Economic Development and Environmental Change in Thailand

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1. INTRODUCTION

Over the past decade, Thailand's economic growth has been one of the highest and steadiest of the developing nations (Table 1.1). In fact, the growth rate of the country's Gross Domestic Product (GDP) has been high and relatively stable since the early 1960s when the first economic development plan was implemented (Table 1.2). Between 1960 and 1980, the average rate of real GDP growth was above 7 percent per year. The growth in GDP during 1987-1990 was even more remarkable, averaging over 10 percent per annum. In 1991, real GDP, estimated at US$ 28,648 million by the National Economic and Social Development Board (NESDB 1991) was almost three times of that experienced in 1980. By 1996, GDP at current prices, estimated at US$ 186 billion, was double of that in 1990.

The success story of economic growth in Thailand cited above has been mainly the result of rapid industrialization, export orientation and production diversification. Over the past three decades, the economy has undergone dramatic structural change. Once an inward-looking, import-substitution economy relying on exports of agricultural products and raw materials, Thailand

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has been so transformed that the share of GDP from agriculture has declined from 26 percent in 1970 to 12 percent in 1991. At the same time, the share of GDP from industry has risen from 16 percent in 1970 to 26 percent in 1991, and is expected to continue rising throughout the decade. The magnitude of the changes is even more impressive if one looks at the shifting structure of exports. In 1990, manufactured goods accounted for 75 percent of total merchandise exports, a dramatic increase when compared with the tiny 6 percent share 1970, while the export role of agriculture decreased from 70 percent in 1970 to 23 percent in 1990 (Bank of Thailand 1991). The tourism sector of Thailand has also experienced rapid growth during the past decade. International tourism in 1983 earned US$ 1,002 million, or 17 percent of the total value of exports,

Table 1.1 : Comparison of Growth Rates (in Real GDP) of Asian Countries

Country	1987	1988	1989	1990	Average
Thailand	9.5	13.2	12.0	10.0	11.2
Korea	11.1	11.5	6.1	8.7	9.4
Singapore	8.8	11.1	9.2	8.3	9.4
China	10.6	0.8	4.0	5.0	7.6
Hong Kong	13.8	7.9	2.3	2.3	6.6
Malaysia	5.2	8.9	8.8	9.4	8.1
Indonesia	3.6	5.7	7.4	7.0	5.9
Philippines	4.4	6.3	5.6	2.5	4.8

Source: NESDB for Thailand, Asian Development Bank for other countries.

Table 1.2 : Average Annual Growth of Real GDP and Real per Capita GNP in Thailand, 1960-96

Year	Real GDP	Agriculture	Industry	Services	Real per Capita GNP
60-65	7.2	4.8	11.5	7.2	-
65-70	8.6	6.0	10.4	9.5	-
70-75	5.6	3.8	7.3	5.6	2.9
75-80	7.9	4.0	10.6	8.2	5.3
80-85	5.6	4.9	5.0	6.3	3.5
86	4.5	0.2	7.1	4.6	2.6
87	9.5	0.2	12.8	11.1	7.7
88	13.2	10.2	17.4	11.6	11.4
89	12.0	6.6	16.2	11.1	10.5
90	10.0	1.8	15.8	10.0	8.5
96	N.A.	3.6	9.3	7.9	N.A.

Note: Figures from 1970 are based on the New Series of National Accounts.
Source: NESDB

and US$ 4,640 million in 1990, a fourfold increase within a course of only 7 years. Total earnings from tourism including domestic tourism is clearly much highter.

There is little doubt that the dramatic economic growth in Thailand during the past three decades has brought about significant benefits to the Thai population in terms of job opportunities, higher real income, more consumption goods, and ultimately better living standards. Yet, amidst the affluence generated by industrialization, complex environmental problems have developed. Signs of serious stresses have been evident in many natural resource systems and environmental media. The linkage between economic development and the adverse changes in the state of the environment has been a most important concern of both the public and the government, and both national and international development organizations. Although there exist policies and legal measures for environmental protection and conservation, they are often inefficient or ineffective. To sustain a development process, a review of the state of the environment and an analysis on the linkages between adverse changes in the state of the environment and economic development in a holistic and systematic manner are of utmost importance.

