah has primary responsibility, the few experts available in the local PSL are likely to have participated in preparing the AMDAL documents, and it would thus be a conflict of interest for them to advise on their acceptability. In many provinces, funding to support the operation of the Komisi Daerah is inadequate, and this may limit the participation of experts from the sectoral offices. Some provinces have also complained that, while it takes time for them to conduct a proper review of AMDAL documents, they are under increasing pressure from central agencies to speed up the process of issuing various project permits in order not to delay the implementation of development plans.

6.70 **Challenges of Planning and Inter-Agency Coordination.** Effective environmental management at the regional level would require that provincial and local governments have a strong voice in the design and coordination of development programs. Their ability to plan and coordinate

development programs, however, is limited by the dominance of centrally-funded plans of the central sectoral agencies and by the fact that some of the most critical issues arise from environmental impacts that extend beyond their administrative boundaries. This is particularly true in the case of watershed protection and the management of water resources on Java, but it applies to issues of land management and the conservation of forestry and biodiversity resources in the outer islands as well.

6.71 While the ability of provincial and local governments to actually implement development programs is limited by the shortage of well-trained personnel, they could play a much larger role in the coordinative process. This would require, however, a significant change in the orientation of the central line agencies. In some cases, new agencies will be required that go beyond individual provinces, such as the need for River Basin Management agencies for critical watersheds on Java. In other cases, particularly at the kabupaten, municipal and village level, what is needed is a more concerted effort to coordinate development planning through the existing institutional framework, including a more effective role for the BAPPEDA and closer involvement of private sector interests, community groups, and NGOs.

6.72 There are a growing number of examples where the coordination of development efforts at the provincial and local government levels has been successful, including the development of spatial plans for Jambi Province, the development of uplands conservation initiatives in Yogyakarta, the implementation of improved operations and management for irrigation schemes in several provinces on Java, and the design of Kampung improvement projects in many of the larger urban centers. Such efforts should be encouraged and replicated elsewhere.

6.73 **Capacity for Pollution Monitoring and Control.** As noted above, provincial governments have primary responsibility for pollution monitoring and control. Their capacity for doing so, however, is constrained by a combination of factors, including the diffusion of responsibility and authority for various aspects of environmental monitoring, shortcomings in the quality of laboratory analysis of industrial waste emissions, and the lack of experience by the judicial system with the administration of environmental laws and regulations.

6.74 No single agency at the provincial level has as its primary mandate the control of environmental pollution. Responsibility for the management of **ground water** resources, for example, rests with the Ministry of Mines and Energy, while the responsibility for **surface water** is primarily that of Public Works. Local offices of the Ministry of Public Works monitor the **ambient** quality of rivers and streams, but only representatives of the Ministry of Industry have the authority to enter industrial firms for the purpose of taking samples of their actual **waste emissions**.

6.75 Suspected cases of intentional pollution must be investigated by local police, and presented to the court system by local prosecutors. While BAPEDAL has provided basic training for police and prosecutors in the Prokasih provinces in how to bring a pollution violation to court, there is as yet little successful experience. In the absence of an industrial pollution permit system, prosecutors have had to rely on existing "hinderance ordinances". It remains to be seen whether or not this approach will be effective. In the first industrial pollution case to reach the courts, in East Java, the judge dismissed the charges because of the questionable reliability of the effluent samples submitted to substantiate the charges.

### **Institutional Issues in the Management of Key Natural Resources**

6.76 The challenges of institutional strengthening are especially critical in the management of natural resources—land, water, forests and biodiversity. A key factor in each case is the cross-sectoral nature of resource use, and the need for a regional rather than a purely sectoral focus

6.77 The challenges of **land resource management** relate to emerging conflicts in land use as a result of population growth, rapid urbanization and increasing pressure on protected areas and sensitive ecosystems, efficiency in land allocation and use, and in the mobilization of public resources from increases in land value, and concerns about equity arising from compensation and resettlement issues in the acquisition of land for development projects. Institutional improvements needed include:

- o clarifying the framework of land laws and regulations, including the relationship between traditional (*adat*) and modern property rights, and the role of BPN and other agencies responsible for various aspects of land administration in Indonesia;
- o encouraging a more market-oriented system of land allocation, based on much wider coverage of land titling and registration, improved efficiency in land transfers and the collection of land taxes, and increases in tax rates and the pricing of state-owned land transfers to ensure appropriate returns to government;
- o improving the availability of land information and accurate and uniform-scale maps, and clarifying the role of national, provincial and municipal agencies in land use planning and allocation under the recently-enacted law on spatial planning; and
- o enhancing the mechanisms for conflict resolution in the use of land (including the protection of communal *adat* rights for indigenous people), and the participation of community groups and individual citizens in the decision-making process, with particular attention to appropriate levels of compensation and the restoration of the livelihoods of affected parties when existing land rights are surrendered in the broader interests of national development.

6.78 The challenges of **water resources management** apply most critically on Java, where the two main issues relate to increasing competition for water by alternative activities (including irrigation, municipal and industrial use), and increasing issues of water quality arising from urban and industrial pollution, with serious effects on human health, downstream economic activity, prospects for continued growth, and long-run costs of cleanup. Institutional improvements needed include:

- o improving cross-sectoral and inter-agency coordination of water resources, focused on improved management in the most critical river basins but including both surface and ground water resources, with new institutional arrangements and mandates as needed, particularly for river basins that cover two or more provinces;
- o expanding the focus of water resources management, especially on Java, to include both water allocation and water quality issues, with a significant improvements in the provision of sewerage and sanitation services in the major urban centers; and

- o clarifying the legal mandate for industrial pollution control, including provisions for a permit system and the charging of effluent fees by provincial or river basin authorities, and strengthening the institutional capacity for pollution monitoring, and the subsequent enforcement of pollution laws and regulations.

6.79 The challenges of **forestry management and the conservation of biodiversity** involve a variety of economic, social and inter-generational issues, focused primarily on: optimizing the long-run use of both timber and non-timber forest resources; and ensuring an equitable sharing of the costs and benefits of forest resources, between Indonesia and other affected countries, between the public and private sector in "economic rent", and between firms and local communities whose welfare may be affected by the commercial exploitation of resources. Improvements needed include:

- o greater accuracy in the delineation of forest land and protected areas (consistent with actual areas of forest cover and the existence of forest-dwelling communities), and improved monitoring of the stock and flows of forestry resources;
- o improving the care and efficiency with which forest resources are exploited, (including subsequent processing) through higher log prices, effective monitoring and enforcement of forest regulations, increased research on sustainable management issues, and institutional strengthening of forest management agencies at all levels; and
- o enhancing participation by local communities in the management of forests and other protected areas, including their involvement in planning for the conservation of such resources, greater recognition of *adat* rights and other mechanisms to ensure a more equitable sharing in the benefits derived from the exploitation of forest resources.

### **The Search for Creative Solutions**

6.80 To deal with all of the institutional challenges described in this Chapter will obviously require a sustained commitment over a long period of time, as well as significant additional expertise and financial resources. The process of decentralization, the clarification of legal mandates, and the creation or strengthening of new agencies, all involve difficult political and administrative issues that may be especially time-consuming to resolve. A major theme of this report, however, is that many of Indonesia's environmental problems require immediate attention. While the longer-term process of institutional strengthening is underway, therefore, a concerted effort should also be made to seek creative "interim" solutions to the most important issues of sustainable development. Given the existing institutional short-comings, such solutions should be based on the following key principles:

- o **Targeting:** in recognition of limited financial and administrative resources, interim solutions should focus on the most critical problems and the major causal factors underlying those problems;
- o **Power-sharing:** to overcome conflicting or diffused legal mandates, interim solutions should focus on improving inter-agency coordination through the development of innovative combinations of high-level leadership and formal--but non-structured--sharing of political power and administrative authority by existing agencies;

- o The Skills Gap: to deal with the scarcity of critical environmental skills, interim solutions should minimize the need for such skills by government agencies, and make effective use of private sector skills whenever possible, including the "contracting out" of monitoring and inspection services wherever appropriate;
- o Publicity: to take advantage of Indonesia's unique cultural characteristics, interim solutions should rely on the power of publicly available information--on environmental trends and conditions, and on the behavior of public sector agencies and private sector firms--to mobilize popular support and to enhance accountability and compliance with standards and regulations; and
- o Community Involvement: since most environmental problems occur at the local level, and their resolution must be tailored to local conditions, interim solutions should build on the special knowledge and existing cultural arrangements of affected communities, with the support and encouragement of national, provincial and local authorities.

6.81 Indonesia's Prokasih Program (see Box 4.7) is one of the best examples of the application of these principles. Based on the recognition that something had to be done to reduce industrial pollution, it represents a unique attempt to solve this problem through the sharing of legal power across agencies at the national and provincial levels. Although based only on voluntary agreements with firms, it provides a sound starting point for the development of a more rigorous system of industrial pollution control as the remaining legal and institutional problems are overcome. The development of Indonesia's Integrated Pest Management Program is also based on most of these same principles, including high-level leadership and coordination by BAPPENAS and the direct involvement of affected farmer groups in the implementation of the program (see Box 6.7, below)

6.82 These same principles could be applied in at least three other areas. **First**, to improve the attention given to issues of sustainable development in macroeconomic and sectoral policies, the agenda of the Coordinating Ministries (EKUBANG and INDAG) could be expanded, with MLH included for the review of selected proposals for policy reform. This would require the provision of additional resources for policy analysis, to be supervised by MLH and carried out by (inter alia) CPIS and other government-supported research organizations. At the same time, MLH's coordinating role could be enhanced through an expanded mandate to develop, monitor and publish a targeted set of environmental indices, based on a collaborative effort with the AMDAL Commissions of those agencies to complete sectoral EIAs and sectoral action plans for improving environmental impacts;

6.83 **Second**, an effort could be made within the existing AMDAL Program to target a limited number of large and/or potentially damaging projects for special attention. This could be achieved through ad hoc AMDAL Commissions, chaired by BAPEDAL or MLH, with a mandate not only to review and approve the projects' environmental impact assessments but also to oversee and report on the implementation of their proposed monitoring and mitigation plans. To ensure minimal delay in the review of such projects, additional resources would be needed to allow the Commissions to "contract out" for the technical expertise required for a thorough and expeditious review. To ensure that local concerns are taken into account, the participation of provincial government authorities, NGOs and representatives of affected communities would also need to be given priority attention.

6.84 **Third**, until the implementing regulations have been issued for the recently approved Spatial Planning law, and strategic structural plans have been formulated for major urban areas and critical rural ecosystems (including watersheds, coastal zones, and endanger protection and conservation areas), it may be useful to establish temporary regional "natural resource management councils", chaired by the relevant BAPPEDA, and including representatives of the key line agencies and those involved in the approval of investment and location permits. To ensure that local environmental effects and trade-offs in the use of natural resources are fully anticipated, these councils could also include representatives of private sector firms and local community groups. Their mandate could include both participation in the ad hoc AMDAL Commissions' review of EIAs for major projects (as suggested above), and serving as a mechanism for the resolution of local conflicts in the use of natural resources--by facilitating, for example, consultations and negotiations between affected parties and project sponsors for major changes in land use, and between polluting firms and surrounding communities where environmental degradation has reached unacceptable levels, but where official monitoring and enforcement efforts have not yet become effective.

6.85 Other areas where creative interim solution would be helpful include the search for more effective technologies for environmental management, coordinated by BPPT, including "clean technology" for industry and more efficient and cost-effective technologies for dealing with industrial and municipal waste, as a critical element in Indonesia's overall strategy for sustainable development.

## **E. THE NEED FOR CONSTRUCTIVE PARTICIPATION**

6.86 Indonesia can be justifiably proud of its development efforts over the past twenty five years. As noted in Chapter 1, however, the future will be different from the past, and new approaches will be required to maintain the momentum of success. A common feature of these new approaches will be the need for more constructive partnerships among and between the Government, the private sector and the general public. Wider participation in the development process will be increasingly important, not only for continued rapid growth and poverty reduction, but also for ensuring the sustainability of development and greater equity in the distribution of costs and benefits.

### **The Rationale for Participation**

6.87 The rationale for wider participation in the development process is two-fold: (a) to minimize the economic, environmental and social costs that may arise as a direct result of non-participation; and (b) to maximize the considerable benefits that may be possible in each of these areas from timely and constructive participation. There is, for example, a small but growing body of evidence among development agencies who have evaluated the outcome of past projects that greater participation improves the chances for success--in terms of development effectiveness and economic sustainability. Most of this evidence has been found among projects that directly effect the environmental sustainability of development efforts (e.g., farmers' involvement in agricultural projects), and among projects with a close link between poverty and environmental quality (including community involvement in village water supply and sanitation). Participation by project beneficiaries, therefore, can help to ensure that development resources supportive of environmental goals are not wasted (see Box 6.4). This will be especially important for women, who play a critical role in managing natural resources and in household water supply and sanitation (see World Bank. 1992b).

**Box 6.4: The Benefits of Participatory Development: Emerging Lessons**

As noted in a recent World Bank report (*Participatory Development and the World Bank*), rigorous empirical evidence on the benefits of participation is relatively scarce. A growing number of studies, however, provide positive indications of its potential importance for development effectiveness and economic sustainability:

- o A 1976 report by Development Associates, Inc. which reviewed its experience with rural development projects in 10 African and Latin American countries found that small farmers' involvement in project decision-making, and their willingness to make a resource commitment to the project, were key factors in whether or not the projects achieved their development objectives;
- o A 1985 impact evaluation study by the World Bank's Operations Evaluation Department analyzed 25 Bank projects (mostly in agriculture and rural development) 5 to 10 years after completion, and documented the link between grass-roots participation and project sustainability;
- o Similarly, a 1987 World Bank study of 42 projects in the irrigation sector found that economic returns were consistently higher for projects that involved farmers in planning and management of the irrigation systems;
- o A 1990 study by the U.S. Agency for International Development of 52 projects in various sectors demonstrated a positive correlation between participation and project success, almost as strong as the correlation between project success and the availability of finance;
- o Preliminary results from a study being undertaken by the UNDP-World Bank Water and Sanitation Program indicate strong associations between overall project effectiveness, sustainability and participation-related variables. While participation appears to be highly correlated with improved quality of project design and implementation, the linkages are even stronger for the involvement of women.

Evidence is also growing on the importance of participation when changes are required in community behavior (e.g., in the management of natural resources), or the behavior of individuals and household (as in the case of family planning and water and sanitation programs). The impact on program effectiveness and sustainability in these areas is often linked to the social influences of cooperative effort on joint ownership and responsibility, and reinforced by clear evidence of the benefits of participation for all of those involved.

**Development Effectiveness and Sustainability**

6.88 Programs to support growth and efficiency, and targeted programs for the reduction of poverty, will continue to be central to Indonesia's development strategy. Development effectiveness will require that these programs be economically and environmentally sustainable. There is a growing body of evidence that the achievement of these objectives will depend increasingly on development activities tailored to local conditions, opportunities and constraints, and involving the participation of local community groups, individuals and households, private enterprises and NGOs in their design and implementation. The paragraphs below describe selected examples of this evidence.

**6.89 Rural Water Supply and Sanitation.** Few things are more important for human health and welfare than adequate supplies of safe water supply. Polluted water often results in a high incidence of diarrheal diseases, with direct effects on infant mortality and the productivity of adult labor. In areas where water is scarce, women and children often spend considerable time and energy carrying water long distances, which could otherwise be spent in far more productive ways. To improve the quality of life and household income, therefore, village water supply schemes should be given high priority in targeted programs to reduce rural poverty.

**6.90** There is considerable variability in the access of rural households to adequate supplies of safe water, with some areas having only seasonal access and others facing year-round scarcity. Support for village water supply schemes is provided by a number of ministries (Public Works, Health, and Social Affairs). In contrast with Government programs for health care and education, however, there is no national program designed to ensure equity and consistency in the availability of water for human consumption at the local level.

**6.91** Government-sponsored projects in the past focused primarily on the "hardware" aspects of village water supply: construction of community wells and the provision of handpumps. Projects were often selected and funded without significant input from local villagers. When they were consulted, their input was typically limited to the selection of design options, with no involvement in implementation and no contribution required for future operation and maintenance. As a result, many of these projects failed after a relatively short time.

**6.92** More recent approaches, supported by a World Bank/UNDP project, involve a high degree of participation in project design and implementation. In the pilot stage, the Ministry of Public Works contracted with an Indonesian NGO (Yayasan Melati) to assist in establishing women's user groups and to provide leadership training. These groups then participated in decisions on the location of the wells, were trained in how to maintain the pumps, and were subsequently responsible for collecting the relatively modest fees needed to sustain the project. The results to date have been positive, with a high degree of local ownership and strong commitment to maintaining the projects.

**6.93** This same approach is now being replicated in other villages in Indonesia. Government capacity for widespread implementation, however, is still rather limited. Consideration should also be given, therefore, to stimulating private sector initiatives in the development of groundwater resources in rural areas—especially those involving women—where recent experience in other developing countries has been encouraging (see Box 6.5).

**6.94 Kampung Improvement.** Over the past 25 years the Kampung Improvement Program (KIP) has improved living conditions for about nine million low-income urban residents in 527 cities and towns through provision of an integrated package of basic services, including water supply, sanitation, drainage, roads and footpaths, schools and clinics. While KIP has been very effective in providing basic infrastructure, and is popular among recipients, its top-down approach has revealed significant weaknesses. Improvements in health, for example, require the provision of both clean water and (public) sanitation facilities. Inadequate attention to sanitation and health education, the failure to involve residents in location planning and the absence of training programs for facility maintenance, together with a lack of financial or in-kind contributions by residents, has frequently resulted in poor operations and maintenance, and thus limited use of public sanitation facilities.

**Box 6.5: Private Participation in Village Water Supply and Sanitation:  
Experience in other Developing Countries**

According to the 1992 World Development Report (Development and the Environment), there have been a number of promising examples of private sector participation in small-scale water supply and sanitation schemes in developing countries around the world:

- o In rural Pakistan about 3 million families have wells fitted with pumps, many of which are motorized. All of the equipment is provided and serviced by a vibrant local private sector industry, and paid for in full by the participating households;
- o In Lesotho the government trained bricklayers to build improved pit latrines, and Government banks provided (non-subsidized) credit to finance construction costs. The project has been a singular success, due in no small part to the aggressive role of the bricklayers in expanding their markets and in providing services; and
- o In West Africa a private handpump manufacturer has developed a scheme where the purchase of a pump comes with five years of support, including training and the provision of spare parts. Later on, the community will be able to maintain the pump, with spare parts available from local traders.

The participation of women in such initiatives has also been quite encouraging, in part because of their traditional responsibility for the collection of water and the management of household health and hygiene. As noted in the WDR, "women who are trained to manage and maintain community water systems often perform better than men because they are less likely to migrate, more accustomed to voluntary work, and better trusted to administer funds honestly" (p.113). Examples cited include:

- o Women in Bangladesh, India, Kenya, Lesotho and Sudan who are being trained as caretakers responsible for the maintenance of handpumps;
- o Women cooperatives in Sri Lanka set up to assemble and maintain a locally manufactured handpump; and
- o Women's cooperatives in Honduras, Kenya and the Philippines who are managing communal standpipes and collecting money to pay for metered water supplies.

6.95 In response, central and municipal agencies have attempted to design a more flexible program based on increased community participation in defining local needs and in project design and implementation. This new approach, being initiated in the Jakarta area under a World Bank project, requires a longer implementation period. In each kampung, a three year development cycle has been adopted to allow for a community development process to take place 3-6 months before physical works commence, and another 3-6 months is allowed after all major works are completed so as to prepare the community for operation, maintenance and monitoring of the new facilities. NGOs are being selected to provide assistance to specific kampungs. The NGOs are working with kampung committees to identify problems and needs, to agree on project components, locations, costs, and repayment responsibilities, to assist in negotiations with the KIP implementation units, to organize and train water and sanitation users' associations, and to monitor project implementation.

6.96 Experience to date has highlighted the importance of participation in the initial stages of project design to ensure responsiveness to perceived needs within the community. (A recent innovation, pilot tested in Surabaya, involves focus group discussions to assess community needs, with interesting results—see Box 6.6.) Experience during project implementation, however, has been disappointing, largely due to the failure to maintain active community participation beyond the initial consultation on project design. This outcome, now being corrected, appears to have resulted from a combination of pressure to meet construction (and loan disbursement) targets and a failure of project management and political leadership at the local level to overcome the traditions of a "non-participatory" approach by the implementing agencies.

#### **Box 6.6: Defining Community Needs: An Innovative Approach in Surabaya**

To assist in developing strategies for urban environmental management involving local participation, the World Bank recently sponsored an experiment in "rapid urban appraisal" targeted to the perceptions of urban residents regarding the nature and seriousness of various problems, particularly water and sanitation. Carried out in two kampungs in Surabaya, the experiment involved a number of innovations.

In addition to meeting with official kampung leaders, for example, meetings were also held with informal leaders, members of a women's group, a representative group of household mothers, a group of teenagers, and others who provide services within the kampung (e.g., garbage collectors). Instead of the normal structured interviews, a "focus group" approach was used to rank environmental problems according to the degree of perceived seriousness. Open-ended questions were then used to stimulate a discussion of group perceptions on the underlying causes of these problems, what actions the community had taken to deal with them, and suggestions for future action—by government and by the community.

While this methodology requires further testing, initial results show considerable promise for the rapid identification and prioritizing of perceived community-wide environmental problems, thus laying the foundation for a more participatory approach to project design and implementation. There were also several rather interesting results:

- o ranking scores in one kampung revealed a number of differences in the perception of official community leaders versus household mothers, calling into question the traditional assumption that consultations with formal leaders alone will yield accurate assessments of community needs;

- o some groups noted previous actions by the community to improve footpaths and drainage, but others described impediments to effective action that were beyond their control, including the lack of resources to compensate households that might be affected by such improvements and problems caused by large numbers of temporary/seasonal residents whose behavior contributed to problems of waste and pollution but who were not willing to participate in clean-up activities.

- o other groups noted problems arising from outside their kampung, especially problems with drainage and flooding caused by "up-stream" communities, industrial plants and markets. They argued strongly for the intervention of government authorities to deal with "externalities" such as these which frustrate community efforts to improve local conditions.

6.97 **Agricultural Research and Extension.** Agriculture has been a major success story over the past two decades, contributing substantially to growth and poverty reduction in rural areas. The key to this success was a massive effort to increase the production of a single commodity--rice. This involved major investments in irrigation, primarily on Java, and the introduction of hybrid seeds, fertilizers and pesticides, all of which were subsidized to encourage rapid adoption by farmers. Agricultural research was targeted predominantly to rice, and extension services were tailored to the delivery of "standard packages" of inputs, including calendars for their application.

6.98 According to a recent World Bank report there are good prospects for maintaining self-sufficiency in rice production through further technological advances, despite the conversion of some rice land on Java to other uses (see World Bank. 1992d). As a result of the changing structure of demand, however, a major challenge for the future will be to diversify agricultural production, with particular attention to higher value food crops (fruits and vegetables), livestock (especially poultry) and fisheries (including aquaculture).

6.99 Attention to poverty and regional development will require an improved focus on agricultural development in the outer islands, where the possibilities for non-farm employment and income generation are lower than on Java, and where the prospects for cost-effective development of large-scale irrigation are far more limited because of soil, terrain and hydrological constraints. Greater attention to environmental issues will also be needed, including improved management of agricultural pests and livestock diseases and the development of farming systems adaptable to the more fragile ecological base of converted forest lands--in the outer islands and the uplands of Java.

6.100 To meet these challenges will require more effective linkages between agricultural research, extension services and the ultimate users--farmers. It will also require a major change in the focus of agricultural research and extension: from single commodities to farming systems suitable for different agro-ecological zones; from "standard packages" to a menu of technical options that can be tailored to highly variable local conditions; and from a "top down" extension system to one based on farmer participation in learning and decision-making. Improved methods of farmer training will be especially important for the adoption of new agricultural technology. Fortunately, this process has already been initiated through the design of a new "farmer centered" training methodology in conjunction with Indonesia's Integrated Pest Management program (see Box 6.7). There appears to be considerable promise for the application of this same methodology to many other aspects of sustainable agricultural--including "integrated farm management".

### **Sustainability and Burdensharing**

6.101 There is growing evidence, from Indonesia and elsewhere, of the unintended negative effects of development that may arise from the failure of existing legal and institutional arrangements to ensure equity and appropriate burden-sharing in conflicts over the use of natural resources. Social conflict is, in fact, an often unforeseen outcome of ecologically unsustainable development. Similar issues arise in the case of pollution from industrial firms and its impact on surrounding communities. The prospects for resolving such conflicts through consultations between project sponsors and the affected communities (including negotiated settlements that lead to mutually beneficial outcomes) appear to be quite encouraging in the case of Indonesia. The nature of these conflicts, and possible solutions, are illustrated in the paragraphs below.