In this paper, a systematic and holistic framework of analysis is used to examine the linkages between major environmental issues and economic development in Thailand. The objectives of the paper are to assess the adverse impact of the development process on the environment, and to evaluate policy outcome and performance of the Thai government on its handling of the environmental issues in the direction of sustainable development. Section 2 reviews the current state of the environment in Thailand and the linkages between economic development and environmental problems to provide a background for the subsequent discussions. Sections 3 and 4 analyze the role of the Thai government in environmental management and sustainable development.

Finally, Section 5 offers concluding remarks regarding the formulation and implementation of environmental policy for sustainable development in Thailand.

2. ECONOMIC DEVELOPMENT AND ENVIRONMENTAL PROBLEMS

In this section, the state of the environment or changes in the quantity and quality of the environment due to rapid economic growth in Thailand during

Table 2.1 : Changes in Forest Land Area of Thailand, 1960-1993

Year	Forest Area (rai)	As % of Country Area
1960	173,176,250	54.00
1973	138,925,625	43.32
1976	124,010,625	38.67
1978	109,515,000	34.15
1983	94,219,349	30.01
1985	94,285,000	29.40
1988	89,877,182	28.03
1991	85,436,284	26.64
1993	83,450,625	26.02

Source: Royal Forest Department, 1995.

Table 2.2 : Rate of Deforestation in Thailand by Various Periods, 1973-1993

Period	Area Loss (mil. rai)	Deforestation Rate (mil. rai/year)
1973-1976	14.6	4.8
1977-1978	14.5	7.3
1979-1982	11.6	2.9
1983-1985	4.7	1.5
1986-1988	3.4	1.1
1989-1991	4.9	1.7
1991-1993	2.0	1.0

Source: Royal Forest Department.

the past three decades are reviewed. The linkages between economic development and environmental problems are also analyzed.

2.1 State of the Environment

(a) Forest resources

Thailand, like other developing countries in the tropics, has been facing a serious deforestation problem. The country's natural forest areas have been cleared at an average rate of 3 million rai per year during the past three decades. As a result, the forest areas decreased more than half between 1960 to 1993, from 173.2 to 83.5 million rai (Table 2.1). Most of the cleared land was turned into agricultural land but about 30 per cent was left as fallow land. Despite various efforts by the government to solve the problem, deforestation continues. In 1989 logging was officially banned but land clearance for agriculture and

illegal logging still continued at an average rate of 2 million rai per year during 1991-1993 (Table 2.2). At this rate of forest clearing, it is estimated that Thailand will loose all her forest land within a period of only 29 years from now.

Currently, the forest lands of the country account for about one fourth of the country's total land area. Half of this forest land is in the Northern Region and only a small portion in the Central Region (Royal Forest Department 1995). Most of the remaining forest lands are in steep mountainous or watershed areas. Destruction of watersheds and loss of biodiversity are therefore increasingly recognized as more important than the mere shortage of timber and fuel wood. In addition, it was found that an expansion of agricultural land into "marginal" areas where yields are lower raises the average cost of food crop production for the whole country (Panayotou and Parasuk 1990). In order to protect these pristine natural forest areas and biodiversity, the Thai government has initiated a number of conservation policies. One major policy involves an expansion of protected forest areas of mainly national parks and wild life sanctuaries. As a result, the area of national parks increased 40 per cent during 1987-1994. At present, there are about 55 million rai of protected forest areas which account for 69 and 15 per cent of the total forest and total land areas of the country respectively (Supachit 1994a). However, government budget allocated to protection of national parks and other protected areas does not increase proportionately with the increase in area. The expansion of protected areas is thus accomplished at the expense of effectiveness of protection. Encroachment, wildlife poaching, and illegal logging in all types of protected forest areas in Thailand are common.