**Box 6.7: IPM: A "Farmer-Centered" Approach to Agricultural Extension**

Integrated pest management (IPM) is being introduced on a relatively large scale in Indonesia, posing new challenges and directions for extension-based training. To apply it successfully, farmers must understand the principles of IMP and acquire the knowledge and confidence necessary to make autonomous decisions in response to rapidly changing local conditions. Experience in many developing countries suggests that it also requires a fundamental change in the role of extension agents in relation to their clients. In contrast to their usual role in the top-down delivery of standard instructions, for example, extension agents must become "consultants, facilitators and collaborators, encouraging farmers to analyze their own situation, to experiment and to make constructive choices."

Recognizing these needs, Indonesia designed and implemented a new "farmer centered" training methodology. Classes are offered for groups of farmers selected on the basis of their interest and willingness to attend 12 lessons during one crop season. Each lesson consists of four hours of learning covering such topics as ecology, crop husbandry, crop physiology, and insect feeding habits and population dynamics. Instead of the usual boring lectures, however, the training involves hands-on exploration in their own paddies and active participation in experiments designed to demonstrate key principles of IPM. The life cycles and predatory habits of insects, for example, are studied by rearing them.

Weekly classes focus on the results of various experiments, the careful analysis and recording of conditions in the farmers fields, and group discussion of the data. The data is assembled on a simple chart, and group members are then led through a series of diagnostic questions to decide whether, and what, pest control action may be needed. The extension agents have been trained to facilitate the discussion by asking leading questions and providing technical information. To avoid an authoritarian role, they are encouraged to answer most questions with a question, thus helping farmers to make their own discoveries and to draw their own conclusions.

The response of both farmers and extension workers to this new methodology has been highly positive, as demonstrated by the results. A major expansion of the program is now being planned that will lead to the training of at least 800,000 additional farmers, of which an estimated 30% will be women.

Source: Patricia C. Matteson, "Farmer First in IPM Extension", pp.3-4, Draft paper submitted to the Bulletin of Entomological Research, June, 1992.

6.102 **Unintended Effects of Development Programs.** The vast majority of coastal and forest-dwelling communities in the outer islands depend on the careful management of natural resources for the basic necessities of life. As noted in Chapter 2, most have well-established management systems that maintain ecological sustainability through a combination of traditional (*adat*) rights and strongly enforced communal sanctions. Such communities are particularly vulnerable to development activities arising from outside forces that may have a negative effect on these traditional rights and practices (see Box 6.8). The impact of the 1967 Basic Forestry Law (BFL) has been especially problematic for many forest-dwelling communities. This law was designed to facilitate the commercial exploitation of Indonesia's vast and valuable natural forests, and has led to a major expansion of forest-based exports and a substantial increase in employment.

**Box 6.8: Development Impacts on Natural Resource-Dependent Communities**

Reports on the negative effect of external development activities on natural resource-dependent communities are often anecdotal, but the number of cases that are well documented by researchers is growing, as is the number of incidents reported in the press:

- o In an inland area of Kalimantan, a local community had carried out swidden agriculture, including rattan gardens, for many generations on several hundred hectares of forest land, having bartered originally with another clan for adat rights to the land. Supplemented by hunting, fishing and gathering activities, their forest gardens provided both basic subsistence and a source of cash income. With no advance notice to the community, a private firm was granted a timber concession covering a significant portion of village land. Signs were posted saying the land belonged to the company, and trespassers would be arrested. When they protested this action, village leaders were informed that the company had been granted legal rights to the land and that Government authorities fully supported their development plans. No compensation was provided.

- o In many areas of Kalimantan, private firms granted concessions for logging and forest plantations have constructed roads through land claimed by forest communities. These are often built parallel to a main river, used by local villagers as their primary (and in some cases only) source of transport to downstream markets. The roads, by blocking feeder streams, lower the water level in the river - making boat travel nearly impossible in the dry season. Upstream logging and land clearing often results in heavy siltation, with a marked decline in fish populations - a major source of protein for local communities.

- o A coastal village in Sulawesi, located at the mouth of a river, depended almost entirely on fishing for its livelihood. In the late 1980s, soil erosion caused by upstream logging in a forest concession led to heavy siltation of the bay, which destroyed the reef - and hence the fish population - upon which the village depended for its survival.

- o In the Malukas, local fishing communities have long maintained a system of traditional resource management, controlling the timing and access to off-shore fishery resources by villagers. Local fish catches have declined markedly, however, as a result of illegal actions by Government-licensed trawlers exploiting off-shore shrimp resources.

Not surprisingly, events such as these leave the communities feeling confused, alienated and angry, which accounts for reported cases of (sometimes violent) protest directed at those responsible.

6.103 While the BFL provides for the recognition of *adat* rights of local communities, the implementation of this provision has been less than fully effective--for two main reasons. First, Forest Department maps are based on the assumption that closed canopy forests are state-owned land, and are unable to capture the extent of possible existing land use by forest-dwelling communities, particularly since the boundaries of swidden agriculture and community forest reserves are not visible from the air. Second, given the vastness of the forest, and the shortage of Forest Department staff, monitoring of concessions, parks and other protected areas is extremely difficult. The actions of logging and forest plantation concessionaires, therefore, are not closely supervised.

6.104 In some cases, these firms have failed to consult with local communities before laying out the boundaries of the concession and initiating work on roads and other facilities. In the event of overlaps between *adat* claims of the villagers and the Forest Department maps of the concessionaires villagers may protest, but they are often intimidated by highly educated outsiders armed with official government documents. When compensation is offered, it may be quite low relative to the long-term benefits of fruit trees, rattan gardens and other assets planted and managed by the villagers.

6.105 The Government is fully aware of these issues and has recently passed two important laws containing provisions to protect of the rights of indigenous people: Law No. 10 of 1992 (on population policy) recognizes the rights of "vulnerable people" to their "customary territorial heritage"; and Law No.24 of 1992 (on spatial planning) mandates community access to planning information and consensual participation in development activities that will affect the livelihoods of the community. While the implementing regulations must still be issued, these provisions greatly strengthen the legal framework in support of natural resource-dependent communities, and clearly signal GOI's intentions to ensure them more equitable treatment in development.

6.106 The key to implementing these intentions will be more effective consultations and negotiations between affected communities and the sponsors of development projects. Most of these communities have well-established practices for the settlement of land disputes, including public meetings to discuss and reach a consensus on the issues. The starting point must be an accurate delineation of the *adat* claims of the local community and the identification of precise areas of overlap with competing claims. A methodology for this was developed recently by the Ministry of Forestry, in collaboration with several NGOs, in a pioneering mapping exercise for the village of Long Uli in East Kalimantan (described in Box 6.9). This exercise revealed that the village would be divided in the middle by the proposed boundaries of a forest concession and a national reserve, which together would cover 51% of village-managed land and all of the area under cultivation.

6.107 As a follow-up step, options have been developed that would take advantage of the existing sustainable management practices of the community and would be compatible with the objectives of the Forest Ministry. One option includes changing the proposed national reserve into a biosphere park that would include the village's own area of protected forest--to which they would still have access for traditional hunting and gathering activities--and a core area of restricted access. Another option would include canceling or moving the boundaries of the proposed logging concession so that the village would continue to have access to their traditional source of timber for construction and fuel. A third option would involve negotiations between the community, the Forest Ministry and the concessionaire on the best land use management for the area as a whole, with the aim of reaching a consensus acceptable to all three parties--consistent with the recognition of the existence of customary land rights and the sustainable management of the forest resources.

6.108 This case represents an important model for future use, not only in the protection of customary land rights but also in the protection of biodiversity and other ecological assets in parks and reserves throughout Indonesia. As noted above, the vastness of the country's forests precludes close monitoring by central authorities. The opportunity clearly exists to collaborate with forest-dwelling communities for the sustainable management of these assets, providing that consultations and negotiations lead to equitable solutions and appropriate burdensharing in the costs, as well as the benefits, of the development process.

**Box 6.9: Mapping Community-Managed Forest Lands in Long Uli**

The Long Uli mapping exercise represents a pioneering effort to demarcate historic territorial boundaries of a forest-dwelling community using a combination of sophisticated mapping techniques and anthropological approaches. This project, completed in 1992, was carried out by the Ministry of Forestry in collaboration with several NGOs including the East West Center, WALHI, and the World Wildlife Fund.

Mapping of village lands began with literature searches and the collection of oral histories and traditional narratives. Villagers worked closely with researchers to record the boundaries of traditional resource management areas in sketch maps. Sites and boundaries were then located on a topographic map using compass triangulation and altimeters. Boundaries and points in the landscape were "ground-truthed" by the villagers, who guided researchers to sites indicated in the sketch maps.

Global Position System (GPS) positions were taken at 117 points, including protected village lands, the road, swidden areas, rivers and important cultural sites. Each point was located on a grid using 3-4 satellites positioned over the mapping site simultaneously. The GPS data was fed into a Geographic Information System and a map of the boundaries of distinct agro-ecological management areas were plotted. Subsequent overlays identified the position of customary land boundaries and the areas of overlapping community-managed and GOI claimed forest land.

Based on these maps, Long Uli villagers manage a total of 18,229 hectares. Land under rotational swidden cultivation (including the fallow) covers only 631 ha. (3%) of total village-managed land, but this includes plots where fruit trees and rattan are planted and managed. The village also manages several watersheds which feed into the Bahau River, two of which are designated as protected community-managed forests (or reserves) covering 12,173 ha. of village land (67%). Within these areas villagers are permitted to fish, collect rattan from the river banks and hunt a variety of game, but full tree cover is maintained to protect the village water supply. The remaining village land (30%) is unrestricted forest, where wood for construction and cooking is gathered.

Superimposing the Forest Department maps revealed that the village is divided in the middle by a forest concession and a nature reserve. Together, these two externally-proposed land uses cover 51% of total Long Uli-claimed land, and all of the village land under cultivation.

6.109 **Industrial Pollution Control.** As noted in earlier chapters, rapid growth of the industrial sector is seen as essential to meet future needs for employment and non-oil exports. Much of this growth will be concentrated in areas of relatively high population density, particularly on Java, but there will be significant expansion in some of the outer islands as well. In the absence of more effective measures to promote pollution control, therefore, an increasing number of people and communities will be exposed to the hazards of industrial pollution—with potentially serious consequences for their health and livelihoods. The evidence of community unrest arising from industrial pollution is not well documented, but press reports and anecdotal accounts seem to be increasing. In most reported cases, the community has suffered economic losses and/or serious health effects from the release of industrial effluents into local water or air; compensation by the responsible firm is paid reluctantly—if at all. A fairly typical recent example is described in Box 6.10, below.

**Box 6.10: A Case of Polluted Shrimp Ponds in North Aceh**

As reported in the Jakarta Post (June 24, 1992), residents from seven villages in North Aceh complained that pollution had killed shrimp and fish in the village ponds. They claimed that a foreign company, operating under contract to a major Indonesian firm, had dumped industrial waste into the local river which resulted in the damage to their ponds. Following these reports, local authorities established a special team to investigate the case. The team determined that the company was indeed responsible, and the regent sent a letter ordering the company to stop dumping its waste into the river. No legal action was taken against the company.

When villagers pursued their claim for damages, they were advised that the company would pay compensation if the incident reoccurred. Three months later the ponds were again polluted by industrial waste from the same firm, and more shrimp and fish died. When their claims for compensation again went unheeded, the case was taken up by a legal aid organization (Aceh's Institute for Environmental Advocacy). When its letters to the firm and other contacts with government authorities failed to achieve results, an attempt was made to file a legal claim for damages with the local court. It was advised, however, that it would have to file seven separate suits - one for each village - at a cost of Rp 150,000 each, plus Rp 700,000 for the inspection of the location. (The official tariff for filing a lawsuit is Rp 40,000.)

Due to the lack of financial resources, only one suit was filed - on behalf of 70 residents of one village - seeking damages of Rp 883 million. At last report, the outcome is still pending. Even if successful, however, the villagers are concerned that this will not be the final episode, as they are located within a district being developed as an industrial zone, with five major industries already in operation.

6.110 A more positive outcome occurred in a pollution case near Semarang on the North Coast of Java that offers a potential model for the resolution of such disputes in the future. In this case, a local village had suffered the effects of industrial pollution for a number of years. Both fish ponds and rice paddies had been devastated, the village water supply was unfit for human consumption, and the stream running through the middle of the village was dark green and emitted a strong odor of sulfur. Because it was downstream from a number of industrial firms, it was never able to identify unequivocally which firm was responsible for a particular incident, and claims for compensation went unheeded. Eventually, it sought help from NGOs. The Indonesian Legal Aid Society took on the case, and filed a law suit. In a first-ever case in Indonesia, a consumer boycott against the upstream firms was announced by WALHI, which generated a considerable amount of press coverage. It also captured the attention of senior managers of the firms, as well as that of the relevant Government authorities.

6.111 BAPEDAL became involved--since the firms had signed voluntary agreements under the Prokasih Program to install waste water treatment facilities--and, in cooperation with local authorities, arranged for direct negotiations between the firms and representatives from the village. The negotiated outcome included three elements: (a) compensation for damages was paid; (b) a special fund, also paid for by the firms, was established to be used for village development projects; and (c) the firms agreed to install their waste water treatment facilities, with work to begin almost immediately.

6.112 As noted earlier, it is likely to be many years before GOI is able to establish fully effective pollution monitoring and control agencies at the provincial level. In the interim, negotiations between industrial firms and surrounding communities could go a long way to ensure greater equity and burdensharing in dealing with the costs of pollution. It would also provide an effective incentive for firms to behave in a more socially responsible manner. Experience in other countries confirms the potential of such an approach. In addition to the case of Japan, noted earlier, a recent survey in Bangladesh reveals that firms there are also susceptible to community pressure to clean up their wastes (Huq and Wheeler, 1992). One rather interesting finding, likely to be equally valid in Indonesia, is that the degree of community pressure was directly related to local employment opportunities outside the polluting firm, as well as to other factors such as the extent of pollution damage and whether or not individual polluting firms could be clearly identified.

6.113 Such an approach would require, however, that GOI legitimize, encourage and actively facilitate the mediation process. This would be clearly more cost effective than reliance on a legal system that is ill-equipped to deal with such cases and, as experience in the west demonstrates, can be far more contentious and protracted. BAPEDAL has taken the lead in this area, and its efforts should receive strong support and encouragement.

### **Growth, Equity and Stability: Striking a New Balance**

6.114 There is a clear and growing consensus within Indonesia on the need for wider participation, in political as well as developmental spheres. The appropriate pace of reform, however, is a matter of some debate. This is understandable since the process of participation poses certain risks for the social and political stability that has been a hallmark of GOI's development strategy for more than two decades and has contributed much to its success. This debate has been complicated by increasing pressures from abroad that link the growing concern over environmental sustainability on a global basis with issues of governance, social justice and human rights. These pressures are likely to continue to increase, and could have significant implications for Indonesia's image within the international community. They also pose a definite risk for future trade prospects and could influence the availability of donor financing, at least for certain types of projects.

6.115 "**Green Labeling**". Lobbying by environmental NGOs has already resulted in restrictions on the import of tropical timber and associated products in certain countries, and protest demonstrations have occurred in many others (including a recent one in the U.S. involving plywood imported from Indonesia). These pressures are likely to grow in intensity and be expanded to other products in the future, wherever a link with environmental sustainability can be established (e.g., products involving the use of CFCs).

6.116 **Donor Assistance.** The importance of environmental sustainability is universally accepted within the donor community. Nearly all donor countries and international aid agencies have adopted policies requiring environmental impact assessments for development projects, and many--including the World Bank--also require consultations with local NGOs and affected people as a part of the assessment process. Donors will no longer support development projects that may have negative effects on "indigenous people", and most have also adopted more stringent guidelines on "involuntary resettlement" arising from development projects, with a particular emphasis on ensuring that the livelihoods of those affected are fully restored.

6.117 Dams and other projects that require large numbers of people to be resettled face a special problem. Some NGOs are opposed to such projects on principle, and their political support has been strengthened significantly by the intense and highly negative publicity arising from past projects where insufficient attention and failures of implementation have resulted in unacceptable social and economic losses for the affected people. Bilateral donors may be particularly vulnerable to political pressure from NGOs to avoid any involvement with projects requiring major resettlement, regardless of the social and economic benefits of the proposed investment or the prospects for successful implementation of an agreed resettlement plan.

6.118 With the end of the "Cold War", a number of Western governments are giving increasing attention to issues of democracy, participation, and human rights in their foreign aid. In the European Community, aid plans drawn up in 1991 include new guidelines for international assistance, with an emphasis on (inter alia) human rights, democracy and open and accountable government. In the United States, the new administration has indicated that issues of democracy, human rights and environment will be a key feature of future foreign policy, including aid.

6.119 Indonesia should be prepared to respond to issues of global sustainability head on, in a non-defensive and straight-forward manner wherever possible. Public relations campaigns which stress GOI's commitment to resolving such issues may be helpful, but credibility will require genuine and significant progress on those issues where the country may be particularly vulnerable to external criticism--as in the management of its tropical forests. In this same context, of course, it is entirely legitimate for Indonesia to expect that additional resources will be made available from developed countries to support its efforts to deal with environmental issues involving global benefits, such as the preservation of biodiversity and the reduction of CFCs and other greenhouse gases.

6.120 Regarding calls for greater democracy, it is not clear how these pressures may be pursued but it would be unrealistic to assume that they will go away. According to the 1991 WDR (World Bank, 1991), there is no clear link between economic growth and democratization. As noted earlier, Indonesia has already experienced the political instability and policy grid-lock that can arise from "western style" democracy. (Excessive responsiveness to interest groups, in fact, continues to frustrate the adoption of more responsible fiscal policies in some of the world's leading democratic countries.) Issues of "good governance", however, including greater accountability of public institutions, increased transparency in implementing government policy, and improvements in the legal framework, are legitimate areas of concern. Further progress in these areas will be important for efficient and effective development in Indonesia, and should be pursued.

6.121 Arguments for greater participation in the development process are sometimes part of a broader political agenda but, for reasons noted above, are often based on legitimate donor concerns for effective and sustainable development. Participation, however, should not be seen as an end in itself. Effective participation takes time and can be expensive. The need to consult with potential beneficiaries and other affected parties early in the preparation of development projects, and their continued involvement as projects are implemented, is a labor-intensive process for the sponsors of such projects. In some cases controversy is inevitable and, as experience in the West clearly demonstrates, this can lead to long delays and significantly higher investment costs.

6.122 Where projects involve only minor impacts, or where environmental and social concerns can be met using standard and accepted design criteria, the additional cost of elaborate consultation processes may not be justified. Premature disclosure of plans for some development projects may also lead to speculation and rent-seeking behavior, to the disadvantage of local people. The process of decentralization will not necessarily enhance participation and can result in local elites capturing a disproportionate share of project benefits. Participation, therefore, will not be necessary or appropriate in every case and, in others, the benefits may not outweigh the cost. Despite these caveats, the need to move beyond the rhetoric and the politics of participation--and to get on with the process--is clear. This will require, in the words of one experienced practitioner, "guts and vision".

6.123 **Elements of a Suggested Approach.** Indonesia's tradition and strongly-held cultural value of consensus-seeking is firmly in place, and this forms the cornerstone for constructive participation. Two additional elements needed are **pragmatism** and **experimentation**. A pragmatic approach would suggest targeting the effort to those areas where the payoffs are likely to be highest and/or the risks of failure greatest. The participation of potential beneficiaries in project design and implementation is the least threatening and also has a high payoff in terms of development impact and sustainability. Here, the main challenge will be to allow for the additional time needed to carry out a more participatory approach and to find ways to reinforce the accountability of implementing agencies for the quality of final results--rather than simply progress in the physical aspects of implementation.<sup>4</sup>

6.124 Consultations with people who may be negatively affected by development projects, and negotiations between local communities and project sponsors (whether public or private sector) are potentially contentious and will need to be handled with prudence and common sense--in the "Indonesian way". Western-style forms of consultation may be particularly inappropriate, given the strong cultural aversion to overt confrontations. Experimenting with different approaches may be useful, guided by the vision of an equitable outcome consistent with the long-run goals of Indonesia's development strategy. It will be important to ensure, however, that participation is an on-going process, and to include provisions for an evaluation of the results so that the lessons learned can be incorporated in future projects. Sharing the results widely will encourage both learning and accountability. Particular attention should be given to disseminating examples of "best practice".

6.125 In the case of negotiations between firms and surrounding communities involving allegations of pollution, national and local authorities will need to take an even-handed approach. Here, to overcome private sector resistance, it may be helpful to point out some of the benefits of their participation--including the enhancement of their image within the community. The encouragement of this perspective from the highest political levels would help to ensure a positive outcome--and could help to offset some of the existing tensions between commercial interests and the general public. This process will also require the development of specific skills and experience with the mediation process. As noted above, this is already part of BAPEDAL's mandate and is being supported by a number of donors, including the Bank.

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<sup>4</sup> GOI is not alone in facing this challenge. A recent review of the World Bank's project portfolio concluded that greater emphasis on the quality and impact of Bank projects is also needed - and that this may require a significant change in organizational culture and procedures.

6.126 **Potential Role of NGOs.** Development NGOs operating at the grass-roots level can supplement limited government resources and help improve sustainability through more participatory approaches (e.g., in rural water supply and sanitation and urban kampung improvement projects). This will require a significant change in the orientation of implementing agencies, including appropriate incentives for managers and staff. The generally small size and administrative weaknesses of most local NGOs, however, means that reliance on them is not a panacea. In many cases, there is also scope for encouraging private sector initiatives (see Box 6.5), especially those involving women, and these should be encouraged.

6.127 The role of NGOs in consultations with affected parties and dispute resolution will require further evolution and discrimination in their functions. Recognizing that careful and dispassionate study of environment-related issues is a necessary foundation for more effective advocacy, new NGOs are being formed devoted exclusively to research and policy analysis—separate from those where advocacy will remain the central purpose. To play an objective, "third-party" role in the resolution of environment-related disputes may require a similar distinction and the development of separate NGOs with skills and experience in the mediation process. Here also, a fundamental change in the attitude of central and local government authorities toward NGOs will be needed for a more constructive partnership in this potentially vital area.

6.128 **Striking a New Balance.** As Indonesia's policy-makers are increasingly aware, the challenges of the next twenty five years will require that a new balance be struck among the often conflicting goals of growth, equity and stability. In the past, highest priority has been given to growth and stability, and the success of the Government's development efforts has led to a remarkable reduction in poverty and to significant improvements in the health, education and income of the vast majority of Indonesian citizens. As a direct result of rapid economic growth, however, conflicts over the use of land and access to other natural resources are increasing, and growing numbers of people are exposed to environmental pollution which threatens their health and livelihoods and jeopardizes their prospects for a higher quality of life in the future. Issues of equity and burdensharing, therefore, will become an increasingly important challenge over the coming years.

6.129 To meet this challenge will require new partnerships between the Government, the private sector and local communities and wider participation in the development process, with all of the attendant risks for social and political stability. The alternative, however, will not necessarily lead to greater stability in the longer term, and increasing participation will be required in any event to ensure that development efforts are effective and sustainable. The Government's well-established reputation for "doing the right thing", and the strong cultural traditions of compromise and consensus-seeking, provide grounds for optimism regarding the final outcome. Managing this process will require vision and courage, and will not be easy. Its success, however, will contribute immeasurably to an enduring legacy of social and economic progress.

## **CHAPTER 7**

### **CONCLUSIONS AND RECOMMENDATIONS**

## CHAPTER 7

### CONCLUSIONS AND RECOMMENDATIONS

#### CONTENTS

	<u>Page No.</u>
A. INTRODUCTION . . . . .	209
Visions for the Future . . . . .	209
B. WHAT NEEDS TO BE DONE . . . . .	210
Improving the Management of Natural Resources . . . . .	210
Controlling Urban and Industrial Pollution . . . . .	211
C. ADDITIONAL ELEMENTS OF THE STRATEGY . . . . .	212
"Second Generation" Issues and the Need for Priorities . . . . .	212
Prospects and Perspectives on "Getting the Prices Right" . . . . .	213
The Need for Partnerships and Participation . . . . .	214
D. AN AGENDA FOR THE MEDIUM TERM . . . . .	215
Strengthening Environmental Management . . . . .	216
Land Resources . . . . .	217
Parks and Protected Areas . . . . .	218
Forest Resources . . . . .	219
Water Resources . . . . .	221
Energy Resources . . . . .	222
Urban Environmental Management . . . . .	223
Urban Water Supply . . . . .	224
Sewerage, Sanitation and Solid Waste . . . . .	225
Urban Transport and Vehicle Emissions . . . . .	226
Industrial Pollution Control . . . . .	227

## CONCLUSIONS AND RECOMMENDATIONS

### A. INTRODUCTION

7.1 The previous chapters have covered a lot of ground, touching on the current and future issues in a large number of sectors--on Java, where the majority of Indonesia's people and economic activity is concentrated, and in the outer islands, where issues of natural resources management are vital for improving and sustaining the incomes of rural communities. The main focus of attention has been on issues of environmental sustainability, but these are inextricably linked to issues of efficiency and economic sustainability, as well as issues of equity and burdensharing in the development process.