(b) Biological diversity

Thailand's biological diversity is a world as well as a national heritage. Four main types of habitats in Thailand having the greatest value of biodiversity

Table 2.3 : Number of Animal Species Found in Thailand and the World

Type	Thailand	World
Freshwater Fish	650	20,000 *
Saltwater Fish	2,000	
Amphibians	107	2,500
Reptiles	298	6,000
Birds	916	8,600
Mammals	282	4,500
Total	4,253	41,600

Note: **Fresh and saltwater combined.*

Source: Science Society of Thailand.

are tropical forest ecosystems, mangrove forest ecosystems, fresh water ecosystems, and coral reef ecosystems. The tropical terrestrial and aquatic ecosystems of Thailand are rich in flora and fauna species. More than 10 per cent of the world's known animal species or 4,253 out of the total 41,600 species are found in Thailand (Table 2.3).

In recent years, the biodiversity of most ecosystems in Thailand has been declining in terms of both species number and population size due to a number of causes. Overharvesting, illegal poaching and trading of wild species of animals and plants, natural habitat destruction, outdated laws, and lack of resources for enforcement are major causes. About 143 animal species found in Thailand are under threat of extinction (Table 2.4). About 111 species of flora and fauna are listed in the endangered category (Table 2.5). Over 60 per cent of Thailand's coral reefs are in poor or fair condition. Coral reefs in some areas could become permanently lost. The deterioration is caused by increasing coastal sedimentation and pollution, reef blasting, destructive fishing practices, anchoring on reefs, and overharvesting of fish and shellfish.

Table 2.4 : Species Endemic to Thailand

Type	Number
Freshwater Fish	70
Saltwater Fish	50
Amphibians	13
Reptiles	31
Birds	2
Mammals	8
Total	143

Source: Science Society of Thailand.

Table 2.5 : Endangered Species in Thailand

Type	Number
Fish	12
Amphibians and Reptiles	12
Birds	41
Mammals	40
Insects	3
Plants	3
Total	111

Source: Science and Technology Research Institute of Thailand

(c) Land and soil

Thailand has relatively abundant cultivable land which represents about 65 per cent of the country's 320.7 million rai total land area. The average agricultural land holding is about 27 rai. Only about one fourth of the agricultural land is irrigated and is mostly under paddy fields (Table 2.6). Another one fourth is devoted to field and tree crops. The rest of the land is unsuitable for agricultural

Table 2.6 : Percentage of Agricultural Land Area by Category of Land Capability

Land Capability	Region					
	North	Northeast	Central	East	South	Total
Field Crop/Tree	6.11	9.57	3.8	1.95	4.6	26.03
Paddy Field	5.12	12.67	4.64	1.74	2.03	26.2
Unsuitable for Agriculture	4.59	6.6	1.05	1.74	1.67	15.65
Forest Conserved	17.05	3.76	4	1.25	5.28	31.34
Wet Land	0.19	0.31	0.06	0.02	0.2	0.78
Total	33.06	32.91	13.55	6.7	13.78	100

Source: Department of Land Development.

purposes unless investment in conservation measures is incorporated. Soil erosion, salinity, and acidity affect about half of the country's agricultural land (Department of Land Development 1993). Land misuse and conflict in land use were less in the past when population pressure was less intense. At present, however, as much as 30 million rai of arable land is misused. The Department of Land Development reported in 1990 that moderate and severe soil erosion took place on about 108 million rai of agricultural land. Under-utilization as well as unnecessary fallow land are also evident. The fertile arable land has been converted into residential, commercial, and industrial centers. The trend can be seen in such large cities as Bangkok and Chiang Mai. These settlements as well as industrial centers have become the sources of various waste products, many of which cause deterioration in land and soil quality.