7.2 The aim of this chapter is to summarize the reports conclusions and recommendations. The three main conclusions are: (a) that future growth and development will depend increasingly on Indonesia's stock of key natural resources and critical ecosystems, and the care and efficiency with which they are managed; (b) that the growing volume of urban and industrial pollution poses a serious threat not only to health and human welfare but also to the prospects for continued rapid growth; and (c) that, as a result of rapid growth, issues of equity and budensharing will become increasingly important in the years ahead. The suggested medium-term agenda for action is shown in Section D. Before turning to specific recommendations, however, it may be useful to consider--in broad terms at least--alternative scenarios for the future, and what it will take to achieve the vision that GOI has for the country by the end of the Second Long-Term Plan. These topics are discussed below and in Section B. Success will depend on a combination of factors, discussed briefly in Section C, including the importance of focusing on the right issues, recognizing political as well as economic constraints, and relying increasingly on "partnerships and participation" at the local, national and global levels.

#### Visions for the Future

7.3 GOI's vision for the future has remained essentially constant since the start of the first Long-Term Plan: happy and prosperous families, adults productively employed in high value-added jobs, children healthy and well-educated, and rural and urban citizens alike able to enjoy the fruits of their labor in a natural environment that enhances the quality of their lives. As noted earlier, the tradition of sound macroeconomic management in Indonesia, the structural reforms of the 1980s, and past investments in economic infrastructure and human resources have laid the foundation for further progress toward this vision in the decades ahead. To get there, however, will require continued rapid growth, which will be accompanied by major structural changes in the economy and significant changes in the size and location of the population, including continued rapid growth of cities and towns throughout the country. This growth and change will add substantially to the pressure on natural resources and critical ecosystems, many of which are already threatened by the impacts of past growth and development. It will also add to the existing levels of pollution in urban areas, with human and solid wastes more than doubling and a potential 10-fold increase in pollution from industrial sources. How successfully these challenges are managed will determine whether or not GOI's vision for the future is achieved.

7.4 There are alternative scenarios. Extrapolating current trends into the future, for example, would suggest the likelihood of continued environmental degradation, with serious implications for the prospects for future growth, the economic sustainability of current incomes, and the health and welfare of future generations of Indonesian citizens:

- o disappearing forests, and with them the irretrievable loss of biological diversity and the foreclosure of potential future options;
- o continued degradation of upland watersheds, groundwater aquifers, and coastal and marine ecosystems, to the extent that they may no longer be able to sustain even current levels of economic activity;
- o increasing social conflict in the allocation and use of land, water and other natural resources, and the alienation of local communities from the process of development; and
- o growing urban congestion and pollution, with a loss of economic efficiency, increasing health costs, and declining competitiveness in attracting high value-added jobs.

## **B. WHAT NEEDS TO BE DONE**

7.5 The actions needed to improve the management of natural resources and control urban and industrial pollution fall broadly into three categories: policy reform, investments (public and private), and institutional strengthening. While substantial complementarity exists between the "green" issues of natural resources and the "brown" issues of pollution control, and many of the recommendations for action are similar, there are important differences of emphasis in each case.

### **Improving the Management of Natural Resources**

7.6 Improving the management of natural resources will be important for economic as well as environmental reasons but, in a surprising number of cases, there are also important issues of equity involved. Recommended actions focus on three key areas: getting the prices right; appropriate and targeted Government interventions; and the strengthening of institutional capacities.

7.7 **Getting the Prices Right.** A recurring theme in the management of natural resources is the need to rely on market forces to improve the efficiency with which they are allocated and used. Below-market prices for land, water, forests and energy result in less-than-optimal allocations and wasteful consumption, often with additional negative environmental effects (e.g., higher pollution from waste in the wood processing industries and from "captive generating capacity" in industry).

7.8 **Targeted Interventions.** A second recurring theme is that Government interventions will be needed to protect critical ecosystems and improve equity in the costs as well as the benefits of the development process. Caution is needed, however, as there appears to be a serious risk of perverse effects on efficiency, sustainability and equity from well-intended interventions (e.g., subsidies on electricity and water that fail to reach the poor, land market interventions that add to urban sprawl, and cross-subsidies for piped water that lead to the over-extraction of groundwater).

7.9 **Institutional Strengthening.** In virtually every case, the design and implementation of policy reforms and targeted interventions to improve sustainability and ensure equity in the use of natural resources will require a substantial strengthening of the relevant government agencies. Since most environmental problems occur at the local level, and require solutions tailored to local conditions, institutional change will need to include the devolution of authority and responsibility from central to provincial and lower levels of government. In addition to staff training and development, additional incentives will be needed to facilitate and encourage more effective participation of project beneficiaries and affected communities in the design and implementation of development programs.

### **Controlling Urban and Industrial Pollution**

7.10 Dealing with the issues of urban and industrial pollution will require a substantial increase in public and private sector investment. Increased public sector investments can largely be covered by the revenue effects of moving to market prices for natural resources and "full-price" cost recovery, wherever feasible, for urban services. But getting private sector firms to invest in pollution abatement, and households and individuals to behave in a more environmentally responsible manner, will require a carefully balanced mix of policies and instruments and greatly enhanced institutional capacities for urban environmental management and industrial pollution control.

7.11 **Public Sector Investments in Environmental Protection.** On the urban side, public sector investments will need to focus on water supply and drainage systems, sewerage and sanitation, and urban transport. Greater reliance on private sector participation in the transport sector would help to reduce the need for Government expenditures, and management contracts, as well as privately owned and operated transport systems, may be essential for improving quality and efficiency. In other areas the involvement of the private sector should be approached with a certain degree of caution, given the "public good" nature of the services, and would need to be based on a carefully designed and transparent framework for regulating prices and the quality and availability of services. A careful examination of costs and benefits, as well as financing and cost-recovery prospects, will be essential for major capital expenditures on water-borne sewerage systems and "mass transit" systems to ensure that these do not become an unsustainable drain on municipal budgets.

7.12 **A Balanced Mix of Policies and Instruments.** Influencing the behavior of private sector firms, households and individuals represents a special challenge at this stage of the development process in Indonesia. The use of regulatory measures will be essential in some cases to achieve the desired level of pollution reduction from major point-sources, but will generally be constrained by weaknesses in monitoring and enforcement capacity and low rates of voluntary compliance in tackling non-point sources (like vehicles), small-scale enterprises and individual households. For industrial pollution in general, highest priority should be given to preventing pollution before it occurs, through measures that encourage the adoption of "clean technology" by individual firms. The adoption of direct charges on industrial pollution, and pollution-based taxes on fuels used in industry and transport, would be helpful. While unlikely, by themselves, to have a major impact on pollution, they would send important signals to producers and consumers, and could be used to fund monitoring and enforcement efforts and to finance environmental protection initiatives. The power of public information, both to build consensus and to bring community pressure to bear on environmentally irresponsible behavior, should feature prominently in the arsenal of policies and instruments for controlling urban and industrial pollution.

7.13 **Institutional Strengthening.** Urban environmental management and industrial pollution control are both relatively new issues for most developing country governments, especially at the local level. With the exception of a few large cities, municipal governments in Indonesia have little experience and few well-trained staff capable of taking on these issues. This will have to change, but it will not happen over night. On an interim basis, creative solutions will be needed to overcome the existing shortcomings in institutional capacity. In the Indonesian context, there would appear to be considerable potential for the development of more effective partnerships between the Government, private sector firms and local communities. A key ingredient in tapping this potential would be the development of a consensus within the business community on the virtues of environmental protection as part of a sound strategy for profitable and sustainable growth. Minimizing the resistant/defensive attitudes that were common in the early stages of environmental protection movements in the West and moving directly to the adoption of the kind of "environmentally responsible" approach that is now common among the more progressive and globally competitive firms, has the potential to improve the comparative advantage of individual firms. It would also go a long way toward ensuring that GOI's vision for the future will, in fact, be achieved.

### C. ADDITIONAL ELEMENTS OF THE STRATEGY

7.14 As noted in Chapter 6, progress in addressing the underlying causes of environmental degradation on a national basis has been painfully slow in nearly every country in the world, and issues of regional and global concern have only recently begun to be addressed. To close the gap between rhetoric and reality will not be easy. It will require concentrated attention on the key issues, realism—as well as a sense of urgency—in the pace of reform, understanding on all sides and more effective partnerships and participation at the local, national and global levels.

#### **Second Generation Issues and the Need for Priorities**

7.15 Time, attention, skills and money are all scarce resources, and only so much of each can be devoted to environmental issues and concerns. It will be vital, therefore, to focus on the right issues. In the past, much of the debate has centered on concepts of sustainable development, on the need to preserve Indonesia's remaining biological assets, on the affordability of urban and industrial pollution control, and similar concerns. These are "first generation" issues. The challenge for the future will be to move beyond these issues and get on with the process of implementing a sustainable development strategy. The "second generation" issues are mostly about "how to do it".

7.16 GOI, for example, clearly recognizes the need to conserve its natural resources and to use them more efficiently, and has set aside nearly 50 million ha of its tropical rainforest for the protection of biodiversity and watersheds. The real issue is that it does not yet have sufficient capacity to manage so large an area effectively. The problem is about trees, but the solutions are about people; and it's not about keeping them out, but getting them in—to the process of managing protected areas and more sustainable activities within and outside these areas. The ICDP approach may work, but is not yet proven and is likely to be expensive, time consuming and difficult to implement. External funding, skills and expertise will need to be increased. The long-term solution, however, as in the case of Java's uplands, will have to involve jobs in cities and towns that can draw people out of rural areas. A more open global trade regime would help to facilitate this transition.

7.17 Similarly, the question is no longer whether or not Indonesia can afford to protect its environment. Likely future trends in urban and industrial pollution, and the implications for growth and human health and welfare, make it clear that GOI cannot afford **not** to tackle these problems. Again, the question is how. Environmental NGOs (and lawyers) argue for the more costly regulatory approaches--in part because they offer the best chance of actually reducing pollution, while economists argue for market-based approaches because they are "cost effective"--whether or not they actually reduce pollution. In reality, it will be years before GOI has sufficient monitoring and enforcement capacity in place for either system to work very well, and the problems of industrial pollution can't wait. One issue is what to do in the meantime to control such pollution. The key issue, however, is how to prevent it in the first place. For both prevention and clean-up, making information public, encouraging more responsible attitudes and stimulating innovation by the business community appear to offer the best, if not the only, hope until alternative approaches are in place.

7.18 Indonesia has demonstrated a strong commitment to issues of global sustainability, but will need increasing amounts of technical assistance and expertise, as well as incremental grant funding, to fully meet its commitments. It will be important to ensure, however, that pressures to address issues of global sustainability do not lead to an imbalance in addressing issues of local sustainability. Establishing priorities, and sticking to them, will be vital. The temptations are many, with both donors and NGOs likely to propose an ever-expanding array of proposals for action. Given current budgetary and administrative constraints, however, trying to do everything at once will only result in delaying needed progress on the highest priority issues.

### **Prospects and Perspectives on "Getting the Prices Right"**

7.19 Despite the apparent compelling logic of moving to market prices for natural resources, most governments in the developing world have been reluctant to do so. Given the importance of this topic, and the need for realism in the pace of reform that is possible, it may be useful to consider the factors that have influenced the adoption of such recommendations in Indonesia in the past, and the effect that changing circumstances may have on their adoption in the future.

7.20 **An Historical Perspective.** Twenty-five years ago, per capita income was US\$50 and an estimated 60% of the population was living in absolute poverty. Indonesia's primary assets were its people and its vast--but relatively undeveloped--natural resources. At that point in time, subsidizing the use of natural resources was seen as a way of: (a) encouraging the expansion of economic activity, the creation of jobs and the growth of exports; and (b) "sharing the wealth" of these gifts of nature, and thus achieving a more equitable distribution of the gains of development.

7.21 Times have changed, however, and the future will be different from the past. As a result of twenty-five years of growth, scarcity issues have come to the fore and conflicts are emerging in the use of land and water. Surplus oil for export has declined to the point where Indonesia may become a net importer by the turn of the century, and the rate of timber extraction from the natural forest calls into question the longer-term supply of logs for the wood processing industries. The outward focus of the economy and the need to replace oil as a major source of foreign exchange will require increasing efficiency in domestic production in order to enhance globally competitiveness. Moving to market prices for natural resources, therefore, is now clearly in the national interests on economic grounds, even without the important additional benefits for the environment.

**7.22 A Political Perspective.** Raising taxes, removing subsidies and increasing the price of public services are not easy things for policy-makers to do--in Indonesia or anywhere else.<sup>1</sup> The potential for resistance--by the business community and the public--is sometimes underestimated by well-intentioned external advisors, but Government officials are all-too-keenly aware of the possibility of widespread protests in response to higher prices for the necessities of life. Counter-balancing the temptation to avoid such increases is the necessity of balancing fiscal and foreign accounts, at least over the medium term. In the case of Indonesia, the current level of external debt has reinforced the need to mobilize domestic savings and to rely less in the future on foreign borrowing to finance development expenditures. The revenue effects of moving to market prices for natural resources, therefore, will provide additional incentives for getting the prices right. The recent removal of subsidies on nearly all petroleum-based fuels, for example, will switch a subsidy of Rp 1 trillion to a budgetary surplus of Rp 2 trillion, with total savings amounting to 1.1% of GDP.

**7.23 Key Elements of a Successful Strategy.** Given the virtues of getting the prices right, and the difficulties of doing so, it will be important to define a strategy for moving in the right direction. Judging from the experience over the past decade with GOI's structural adjustment program, there would appear to be four key elements of a successful strategy:

- o **Build a consensus** on why the prices of key natural resources should be raised to market levels, taking full advantage of growing popular support for actions that will enhance environmental quality and sustainability;
- o **Recognize the tradeoffs involved**, including, on the one hand, the potential for social unrest and economic disruption from large and unexpected changes in prices and, on the other hand, the losses in economic efficiency and environmental sustainability that will continue to accrue if action is delayed;
- o **Provide for social safety nets**, to ensure that the poor are not disadvantaged, and make explicit a commitment to use a portion of the resulting increase in public revenues for targeted interventions on their behalf; and
- o **Allow firms and individuals time to adjust** by moving in the right direction in a deliberate, transparent and orderly fashion, where feasible by announcing in advance the schedule for future price increases--and then sticking to the schedule, and by building in, wherever possible, regular and automatic price adjustments to account for inflation.

### **The Need for Partnerships and Participation**

**7.24** As noted in Chapter 4, some of the issues of global sustainability have become increasingly contentious (and politicized) in recent years, in part reflecting the dichotomy of interests between the industrialized West and the developing world. At the same time, while hopes were

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<sup>1</sup> Recent efforts in the U.S., for example, to raise the price for grazing on public lands and logging in public forests have not met with much success, and a recent proposal for a tax on the Btu content of various energy sources was defeated because of strong political opposition.

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raised in anticipation of the 1992 UNCED meetings in Rio for real and substantial progress on global partnerships--including a significant increase in funding in support of these issues--actual progress has been disappointing to date. Recessions in the donor countries, expanding needs for traditional aid, especially for Eastern Europe and the former Soviet Union, and continued debate on the details of some of the specific conventions, have prevented the resolution of "burden sharing" issues. These factors are understandable, and hopefully will be overcome.

7.25 As noted by President Soeharto in his UNCED speech, the basis for effective global partnerships must be less confrontation and more understanding on all sides. These sentiments apply as well to issues of local sustainability, whether in conflicts over land and access to natural resources or disputes arising from the "downstream effects" of urban and industrial pollution. As noted in Chapter 6, the solutions to these issues will require new partnerships between the Government, the private sector and local communities, and wider participation in the development process. Increasing participation will be required in any event to insure that development efforts are effective and sustainable, and will thus play a vital role in achieving GOI's vision for the future.

#### **D. AN AGENDA FOR THE MEDIUM TERM**

7.26 In the following pages we have attempted to summarize the key recommendations for each major topic covered in this report. These recommendations are organized into four categories: policy reforms, expenditure and investment needs, institutional strengthening, and areas for further study. Our hope is that these recommendations, supported by the analysis contained in this report, provide not only a useful input for the preparation of REPELITA VI, but for the implementation of a more sustainable development strategy over the longer term.

7.27 While the proposed agenda for action is quite substantial, it should in no way be seen to detract from all that has been accomplished in the past. GOI is aware of the challenges it faces, and its intentions are clear. As President Soeharto stated in a speech to Parliament in January 1993: "We will consolidate, expand and deepen all that is good. We will put in order what has been neglected."

**Table 1: STRENGTHENING ENVIRONMENTAL MANAGEMENT**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Expand MLH's mandate to review environmental implications of macroeconomic and sectoral policies.</li> <li>• Implement the revised AMDAL regulations to make procedures more efficient and results more effective.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate budget support for strengthening the agencies responsible for environmental planning and management at the central, provincial and local levels, especially with respect to human resources development (including staff training and development).</li> <li>• Increase investment and recurrent expenditures for GOI laboratories responsible for environmental monitoring and evaluation of ambient and effluent/emission qualities.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue strengthening MLH, BAPEDAL and other central, provincial and local agencies responsible for environmental planning and management and pollution monitoring and control.</li> <li>• Strengthen policy analysis capacity available to MLH for review of environmental effects of proposed macroeconomic and sectoral policies.</li> <li>• Strengthen AMDAL implementation, including Review Commissions and private sector capacity, and promote the involvement of local community groups and NGOs in the AMDAL process.</li> <li>• Expand the quality, timeliness and availability of data on environmental conditions and trends.</li> <li>• Promote the preparation of sectoral EIAs, and strengthen the capacity of central agencies to prepare and implement sectoral action plans for addressing environmental impacts.</li> </ul>	<ul style="list-style-type: none"> <li>• Clarify the legal mandate for pollution monitoring and control, including establishment of a permit system and the introduction of direct charges on industrial effluents/emissions by provincial, municipal and river basin authorities.</li> <li>• Continue to explore and support "alternative dispute resolution" mechanisms and other means to resolve conflict over natural resources and environmental degradation.</li> </ul>

**Table 2: LAND RESOURCES**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• To improve efficiency and achieve "highest and best use" of land, rely more on market forces. Specifically, strengthen ability of land markets to function by: clarifying and simplifying the legal framework; expediting land titling and registration; improving the availability of land information; "moving to market prices" for the allocation of state land for development purposes; and reviewing current practices of land acquisition permits.</li> <li>• To improve sustainability, in both urban and rural areas, give high priority to developing the implementing regulations for spatial planning.</li> <li>• To improve equity, and the sustainable use of land: adopt a national policy on compensation for property rights and resettlement of people affected by development projects, with particular attention to ensuring that their livelihoods are fully restored; and improve the legal framework for the recognition of traditional (<i>adat</i>) rights to land (and related access and use rights), including mechanisms for the registration of communal <i>adat</i> rights.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate budget resources for strengthening operations of BPN and other national, provincial and municipal agencies responsible for land administration, including both software (e.g., staff training and development) and hardware (e.g., equipment and vehicles).</li> </ul>	<ul style="list-style-type: none"> <li>• Clarify the mandates of BPN and other agencies responsible for various aspects of land administration, and seek creative interim solutions too improve coordination in the near and medium term.</li> <li>• Strengthen capacity of the relevant national, provincial and local agencies for: the design and implementation of "strategic structural plans", including protection of critical ecosystems and improved guidance for the expansion and location of public and private sector development projects.</li> <li>• Strengthen capacity of BPN and other agencies responsible for: efficient processing of land titling and registration; collection and analysis of data on land characteristics (use, soil conditions, productivity, erosion, etc.), and preparation and availability of uniform scale maps, remote sensing data and other forms of land information.</li> <li>• Develop and issue implementing regulations for land acquisition.</li> </ul>	<p>Complete efforts currently underway to compile and categorize the laws and regulations applicable to land administration in Indonesia, as a first step in the process of clarifying and simplifying the legal framework.</p>

**Table 3: PARKS AND PROTECTED AREAS**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Continue efforts to stimulate rapid growth of labor-intensive, export-oriented industries to help draw people out of rural areas into higher-value-added jobs in cities and towns.</li> <li>• Recognize the limitations of efforts to restrict access to protected areas, and devote increasing attention to expanding community involvement in their management, including the potential for NGO involvement in project design, implementation and evaluation. Specifically, continue efforts to develop "Integrated Conservation and Development Projects" (ICDP), social forestry, joint-GOI/community management of parks and reserves, and similar models of direct and cooperative participation.</li> <li>• Strengthen the legal framework for the recognition of traditional (<i>adat</i>) rights to land (and related access and use rights), including mechanisms for the registration of communal <i>adat</i> rights.</li> <li>• Increase visitor fees to (selected areas) of parks and reserves, and seek additional ways to increase the revenue from "ecotourism", to assist in funding park management activities.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate budget resources for strengthening PHPA and other national, provincial and local agencies responsible for the management of parks and protected areas, including both software (e.g., staff training and development) and hardware (e.g., equipment and vehicles).</li> <li>• Substantially increase the resources devoted to management of parks and protected areas (for ICDP, social forestry, and similar initiatives), including the mobilization and improved coordination of donor funding, in line with absorptive capacity of implementing agencies.</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening the capacity of PHPA and other national, provincial and local agencies responsible for the management of parks and protected areas.</li> <li>• Strengthen the collection and analysis of data on environmental conditions and trends in parks and protected areas.</li> <li>• Develop the institutional capacity for implementing an "ex situ" biodiversity conservation program, including collection, research, training, education and promotion of biological genetic resources.</li> <li>• Continue efforts to strengthen extension services to farmers in uplands areas for the adoption of appropriate soil conservation technologies.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop feasible options for income-generating activities outside protected areas in the context of ICDPs.</li> <li>• Continue efforts to identify and document the range, location and vulnerability of biodiversity, and adjust the current delineation of protected areas to ensure they reflect adequate coverage, particularly low-land forests and wet lands.</li> </ul>

**Table 4: FOREST RESOURCES**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Revise the classification of forest lands to reflect the need to reclassify some areas as protection forests or as reserves for biodiversity protection.</li> <li>• Ensure the sustainable development of land converted to other uses for poverty and employment purposes, and minimize future conversion of regenerating forest land by concentrating plantations, tree crop and other projects on already degraded land.</li> <li>• Improve the incentives for sustainable use of timber resources by: (a) moving log prices to international levels according to a pre-announced schedule; (b) raising the share of forestry revenues received by GOI with the intention of maximizing rent capture; (c) reviewing the need for continued subsidies for forest plantations; and (d) discontinuing earmarking of forestry revenues for the forestry sector, to allow their use in support of other high priority development goals.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate budget resources for institutional reform in Ministry of Forestry and other national, provincial and local agencies responsible for the management of forest lands, including staff training and development, equipment and vehicles.</li> <li>• Expand the budget for research and development on sustainable management of forest lands.</li> <li>• Review the level of expenditures for the greening and reforestation programs to ensure adequate funding, consistent with the need to channel a portion of the future increases in GOI forestry revenues to other priority development efforts.</li> </ul>	<ul style="list-style-type: none"> <li>• Improve the focus of agricultural research and extension on non-rice crops and on farming systems tailored to local ecological conditions, and continue to improve both the linkages between research, extension services and farmers and extension methodology (e.g., the IPM model), to ensure more sustainable use of converted forest land.</li> <li>• Develop more effective long-term mechanisms for inter-agency coordination for forest land conservation and development, and seek creative interim solutions (e.g., a provincial level "natural resource management council" chaired by the relevant BAPPEDA).</li> <li>• Review the mandates and organization of forest sector agencies, especially the need for increasing devolution of responsibility and authority for management and oversight to provincial and local agencies, and begin the development of an independent inspection service.</li> </ul>	<ul style="list-style-type: none"> <li>• Carry out a systematic inventory of the existence and location of forest-dwelling communities, against the current delineation of forest department boundaries for various land-use classifications, as a basis for boundary adjustments and improvements in the involvement of local communities in the management of forest lands.</li> <li>• Complete the forest inventory and strengthen the collection and analysis of data on resource stocks and flows, including the development of efficiency measures for the wood processing industries.</li> <li>• Review technical potential and develop improved techniques for the use of already degraded forest lands for the development of timber plantations, tree crops and other agricultural uses.</li> </ul>