Insecurity of land ownership is another fundamental problem affecting the utilization of land resources in Thailand. More than 40 per cent of agricultural land is occupied and farmed without legal land titles. This factor deprives farmers of both access to credit and incentive to improve and properly manage their land. Moreover, the issue of landlessness, rural poverty, and forest encroachment are intertwined. As much as 80-90 million rai or 38 per cent of the total forest land has been encroached upon by some 10 million landless farmers. Crop yields in newly cleared land are high during the first few years and decline rapidly

thereafter. The land thus deteriorates and turns into wasteland. New land is further cleared for cultivation and subsequent soil exhaustion continues (Technical Committee on the Global Environment 1992).

(d) Water

Competition for water resources, water shortages, and floods have become major problems in Thailand for many years. Although Thailand receives about 800 billion cubic meters of rainfall a year, Thailand has made increasing use of its water resources. Water demand is increasing rapidly in the Central Region due to rapid industrialization, urbanization, and expansion of dry-season cropping. The shortage of water for dry season irrigation in the Central Plain and for piped water supply in Bangkok and other large cities have become critical in recent years. Most of the reservoir sites have already been used. At the same time, many of the remaining water sources are no longer easily drawn on to serve the water demand of the Central Plain and Bangkok due to the increasing demand for water in other regions. Ground water has been overextracted in Bangkok Metropolitan areas for more than a decade. The Metropolitan Water Works Authority (MWWA) currently uses more than 500, 000 cubic meters of ground water a day for piped water supply. Private industry, such as factories, large hotels and housing estates, is also using a large quantity of ground water. This overextraction of ground water has caused serious land subsidence in certain areas in Bangkok and its nearby provinces. Land subsidence rates in the areas of Sukhumvit, Phrakhanong, Bang Na, Ladprao, and Hua Mark, have exceeded 10 centimeters a year. Although the Department of Geological Resources has recently implemented higher charges for ground water, the problem will not be solved only by this measure because demand for water has increased rapidly along with the country's high growth rates.

While water shortage occurs in the dry season, in the rainy season flooding occurs in many areas of the country including the Bangkok Metropolitan Area. The floods in Bangkok cause significant political and economic impacts and, at the moment, there is no effective prevention measure for the problem. Clearly, Thailand needs to adopt a more efficient and effective approach to water resource management if sustainable development is the country's prime objective.

(e) Coastal resources

Major coastal resources in Thailand include mangrove forests, coastal and marine fishing and breeding grounds, recreational resources, and a use as

waste sink. Like other natural resources, coastal resources in Thailand have been exploited and are in a deteriorated condition due to rapid economic development without environmental concerns and measures.

In 1961 Thailand had about 2.3 million rai of mangrove forest area. In 1993, the mangroves had decreased to about a million rai due to rapid conversion of mangrove areas for other uses, such as settlement, industries, aquaculture, mining, etc. (Table 2.7). Examples are coconut plantations and shrimp farms in Samut Songkram and Samut Sakhon, resettlements and industrial sites in

Table 2.7 : Changes in Mangrove Area in Thailand, 1961-1993

Unit: rai

Year	Area
1961	2,299,375
1972	1,954,375
1979	1,795,675
1986	1,227,674
1989	1,128,750
1991	1,112,694
1992	1,096,169
1993	1,054,266

Source: Royal Forest Department.

Chachoengsao, and fuel wood production along the west bank and Mae Klong River. The area under shrimp farming has increased rapidly during the last decade, from 283, 549 rai in 1986 to 455, 075 rai in 1992 (Table 2.8). It now accounts for over 90 per cent of aquaculture (Fishery Department 1990).

Overfishing is caused by combined factors such as population pressure, modern technology, new economic opportunities, and ineffective legislation and management. Although total marine fishery production has not yet decreased, there is an increasing percentage of low economic value fish in the composition of marine catch. The share of these low economic value fish has increased from 22 per cent in 1971 to 41 per cent in 1988 (Ministry of Agriculture and Cooperatives 1989/90).