**Table 4: FOREST RESOURCES**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Replace the current 20-year term limit of forest concessions by a system of five-yearly renewals, subject to sustainable management practices, and improve the effectiveness of GOI oversight through development of an independent inspection service that could provide technical advice and "certify" as to whether or not current practices are "sustainable".</li> <li>• Ensure advance consultation with forest-dwelling communities affected by forest development projects, and put in place mechanisms to ensure equitable participation in the benefits, including possible joint-management of regenerating areas based on traditional resource management systems.</li> <li>• Develop regulations to implement recent improvements in the legal framework for the recognition of the rights of indigenous people and other natural resource-dependent communities.</li> </ul>		<ul style="list-style-type: none"> <li>• Strengthen the capacity for technical assistance and extension services in sustainable forest management, including social forestry and other community uses as well as improved practices for sustainable production management.</li> <li>• Strengthen the capacity for research and development on sustainable forest management including social forestry, extractive reserves, and sustainable management of production forests.</li> </ul>	<ul style="list-style-type: none"> <li>• Complete inventories and mapping of ecological resources, and identify areas within current concession areas for preservation/limited production usage.</li> </ul>

**Table 5: WATER RESOURCES**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Adopt the Integrated River Basin Development approach for the management of surface and groundwater resources, especially for the critical watersheds on Java.</li> <li>• Manage the demand for water and mobilize finance for O&amp;M and additional investments through the expansion of service charges for irrigation water throughout Indonesia.</li> <li>• Clarify the legal provisions for a permit system and the charging of effluent fees by provincial or river basin authorities.</li> <li>• Incorporate rural water supply and sanitation improvements more systematically in targeted poverty programs.</li> <li>• Provide for community participation (including womens' groups) in the design and implementation of projects to improve the availability of safe water.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate budget resources for the proposed river basin management organizations.</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen the capacity and authority of the agencies responsible for the sustainable use of groundwater.</li> <li>• Develop more effective mechanisms for cross-sectoral and inter-agency coordination for water resources management, through the formulation of provincial and national "Water Boards".</li> <li>• Strengthen the collection, analysis and monitoring of data on water pollution in rivers, streams and aquifers, including measures of the efficiency of water use in irrigation, municipal and industrial uses.</li> <li>• Strengthen the institutional capacity of GOI agencies involved in rural water supply and sanitation, and cooperative efforts with NGOs and the private sector.</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate the efficiency implications of existing policies and incentives for the allocation and use of surface and groundwater.</li> <li>• Determine the water balance on Java and design a more integrated approach to "real time" management of water resources.</li> </ul>

**Table 6: ENERGY RESOURCES**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Implement a program to facilitate the transfer and application of energy efficient technology and practices in the industrial sector.</li> <li>• Implement a demand side management program to increase the efficiency of electricity use in all sectors.</li> <li>• Phase out the subsidies on kerosene and "small" residential and industrial electricity consumption.</li> <li>• Consider the feasibility of introducing pollution-based fuel taxes that reflect the social damage of energy-related pollution.</li> <li>• Identify appropriate measures (regulatory or market-based) to phase out the use of coal in urban areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide funds for the implementation of an industrial energy conservation program.</li> <li>• Provide funds for the implementation of a demand side management program.</li> <li>• Invest in refinery upgrading and other facilities as required to reduce the lead content of gasoline and supply unleaded gasoline.</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen the institutional capacity for the promotion of energy efficiency and expanded use of renewable energy resources (especially non-traditional resources for use in rural electrification).</li> <li>• Strengthen the collection and analysis of data on energy resources and consumption, including measures of the efficiency of energy production and use.</li> </ul>	<ul style="list-style-type: none"> <li>• Review the policy and incentives framework for expanding the use of renewable energy sources in rural areas.</li> <li>• Evaluate the impacts of air pollution, including acid rain, on human health, construction materials and natural ecosystems.</li> <li>• Evaluate the fuel efficiency in the transport sector and its implications for air pollution.</li> </ul>

**Table 7: URBAN ENVIRONMENTAL MANAGEMENT**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Develop spatial plans to guide urban growth as a participatory process to ensure consensus on priorities and a "shared vision" of the future spatial development.</li> <li>• Improve land administration, relying primarily on market prices to ensure efficient use of land.</li> <li>• Wherever possible, move to "full cost" pricing of urban services for demand management and cost recovery, including contributions from real estate developers for part of the costs of "trunk" lines.</li> <li>• Improve the assessment and collection of local taxes, especially land and building taxes (PBB) as a part of cost recovery and "full cost" pricing of urban services.</li> <li>• Ensure community participation in defining urban service needs, and involve project beneficiaries in project design.</li> <li>• Promote constructive partnerships for improving urban environmental quality, such as recent NGO initiatives (PEDULI) to support recycling.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate budget resources for strengthening municipal government agencies, including staff training and development and related needs.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue efforts to strengthen the capacity of municipal government agencies to plan and implement development projects, as a key element in the devolution of additional authority and responsibility.</li> <li>• Strengthen the capacity for urban sector environmental planning and management, including the design and implementation of "strategic structural plans", the development of policies and incentives for encouraging environmentally responsible behavior by firms, households and individuals and improve mechanisms for inter-agency coordination.</li> <li>• Strengthen the collection and analysis of data on ambient quality of water and air in urban areas, and the extent of compliance with GOI standards.</li> </ul>	

**Table 8: URBAN WATER SUPPLY**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Improve cost recovery by targeting the residential piped water subsidies to lifeline consumption levels and eliminating the subsidy at higher levels of consumption.</li> <li>• Improve the affordability of piped water supply by rolling over part of the connection fee onto the monthly charges.</li> <li>• Reduce distortion in water pricing through an increase in groundwater fees in relation to piped water charges.</li> <li>• Formulate a regulatory framework for the PDAMs that would strengthen their structure and increase their managerial autonomy.</li> <li>• Provide for community participation (including womens' groups) in the design and implementation of projects to improve the availability of safe water.</li> <li>• Improve the quality of initial construction and pay increased attention to O&amp;M needs.</li> </ul>	<ul style="list-style-type: none"> <li>• Increase investments in poverty-oriented programs to improve the availability of safe water in urban areas.</li> <li>• Expand the piped water distribution network taking into account the "revealed demand" by households at different levels of income.</li> <li>• Provide funding for O&amp;M improvements to reduce "unaccounted for" water losses and supply interruptions.</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen the capacity of PDAMs to implement the needed investments, improve the reliability of supply and reduce water losses in urban areas.</li> <li>• Strengthen the collection and analysis of data on access to safe water and sanitation and surface and groundwater contamination.</li> </ul>	

**Table 9: SEWERAGE, SANITATION AND SOLID WASTE**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Recover the full costs for the provision of sewerage, sanitation and solid waste management services from industrial and commercial developments, and increase cost-recovery from households to the extent feasible.</li> <li>• Take advantage of the potential for community self help in the design and implementation of sewerage, sanitation and waste management projects.</li> <li>• Encourage greater involvement of private operators in solid and hazardous waste collection and disposal, but improve management and regulation of landfills and ensure safe operation of hazardous waste treatment facilities.</li> <li>• Develop a long term plan for the siting of future landfills.</li> </ul>	<ul style="list-style-type: none"> <li>• Increase investments in poverty-oriented programs to improve on-site sanitation in urban areas.</li> <li>• Facilitate private investments in solid waste collection, including transfer stations in larger cities.</li> <li>• Facilitate private sector investment in the construction of industrial waste treatment plants as needed.</li> <li>• Substantially increase investments in conventional sewerage systems in high-density inner cities.</li> </ul>	<ul style="list-style-type: none"> <li>• Determine institutional arrangements for development of public sewerage systems and strengthen the capacity of the selected agency for planning, implementation and operations and maintenance.</li> <li>• Improve the management of existing landfills, especially those located in environmentally vulnerable areas.</li> <li>• Strengthen the collection and analysis of data on volumes of solid waste collected and recycled, and toxic and hazardous wastes.</li> </ul>	<ul style="list-style-type: none"> <li>• Explore the least cost options for the expansion of sewerage and sanitation services, including in situ and off-site approaches.</li> <li>• Evaluate strategies for financing and cost recovery arrangements for the expansion of sewerage and sanitation systems.</li> </ul>

**Table 10: URBAN TRANSPORT AND VEHICLE EMISSIONS**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Increase the recovery of road costs through raising vehicle registration fees and the introduction of road user charges.</li> <li>• Promote public transport through the establishment of bus lanes, and improved provisions for pedestrian access and intermodal transfers.</li> <li>• Consider the introduction of pollution-based fuel taxes to promote the use of cleaner fuels, such as unleaded gasoline and CNG.</li> <li>• Introduce vehicle emissions inspection for high use ("fleet") vehicles in key urban centers wherever feasible.</li> </ul>	<ul style="list-style-type: none"> <li>• Increase the investment program for urban roads, but improve both road design and network development.</li> <li>• Invest in improvements in traffic management, including improved intersections, traffic signals and provisions for non-motorized vehicles and pedestrians.</li> <li>• Implement an investment program to supply CNG as a transport fuel in Jakarta and Surabaya, and to develop the refining capacity for low- and un-leaded gasoline.</li> </ul>	<ul style="list-style-type: none"> <li>• Coordinate development of transport networks, employment centers and residential areas so as to reduce the need for long-distance commuting and encourage non-motorized transport, and improve alternative forms of communications.</li> <li>• Improve the quality and efficiency of urban bus systems, relying as much as possible on private sector participation for both investment and management skills.</li> <li>• Develop an education and awareness program, including published data on ambient air quality trends to strengthen the consensus for needed policy measures.</li> </ul>	<ul style="list-style-type: none"> <li>• Review technical options for vehicles and fuels, including engine design and emissions standards, CNG and unleaded gasoline.</li> <li>• Develop carefully designed program to phase out two-stroke motorcycle engines.</li> <li>• Evaluate the feasibility of a "mass transit" system for Jakarta, including issues of financing and cost recovery.</li> <li>• Review prospects for congestion pricing and other market-based incentives for reducing reliance on private vehicles and encouraging public transport.</li> <li>• Review improvements needed in the areas of intermodal transport and prospects for "car pools".</li> </ul>

**Table 11: INDUSTRIAL POLLUTION CONTROL**

Policy Reform	Expenditures/Investments	Institutional Strengthening	Areas for Further Study
<ul style="list-style-type: none"> <li>• Continue to improve the incentives framework for rapid and efficient industrial sector growth, including encouragement of direct foreign investment.</li> <li>• Adopt "pollution prevention" as the highest priority in the hierarchy of industrial pollution control strategies.</li> <li>• Develop a balanced and complementary mix of policies and instruments, tailored to conditions in Indonesia, with heavy reliance on the power of public information, and the introduction of direct charges on industrial water and air pollution on a pilot basis as soon as feasible.</li> <li>• Develop a targeted program of AMDAL reviews for new industrial investments, including the review of technology choice, "contracting out" for the necessary expertise and to ensure satisfactory "turnaround time".</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate budget resources for strengthening BAPEDAL, MLH and other central, provincial and local agencies responsible for pollution monitoring and control.</li> <li>• Consider the use of "earmarked" charges on industrial pollution to improve resource availability and to provide "budget neutral" financial assistance to smaller firms for waste minimization, joint waste-treatment and similar initiatives.</li> </ul>	<ul style="list-style-type: none"> <li>• Clarify the legal mandate for pollution control, and strengthen the institutional capacity to implement pollution control strategies, including laboratories, pollution monitoring and control authorities, and the legal system, including alternative procedures for resolving disputes.</li> <li>• Establish a capacity for supporting "pollution prevention pays" campaigns, including environmental efficiency audits and industry-specific technical assistance.</li> <li>• Finalize the draft regulations on the storage, transport and treatment of hazardous waste, and develop the institutional capacity for effective regulation and emergency response.</li> <li>• Strengthen the AMDAL capacity of key government agencies responsible for industrial sector investment approvals and the integration of waste minimization, "clean technology" and cost-effective pollution control measures into industrial sector policy.</li> </ul>	<ul style="list-style-type: none"> <li>• Review the legal and administrative issues involved in the introduction of direct charges on industrial water and air pollution, including the possibility of "earmarking" those charges to fund pollution monitoring and control programs and a program of positive incentives for waste reduction and treatment-- especially for smaller firms.</li> <li>• Develop more precise estimates of the current and future level of toxic and hazardous waste generated in specific areas as a key element in planning for waste treatment facilities.</li> <li>• Carry out further studies of the appropriateness and availability of "clean technology", including cost differences for different sectors.</li> </ul>

**Table 11: INDUSTRIAL POLLUTION CONTROL**

<b>Policy Reform</b>	<b>Expenditures/Investments</b>	<b>Institutional Strengthening</b>	<b>Areas for Further Study</b>
<ul style="list-style-type: none"><li>• Encourage the adoption of more responsible attitudes to sustainable development by the business community, including a "waste mimimization/clean technology" approach to process innovation as an element of competitive business development strategy for the longer term.</li></ul>		<ul style="list-style-type: none"><li>• Encourage private sector development of industrial estates to improve the location of industrial firms and to take advantage of economies of scale in the provision of waste-treatment facilities.</li></ul>	

**INDONESIA: ENVIRONMENT AND DEVELOPMENT  
CHALLENGES FOR THE FUTURE**

**ANNEXES**

# ANNEXES

## CONTENTS

	<u>Page No.</u>
ANNEX A. Contributors to this Report . . . . .	231
ANNEX B. Tables . . . . .	233
ANNEX C. Methodologies Used in this Report . . . . .	239
C1. Basic Economic Projections . . . . .	239
C2. Demographic Projections . . . . .	241
C3. Indonesian Manufacturing Projections . . . . .	243
C4. The Industrial Pollution Projection System . . . . .	245
C5. Estimating The Costs of Environmental Pollution . . . . .	248
C6. Priority Rankings for Major Issues . . . . .	260
ANNEX D. The Global Warming Issue . . . . .	263
ANNEX E. Indonesia's AMDAL (EIA) Program . . . . .	269
ANNEX F. The Management of Aquatic Resources . . . . .	274
ANNEX G. Selected References . . . . .	280

## CONTRIBUTORS TO THIS REPORT

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The analysis of **industrial sector growth, projections of industrial sector pollution and estimated abatement costs** are based on the work of a team of Bank and non-Bank staff led by David Wheeler. (See Annexes C-3 and C-4 for a description of this work and the various staff and agencies involved.)

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5. The principal author of the Chapters in the main text was Richard Calkins, with initial drafts of Chapters 2 and 3 and the Tables in Chapter 7 prepared by Andres Liebenthal. Swati Ghosh made a major contribution to the analysis contained in Chapters 1 and 5, and Don Hanna provided additional material for Chapter 4. Paul Martin contributed to the section on industrial pollution in Chapter 3, with assistance from Shakeb Afsah on the graphics.

6. The Tables in Annex B were prepared by Swati Ghosh, who also drafted Annex C-1. Annex C-2, and the demographic projections used in the report, were contributed by Eduard Bos. Paul Martin prepared Annexes C-3 and C-4, with assistance from David Wheeler. Annex C-5 was written by Andres Liebenthal, who also contributed Annex D. Annex C-6 and Annex E were written by Richard Calkins. Sofia Bettencourt contributed Annex F. Sharon Gustafson served as the Administrative Assistant, and guided the overall production of the report—including compiling the references in Annex G.

7. The main mission visited Indonesia in June/July, 1992. A draft of the report was discussed with Government agencies during missions in September and November 1993, and the final draft of the report was cleared by Government in March 1994.

**Table 1: GDP**  
(Rp billion, in constant 1983 prices)

Sector	1971	1980	1990	2000	2010
Oil/LNG	9,607	19,531	21,145	23,188	23,484
Non-oil					
Agriculture	11,702	16,242	22,423	29,510	39,659
Manufacturing	2,210	6,696	17,150	46,284	120,049
Services	10,556	22,990	45,588	82,686	148,079
Other <sup>a/</sup>	1,419	4,833	8,837	20,915	37,456
Total	35,493	70,293	115,143	202,583	368,727

<sup>a/</sup> Includes construction and electricity & non-oil mining.

Source: BPS and World Bank staff estimates.

**Table 2: SHARE OF TOTAL GDP**  
(percent)

Sector	1971	1980	1990	2000	2010
Oil/LNG	27.1	27.8	18.4	11.5	6.4
Non-oil					
Agriculture	33.0	23.1	19.5	14.6	10.8
Manufacturing	6.2	9.5	14.9	22.8	32.6
Services	29.7	32.7	39.6	40.8	40.2
Other <sup>a/</sup>	4.0	6.9	7.7	10.3	10.2
Total	100.0	100.0	100.0	100.0	100.0

<sup>a/</sup> Includes construction and electricity & non-oil mining.

Source: BPS and World Bank staff estimates.

**Table 3: CONTRIBUTION TO TOTAL GDP GROWTH  
(percent)**

Sector	1971-1980	1980-1990	1990-2000	2000-2010
Oil/LNG	28.5	3.6	2.3	0.2
Non-oil				
Agriculture	13.0	13.8	8.9	6.4
Manufacturing	12.9	23.3	33.3	44.4
Services	35.7	50.4	42.4	39.4
Other <i>a/</i>	9.8	8.9	13.0	9.7
Total	100.0	100.0	100.0	100.0

*a/* Includes construction and electricity and non-oil mining.

Source: BPS and World Bank staff estimates.

**Table 4: EMPLOYMENT  
(in millions)**

Sector	1971	1980	1990	2000
Oil/LNG	0.03	0.03	0.03	0.036
Non-oil				
Agriculture	26.50	33.50	42.37	50.00
Manufacturing	2.70	4.90	7.69	12.79
Services	5.40	11.20	16.05	25.53
Other <i>a/</i>	6.80	10.10	9.69	9.70
Total non-oil	41.40	59.70	75.80	96.02
Total	41.43	59.73	75.83	98.05

*a/* Includes electricity, gas & water, construction, public services and non-oil mining.

Source: BPS and World Bank estimates.

**Table 5: SHARE OF TOTAL EMPLOYMENT  
(percent)**

Sector	1971	1980	1990	2000
Oil/LNG	0.07	0.06	0.04	0.03
Non-oil				
Agriculture	63.96	56.08	55.87	51.00
Manufacturing	6.52	8.20	10.14	13.04
Services	13.03	18.75	21.17	26.04
Other <u>a/</u>	16.41	16.91	12.78	9.89
Total Non-oil	99.93	99.94	99.96	99.97
Total	100.00	100.00	100.00	100.00

a/ Includes electricity, gas & water, construction, public services and non-oil mining.

Source: BPS and World Bank estimates.

**Table 6: CONTRIBUTION TO EMPLOYMENT GROWTH  
(percent)**

Sector	1971-1980	1980-1990	1990-2000
Oil/LNG	0.0	0.0	0.0
Non-oil			
Agriculture	38.2	55.1	34.3
Manufacturing	12.0	17.3	23.0
Services	31.7	30.1	42.7
Other <u>a/</u>	18.0	-2.5	0.0
Total Non-oil	100.0	100.0	100.0
Total	100.0	100.0	100.0

a/ Includes electricity, gas & water, construction, public services and non-oil mining.

Source: BPS and World Bank estimates.

**Table 7: EXPORT SHARE IN CURRENT PRICES  
(percent)**

Sector	1971	1980/81	1990	2000
Oil/LNG	36.4	81.9	45.1	16.1
Non-oil				
Agriculture	52.4	11.9	16.1	15.3
Manufacturing	4.5	3.0	33.8	61.6
Other <i>a/</i>	6.7	3.3	5.0	7.1
Total Non-oil	63.6	18.1	54.9	83.9
Total	100.0	100.0	100.0	100.0

*a/* Includes non-oil mining.

Source: BPS and World Bank estimates.

**Table 8: CONTRIBUTION TO EXPORT GROWTH  
(percent)**

Sector	1971-1980	1980-1990	1990-2000
Oil/LNG	70.9	44.2	-14.1
Non-oil			
Agriculture	16.7	4.6	20.5
Manufacturing	7.5	47.3	82.1
Other <i>a/</i>	5.0	3.9	11.5
Total Non-oil	29.1	55.8	114.0
Total	100.0	100.0	100.0

*a/* Includes non-oil mining.

Source: BPS and World Bank Estimates.

**Table 9: DIRECT CONTRIBUTION OF NATURAL RESOURCES TO GDP**  
**(Rp billion, in constant 1983 prices)**

	1971	1980	1990	2000	2010
Renewable Resources	11,702.0	16,242.0	22,423.5	29,509.5	39,659.0
Agriculture	9,853.1	13,448.4	19,483.1	25,252.0	33,316.6
Food Crops	6,904.2	9,566.5	14,130.6	17,941.8	23,359.1
Other Crops	1,743.6	2,306.4	3,211.5	4,205.1	5,274.6
Livestock	1,205.3	1,575.5	2,141.0	3,364.1	4,897.9
Fishing	795.7	1,104.5	1,926.9	3,138.0	5,111.4
Forestry	1,053.2	1,689.2	1,013.5	1,119.5	1,231.0
Exhaustible Resources	9,607.0	19,697.2	21,882.2	24,861.2	26,480.4
Oil & LNG	9,607.0	19,531.0	21,145.0	23,188.0	23,484.0
Other mining	n.a.	166.2	737.2	1,673.2	2,996.4
Total <sup>1</sup> Primary Resource Use	21,309.0	35,939.2	44,305.7	54,370.7	66,139.4
Total GDP	35,493.0	70,293.0	115,143.0	202,583.0	368,727.0

Source: BPS and various World Bank reports and staff estimates.

**Table 10: TOTAL POPULATION  
(in thousands)**

	1970	1980	1990	2000	2010	2020
Java	76,086	91,271	106,919	120,902	134,045	145,741
Sumatra	20,809	26,017	36,232	43,981	51,087	57,833
Kalimantan	5,155	6,723	9,059	11,402	13,606	15,757
Sulawesi	8,527	10,409	12,447	14,151	15,863	17,304
Other	8,632	11,073	13,576	16,077	18,418	20,424
Indonesia	119,209	147,062	178,233	206,513	233,019	257,059

**Table 11: URBAN POPULATION  
(in thousands)**

	1971		1980		1990		2000		2010		2020	
	Urban	% of total	Urban	% of total	Urban	% of total						
Java	13,731	18.0	22,926	25.2	37,514	35.1	52,711	43.6	68,573	51.2	84,727	58.1
Sumatra	3,698	17.8	5,480	19.6	9,579	26.4	13,893	31.6	18,388	36.0	23,042	39.8
Kalimantan	1,124	21.8	1,441	21.4	2,513	27.7	3,643	32.0	4,823	35.4	6,045	38.4
Sulawesi	1,403	16.5	1,654	15.9	2,909	23.4	4,228	29.9	5,598	35.3	7,015	40.5
Other	658	7.6	1,465	13.2	2,606	19.2	3,817	23.7	5,075	27.6	6,378	31.2
Indonesia	20,613	17.3	32,966	22.4	55,121	30.9	78,292	37.9	102,457	44.0	127,207	49.5

a/ Definition of "urban" was changed between the 1971 and 1980 census; thus, figures from 1971 are not comparable with those of later dates.

**Table 12: RURAL POPULATION  
(in thousands)**

	1971	1980	1990	2000	2010	2020
Java	62,355	67,914	69,405	68,191	65,472	61,014
Sumatra	17,112	22,537	26,653	30,088	32,699	34,791
Kalimantan	4,031	5,282	6,546	7,759	8,783	9,712
Sulawesi	7,124	8,755	9,538	9,923	10,265	10,289
Other	7,974	9,608	10,970	12,260	13,343	14,046
Indonesia	98,596	114,096	123,112	128,221	130,562	129,852

Source: Central Bureau of Statistics, Census Reports 1971, 1980, and 1990, and SUPAS 1985.

## BASIC ECONOMIC PROJECTIONS

1. **Overall Framework.** The macroeconomic projections of growth, structure of output, exports and employment are based on a Revised Minimum Standard Model (RMSM) consistency model for Indonesia. The central assumption underpinning the projections is a target growth rate of non-oil GDP of 6.5-7% per annum. This rate of growth is considered necessary to achieve Indonesia's goal of absorbing its growing labor force at higher levels of productivity and income during REPELITA VI and beyond. The growth target has to be achieved, however, within two constraints: an external balance constraint and a domestic savings constraint. The external balance constraint arises from the need to reduce the current account deficit to around 2% of GDP over the decade, in order to reduce Indonesia's debt burden to more prudent levels. Given the current account deficit target, and the import requirements associated with a 6.5-7.0% per annum growth rate of non-oil GDP, the model projects a consistent path of total exports of about 6.5% per annum (and around 12% for non-oil exports). Given the current account deficit (foreign savings) and the investment requirements needed to sustain the target growth path, the model then checks for consistency, i.e., that the level of domestic savings available is consistent with the growth and foreign savings path. The model thus ensures that the projected paths for the macroeconomic variables are consistent with each other.