Apart from overfishing and the direct exploitation of mangrove forest, inland discharge is another major cause for coastal and marine resource deterioration. For a long time both industries and tourism development have discharged their wastes into rivers and seas and thus affected much of the coastal resources. In several major tourist areas such as Pattaya, Chon Buri, Kho Samed,

Table 2.8 : Changes in Areas of Shrimp Farms in Thailand, 1986-1992

Unit: rai

Province	Year			
	1986	1988	1990	1992
Trat	5,975	8,748	11,382	14,000
Chanthaburi	12,029	38,474	52,898	88,146
Rayong	278	6,326	10,833	9,472
Chonburi	3,687	4,378	3,900	3,114
Chachoengsao	10,326	10,939	20,520	16,972
Prachinburi	-	-	-	1,500
Samutprakan	43,741	48,072	38,000	37,822
Bangkok	23,168	27,328	22,521	19,482
Sanutsakhon	47,646	71,062	50,080	46,221
Samutsongkhram	39,114	53,975	24,107	16,328
Ratchaburi	-	24	-	-
Phetchaburi	12,689	26,324	18,200	15,268
Prachuapkhirikhan	6,184	8,669	5,000	6,293
Chumporn	1,413	6,197	2,238	12,007
Suratthani	23,098	41,580	55,030	59,540
Nakhonsithammarat	47,220	52,489	62,500	65,019
Songkhla	-	1,169	4,000	18,321
Phatthalung	-	20	120	1,120
Pattani	1,160	2,261	2,800	3,983
Narathiwat	-	-	-	21
Ranong	7	27	800	1,913
Phangnga	-	253	800	3,225
Phuket	145	459	1,100	1,695
Krabi	206	266	380	2,400
Trang	-	356	750	3,372
Satun	5,463	5,795	5,828	7,841
Total	283,549	415,191	393,787	455,075

Note: No data available for Prachinburi prior to 1992 and it is areas of freshwater shrimp farms.
Source: Department of Fishery, 1992.

Kho Samui, and many other islands, there are inadequate or no sewage systems (see Supachit 1992). Heavy loads of biochemical oxygen demand (BOD) draining from these areas into the Gulf of Thailand have already reduced the dissolved oxygen (DO) levels in many sections around all estuarine areas to near zero. Heavy metals and pesticide run-off from industrial and agricultural wastes affect the reproductive and the survival rates of fishery resources. Moreover, harmful impact on fish in their natural habitats can be further passed to aquacultural farms in the same way. Therefore, if these wastes are not

properly managed, they can cause permanent loss of valuable marine fishery products.

(f) Ambient quality

The problems of ambient quality are more a concern for urban areas.

Table 2.9 : Changes in Quality of Serface Water Sources in Thailand

Region/River	Standard Value			1992			1993		
	DO	BOD	TCB	DO	BOD	TCB	DO	BOD	TCB
Central Region									
Chao Phraya River									
Upper Part	≤ 6	≥ 1.5	≥ 5,000	5.6	2.2	210,000	5.9	1.7	39,700
Middle Part	≤ 4	≥ 2	≥ 2,000	3.8	1.7	207,777	4.9	2.3	248,700
Lower Part	≤ 2	≥ 4	-	0.3	8.2	-	1.5	2.7	257,700
Thachin River									
Upper Part	≤ 6	≥ 1.5	≥ 5,000	3.2	3.4	43,000	2.9	3.3	84,200
Middle Part	≤ 4	≥ 2	≥ 2,000	3.0	5.8	210,000	3.6	2.1	109,500
Lower Part	≤ 2	≥ 4	-	2.2	6.7	765,000	2.4	4.2	84,300
Maeklong River	≤ 4	≥ 2	≥ 2,000	4.3	3.0	10,000	6.7	1.6	87,100
Bang Pakong River	≤ 4	≥ 2	≥ 2,000	3.8	1.2	250,000	4.4	2.3	37,400
Pasuk River							6.4	1.3	205,200
Sakhaekang River							5.3	1.9	133,000
Northern Region									
Ping River				7.0	1.1	24,400	6.4	1.1	67,500
Wang River				7.6	1.5	20,300	6.1	1.1	126,500
Yom River				6.5	1.6	21,700	5.7	1.4	49,000
Nan River				6.6	1.4	25,600	6.3	1.3	83,900
Northeast Region									
Chi River				7.7	1.8	3,000	6.8	1.9	8,600
Mun River				7.7	3.0	35,000	6.6	1.5	7,200
Pong River							4.4	1.5	7,000
Southern Region									
Tapee-Pumduang									
River				6.0	1.4	4,500	6.5	1.9	122,700

Source: Department of Environmental Planning and Policy, 1995.

Major issues of ambient quality include air pollution, water pollution, solid and hazardous wastes. Industrial, agriculture, and domestic areas are significant sources of water pollutants because of an inadequate sewage infrastructure and a shortage of sewage treatment facilities. Untreated waste water from all sources are directly discharged into rivers and canals. Residential waste water discharges are now a serious threat to water quality in Thailand, particularly in urban areas like Bangkok. In 1988 the BOD load from residential sources accounted for 80 per cent of the total BOD load to Chao Phraya River. The Ministry of Science, Technology and Environment reported that while the quality of major rivers in the Northern, Northeastern, and Southern Regions of the country are still in a fair condition, there are signs, such as an increase in the concentration of the total coliform bacteria (TCB) in those water sources, indicating the deteriorated trend of these water sources, particularly in areas of concentrated settlement and industrial development (Table 2.9). The untreated waste water discharged from the domestic, commercial and industrial sectors into the surface water sources is the main cause of water pollution problem in these regions. In the Central Region, which is the most populated and industrialized region of the country, the water quality of its major rivers are much poorer than other regions. The water quality of the middle and lower range of the Chao Phraya Rivers are very poor as indicated by the values of DO, BOD, and TCB of the river. The water quality of other major rivers, such as Tha Chine, Mae Klong and Pasak, has also deteriorated rapidly in recent years due to an increase in the use of the rivers as a waste receptacle.

For ambient air quality, the quality of air in Bangkok is usually much poorer than the average and considerably much worse than in the rural areas. This is due to the concentration of industrial and economic activities, high intensity of energy use, traffic congestion and overcrowding (see Table 2.10 for trends in the production, import and consumption of energy in Thailand). Efforts in ambient air quality monitoring on a regular basis have taken place only in Bangkok, and on a periodic basis in a few big cities. The average values of all parameters monitored and measured, such as lead, suspended particulate matter, and carbon monoxide have increased significantly since the last decade. In fact, Bangkok has already been placed among the top ten worst cities in the world in terms of air and noise pollution (Boonthiam Khemaphirat et al. 1991). The mean maximum values of carbon monoxide and lead in major Bangkok streets have been high and occasional breaches of the standards do occur. The level of suspended particulate matters in major streets of Bangkok has exceeded the National Ambient Air Quality Standard value (Table 2.11). Air quality problems also exist in areas where mining and lignite power plants are located, for example