**TABLE 1: GROWTH OF GDP**  
(% per annum)

Sector	Actual 1980-1990	Projected 1990-2000	Projected 2000-2010
Oil/LNG	0.8	0.9	0.1
Non-oil	6.4	6.7	6.8
Agriculture	3.3	3.0	2.8
Manufacturing	9.9	10.4	10.0
Services	7.1	6.1	6.0
Other <sup>a/</sup>	6.2	8.6	6.4
<b>Total</b>	<b>5.1</b>	<b>5.8</b>	<b>6.2</b>

<sup>a/</sup> Includes construction and electricity & non-oil mining.

Source: BPS and World Bank staff estimates.

2. **Structural Composition of Output, Employment and Exports.** The structural change in output is projected on the basis of sectoral, supply side factors and the changing structure of demand associated with growing incomes, based on cross country evidence. The projected sectoral growth rates during 1990-2010 are given in Table 1. The employment levels are derived from the projected structure of output and sectoral employment elasticities. The composition of exports are based on supply side considerations, external market constraints (such as NTBs), and prospects on the demand side.

3. **The Level and Pattern of Resource Use.** The level and pattern of resource use is based on the projections of the structural composition of output. Renewable resources comprise of agriculture, forestry and fishing. Exhaustible resources comprise of oil/LNG and other mining. These two together make up projections of total primary resource use. Projections of the composition within manufacturing and therefore the "indirect" contribution of natural resources (in the form of basic processing of commodities), have been based on an analysis of the changing composition of manufacturing at different per capita income levels, taken from a large sample of industrialized and industrializing countries (discussed in Annex C3 below). Table 2 gives the estimated growth in the contribution of natural resources to GDP during 1990-2010.

**Table 2: GROWTH OF DIRECT CONTRIBUTION OF NATIONAL RESOURCES  
(% per annum)**

	Actual 1980-1990	Projected 1990-2000	Projected 2000-2010
Renewable Resources	3.3	2.8	3.0
Agriculture <sup>a/</sup>	3.8	2.8	2.8
Fisheries	5.7	5.0	5.1
Forestry	-5.0	1.0	1.0
Exhaustible Resources	1.1	1.3	0.6
Total Primary Resource Use	2.0	2.0	1.9

<sup>a/</sup> Excluding Fisheries and Forestry

Source: BPS and World Bank staff estimates.

## DEMOGRAPHIC PROJECTIONS

1. **Base Population.** Total population for the base-year (1990) population is from the October 1990 census, projected to mid-year 1990.
2. **Age Structure.** The distribution of the 1990 population by age and sex is a projection made by Biro Pusat Statistik (BPS) (1988) from 1985 Survei Penduduk Antar Sensus (SUPAS) data, adjusted to agree with the 1990 census results. Future age structures are obtained through cohort-component projection, i.e., application of age-specific fertility, mortality, and migration rates to the 1990 age distribution.
3. **Fertility Level and Trend.** Fertility is specified as sets of age-specific fertility rates and total fertility rates (TFR) for the first projection period (1990-95). For Indonesia as a whole and for the three large aggregates consisting of Java-Bali, Outer Islands I, and Outer Islands II, these are derived from the preliminary 1991 Demographic and Health Survey results. For individual provinces, fertility rates are from the 1988 BPS publication, adjusted to conform with overall levels. Future TFRs are projected on the basis of an assumed year in which the net reproduction rate reaches one which varies between 1995 and 2015, depending on the current level of the TFR.
4. **Mortality Level and Trend.** Mortality is specified as Coale-Demeny model life table levels, selected on the basis of infant mortality and overall life expectancy. To allow greater flexibility in mortality patterns, life table levels are split at age 15, i.e., different levels may be indicated for those under 15 and those over 15. Estimates of current mortality are based on an analysis of children ever born and children surviving, as reported for aggregate regions in the sub-sample drawn from the 1990 census (3PS, 1991). For individual provinces, mortality rates are from the 1988 BPS publication, adjusted to conform with overall levels. Future mortality rates are also specified as Coale-Demeny model life tables, and show declining mortality over time following a standard pattern (Bulatao, et al., 1989).
5. **Migration Level and Trend.** Estimates of net migration for aggregate regions are based on a tabulation in the 1990 census sample volume (BPS, 1991). For individual provinces, migration is treated as a residual indicated by projecting 1980 census results to 1990. The age pattern of migration is based on a model (Hill, 1991). Future net migration is assumed to remain constant in number, resulting in declining migration rates. Overall net migration is zero, i.e., international net migration is assumed to be insignificant.
6. **Rural-Urban Projections.** Estimates and projections of the urban-rural populations of the larger islands are made on the basis of trends observed between the 1990 and 1980 censuses in percent urban, which is used to calculate urbanization rates.
7. **Degree of Consistency of Projections.** The projections of individual provinces are, by and large, consistent with those of the larger islands groups, with urban and rural projections, and with the overall projection of Indonesia. Inconsistencies in total population are less than 0.25 percent at any year during 1990-2020.

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## INDONESIAN MANUFACTURING PROJECTIONS 1990-2020

1. **Background.** World Bank staff estimated the future growth of industrial sector output, the likely changes in the structure of that output, the location of production by province, and the rural/urban distribution of production. The starting-point for these estimates is historical data (1975-89) on the value of manufacturing output by sector (at the 4-digit ISIC level of aggregation) and by location (down to the Kabupaten level). Estimates of the growth of industrial output are based on Bank staff projections for the level of aggregate growth of the Indonesian economy.

2. **Industrial Composition.** Projections of the changing composition of output are based on estimates of the shares in manufacturing of specific sectors at different levels of per capita income. These estimated shares are calculated from an analysis of a large sample of other industrialized and industrializing countries, using per capita income data adjusted for changes in purchasing power.<sup>1</sup> Beginning with actual shares in Indonesia in 1989, future changes in the structure of production have been estimated on the basis of assumed growth rates of GDP per capita.

3. **Industrial Location.** Projections of the location of future manufacturing output are based on historical data on the rank and size of individual sectors by area, and calculated from projected total industrial output, national changes in sectoral shares, and the estimated future relative share of total production for each geographic area.

4. **Classification by Processing and Assembly Groups.** The purpose of projecting manufacturing output is to facilitate the analysis of future trends in industrial pollution. Since pollutants are harmful residuals from manufacturing, it is reasonable to suppose that activities which are intensive in the processing of primary materials will also be differentially pollution intensive, because of relatively high levels of wastage. This intuition was confirmed on analyzing sectoral pollution intensities divided into two groups, "Processing" and "Assembly", as shown in Table 1. Almost all of the top-quartile sectors ranked by pollution intensity, for all pollutants, are in the "Processing" group. Consequently, this classification serves as a useful summary indicator of trends in the pollution intensity of total manufacturing output.

5. **Caveats and Refinements.** A number of caveats must be attached to the estimates of industrial sector growth, composition and location. Industrial growth prospects are estimated on the basis of overall growth rates, and these in turn are subject to obvious caveats, including the pace of policy reform which will influence both growth rates and the efficiency of industrial sector investments. The projected sectoral shares of industrial production take into account the structure of Indonesian manufacturing output in 1989, which reflects Indonesia's comparative advantage and the policy regime prevailing in that year. Any major policy shifts, technological breakthroughs or changes in resource availability affecting individual sectors could result in significant differences in sectoral shares from the projected results, which assume these underlying factors remain essentially constant. Similarly, the locational analysis is based on the pattern of regional industrial growth over the last 15 years, and does not take into account the effect of future exogenous discontinuities, such as the impact of policies designed to promote regional growth-poles. Further work will aim to refine

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<sup>1</sup> Based on the Summers and Heston International Comparisons Project at the University of Pennsylvania.

these projections by examining in more detail the additional factors likely to affect the growth and location of the most polluting industrial sectors, only seven or eight of which account for 50%-90% of the total load of most pollutants (see Chapter 4, Figure 4.1).

**Table 1: ISIC Sectors by Processing/Assembly Group**

<u>Processing</u>		<u>Assembly</u>	
ISIC	Sector	ISIC	Sector
3110	Food Products	3210	Other Textile Products
3130	Beverages	3220	Wearing Apparel
3140	Tobacco	3230	Leather and Products
3211	Spinning, Weaving	3240	Footwear
3310	Wood Products	3320	Furniture, Fixtures
3411	Pulp, Paper	3410	Other Paper Products
3510	Other Industrial Chemicals	3420	Printing, Publishing
3511	Basic Industrial Chemicals	3520	Other Chemical Products
3512	Agricultural Chemicals	3560	Plastic Products
3513	Synthetic Resins	3810	Metal Products
3522	Drugs and Medicines	3820	Other Machinery n.e.c.
3530	Petroleum Refineries	3825	Office and Computing Machinery
3540	Petroleum and Coal Products	3830	Other Electrical Machinery
3550	Rubber Products	3832	Radio, Television, etc.
3610	Pottery, China, etc.	3840	Transport Equipment
3620	Glass and Products	3841	Shipbuilding, Repair
3690	Non-Metal Products n.e.c.	3843	Motor Vehicles
3710	Iron and Steel	3850	Professional Goods
3720	Non-Ferrous Metals	3900	Other Industries

## THE INDUSTRIAL POLLUTION PROJECTION SYSTEM

1. **The Conceptual Goal.** The Industrial Pollution Projection System (IPPS), developed by World Bank staff, allows estimates of industrial pollution to be made from manufacturing activity data. Although standard engineering estimates of pollutant releases based on mass-balance calculations are available for a large number of processes and technologies, these require more detailed information about the actual technologies employed than is widely available for most developing nations. IPPS is designed to make reasonable estimates of pollutant releases from readily accessible national and international databases. To the extent that production in a particular manufacturing sector is associated with a characteristic form and amount of pollution, analysts can convert information regarding activity in that industry into an estimate of pollution. To perform this conversion, they must multiply the output data by an index of pollution intensity, expressed as a ratio of emissions per unit of manufacturing activity:

$$\text{pollution intensity} = \frac{\text{total emissions}}{\text{total manufacturing activity}}$$

Multiplying this index by the appropriate measure of manufacturing output will then give an estimate of the associated volume of pollution. Analysts can then use IPPS to estimate industrial pollution for any country or area of a particular country, for which manufacturing activity data are available.

2. **The Building Blocks for IPPS.** Pollution intensity, as defined above, has been estimated on the basis of emissions recorded in the U.S. Environmental Protection Agency (EPA) databases and the measures of industrial activity recorded in the U.S. Census of Manufactures (CM). The IPPS project has focused on developing pollution-intensity figures at the four-digit ISIC level of sectoral aggregation, this being the most detailed and comprehensive level of reporting used by UNIDO. To achieve this, reported emissions were summed by ISIC sector and then divided by the summed measure of manufacturing activity within that sector. Three major EPA databases were used in developing IPPS:

- o The Toxic Chemical Release Inventory;
- o The Facility Subsystem of the Aerometric Information Retrieval System; and
- o The Permit Compliance System of the National Pollutant Discharge Elimination System.

In addition, the Human Health and Ecotoxicity Database was employed to provide common units for the chemicals reported in the Toxic Chemical Release Inventory. For industrial activity data, the data was drawn from the Longitudinal Research Database, which is an establishment-level database, constructed from information contained in the U.S. Census of Manufactures (CM).

3. **Construction of Pollution-Intensity Indices.** The first task in the development of a pollution-intensity index from the EPA and LRD data was to match the two sets of information at the facility level. This matching was necessary to ensure that the sector-specific intensities were calculated using emissions and production data from the same set of facilities. Once the matched data-sets were created, the pollution-intensity indices were calculated as outlined above, with pollutant emission expressed as a unit of mass divided by manufacturing activity. The LRD provides a number

of options for the measure of manufacturing activity. Four of the most obvious are (1) physical volume of output, (2) shipment value, (3) value added, and (4) employment. In choosing between them, the need to develop a measure of pollution intensity that could be used for international comparisons discouraged the use of either value added or employment, because of international variations in factor proportions arising from very different relative factor prices. Conceptually, the most appealing choice is physical volume of output, but the information relating to output volume in the UNIDO data, the main source for international comparisons, is not comprehensive. Consequently, we used value-of-shipments as the measure of manufacturing activity in the denominator of the pollution-intensity index. Although this statistic has obvious relative price problems, particularly in the international context, it has the advantages of a relatively complete UNIDO coverage and the usual benefit of the dollar metric in allowing inter-sectoral comparison.

4. **The Application of IPPS.** IPPS pollution intensities are available for seven criteria air pollutants, three measures of water pollution, and four indicators of toxic releases. All these indices represent estimates of pollution intensity for U.S. manufacturing industry in 1987. It is clear that the absolute values of these indices must be adjusted for non-U.S. circumstances, although the relative rankings of the industrial sectors are relatively robust. In order to adjust the indices to reflect current Indonesian industrial practices, a number of recent reports on industrial pollution in Indonesia were consulted. These indicated that industrial pollution intensities in Indonesia are higher than in the U.S., due to differences in both process technology and end-of-pipe controls. Pollutant-specific mark-up factors were developed from the available data and used to adjust the sectoral pollution indices to provide better estimates of pollution loads in Indonesia. A twofold mark-up was applied to all the water pollution parameters, and threefold to all those relating to air pollution, except particulate emissions. For both fine particulates and total particulates, the large difference between the estimated U.S. intensities and the reported Indonesian emissions suggest that a sixfold mark-up should be applied.

5. **Limitations and Further Work.** The IPPS pollution intensity figures are developed from a sample of U.S. manufacturing facilities, and so constitute an estimate of U.S. conditions. Currently work is underway to expand the size of the sample, and so improve the accuracy of the U.S. estimates. However, even with accurate U.S. intensities, a number of sources of variation will continue to affect the reliability of the IPPS pollution estimates for Indonesia. At the four-digit ISIC level of aggregation, there may be significant variation between Indonesia and the U.S. in the product mix within each sector. Further, even with similar intra-sector product composition, the mark-up factors described above represent only a crude adjustment for the difference in the production and pollution control technologies applied in the two countries. Further work by Bank staff will focus on providing a more detailed analysis of the technologies employed in the most polluting industrial sectors, seven or eight of which account for 50%-90% of the total load of most pollutants. In the longer term, given the importance of having reliable data on actual pollution intensities in Indonesia for the development of efficient pollution control policies, some consideration should be given to collecting and analyzing Indonesian data, for example by adding an environmental expenditure component to the BPS survey of manufacturing.

6. **Acknowledgements.** Many people within and outside the World Bank have made invaluable contributions to the continuing development of IPPS. The project was initiated in the Industry and Energy Department of the Bank, progressed in the Environment Department and, under the continued leadership of David Wheeler, now forms part of the research program in the environment unit of the Development Economics Vice Presidency. Team members within the Bank

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## ESTIMATING THE COSTS OF ENVIRONMENTAL POLLUTION

1. An economic evaluation of the damages of pollution would require an understanding of the entire array of sources, interactions, media, dissemination, exposure, response, damage and costs. Unfortunately, the complexity of and the present scarcity of information about the interactions of natural and man-made factors involved in causing pollution and the associated impacts makes it difficult to obtain such an understanding. As a result, this review will be limited to a discussion of available information on some of the damage costs of pollution in order to illustrate the issues involved and contribute at least a notion of some of the economic magnitudes and relative costs that need to be considered.

### The Health Costs of Air Pollution

2. The fact that the death rate from respiratory diseases in Jakarta is about twice the average for Indonesia, suggests that there could be a problem with air pollution in urban areas. However, in spite of the ample descriptive evidence, the available statistical information on Indonesia is insufficient to conclusively establish a linkage between respiratory conditions and indoor and outdoor air pollution. Nevertheless, to illustrate the approach to be used, and arrive at a preliminary quantification of the health impacts of outdoor air pollution, it is useful to apply some results obtained from other countries, mainly the U.S., U.K. and Canada. The approach involves four steps:<sup>1</sup>

- (a) the first step is to develop estimates of the change in the probability of a given health effect associated with a change in ambient air quality, i.e., the slope of a dose-response function. In the absence of adequate data from Indonesia, dose-response functions have been taken from the published epidemiological literature.
- (b) the second step involves multiplying this slope by the affected population. For certain pollution-related health effects this may include the entire exposed population, for other effects there may be particularly sensitive groups such as children, asthmatics, or individuals with pre-existing chronic respiratory disease.
- (c) the next step involves the change in air quality under consideration. For the purposes of illustration, it is postulated that the relevant pollutant concentrations will change from the existing levels to the proposed Indonesian standards (See Table 1).<sup>2</sup>
- (d) finally, the economic value of the health impacts is developed based on tentative assumptions about the willingness-to-pay to reduce mortality and estimates of the cost of illness.

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<sup>1</sup> For a detailed description, see Ostro, B., Estimating the Health and Economic Effects of Air Pollution: Applications to Jakarta and Mexico City, Policy Research Working Paper, World Bank (in preparation).

<sup>2</sup> The mission's air dispersion matrices for Jakarta are based on Bachrun, R., Air Pollution Monitoring and Control (First Jabotabek Urban Development Project). Draft Interim Report, Institut Teknologi Bandung for Ministry of Communications, 1991.

**Table 1: NATIONAL AMBIENT AIR QUALITY STANDARDS**

No.	Parameter	Time of Measurement	Standards
1	Sulfur dioxide	24 hours	260 $\mu\text{g}/\text{m}^3$ (0.10 ppm)
2	Carbon monoxide	8 hours	2260 $\mu\text{g}/\text{m}^3$ (20 ppm)
3	Nitrogen oxides	24 hours	92.50 $\mu\text{g}/\text{m}^3$ (0.05 ppm)
4	Ozone	1 hour	200 $\mu\text{g}/\text{m}^3$ (0.10 ppm)
5	Dust	24 hours	260 $\mu\text{g}/\text{m}^3$
6	Lead	24 hours	0.06 $\mu\text{g}/\text{m}^3$
7	Hydrogen sulphide	30 minutes	42 $\mu\text{g}/\text{m}^3$ (0.03 ppm)
8	Ammonia	24 hours	1360 $\mu\text{g}/\text{m}^3$ (2 ppm)
9	Hydrocarbon	3 hours	160 $\mu\text{g}/\text{m}^3$ (0.24 ppm)

Source: The Decree of the State Minister for Population and the Environment No. 02/1988. Annex III, p. 29

**DRAFT NATIONAL AMBIENT AIR QUALITY STANDARDS FOR INDONESIA**

No.	Parameter	Measuring Time	Standard
1	Sulfur dioxide	1 hour 24 hours 1 year	900 $\mu\text{g}/\text{m}^3$ (0.34 ppm) 300 $\mu\text{g}/\text{m}^3$ (0.11 ppm) 60 $\mu\text{g}/\text{m}^3$ (0.02 ppm)
2	Carbon monoxide	1 hour 8 hours	30,000 $\mu\text{g}/\text{m}^3$ (26 ppm) 10,000 $\mu\text{g}/\text{m}^3$ (9 ppm)
3	Nitrogen dioxide	1 hour 24 hours 1 year	400 $\mu\text{g}/\text{m}^3$ (0.21 ppm) 150 $\mu\text{g}/\text{m}^3$ (0.08 ppm) 100 $\mu\text{g}/\text{m}^3$ (0.05 ppm)
4	Oxidant as O <sub>3</sub>	1 hour	160 $\mu\text{g}/\text{m}^3$ (0.08 ppm)
5	Suspended particulates	24 hours 1 year	230 $\mu\text{g}/\text{m}^3$ 90 $\mu\text{g}/\text{m}^3$
6	Lead	24 hours 1 year	2.0 $\mu\text{g}/\text{m}^3$ 1.0 $\mu\text{g}/\text{m}^3$
7	Hydrocarbon	3 hours	160 $\mu\text{g}/\text{m}^3$

Remarks: These values have been determined based on the following at the atmospheric conditions, i.e., temperature: 25°C, and 1 atmosphere.

3. Based on the above approach, the mission prepared illustrative estimates of the health effects of outdoor air pollution in Jakarta. Separate estimates were prepared for total suspended particulates (TSP), lead and NO<sub>x</sub>. Estimates for other pollutants such as carbon monoxide, ozone and sulfur dioxide have not been covered because of a lack of monitoring (O<sub>3</sub>), a lack of well-developed dose-response functions (CO), and concentrations that are below the ambient air quality standards (SO<sub>2</sub>).

4. **Total Suspended Particulates (TSP).** TSP is the most widely monitored pollutant in Indonesia, mainly because it is highly visible and relatively easy to measure. On an annual average basis, the measured concentrations in Jakarta range from 181  $\mu\text{g}/\text{m}^3$  to 392  $\mu\text{g}/\text{m}^3$ , as compared to the proposed standard of 90  $\mu\text{g}/\text{m}^3$ . This information suggests that at all measurement stations in Jakarta, TSP concentrations have consistently been at a least twice the proposed annual average standards. Indeed, Indonesians already experience high rates of mortality and morbidity from acute respiratory infections and high prevalence of chronic respiratory disease. The 1990 Census indicates that among children under five, acute respiratory infections account for 14.4% of all mortality. Its is the second leading cause of death after diarrheal disease which accounts for 15.6% of all mortality in this age group. For the population as a whole, based on the 1986 Household Health Survey<sup>3</sup>, inflammation of the respiratory tract what the sixth leading cause of death (after accidents, diarrhea, cardiovascular disease, tuberculosis and measles), accounting for 6.2% of all mortality.<sup>4</sup> In Jakarta, however, this outcome accounts for 12.6% of all mortality.<sup>5</sup>

5. Epidemiologic studies carried out mostly in the U.S. provide statistically significant estimates of the dose-response relationship between concentrations of TSP and several adverse health outcomes including: mortality, respiratory hospital admissions, emergency room visits, restricted activity days for adults, lower respiratory illness for children, asthma attacks and chronic disease. Although similar studies have not been undertaken in Indonesia, one set of data from Bandung was used to verify the applicability of the TSP/mortality relationship. On this basis, the adverse health outcomes that can be attributed to the excess of TSP levels in Jakarta above the proposed standards are estimated as follows:

- (a) **Mortality.** A review of regressions run in epidemiologic studies suggest that, as a central estimate, a 10  $\mu\text{g}/\text{m}^3$  change in TSP is associated with a 0.682 percent change in mortality, with upper and lower confidence intervals of 0.891% and 0.478%, respectively. Given Jakarta's 1990 population of 8.2 million and crude mortality rate of 0.007, the excess mortality attributable to the excess level of pollution can be estimated at about 1,500 deaths per year (with upper and lower confidence intervals of about 1,950 and 1,050, respectively.).

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<sup>3</sup> By the Ministry of Health.

<sup>4</sup> In the U.S., diseases related to respiratory tract inflammation account for about 4.4% of all mortality.

<sup>5</sup> Ministry of Health, Health Ecology Research Center, 1991.

- (b) **Morbidity.** In addition to the excess mortality, a high level of TSP pollution is also associated with a significant incidence of morbidity. On the basis of applying relationships obtained from studies in other countries, the annual effects in Jakarta can be tentatively estimated at about six million restricted activity days (days spent in bed, days missed from work and other days significantly restricted due to illness), in addition to about 41,000 emergency room visits and 18,000 respiratory hospital admissions, about 100,000 cases of lower respiratory illness (mainly cough and bronchitis) in children, and about 300,000 asthma attacks.

6. **Lead.** The average 24-hour concentrations measured in Jakarta ranged between 0.5 - 2.0  $\mu\text{g}/\text{m}^3$ , with the highest values during the wet season. These results are just under the proposed standard of 2.0  $\mu\text{g}/\text{m}^3$ . However, considering the location of the stations, it can be postulated that lead concentrations must be far above the standards in the more heavily trafficked areas of Jakarta, and some other major cities. This is consistent with the findings of the two epidemiological studies summarized below.

7. Two recent Indonesian studies point to the health impact of lead pollution in urban areas. A 1987 study compared the blood lead levels of a cohort of *bemo* (tricycle) drivers in downtown Jakarta with a control group of farmers living in the suburbs.<sup>6</sup> The *bemo* drivers had double the level of lead in the blood, 18.4  $\mu\text{g}/\text{dl}$ , versus the control group's average of 9.0  $\mu\text{g}/\text{dl}$ .<sup>7</sup> A 1991 study measured the blood lead levels in *bemo* drivers (7.0  $\mu\text{g}/\text{dl}$ ), street vendors (9.3  $\mu\text{g}/\text{dl}$ ), slum dwellers (29  $\mu\text{g}/\text{dl}$ ) and a control group of rural residents (6.5  $\mu\text{g}/\text{dl}$ ).<sup>8</sup> Among the slum dwellers, 74% had blood lead levels above 30  $\mu\text{g}/\text{dl}$ , versus 14% in the control group. These data, although sparse, indicate that urban slum dwellers and street vendors are at significant risk from lead exposure. Since a large portion of Jakarta residents live in densely populated districts with heavily travelled streets, and a large share of the economy consists of an informal sector of street vendors and markets, it is likely that exposure to lead is a significant problem.

8. Several studies estimate the associated dose-response relationships using data from the U.S. Based on these relationships, it can be estimated that the health effects of excessive ambient air concentrations of lead in Jakarta include about 62,000 cases of hypertension (diastolic pressure greater than 90 mm Hg) and 350 cases of coronary heart disease, 340 cases of mortality related to cardiovascular disease in adult men, and some decline in the intelligence of children.<sup>9</sup>

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<sup>6</sup> Tri-Tugaswati, A. et al., Health Effects of Air Pollution due to Automotive Lead in Jakarta, Asia Pacific Journal of Public Health 1(4), 1987.

<sup>7</sup> To put this number into perspective, the average blood lead level in the U.S. in 1975 (just as unleaded gasoline was being adopted) was around 16  $\mu\text{g}/\text{dl}$ .

<sup>8</sup> Achmadi, U.F., Risk Analysis of the adverse effects of air pollutants (CO and Pb) to the urban population of Jakarta, University of Indonesia, 1991.

<sup>9</sup> Based on the mission's review of the epidemiological literature, a 1.0  $\mu\text{g}/\text{m}^3$  increase in air lead concentration is associated with a loss of 0.975 IQ points on average for all exposed children.

9. **Nitrogen Dioxide.** NO<sub>x</sub> measurements at eleven stations in Jakarta show generally low, albeit increasing values, with the highest average at about half the proposed standard of 100 µg/m<sup>3</sup> (24-hour average). As with lead, however, recent roadside measurements carried out in Jakarta, ranging from 80 to 190 µ/m<sup>3</sup> and Bandung, of around 100 µ/m<sup>3</sup>, show concentrations close to or above the standard. The difference between the station records and the roadside measurements is not surprising, considering the location of the stations.

10. The epidemiologic evidence indicates a statistically significant relationship between ambient air NO<sub>2</sub> concentration and the increased likelihood of phlegm production. Based on this relationship, it can be estimated that the incremental respiratory symptoms attributable to NO<sub>2</sub> concentrations at current levels, as compared to the proposed standard, is about 1.8 million cases per year. In addition, NO<sub>2</sub> is a precursor of ozone, nitrates (a constituent of TSP), nitric acid, and potentially carcinogenic nitrogen compounds. Finally, at higher levels of exposure, there is evidence that NO<sub>2</sub> may be associated with respiratory symptoms and disease in children.

11. Table 2 provides a summary of the health impacts of the air pollutants discussed above.

**Table 2: HEALTH IMPACTS OF SELECTED AIR POLLUTANTS IN JAKARTA, 1990**  
(units/year)

Pollutant	Lower Confidence Interval	Central Estimate	Upper Confidence Interval
<b><u>Total Suspended Particulates:</u></b>			
Avoidable Mortality (cases)	1,050	1,500	1,950
Restricted Activity Days	4,400,000	6,200,000	9,800,000
Outpatient Visits	22,000	41,000	59,000
Hospital Admissions	11,000	18,000	24,000
Respiratory Illness (children)	49,000	104,000	147,000
Asthma Attacks	153,000	303,000	451,000
Respiratory Symptoms (days)	37,000,000	46,000,000	58,000,000
<b><u>Lead:</u></b>			
Avoidable Mortality (cases)		340	
Hypertension (cases)		62,000	
Myocardial Infarction (cases)		350	
IQ Loss in Children (points)		300,000	
<b><u>Nitrogen Dioxide:</u></b>			
Respiratory Symptoms (days)	1,000,000	1,800,000	2,500,000

12. **Economic Cost of Health Effects.** In principle, the economic cost of a health effect should reflect the full impact to the affected individuals, including out-of-pocket expenses, such as medical costs and lost income (i.e., the "cost of illness"), and less tangible effects on well-being, such as pain and discomfort and restrictions on non-work activities. On this basis, the full economic value of the health effect is reflected by an individual's "willingness to pay" to avoid or reduce the health effect.

13. In practice, willingness to pay (WTP) estimates for a change in the mortality risk or a health effect are difficult to obtain, particularly for small changes in such probabilities. Studies carried out in the U.S. and U.K. evaluated the implicit WTP expressed as wage premiums associated with on-the-job risks and surveyed the explicit WTP for avoiding such risks.<sup>10</sup> These studies conclude that most of the reasonable estimates of the WTP to avoid a mortality risk increment of 0.0001 are clustered in the range of \$300 to \$700 per year. In the absence of any such studies in Indonesia, it can be postulated that the WTP in Indonesia is in the same proportion to income level. I.e., if Indonesian wages are, on average, one-fortieth of U.S. wages<sup>11</sup>, then the WTP in Indonesia can be assumed to be, on average, one-fortieth that in the U.S. Thus, the WTP to avoid an increment in mortality risk of 0.0001 in Indonesia could range from \$7.5 to \$17.5 per year.

14. Summing this WTP across all people can provide an estimated value of a statistical life. Rather than the value for any particular individual's life, the value of a statistical life represents what the whole community is willing to pay for reducing each member's risk by a small amount. Thus, if the postulate above is correct, the implied economic value of an avoided statistical death would range from \$75,000 to \$175,000.

15. As an alternative approach, it can be postulated that, at the very least, the economic value of an avoided death is equivalent to the discounted present value of lifetime income. For the case of Jakarta, the DPV of lifetime income can be postulated at, say, \$10,000. Given a range of \$75,000 to \$175,000 with the WTP approach and \$10,000 with the DPV approach, a value of \$75,000 would fall about in the middle of the range, and thus represent an approximate central value.

16. Given the above estimate that, in Jakarta, about 1,500 deaths annually can be attributed to excessive ambient air concentrations of TSP, and applying the central value of \$75,000, the economic benefit of avoiding this health outcome is about \$112.5 million, with a range of \$15 million to \$262 million depending on the value used for an avoided death. In the same way, the value of avoiding the projected excess of 340 deaths annually from coronary heart disease associated with the excess of ambient air lead concentrations would be about \$25.5 million, with a range from \$3.4 million to \$59.5 million.

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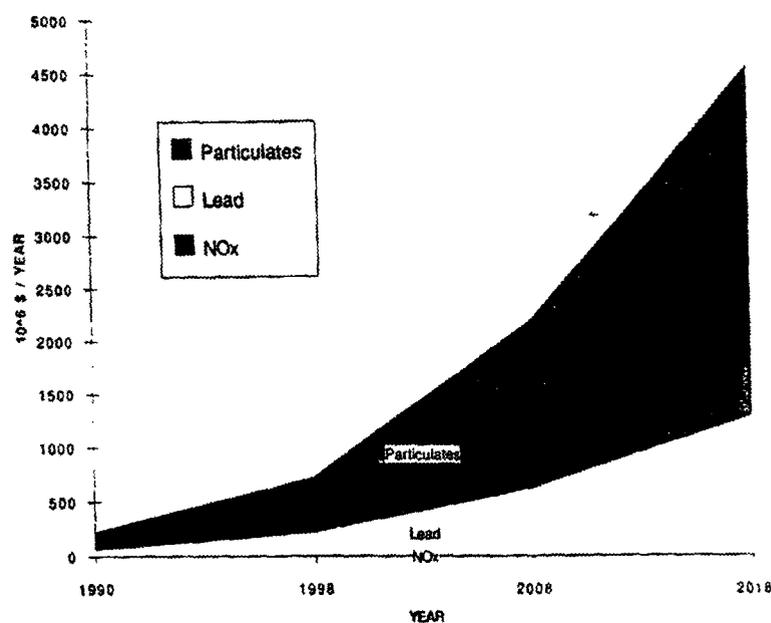
<sup>10</sup> See for example Fisher, A., L.G. Chestnut and D.M. Violette, The Value of Reducing Risks of Death: A Note on New Evidence, Journal of Policy Analysis and Management, Vol. 8, No.1, pp. 88-100, 1989, and Viscusi, W. Kip, Fatal Tradeoffs: Public and Private Responsibilities for Risk, Oxford University Press, New York, 1992.

<sup>11</sup> Based on comparison of GDP/capita at official exchange rates. Based on purchasing power parity, Indonesian GDP/capita is about one-tenth of that of the US.

17. For the valuation of morbidity, WTP estimates are difficult to come by and the mission had to rely on cost of illness estimates from the literature and Indonesian sources. Based on a recent Bank report<sup>12</sup>, the cost per hospital inpatient day (in a state-owned facility) in Indonesia was valued at \$9 to \$137, and an outpatient visit at \$7 to \$26. These values bracket equivalent estimates obtained in the U.S. when adjusted by a 1:40 average wage rate index. By applying the same adjustment to other cost of illness components obtained from U.S. sources, a day missed from work can be valued at \$3.1, a restricted activity day due to symptoms of illness at \$0.4, an asthmatic attack at an average of \$2.5 (including restrictions in activity, doctor or hospital visits and medication), a case of hypertension at an average of \$5.5 (including days lost from work, physician charges, medication costs and hospitalization costs), and a case of coronary heart disease at \$1,230. Overall, as these morbidity valuations are based on the direct cost of illness, and do not include the indirect effects on well-being associated which would be included in the WTP approach, they will tend to underestimate of the full cost of the health effect.

18. The results of applying these economic costs to the projected health effects of excess levels of air pollution in Jakarta in 1990 are summarized in Table 3. Of course, unless appropriate measures are taken, these costs will increase rapidly in line with energy use and population increase. As shown in Figure 1, estimates are that these costs could increase ten-fold by 2010 and twenty-fold by 2020.

Figure 1: The Rising Health Costs of Air Pollution in Jakarta



<sup>12</sup> World Bank, Indonesia: Health Planning and Budgeting, Report No. 7291-IND, 1989.

**Table 3: COSTS OF HEALTH DAMAGE FROM AIR POLLUTION IN JAKARTA, 1990**

Pollutant	Quantity <sup>13</sup> (Units/yr)	Unit Value (\$US)	Total Value (million \$US/yr)		
			Low	Central	High
<b><u>Suspended Particulate Matter:</u></b>					
Avoidable Mortality (cases)	1,500	75,000	15	112.5	262.5
Restricted Activity Days	6,200,000	3.1	19.2	19.2	19.2
Outpatient Visits	41,000	16	0.3	0.7	1.1
Hospital Admissions <sup>14</sup>	18,000	260	1.6	4.7	24.7
Respiratory Illness (children) <sup>15</sup>	104,000	5.6	0.6	0.6	0.6
Asthma Attacks	303,000	2.5	0.8	0.8	0.8
Respiratory Symptoms (days)	46,000,000	0.4	18.4	18.4	18.4
<b>Subtotal</b>			<b>55.9</b>	<b>156.9</b>	<b>327.3</b>
<b><u>Lead:</u></b>					
Avoidable Mortality (cases)	340	75,000	3.4	25.5	59.5
Hypertension (cases)	62,000	5.5	0.3	0.3	0.3
Myocardial Infarction (cases)	350	1,230	0.4	0.4	0.4
IQ Loss in Children (points) <sup>16</sup>	300,000	115	36.1	36.1	36.1
<b>Subtotal</b>			<b>40.2</b>	<b>62.3</b>	<b>96.3</b>
<b><u>Nitrogen Dioxide:</u></b>					
Respiratory Symptoms (days)	1,800,000	0.4	0.7	0.7	0.7
<b>Total</b>			<b>96.8</b>	<b>219.9</b>	<b>424.3</b>

<sup>13</sup> Central Estimate, as per Table 2.

<sup>14</sup> The average hospital admission for respiratory disease is assumed to last 10 days, at a cost of \$9-137 per day.

<sup>15</sup> Each illness is assumed to last two weeks and cost \$0.4 per day, including restrictions in activity, doctor or hospital visits and medication.

<sup>16</sup> As discussed above, lead exposure has a neurodevelopmental effect on children, affecting their IQ, their subsequent educational attainment, wage rate and labor force participation. On the basis of Strategic Plan for the Elimination of Childhood Lead Poisoning, Center for Disease Control, U.S. Department of Health and Human Services, 1991, it can be estimated that, on average, each loss of one IQ point results in lost lifetime earnings of \$4,588 per child. Adjusting this figure to Indonesian average wages results in an expected loss in earnings of \$115 per IQ point.

19. These estimates of the health effects of pollution in Indonesia based on dose-response relationships estimated in other countries are fraught with uncertainty. These uncertainties arise from the assumption that the population factors that relate to the sensitivity to air pollution in the U.S. will be similarly distributed in Indonesia. This includes predisposing factors such as age and gender distribution, smoking rates, general health status, exercise and diet, medical access and use, averting behavior and activity patterns, and as alternative pathways for exposure, such as indoor occupational exposures to chemicals, dust and fumes, as well as contaminated food and water.

20. A comparison of activity patterns can be used to indicate the importance of these differences. Studies of populations in the U.S. suggest that people spend about 90% of their time indoors. Many of these indoor environments are well sealed and are subject to limited penetration of outdoor pollutants. Therefore, dose-response relationships between ambient air pollution and health, by necessity, incorporate a large proportion of time spent indoors by most people. This aspect will lead to a significant underassessment of dose when applying the existing dose-response functions to warm climates such as those in Indonesia. If this is true, it is likely that a given level of air pollution, everything else held the same, would generate much greater health effects. Several other predisposing factors, such as the higher prevalence of smoking and chronic respiratory diseases in Indonesia, are also likely to significantly increase the health response to most air pollutants.

21. In regard to alternative sources of exposure, one can point to the higher TSP exposure from indoor cooking with firewood and kerosene fumes, and the likelihood of enhanced lead exposure from water, food, cooking utensils, flaking paint and occupational environments. The relative disease burden of these sources is difficult to establish without additional epidemiological studies. Nevertheless, here again, the above estimates of health effects based solely on exposure to outdoor ambient air concentrations would seem to underestimate of the total exposure levels of the population to the subject pollutants. Overall, the estimates of mortality and morbidity noted above are probably quite conservative.

### **Other Costs and Risks of Air Pollution**

22. In comparison with health effects of air pollution, much less is known about the impacts on other environmental receptors. Of these, the most important ones are believed to be the following (Scholz and Haffner, 1992):

- o **Soil productivity.** The deposition of SO<sub>2</sub> and NO<sub>x</sub> on the surface of the soil can lead to soil acidification, which could affect plant growth and the productivity of the soil. Fortunately, most soils in Java have developed from either volcanic deposits, or from limestone or lime-containing coastal and alluvial deposits, and have basic properties which buffer the effect of acidification. For this reason, for about 95% of Java, soil acidification is unlikely to become a major problem under present pollution levels, except in a critical area<sup>17</sup> around the major urban centers in the western part of Java. For the long term, however, the continuing acidity input from SO<sub>2</sub> and NO<sub>x</sub> pollution may slowly exceed the buffer capacity of the soils in ever greater parts of Java.

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<sup>17</sup> Critical areas are defined as areas where the concentration of at least one pollutant exceeds the threshold level for at least one category of receptor.

- o **Ground water contamination.** The deposition of TSP containing heavy metals, aluminum and nitrate can contribute to ground water contamination. The risk would be greatest in areas with permeable sandy soils and a high ground water table, such as the densely populated northern coastal areas, including the industrial agglomerations of Jakarta-Bogor and Surabaya. The airborne pollutants here would aggravate the already serious risks arising from contamination by polluted surface waters. An estimate of the incremental effects of airborne heavy metals would require more information on their deposition pattern.
- o **Aquatic Ecosystems.** Most of the aquatic ecosystems of Java are already heavily polluted, primarily with industrial effluents and urban waste. Compared to pollution from these sources, the incremental effects cause by airborne pollutants are only likely to be of minor importance.
- o **Materials Damage.** Air pollution, primarily SO<sub>2</sub>, is known to accelerate corrosion of some metals, painted surfaces and stone materials, such as concrete, sandstone and marble. Cost estimates of corrosion damage are uncertain because of the limited information about the dose-response relationships involved, the value of capital stock exposed and maintenance costs. Because of low ambient air concentrations of SO<sub>2</sub> in Indonesia, corrosion damage from air pollution is not expected to be a major problem.<sup>18</sup>
- o **Amenity Loss.** Aside from biological, chemical and physical effects summarized above, air pollution is also a nuisance that reduces the amenity value of every area where it is present. This could have significant economic costs as it reduces the attractiveness of the local environment to tourists and potential investors, as well as the local population.

### **The Health Costs of Water Pollution**

23. While the health impact of water pollution is well understood, a quantitative estimation of this linkage is difficult because of the many causative factors associated with the incidence of waterborne diseases. Due to interactions among causative variables, it remains unclear whether improvements in water quality alone can result in a significant decrease in the incidence without accompanying increases in water availability, as well as the treatment of related risk factors and attitudes concerning basic hygiene, sanitation, drainage, and solid waste. What can be expected is that the provision of a package of services related to the use of water, including human waste disposal, the provision of high quality drinking water, and an education component aimed at improved personal and domestic hygiene, will have significant impact on the incidence of waterborne diseases. In fact, a recent review of 84 studies on water quality and quantity, hygiene and sanitation from 30 different countries indicates that improved water and sanitation can be expected to reduce diarrheal mortality by 55% to 60%, and morbidity by 25%.<sup>19</sup>

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<sup>18</sup> Some of the most treasured cultural sites in Java, notably the Borobudur temple, are exposed to SO<sub>2</sub> emissions from nearby volcanoes.

<sup>19</sup> Esrey, S. et al, Health Benefits from Improvements in Water Supply and Sanitation: Survey and Analysis of the Literature on Selected Diseases, report for USAID, 1990.

24. If the above linkage can be accepted, then the health benefits of improving water supply and sanitation is great, as can be illustrated with the example of Jakarta. Applying the **1986 Household Health Survey** finding that 12% of mortality is due to diarrhea to Jakarta's population of 8.2 million and crude mortality rate of 0.007, yields a diarrhea-related mortality estimate of about 7,000 per year. Using the same willingness to pay estimates discussed above for the case of air pollution, the economic value of reducing this mortality by 55-60% (3,800-4,200 avoided deaths/year) would be about \$38-735 million/year. These estimates are solely based on the WTP of reducing the risk of diarrhea related mortality, and do not include additional benefits associated with reduction in diarrhea related morbidity and reductions in the overall incidence of other waterborne diseases.<sup>20</sup>

25. Diarrheal disease is among the largest causes of morbidity in Indonesia. Based on 1990 Census data for Jakarta, the prevalence of diarrhea among children below age five is about 158.6 episodes per 100 children annually, or about 1,440,000 cases per year. Based on the review cited above<sup>21</sup> the provision of water supply and sanitation can be expected to bring about a 25% reduction in diarrheal disease. For Jakarta, such a reduction from the provision of safe water and adequate sanitation would amount to 360,000 fewer diarrheal episodes per year.

26. The economic value of reducing diarrheal disease will depend on the applicable cost of illness, including doctor and hospital visits, laboratory tests and medication. A recent report indicates that there were 10,600 hospitalizations for diarrhea in Jakarta in 1990. Separately, based on 1990 Census data, about 45% of those reporting an episode of diarrheal disease visited a local health clinic. The remaining cases can be assumed to have been self-medicated. As discussed above, an adequate supply of safe water and sanitation can be expected to reduce the number of cases, and the associated costs, by 25%. On this basis, the economic costs of avoidable diarrheal morbidity can be estimated as \$1.2-6 million annually. Table 4 summarizes the economic costs of diarrheal disease attributable to inadequate water supply and sanitation in Jakarta.

27. Indirect evidence of Indonesian households' willingness to pay for safe water can be obtained from an analysis of sales of bottled water, which have grown from 63,000 m<sup>3</sup> in 1985 to 383,000 m<sup>3</sup> in 1990 and are projected to increase to 1,170,000 m<sup>3</sup> by 1995 (Indonesia Commercial Newsletter, No. 33, 19 May 1991). At an average sale price of Rp 230/liter (in 1991), this implies sales of about \$90 million/year in 1990 and \$270 million in 1995.

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<sup>20</sup> An indirect indication of Indonesian households' willingness to pay for safe water can be obtained from an analysis of sales of bottled water, which have grown from 63,000 m<sup>3</sup> in 1985 to 383,000 m<sup>3</sup> in 1990 and are projected to increase to 1,170,000 m<sup>3</sup> by 1995 (Indonesia Commercial Newsletter, No. 33, 19 May 1991). At an average sale price of Rp 230/liter (in 1991), this implies sales of about \$90 million/year in 1990 and \$270 million in 1995.

<sup>21</sup> Esrey, S. et al, op. cit.

**Table 4: COSTS OF HEALTH DAMAGE FROM UNSAFE WATER IN JAKARTA, 1990**

Health Outcome	Quantity <sup>22</sup> (Units/yr)	Unit Value (US\$)	Total Value (million US\$/yr)		
			Low	Central	High
<u>Diarrheal Disease</u>					
Avoidable Mortality (cases)	3,800-4,200	75,000	40	300	700
Outpatient Visits	162,000	16	1.1	2.6	4.2
Hospital Admissions <sup>23</sup>	2,650	130	0.1	0.3	1.8
<b>Total</b>			41.2	302.9	706

28. The use of willingness-to-pay measures estimated in other countries and adjusted for differences in the level of earnings in Indonesia does not provide a satisfactory estimate of actual health damage costs in Jakarta. Their use in the above calculations is intended simply to provide an "order of magnitude" sense of potential damage costs. Empirical validation of the WTP for reducing risk of death is an important analytical issue and should be pursued with appropriate research to obtain Indonesia-specific data. We recommend that such studies be carried out as a matter of priority in order to improve the analytical foundations for policy-making on issues of pollution control.

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<sup>22</sup> Central Estimate, as per Table 2.

<sup>23</sup> The average hospital admission for respiratory disease is assumed to last 5 days, at a cost of \$9-137 per day.

## PRIORITY RANKINGS FOR MAJOR ISSUES

1. As a part of this study a simple ranking exercise was undertaken comparing each of the issues discussed in this report against each of the three key objectives of the Government's development strategy: achieving rapid **growth with macroeconomic stability**; enhancing **equity** (including poverty reduction and improvements in health and human welfare); and ensuring the **environmental sustainability** of the development process in Indonesia. While admittedly subjective, the rankings reflect the analysis of costs, benefits and risks for each of the major topics, as discussed in this report. The ranking process is described below, and the results shown in the attached table.

### Results of the Ranking Exercise

2. On the basis of this exercise we have identified five issues that appear to be of the highest priority: **water supply and sanitation, solid waste management, and vehicle emissions in Indonesia's main urban centers; industrial pollution control, particularly on Java; and the management of forest concessions in the outer islands.** In each case there are serious implications for the achievement of GOI's development objectives of growth, equity and sustainability. (All five issues were rated at the highest level for each of the three key development objectives.)

3. Five other issues have a high, but less critical, rating: **the conversion of forest lands in the outer islands to other uses (1.3); the development of forest plantations (1.3); watershed protection forests (1.7); coastal and marine ecosystems (1.7); and efficiency in the wood-processing industries (1.7).** As in the case of forest concession management, those related to the sustainable management of forest lands reflect the implications for growth in output, employment, and exports of the threatened boycott (and/or green-labeling) of Indonesia's forest products by major importing countries. But they also reflect issues of poverty and equity for forest-dwelling communities in the outer islands, as well as the importance to Indonesia of the sustainable management of its remaining tropical forest and other critical ecosystems. Progress in these areas will help to meet Indonesia's commitments to the sustainability of global ecosystems and the protection of biodiversity.

### An Explanation of the Ranking Process

4. These are rankings of **environmental issues.** The intention was to establish the relative priority **among and between them.** As individual issues, it is not possible to assign an intrinsic value to one over the other (e.g., provision of safe water for the urban population versus what happens to forest-dwelling communities in the outer islands as a result of forest concessions taking over their traditional lands). The criterion used, therefore, was the relative importance of specific issues to achieving the key objectives of GOI's development strategy--or, as defined in our report, an "environmentally responsible" development strategy.

5. To start, each topic from the report was broken down into sub-topics. For pollution issues, the sub-topics are mostly related to size or spatial distribution aspects (e.g., major urban centers versus rural villages/Java versus off-Java), while the natural resource sub-topics are mainly the component parts of the larger issue (e.g., "spatial planning" as an issue of land resource management). Within the main topic areas, each sub-topic was then considered against the three key objectives of development (e.g., Water supply and sanitation in major urban areas against growth, equity and sustainability objectives).

6. In deciding on a rating, the question was "how important is this particular sub-topic for achieving this particular objective". The answer was based on one of two considerations: (a) does it make a **significant contribution** to meeting that objective; or (b) does it **represent a serious threat** to achieving the objective. In many cases it was one of "contribution" rather than "threat", but in some it was both. The higher the rating, however, the more important the topic is for GOI.

7. We considered one major topic area at a time, and the process was iterative against both the criteria and the other sub-topics. In every case, within a single topic, it was relatively easy to distinguish between the extremes: vehicle emissions in major urban centers, for example (a "1"), versus vehicle emissions in rural villages (a "4"). It was also easy to make reasonable distinctions in the relative importance of a specific sub-topic across the three key objectives: protection of biodiversity in parks and reserves, for example, is very important for environmental sustainability (rated a "1"), but not very important for the growth objective (rated a "3").

8. Mostly the question was between 1 and 2, 2 and 3, etc. As noted in the main text, for example, water supply and sanitation in rural villages is clearly important for poverty alleviation (rated a "1"), but we debated whether or not it was important for growth. The Bank's Women in Development Report concludes that women could spend their time far more productively than carrying water long distances, and that easily available water would permit the development of income-earning opportunities for them—such as tofu-making). We finally rated it a "3" rather than a "4", but there is obviously room for debate on the rating for many of these sub-topics against almost any of the three objectives. In the end, however, with the exception of the "1" versus "2" choices, it really did not matter: the "highest priority" issues for GOI turn out to be those with ALL "1"s, and even the second rank priorities were limited to those with an average rating between "1" and "2" (i.e., even three "2"s meant that a topic did not make it into the "top ten" priority list).

9. In reflecting on the meaning of a "1" versus a "4", the essential difference is that GOI should not devote its scarce resources to a "4" (to meet a specific objective) until all of the issues with a higher rating have been resolved; an overall rating of "1" implies that if GOI focused its attention only on those issues, they would not miss any other environmental issues that are **MORE important** for meeting their development objectives. Arriving at a rating of "1", therefore, is the most important part of the exercise. **Within each topic**, the relative rankings were straightforward. To be meaningful, however, **those rated "1"** across all three objectives **must hold up in a relative ranking** against similar "highest priority" sub-topics from all other major areas of concern.

10. When we completed the ratings and computed the averages for each sub-topic, it was a simple process to divide them into "highest" (all "1"s) and "second highest" (an average rating "less than 2") categories. On the basis of all of our analysis to date, we found none of the latter that we were inclined to move into the first category, and none with lower average ratings that we would move into the second category.

### RELATIVE RANKINGS AGAINST GOI DEVELOPMENT OBJECTIVES

OBJECTIVES/ MAJOR TOPICS	Growth with Econ. Stability	Equity/Poverty Human Health	Local/National Sustainability	Overall Ranking
<b><u>WATER AND SANITATION</u></b>				
Major Urban Centers	1	1	1	1.0
Secondary Cities	2	2	2	2.0
Smaller Cities/Towns	3	2	3	2.7
Rural Villages	3	1	3	2.3
<b><u>SOLID WASTE MANAGEMENT</u></b>				
Major Urban Centers	1	1	1	1.0
Secondary Cities	2	2	2	2.0
Smaller Cities/Towns	3	3	3	3.0
Rural Villages	4	3	4	3.7
<b><u>VEHICLE EMISSIONS</u></b>				
Major Urban Centers	1	1	1	1.0
Secondary Cities	2	2	2	2.0
Smaller Cities/Towns	3	3	3	3.0
Rural Villages	4	4	4	4.0
<b><u>INDUSTRIAL WATER POLLUTION</u></b>				
Key Watersheds on Java	1	1	1	1.0
Other PROKASIH Provinces	3	1	2	2.0
Other Provinces	3	2	2	2.3
<b><u>INDUSTRIAL AIR POLLUTION</u></b>				
Major Urban Centers	1	1	1	1.0
Secondary Cities	2	2	2	2.0
Smaller Cities/Towns	3	3	3	3.0
<b><u>INDUSTRIAL TOXIC WASTES</u></b>				
Key Watersheds on Java	1	1	1	1.0
Other PROKASIH Provinces	3	2	2	2.3
Other Provinces	3	3	3	3.0
<b><u>POWER/ENERGY DEVELOPMENT (STATIONARY SOURCES)</u></b>				
Energy Conservation	2	2	2	2.0
Fossil Fuels	1	3	2	2.0
Hydro/Geothermal	2	2	2	2.0
Solar/Wind Power	4	3	3	3.3
Nuclear Power	4	4	3	3.7
<b><u>LAND MANAGEMENT</u></b>				
Efficiency/Market Development	2	3	2	2.3
Acquisition/Resettlement	3	1	3	2.3
Recognition of Adat Rights	3	1	2	2.0
<b><u>CONSERVATION/BIODIVERSITY</u></b>				
Parks and Reserves	3	3	1	2.3
Protection Forests	2	2	1	1.7
Conversion Forests	2	1	1	1.3
Coastal/Marine Ecosystems	2	2	1	1.7
<b><u>FORESTRY MANAGEMENT</u></b>				
Concession Management	1	1	1	1.0
Forestry Plantations	2	1	1	1.3
Wood Processing Industries	1	2	2	1.7

## **THE GLOBAL WARMING ISSUE**

### **Sources and Impacts of Greenhouse Gas Emissions**

1. A recent analysis indicates that Indonesia contributed about 1.6-1.7% of global man-made greenhouse gas (GHG) emissions in 1989.<sup>1</sup> Of the total GHG emissions (adjusted on the basis of their greenhouse forcing contribution), about 75.9% was attributed to land use change (mainly deforestation), 12.0% to energy use (including gas flaring), 8.5% to methane emissions (mainly from wet rice agriculture), and 3.6% to chlorofluorocarbons (CFC) use. The pattern of GHG production in Indonesia is quite different from that of the world as a whole, for which land use change, energy use, methane emissions and CFC use accounted for 16.8%, 57.3%, 10.6% and 15.3%, respectively.

2. It is now generally agreed that the buildup of greenhouse gases will increase average temperatures on the planet. The size of the effect is unclear, but the best current estimate of the International Panel of Climate Change (IPCC) is that average world temperatures may rise by 3 degrees Celsius by the end of the next century under their "business as usual" scenario. There is greater uncertainty about the consequences. Potentially significant effects are more likely to result from related changes in soil moisture, storms, and sea level than from temperature as such, and these changes are difficult to predict.

3. To date, there are no reliable assessments of the potential damage of global warming in Indonesia. The major effects are expected to be on the productivity of agriculture, the survival of forests, corals and other natural ecosystems, and human settlements in areas that are already vulnerable to flooding, droughts, landslides and windstorms. A rise in the sea level could flood agricultural land in heavily populated coastal lowlands. Vector borne and viral diseases could shift to new areas, putting new populations at risk. However, climatic conditions for human settlements, agriculture and other living systems could also improve in some areas. In view of the uncertainties and potential risks associated with global warming, Indonesia has signed the Framework Convention on Climate Change in 1992, which commits it to "control, reduce or prevent" the growth of greenhouse gas emissions. In the short-term, given the structure of GHG emissions in Indonesia, greater attention in this regard may need to be given to addressing the problem of deforestation. For the long term, the rate of deforestation is not likely to increase, but CO<sub>2</sub> emissions from energy use could rise by a factor of 6 by 2008 and 13 by 2018. It is thus evident that a serious effort to control greenhouse gas emissions from Indonesia will have to consider the options for their abatement in the energy sector.

### **Options for Reducing Carbon Dioxide Emissions in the Energy Sector**

4. Most of the measures that will abate the local pollution from the energy sector will also have favorable implications for reducing CO<sub>2</sub> emissions. As estimated in a recent Bank review, a program to promote energy efficiency, introduce pollution based fuel taxes and substitute natural gas for petroleum fuels and coal use in the transport and industry sectors will lead to a 20% reduction in the projected emissions of CO<sub>2</sub> from energy use, mainly through improvements in energy efficiency and the lower carbon emissions from natural gas, when compared with other fossil fuels.<sup>2</sup> Nevertheless, carbon dioxide emissions from the fossil fuel use are still projected to increase 10-fold, from about 85 million tons in 1990 to 860 million tons in 2020.

5. Beyond the program that would be justified solely on the basis of its local pollution abatement merits, the review also analyzed those energy options that require the inclusion of global economic benefits, including additional development of renewable sources and nuclear power.

6. **Renewable Energy Sources.** By definition, renewable energy sources do not generate greenhouse gases (GHG). Some of these options, including hydroelectric, geothermal power, the use of agroindustrial and sawmill waste, solar photovoltaic (PV) and wind energy, are already competitive with fossil fuel-based power generation in certain areas. In general:

- (a) **hydropower** is already being developed where suitable sites have been identified. PLN is projecting its own hydroelectric capacity to increase from about 2,300 MW in 1992 to about 6,800 MW in 2004. The total hydropower potential of Indonesia has been estimated at about 75,000 MW, but a major constraint to their further development is that the greatest potential (over 35%) is in Irian Jaya, which has less than 1% of total electricity demand, while Java, with about 80% of the demand, has less than 10% of the total potential, most of which has already been developed.<sup>3</sup> Overall, hydropower generation can be projected to increase from 9.3 TWh in 1990 (18% of total generation) to about 32 TWh in 2020 (5% of total generation).
- (b) **geothermal** resources are also being developed at a rapid pace. The potential resources may approach 10,000 MW: Java 5,500 MW; Sulawesi 1,400 MW; Sumatra 1,100 MW; other islands 2,000 MW. However, the economically developable reserves may be limited to about 1,000 MW.<sup>4</sup> Of these, 140 MW have been developed, which is planned to grow to about 700 MW in 2004. Further expansion is possible, as Indonesia is rich in geothermal resources and new investments in their exploration and development can be stimulated through appropriate incentives. A main issue is the competitiveness of geothermal on Java, where the electricity grid is well developed and the cost of geothermal has to be compared with large scale coal fired or gas fired combined cycle stations. Geothermal generation can be projected to increase from 0.8 TWh in 1990 (accounting for 1.5% of total generation) to about 10 TWh in 2020 (1.5% of total generation).
- (c) **biomass** based power generation is of interest from a global warming perspective if the biomass is the result of a sustainable growth cycle. This appears to be the case for the large amounts of waste materials generated in Indonesia's agriculture sector, but still remains to be verified for the case of most forestry sector wastes. The economic feasibility will vary depending on local circumstances, but tends to be highest when generation is undertaken as an add-on to an existing mill or, for stand-alone dedicated power plants, when the scale is small (50-100 kW) or the operating hours are high.
- (d) **solar PV** technologies are well proven but they are expensive compared to diesel power and their economic viability is limited to remote communities where the cost of diesel is high and loads are small.<sup>5</sup>
- (e) **wind** energy conversion systems are considered to be competitive with diesel-based generation in areas with average wind speeds above 4 m/sec. In Indonesia such wind resources appear to exist in parts of East and West Nusa Tenggara, where potential loads are small.

7. Beyond the limits to which the above renewable resources can be developed based on "national" economic benefits (of which PLN's avoided cost is a good approximation) there is considerable additional potential for their further development at additional cost. The justification for incurring the additional cost would have to be based on the global benefits of GHG abatement. The main issue here revolves around the magnitude of the marginal benefit of GHG abatement or the avoided cost of backstop technologies, i.e., the technologies of "last resort" that can be expected to meet any foreseeable increase in energy demand without adding to GHG emissions.

8. For large scale power generation, biomass, solar and nuclear technologies constitute the most likely candidate backstop technologies. The development and implementation of these backstop options deserve to be considered as an insurance for the contingency that greenhouse gas emission growth may have to be stopped in the future. Based on long term expectations of technology development, it is possible that power from these sources could be supplied at a premium of about 20% above current electricity costs.<sup>6</sup> For non-electric uses of gaseous and liquid fuels, the main backstop technologies are biomass-derived fuels, ethanol or methanol, hydrogen (via electrolysis) using solar or nuclear power as the energy source, or further electrification of the energy markets. As these non-electric options are much more costly, their active consideration in Indonesia should be postponed until technology improvements have made them more economical.

9. **Nuclear Power.** Where the safety and waste management issues are adequately addressed, nuclear power has the environmental advantage of emitting no greenhouse gases. In certain situations, nuclear power can be cost competitive with fossil-based generation. However, the environmental problems associated with radioactive wastes have not been fully resolved in the OECD countries, and as a result, costs have soared and worldwide construction has slowed dramatically. For Indonesia, as with most other developing countries in Asia, the role of nuclear in its total energy supply needs to be reviewed with care, due to: (i) the availability of less expensive alternatives, such as gas and coal; (ii) the shortage of investment capital; and (iii) safety concerns with population density and seismic, volcanic and soil conditions in many areas of Java, where the potential market is located.

10. In light of nuclear power's status as a major backstop option to reduce greenhouse gases, GOI recently commissioned a major study to explore the feasibility of a first nuclear power plant on Java for commissioning in 2005 or soon thereafter. The study (due in late 1993) will take into account the full costs and risks associated with the disposal of radioactive wastes, and with local conditions and population density at or near the proposed site.

11. Simply based on generic comparisons, it is expected that the cost of nuclear power will be at least 50% higher than those of coal based generation without FGD and 20-30% higher with FGD. On this basis, the nuclear option does not appear to be competitive with coal fired generation, unless there is a willingness to pay a premium equivalent to about \$37-64/ton of carbon abatement.<sup>7</sup>

12. **Carbon Taxes.** In terms of moving towards a least cost strategy to stabilize GHG emissions, the incremental cost of CO<sub>2</sub> abatement using the nuclear option, tentatively estimated at about \$37-64/ton of carbon, offers a benchmark for comparison with other globally available options. In terms of the options available in Indonesia, this figure would need to be compared with the costs of, among others, land use change prevention and the incremental development of renewable energy sources. However, the supply of renewable energy, particularly hydropower, geothermal, solar and biomass, is inelastic.<sup>8</sup> A recent review of biomass-base power generation identified a total technical

potential of 12,000 MW based on the use of palm oil residues, sugar cane bagasse, rubberwood, plywood and sawmill residues.<sup>9</sup> Based on a detailed economic analysis, this potential would be economically feasible only if the projects could be credited with a benefit of up to \$70/ton of carbon abatement.<sup>10</sup> On this basis, the preparation and implementation of renewable energy projects needs to be undertaken with care. Also, if economic benefit for CO<sub>2</sub> abatement can be established, then an appropriate market-based incentive for the development of renewable energy technologies is the introduction of a carbon tax.

13. A tax based on the carbon content of fuels would provide the right signals for the development of non-GHG emitting alternatives, with additional benefits from the increased efficiency of energy use. Also, since a carbon tax will have its highest impact on the price and consumption of coal, it could also result in reduced emissions of other pollutants such as SO<sub>x</sub> and NO<sub>x</sub>. Such a tax has already been introduced in several countries and the European Community is considering a proposal to introduce, in a revenue neutral manner, a carbon tax of \$3 per barrel of oil equivalent, which would be gradually increased to \$10/bbl (equivalent to \$70/ton of carbon) by 2000.<sup>11</sup>

14. To evaluate the potential effects of the introduction of a carbon tax in Indonesia, the review cited in para 4. also included a simulation of the effect of the hypothetical introduction of tax of \$10 per ton of carbon, at the upper end of the expected marginal future cost of climate change.<sup>12</sup> This level is equivalent to an additional tax on petroleum products, natural gas and coal of about 4%, 4%, and 23%, respectively. The simulation suggests that it would result in only an additional 3% decline in CO<sub>2</sub> emissions by 2018. This additional abatement would be due to the direct effect of the carbon tax on consumption,<sup>13</sup> as well as estimated increases in the share of renewable energy sources (biomass, hydro and geothermal) in power generation, based on their elasticity of supply.

15. It is important to note at this point that the above projections are based on currently available commercial technology, evaluated at current costs. Expectations are that over the next few decades new and improved technologies, such fuel cells, electrical cars, solar PV generation, solar thermal generation and biomass-based fuel supplies, will become cost-competitive and technically reliable, and make it possible to reduce greenhouse gas emissions beyond what the above projections indicate. As it is difficult to predict which of the many new technological options will become commercially competitive and enter the markets in a major way, the most efficient and robust strategy to stimulate their development is to create a demand for their greenhouse gas reduction features by making polluters pay, e.g., a carbon tax.

16. Overall, these results suggest that an economically optimum solution, based on the mitigation of local pollution impacts, or even the introduction of a carbon tax at a level commensurate with the expected damage from global warming, results in only modest declines in the growth of CO<sub>2</sub> emissions. Thus, from an Indonesian perspective, the priority would seem to lie with adapting to the uncertainties and unpredictable impacts of climate change, rather than in a attempt to stabilize greenhouse gas emissions at the national level. From a global perspective, should the control of greenhouse gas emissions from Indonesia remain a major objective, its accomplishment will require the resolution of the financial burdensharing issue, as the introduction of much more stringent carbon taxes could lead to an imbalance in addressing Indonesia's national priorities for sustainable development.

Endnotes

- <sup>1</sup> World Resources Institute, World Resources 1992-93, a report by the World Resources Institute in collaboration with UNEP and UNDP, New York, Oxford University Press, 1992.
- <sup>2</sup> See World Bank, Indonesia: Energy and the Environment - A Plan of Action for Pollution Control, Report No. 11871-IND, June 1993.
- <sup>3</sup> Nippon Koei Co., Ltd and P.T. Indra Karya, Hydropower Potential Study, Final Report for PLN, 1993.
- <sup>4</sup> Geothermal Energy New Zealand, Ltd., Indonesia Geothermal Study and Evaluation Project, Final Report, 1987.
- <sup>5</sup> PLN with the Bank and the GEF is currently assessing the technical and economic feasibility of PV systems as part of Indonesia's rural electrification program. About 2,000 PV systems have already been installed.
- <sup>6</sup> For a recent discussion of alternative backstop technologies, see Cost-Effectiveness and the Investments of the Global Environment Facility, a Background Paper for the Global Environment Facility, by D. Anderson and R. Williams, draft, Feb, 1993.
- <sup>7</sup> For a generic plant, the cost of coal-based power is estimated to be about \$0.0386/KWh and nuclear power about \$0.0572/KWh (See World Bank, Indonesia: Suralaya Thermal Power Project, Report No. 10550-IND, June 1992). Given a consumption of about 0.290 kg of carbon/KWh (0.403 kg of coal/KWh, at 718 g of carbon/Kg of coal) the choice of nuclear power, with an incremental cost of \$0.0186/KWh, implies abatement cost of about \$64/ton of carbon.
- <sup>8</sup> Based on the surveys cited above, the long-run supply elasticity of hydropower is about 0.6, and of geothermal, 0.3.
- <sup>9</sup> Indonesia: Prospects for Biomass Power Generation with Emphasis of Palm Oil, Sugar, Rubberwood and Plywood Residues, Report No.-- of the Joint UNDP/World Bank Energy Sector Management Assistance Program, (Draft) January 1993.
- <sup>10</sup> This level is equivalent to a proposed carbon tax of \$10/barrel of oil being discussed in the European Community, or about \$20/ton of CO<sub>2</sub>.
- <sup>11</sup> Taking a more comprehensive economic framework into account, Shah, A. and B. Larsen, Carbon Taxes, the Greenhouse Effect and Developing Countries, Background paper No. 6, World Development Report 1992, World Bank, Washington, D.C., 1992, suggests that, for Indonesia, the introduction of a carbon tax in parallel with a revenue neutral reduction in the corporate income tax would improve economic welfare. The paper suggests that the direct and indirect costs borne by consumers as a result of the carbon tax would be more than compensated by the increased investment, employment and output that would be stimulated by an equal yield reduction in the corporate income tax. For an illustrative calculation based on 1987 data, a carbon tax of \$10/ton of carbon would yield revenues of \$266 million/year that, if transformed into a reduced

corporate income tax, would yield a net welfare gain of about \$23 million/year. Converting the carbon tax revenue into an equal yield investment tax credit should provide even greater welfare benefits.

- <sup>12</sup> For a more detailed discussion see Nordhaus, William D., Climate and Economic Development: Climates Past and Climate Change Future, paper prepared for the World Bank's Annual Conference on Development Economics, Washington, D.C., May 1993.
- <sup>13</sup> The long term price elasticity of demand was assumed to be 0.4 for all fuels, based on a review of available estimates for Indonesia.

## INDONESIA'S AMDAL PROGRAM

### Essential Elements of the AMDAL Program

1. The requirement for environmental impact assessments (EIA) in Indonesia (known as the AMDAL program) is defined in Law No. 4 (Article 16) of 1982. That law stipulates that an EIA should be carried out for any proposed activity that is expected to have significant environmental effects. Regulation No. 29, issued by MLH in 1986, sets out the general procedures for carrying out an EIA. The essential elements of the AMDAL program under that regulation were as follows:

- o *Scope.* Regulation 29 required that both new project proposals and those already operating should be subject to the EIA process. Assessments should include social and cultural, as well as environmental, impacts.
- o *Documents.* Regulation 29 defined five separate documents: a PIL (or PEL for existing projects) which sets out a preliminary assessment of environmental impacts and how they might be mitigated; a KA ANDAL (or KA SEL) which defines the Terms of Reference for carrying out the assessment; the ANDAL (or SEL) which provides the actual assessment of environmental and socio-cultural impacts; the RKL which specifies the design and operating plans for mitigating potentially negative impacts; and the RPL which sets out the plans for monitoring and reporting on actual environmental impacts.
- o *Process.* Under Regulation 29, AMDAL begins with a screening process, normally based on the PIL or PEL, at which point the project may be exempted from further evaluation, if no significant impacts are expected, or rejected if clearly unacceptable. For projects with potentially significant impacts, terms of reference for the EIA must be submitted for approval, followed by the actual assessment itself, which must then be approved (with or without comment) or rejected as unacceptable. Finally, the RKL and RPL are submitted for review and approval. This process is expected to be closely linked to project feasibility and design studies, and investment, location and other permits cannot be issued until the AMDAL process has been successfully completed. Maximum time periods have been established for the review of documents by the relevant AMDAL Commission (up to 90 days for review of the EIA itself).
- o *Institutions.* Responsibility for overseeing the implementation of AMDAL and for monitoring outcomes, originally with MLH, has since been transferred to BAPEDAL. The authority for implementing the process lies with central agencies and provincial governments, which are expected to establish inter-agency AMDAL Commissions to review documents submitted by project proponents. Central commissions, Komisi Pusat, are normally chaired by the Secretary General of the relevant agency, and deal with most large-scale projects in the relevant sector. Permanent members include representatives from BAPEDAL, Ministry of Home Affairs, university or other experts, and the agency itself, supported by a Technical Committee and a Secretariat. At the Provincial level, Komisi Daerah are normally chaired by the head of the Development Planning Board (BAPPEDA). Members include representatives from the provincial Population and Environment Bureau (BKLH), and university experts from the local Environmental Studies Centers (PSLs).

## Experience to Date and Areas for Improvement

2. The expectations for AMDAL have been high, since the process was originally conceived of as an effective tool for encouraging both public and private sector project sponsors to integrate environmental concerns into their development plans. There are many positive aspects in the design of AMDAL, including the fact that it covers social and cultural as well as environmental impacts, provides for inter-agency commissions to review individual project documents, and - while not required - allows for public participation. The establishment of AMDAL commissions in each agency, with a high level of representation from within the agency, was seen as a means of gaining the attention of senior officials. Linking the AMDAL process with the approval of project permits was considered vital for the enforcement of environmental standards and regulations.

3. In comparison with its original expectations, however, experience to date with the AMDAL program has been disappointing. In part this is due to unrealistic expectations. The requirement, for example, that all existing projects, as well as all new projects, be subject to EIAs did not take into account the shortage of expertise to prepare EIAs, or the capacity of the AMDAL commissions to review them. Even for new projects, however, a number of weaknesses in the have been identified in the AMDAL process, some of which will take considerable time and effort to overcome. A review undertaken by BAPEDAL, as a preliminary step for revising the AMDAL regulations, pointed out the following areas where improvement would be needed:

- o *project screening and scoping*, where the initial screening of projects could be streamlined by the provision of sector-specific guidance to project sponsors, and the terms of reference for impact analysis could be far better targeted though improvements in the project "scoping" stage, including the involvement of representatives from local community groups. A few line agencies have issued screening guidelines, but much more needs to be done. AMDAL regulations allow for, but do not require, public participation. Community groups, however, are rarely involved in project scoping exercises;
- o *integration with project design and approvals*, where preparation of AMDAL documents should proceed on a parallel basis with studies of project feasibility, rate of return calculations, the consideration of alternative projects and sites, and the approval of detailed project designs—including plans for the mitigation and monitoring of social and environmental impacts. In many cases, however, the AMDAL process has been seen as an "add-on" exercise unrelated to the technical and economic analysis of project proposals. This is reflected in the number of cases where investment and location permits have been issued before an EIA has been prepared—much less approved;
- o *integration with standards and area-specific development plans*, where the availability of clear environmental standards, and guidance from provincial and local governments on location and ecosystem concerns would allow project sponsors to take these factors into account in project design and in the assessment of potential environmental impacts. To date, KLH has issued water emission standards for existing firms in 14 industries. Standards for air emissions, hazardous waste, and water emissions for other industries are still under preparation. The recent law on spatial planning provides a legal foundation for area-specific development plans, but effective implementation will take considerable time. In the interim, the participation of affected community groups could help to identify significant issues of local concern;

- o *availability of expertise*, where the number of well-trained and experienced people, able to prepare and review EIAs, will need to be greatly expanded before the AMDAL program can become fully effective. AMDAL training is now coordinated by BAPEDAL, and carried out mainly by PSLs. Over 5000 public and private sector representatives have been trained in the basics of the AMDAL process, and another 750 have received training in how to prepare EIAs. The critical shortage, however, lies in the availability of people with the technical knowledge required to analyze (and review) social and environmental impacts and to design the necessary mitigation and monitoring plans.<sup>1</sup> While many consultants now claim to be qualified to carry out EIAs, the quality of their analysis is often far below the desired standard; and
- o *potential for conflicts of interest*, where, in the case of public sector projects, the same agency is responsible both for preparing the AMDAL documents and for their review and approval, and for private sector projects, the line agency responsible for approving AMDAL documents has an obvious interest in encouraging investment in the sector. The risk of such conflicts can be minimized by having outside experts from the PSLs, BAPEDAL, affected community groups and NGOs represented on the AMDAL commissions. The quality of the review process, however, is constrained by the same lack of expertise among these groups as that noted above for the preparation of EIAs.

4. **Experience at the National Level.** There is considerable variation among line ministries in the extent to which they have adopted the spirit and intent of the AMDAL program.<sup>2</sup> The first to establish and operationalize its AMDAL commission was Mines and Energy, which has also issued screening guidelines for projects. It was also the first to engage in local consultations with affected people, in connection with a World Bank-financed power project. Other ministries with active AMDAL commissions include Public Works, Industry and Forestry. Preliminary (somewhat rough) data from central agency commissions indicates that, by mid-1991, nearly 1,600 AMDAL documents had been reviewed, and that about 235 projects had completed the full AMDAL cycle. Mines and Energy accounted for about 40% of the documents reviewed, and Public Works, Industry and Forestry for another 50%, or 90% for just these four departments alone (out of 14 central ministries and non-ministerial agencies).

5. Many Government agencies are working to develop screening procedures and training programs for their staff, establish project tracking systems, and compile rosters of consultants with

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<sup>1</sup> A recent report from the Ministry of Forestry, for example, indicates that only 173 of the 640 existing firms have been able to complete their EIAs, and the main reason has been the lack of expertise. With fewer than 100 AMDAL consultants registered with the Ministry, who can produce at most 20 EIAs a month, it will take at least another two years to complete the process, well past the deadline set for existing projects. The AMDAL Commission for Jakarta has received several hundred documents from existing firms, and has extended the deadline for AMDAL submissions, but has only been able to review a small proportion of these submissions due to the shortage of staff.

<sup>2</sup> For an analysis, see John Dick and Lynn Bailey, Indonesia's Environmental Assessment Process (AMDAL): Progress, Problems and a Suggested Blueprint for Improvement, a report of EMDI Program Advisors, June 1992.

expertise in the relevant sectors. Some are also beginning work on the development of sectoral EIAs which take into account cross-sectoral and "downstream" environmental effects. Despite the current shortcomings of the AMDAL program, therefore, there is still considerable hope that the AMDAL commissions will play a key role in the integration of environmental issues and concerns more directly into the design of sectoral policies and development programs by the central line agencies.

6. **Experience at the Provincial Level.** The operation of AMDAL at the provincial level has encountered all of the same problems as those noted above at the national level. The Komisi Daerah have primary responsibility for reviewing only those projects funded directly out of the provincial budget, and those with an investment cost under Rp 600 million (US\$300,000). AMDAL regulations also stipulate, however, that Komisi Daerah have an opportunity to participate in the review of larger projects by the Komisi Pusat. In the absence of area-specific development plans, such participation may be critical for ensuring a proper review of projects against local environmental concerns. Project sponsors are supposed to send copies of AMDAL documents to the Komisi Daerah two weeks before submitting them to the Komisi Pusat; provincial representatives are supposed to attend the review meeting in Jakarta or, at a minimum, to send written comments. In practice, however, they often fail to receive the copies in time, if at all, and are rarely invited to attend meetings of the Komisi Pusat.

7. The scarcity of relevant expertise in many provinces is an even more serious constraint even when AMDAL documents are received in time. In fact, for smaller projects where the Komisi Daerah has primary responsibility, the few experts available in the local PSL are likely to have participated in preparing the AMDAL documents, and it would thus be a conflict of interest for them to advise on their acceptability. In many provinces, funding to support the operation of the Komisi Daerah is inadequate, and this may limit the participation of experts from the sectoral offices. Some provinces have also complained that, while it takes time for them to conduct a proper review of AMDAL documents, they are under increasing pressure from central government agencies to speed up the process of issuing various project permits in order not to delay the implementation of development plans.

8. While the AMDAL program is still relatively new, experience over the past several years clearly indicated a need for change. In response, BAPEDAL has undertaken a systematic review of the strengths and weaknesses of the program, in close consultation with the sectoral departments and agencies. This review has culminated in a revision of the original implementing regulations (PP29), issued as PP51 in October 1993 as part of a package of deregulation measures introduced by GOI.

### **Recent Changes in the AMDAL Implementing Regulations<sup>3</sup>**

9. While the basic features of the program remain intact, a number of changes have been made to simplify and streamline the process as well as to strengthen the authority of BAPEDAL in carrying out its coordinating role. Key changes introduced in order to simplify, clarify, and speed up the AMDAL process include:

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<sup>3</sup> The following description is based on a paper prepared by Peter A. Neame (EMDI) and Rusdian Lubis (BAPEDAL), Highlights of PP51/1993 (Revised Government Regulation Concerning EIA Process), November 1993, Jakarta, Indonesia.

- o **Simplification of the Screening Process.** BAPEDAL will now establish the screening criteria for use by the AMDAL commissions in the sectoral departments and agencies to use in deciding whether or not an ANDAL is required.
- o **Simplification of the Assessment Process.** The PIL, originally intended as a preliminary information document, has been dropped. Projects which, under the screening criteria, are likely to have a significant impact will require a KA (Terms of Reference for the impact study), ANDAL (the Environmental Impact Statement Document), RKL (the Environmental Management Plan), and an RPL (Environmental Monitoring Plan). The ANDAL, RKL and RPL will all be submitted at the same time (as opposed to sequentially under the previous rules).
- o **Reduced Time Limits.** To speed up the process of arriving at a decision, AMDAL Commissions will have 12 working days to review the KA, and 45 working days to review the ANDAL/RKL/RPL.
- o **New Process for Multisectoral Projects.** Multisectoral projects, involving several sectoral departments or agencies, will be handled by an AMDAL Commission in BAPEDAL, thus avoiding overlapping mandates and a potential duplication of effort by project proponents.
- o **Reduced Requirements for Industrial Estates.** Industrial estates, and certain other defined areas, will require an ANDAL for the area concerned, but not necessarily for each individual business or activity within the estate or defined area.
- o **Application of AMDAL to Regional Planning.** Environmental assessments will, in future, be applied to regional planning areas, in a new process known as AMDAL Regional. A separate regulation will be issued for this new initiative, which will be linked to both spatial planning and regional development planning efforts.
- o **Clarification of Permitting.** The linkage to permitting is strengthened by specifying that operating permits for a business (Izin Usaha Tetap) may only be issued if the provisions of the RKL and RPL have been implemented.
- o **Amdal Commission Membership.** Central AMDAL Commissions will add BKPM (the National Investment Coordinating Board) and BPN (the National Land Agency) as permanent members, and will specify NGOs as non-permanent members. Regional AMDAL Commissions will add BKPM and BPND as permanent members, and NGOs as non-permanent members.
- o **Time Limits on ANDAL Validity.** Once an ANDAL has been approved, project sponsors must implement the activity within three years or the approval will lapse.

10. Together, these changes are expected to result in fewer but better and more appropriate EIAs being carried out. The more proactive role for BAPEDAL in setting criteria and guidelines should also help to streamline the process and strengthen its oversight of the revised AMDAL procedures.

## THE MANAGEMENT OF AQUATIC RESOURCES

1. At 81,000 km, Indonesia's coastline is the largest in the world, totaling 14 percent of the earth's shoreline (Burbridge and Maragos 1985). Its aquatic resources exhibit tremendous natural variation, being found in coral reefs, lagoons, wetlands such as lakes, streams, ponds and rivers, open and enclosed coastal areas, and the deep seas. It is generally recognized that the full potential of the Indonesian aquatic resources, including 5.8 million km<sup>2</sup> of marine waters and 0.55 million km<sup>2</sup> of inland waters, has not been fully exploited: the extent of marine landings is presently 2.37 million metric tons, out of a potential maximum sustainable yield of 6.7 to 7.7 million MT; inland water production is only 790,000 MT out of a potential 1.4 to 3.6 million MT; only a third of the suitable mangrove area is under brackishwater culture production; and less than 30 percent of the potential for inland fish culture has been realized (Chong and Hutagalung 1992). During the next 25-year development plan, it is expected that the sector will be targeted as a major contributor to economic growth, especially in the Outer Islands. Per capita consumption of fish, which currently comprises more than 60 percent of the animal protein found in the Indonesian diet, has grown from 10 kg/ca/yr in the late 1960's to projected 1994 levels of 16.8 kg/ca/yr, and fisheries are expected to experience the fastest growth of all major natural resource categories in terms of contribution to GDP (about 5 percent per year). By the year 2010, fisheries' importance as a share of the GDP could rival non-food crops', attaining a value four times as high as forestry (Annex B, Tables A.9; Annex C1; Table 2), and demand for fish products is expected to attain 6 million MT by the year 2010 (Chong and Hutagalung 1992).

2. The achievement of the above goals will be dependent upon sound resource management practices, marketing development, the alleviation of outside pressures impacting upon fisheries, and an increased reliance on aquaculture over capture fisheries. Aggregate maximum sustainable yield estimates obscure the fact that over 50 percent of the potential MSY comprises small mid-water (pelagic) species of little commercial value. The status of the fisheries stocks also exhibits wide regional variations, with coastal fisheries in the Straits of Malacca, North Java and South Sulawesi considered heavily exploited, whereas offshore fisheries are generally viewed as under-exploited. Furthermore, the large distances involved and the paucity of markets renders the prospects of shifting fishing efforts towards remote Outer Island waters unrealistic in the short to medium term. The development of value-added products (e.g., canned tuna) is constrained by shortages of raw material, and the fishery sector is heavily over-capitalized near the major urban centers. As much as 30 percent of the catch is lost due to poor handling. In areas close to the markets, the use of increasingly efficient, and for the most part non-selective gear, has led to severe over-exploitation of valuable fishery resources (e.g., shrimp), and there is evidence that the size and species composition of the catch is changing, with higher valued species decreasing in both share and size (Chong and Hutagalung 1992). Finally, widespread environmental degradation and increased human pressure is severely impacting upon the productivity of aquatic ecosystems. Four major and related issues are likely to affect the future status of aquatic resources in Indonesia.

### Environmental Degradation

3. With 70 coral genera, Indonesia's reefs exhibit the highest degree of coral biodiversity in the world, three-and-a-half times that found in the Caribbean seas, and 10 times that found in the eastern Pacific (Wilkinson 1992). Nonetheless, in localized areas of western and central Indonesia,

coral reefs are in critical condition, and are likely to face virtual collapse within 10-20 years unless the current levels of human-induced stress can be reduced (Wilkinson 1993). Reef ecosystems in eastern Indonesia, while in many cases still in excellent condition, are also under threat from selective fishing aimed at high value species (e.g., groupers and parrot fish) as well as destructive fishing practices that include dynamite and blast fishing. Anthropomorphic stresses include human settlement pressures in coastal areas (e.g., organic and inorganic pollution), excessive sedimentation from land clearance and deforestation, and increasing fishing effort aimed at coral fish (Wilkinson et al. 1993). Recognizing the importance of protecting these resources, Indonesia has identified 2.6 million ha of marine protected areas (MPA), and a target 30 million ha are envisaged by the year 2000 (Kelleher and Bleakley 1992). However, management plans for these areas are lacking, and enforcement capabilities to police extensive and often remote areas pose insurmountable problems. The loss in potential revenue resulting from the destruction of coral ecosystems, although difficult to quantify, is thought to be considerable. Coastal communities, for example, use coral reefs extensively for subsistence fishing as well as to supply local markets. The potential for tourist revenues can be substantial as demonstrated by comparative areas in Southern Thailand and the Caribbean. By establishing physical barriers, coral reefs also provide coastal areas with effective protection against wave-induced erosion of valuable agricultural land (Burbridge and Maragos 1985). Studies done for comparative ecosystems in the Caribbean indicate, for example, high potential revenues for marine parks used primarily for recreation: in Bonaire, an island of 28,800 ha, direct and indirect revenues to the National Marine Park are estimated at US\$23.4 million per year excluding taxes. Annual revenues to the Virgin Islands National Park, which depends mostly on its aquatic scenery, are estimated at US\$23.3 million (Dixon, Scura and van't Hof 1993).

4. In addition to coral reefs, many coastal ecosystems such as mangrove areas (of which Indonesia has the highest surface area in the world), swamps, and estuaries are similarly experiencing widespread anthropomorphic pressures, affecting the recruitment and survival of commercial fish and crustacean species, and threatening future opportunities for expansion in the sector's productivity. As much as 300,000 ha of tidal swamps, for example, have been reclaimed for agriculture in Kalimantan and Sulawesi, and widespread conversion of mangrove areas into tambak are reported despite Government regulations restricting the practice (Burbridge and Maragos 1985). Being located downstream, coastal areas are particularly vulnerable to externalities created by other sectors such as forestry, industry development, and urbanization. While it can be argued that part of the fishing effort can be shifted away from overcrowded fisheries in western Indonesia to the relatively unexploited waters of the eastern islands, it is unrealistic to expect a substantial reallocation in fishing effort due to the remoteness, in eastern Indonesia, of the urban markets to which coastal fisheries cater. A much broader effort will thus need to be directed towards the protection of threatened coastal ecosystems, as well as to solve the underlying causes of fisheries overexploitation in crowded areas.

### Population Pressures

5. Perhaps more important than its contribution to the GDP is fisheries importance in the food security of remote communities, especially in the Outer Islands. At a national level, over 60 percent of the annual protein consumption is derived from fish, and this share is considerably higher in remote coastal areas where meat is scarcely available. Furthermore, with its minimal investment requirements, fishing often becomes the occupation of choice for the poorest segments of the population. In the mid-1980's, the sector was estimated to employ as many as 3 million people, or 5 percent of the total workforce (Burbridge and Maragos 1985). While farming requires access to land,

many fisheries' communities are built in the intertidal zone that requires no land ownership: consequently, landlessness is frequent, and job opportunities outside the fishery limited. Annual per capita incomes among fishermen average only US\$150, barely two-thirds of the average income of farmers (US\$220), and less than one-third of the national average (US\$550) (Chong and Hutagalung 1992). The crucial role of fisheries in job and food security among the poor should receive wider recognition in the poverty reduction programs now envisaged under Repelita VI.

6. Given the importance of the sector in the rural diets and employment, it is a paradox that same populations which depend on the fisheries resources for their livelihood are the ones responsible for their rapid destruction through overfishing and ecosystem degradation. Many of the poorest fishermen work as crews in boats on a share basis. This system tends to favor short term exploitation over sound resource management. Even when productivity is found to decline in an area due to conditions of open access, inframarginal rents can still be captured through increases in fishing efficiency, skill, or pure luck. Mobility between fishing areas is also facilitated by the open access nature of resource exploitation. This set of conditions, aggravated by fishermen's low educational levels, particular life styles, chronic indebtedness, and lack of capital, make fishing an easy occupation to enter, but difficult to leave. As a result, over-capitalization and surplus of labor tend to characterize fisheries closer to the major markets. Such populational pressures can only be expected to be alleviated by local policies aimed at improved resource management, and labor diversification, of which aquaculture and value-added processing offer perhaps the most immediate alternative.

### Aquaculture Development

7. In 1989, Indonesia produced 67,470 MT of farmed shrimp at an export value of US\$788.8 million, making it the third largest producer in the world (12.6 percent of the total share). Indonesia is currently believed to have overcome Ecuador as the second largest farmed shrimp producer after China (New 1991; Chamberlain 1991a). In order to maintain this advantage, Indonesia will need to operate in an increasingly competitive and selective market. Japan, by far the largest importer of Indonesian shrimp, appears to be achieving market saturation and penetration into the US market will not be competitive unless Indonesian shrimp is able to avoid current block listing practices of quality control (Skladany 1992; Chamberlain 1991a). The need for increasing market competitiveness is likely to constrain the future profitability of highly intensive, high-risk systems (Skladany 1992). It is expected that quality improvements at both grow-out and post-harvesting stage, as well as consistency of supply, will be key determinants in future export potential. Furthermore, the experiences of Taiwan, and recently of Thailand, show that environmental problems and disease can bring the industry, and especially intensive systems, practically to a halt. The problems range from increased salinization of freshwater sources, to eutrophication and pollution by feed residues and antibiotics, mangrove conversion, and social conflicts with traditional farmer and fishermen. Taiwan's shrimp production, for example, collapsed from a level of 88,260 MT in 1987 to a mere 24,000 MT in 1989 (New 1991).

8. Extensive brackishwater aquaculture systems (tambak), and pond culture have been practiced in Indonesia for centuries. Recently, however, capital resources, institutional support, and research has been disproportionally allocated to the development of export-oriented shrimp aquaculture. Marked shifts have also occurred towards intensification of shrimp farming (Chamberlain 1991b), resulting in conflicts with traditional coastal activities in certain areas. Concomitantly, the emphasis on the export potential of brackishwater aquaculture has undermined the development of less capital intensive cultures practices that provide higher social benefits in terms of

labor absorption, dietary improvements, and the creation of local markets in isolated areas. This has been recognized recently by the Government, which has launched expanded programs for, among others, rice-fish farming systems throughout the nation. Targets of 10,000 ha of rice-fish production for the 1989-90 wet season, for example, were exceeded by 25 percent (Fagi and Suriapermana 1992). Reservoir aquaculture also offers tremendous potential, as attested by a floating net cage program initiated in 1986 in the Saguling Reservoir (West Java). In a mere 3 years, this program was able to achieve 2,500 tons production, contributing to 20 percent of Bandung's fish requirements (Costa-Pierce 1992). Current levels of production have reportedly doubled.

9. Asides from aquaculture, seed enhancement programs also hold considerable potential for improved aquatic resource management. This includes ranching (releasing fish larvae into the wild), as well as seed stocking for benthic organisms such as bivalves. Because of their lack of stock-recruitment relationships, however, the survival of wild shrimp stocks should continue to depend primarily on the environmental and ecological conditions of traditional nursery grounds such as mangrove and estuarine areas.

### Resource Management

10. Indonesia has numerous vestigial common property arrangements to fisheries management. These include the 'sistem lubuk laragan' in North Sumatra and Kalimantan, and the 'sistem sasi' of Irian Jaya and the Moluccas. These traditional management schemes were developed locally over the course of generations, and were based on widely accepted concepts of resource user rights (Chong and Hutangalung 1992). Contrary to open access (*res nullus*), common property arrangement (*res communes*) restricted the use of fishing areas to the co-owners of the resource, and thus limited resource over-exploitation (Ciracy-Wantrup and Bishop 1975). No provision for the recognition of these customary rights is made by the Basic Fisheries Law No. 9/85. Instead, marine areas have become *de facto* open access, where any community's efforts to reduce entry into the fishery by outsiders are voided by lack of legal standing. Furthermore, no fishing fees are levied on domestic fishermen, robbing fishing authorities of one of the most effective methods of controlling entry (Chong and Hutangalung 1992). This situation is aggravated by the geographical remoteness of many fishing grounds, rendering enforcement costs prohibitive, and increasing returns for non-compliance. Under these circumstances, it is unrealistic to attempt to enforce sound fisheries management without relying on local authorities and coastal communities for self-policing and enforcement.

11. With the shift in the patterns of utilization from a multiple use strategy towards single-purpose exploitation, as well as an increase in social mobility among coastal communities, many traditional systems of coastal zone management may no longer be appropriate to guarantee optimal levels of exploitation. However, as indicated by a recent Bank report, insecurity of tenure over fishing areas has been recently recognized as the single most important factor responsible for the failure of coastal-based management initiatives in the Central Visayas, Philippines (World Bank 1993). Modifications of traditional tenure systems can be achieved by allocating communities and/or fishermen groups with legally recognized exclusive user rights to particular fishing areas. These rights can be allocated to enclosed or delimited areas, artificial reefs, or fish attraction devices. In certain cases, local governments could auction off exclusive user rights to either private individuals, fishermen's groups, or even local middlemen who would then acquire monopsonistic rights over the catch. Such systems have been documented for the Philippines with success (Smith and Panayotou 1984).

12. In coastal areas where multiple use conflicts exist, management systems will necessitate more complex and pragmatic approaches that require local government and community involvement and coordination with upstream activities. Elements of such an integrated coastal zone management should include better inter-agency coordination at the local level, multi-use conflict resolution through improved spatial planning, the promotion of alternative activities to fisheries (e.g., coastal aquaculture), buy-back programs to decrease fleet over-capacity, the introduction of user fee systems for fishing, diversification of production and markets, e.g., by promoting consumption of under-utilized products, seed multiplication programs, substrate enhancement techniques (e.g., artificial reefs), improved value-added processing and post-harvest handling, a more stringent enforcement of illegal fishing methods, and environmental protection campaigns, among others (Chong and Hutagalung 1992; Burbridge and Maragos 1985). The development of such coastal zone management strategies is currently in incipient form in Indonesia (see Burbridge and Maragos 1985; Knox and Miyabara 1984) and should receive much higher priority during REPELITA VI.

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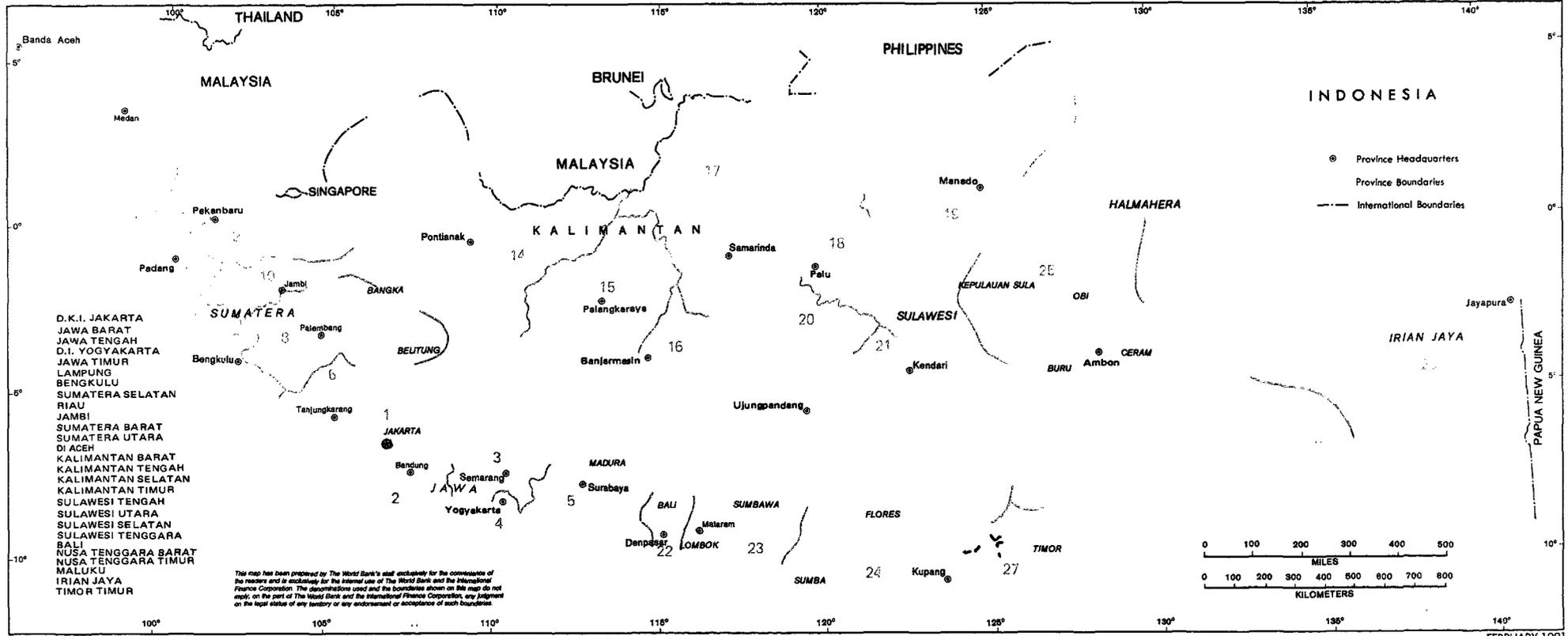
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