Table 2.10 : Production, Import and Consumption of Energy in Thailand, 1991-93

Unit: barrel of crude oil/day

Category	Quantity			% Change		
	1991	1992	1993	1991	1992	1993
Production	**290,212**	**310,788**	**331,766**	**17.00**	**7.09**	**6.75**
Crude Oil	24,503	26,317	24,694	2.23	7.40	-6.17
Condensate	19,211	24,589	26,416	26.92	27.99	7.43
Natural Gas	140,605	150,386	168,747	24.03	6.96	12.21
Lignite	85,894	91,085	95,873	16.33	6.04	5.26
Hydro Power	19,999	8,411	16,036	-8.06	-7.94	-12.90
Import	**372,920**	**429,249**	**502,284**	**5.19**	**15.10**	**17.01**
Crude & Refined	381,455	435,410	497,875	5.81	14.14	14.35
Condensate (Export)	-17039	-14532	-10227	12.42	-14.71	-29.62
Coal	5,871	6,247	11,704	37.69	6.40	87.35
Electricity	2,633	2,124	2,932	-9.08	-19.33	38.04
Consumption	**666,520**	**721,097**	**807,049**	**10.63**	**8.19**	**11.92**
Crude & Refined	410,794	451,899	509,873	6.42	10.01	12.83
Natural Gas	140,794	150,614	169,011	24.04	6.95	12.21
Coal	5,871	6,247	11,704	37.69	6.40	87.35
Lignite	86,283	91,714	97,438	16.72	6.29	6.24
Hydro/Electricity	22,752	20,623	19,023	-8.09	-9.36	-7.76
Import/Consumption(%)	55.95	59.53	62.24			

Source: Office of the National Committee of Energy Policy

Table 2.11 : Air Quality Near Major Streets in Bangkok, 1994

Units: mg/m^3

Pollutants	Measured Range	Standards
Carbon Monoxide (8 hrs. avg.)	10-22	20
Lead (24 hrs. avg.)	0.001-0.006	0.01
Suspended Particulate Matter (24 hrs. avg.)	0.2-1.4	0.33

Source: Office of the National Environment Board.

Mae Moh in Lampang Province. However, based on the available information on the changes in level of various air pollutants in areas near major streets in Bangkok, the quality of ambient air in Bangkok is improving (see Tables 2.12-2.14). But the 24-hour average noise level in many business areas in Bangkok has increased from 68 dBA to 78 dBA compared to the standard noise level set by the National Environmental Board at 70 dBA (Table 2.15).

Table 2.12 : Changes in the Concentration of 24-hour-average Suspended Particulate in Areas near Major Streets in Bangkok between 1992 and 1993

Unit: mgs/m^3

Permanent Monitoring Station	1992	1993	Change
Department of Case Enforcement	0.31	0.33	0.02
Bang Yeekhan Electricity Sub-station	0.24	0.33	0.09
Phratoonam	0.62	0.73	0.11
Thai Military Bank	*	0.21	*
Yaowaraj	0.79	0.5	-0.29
Office of National Statistics	0.29	0.23	-0.06
Bang Lampoo	*	0.27	*
Samsean Kindergarten School	*	0.21	*
Rachapak Bansomdej Institute	*	0.49	*
Saphan Khawai	0.28	0.31	0.03
Bangkok Christian Hospital	0.4	0.34	-0.06
Police Department	0.34	0.29	-0.05
Huamark Post Office	0.97	0.83	-0.14
Department of Land Development	0.27	0.24	-0.03
Department of Domestic Animals	*	0.43	*

Note: The 24-hour-average ambient standard for suspended particulate matters is 0.33 mgs/m^3.
** No measure.*
Source: Department of Pollution Control.

Table 2.13 : Change in the Concentration of 24-hour-average Lead Level in Areas near Major Streets in Bangkok between 1992 and 1993

Unit: mgs/m^3

Permanent Monitoring Station	1992	1993	Change
Department of Case Enforcement	*	0.35	*
Bang Yeekhan Electricity Sub-station	0.26	0.35	0.09
Phratoonam	0.66	0.68	0.02
Yaowaraj	0.71	0.61	-0.1
Office of National Statistics	0.74	0.37	0.37
Bang Lampoo	*	0.37	*
Samsean Kindergarten School	*	0.27	*
Rachapak Bansomdej Institute	*	0.67	*
Thai Military Bank	*	0.18	*
Saphan Khawai	0.94	0.35	-0.59
Bangkok Christian Hospital	0.65	0.44	-0.21
Police Department	0.48	0.32	-0.16
Huamark Post Office	1.47	1.11	-0.36
Department of Land Development	*	0.22	*
Department of Domestic Animals	*	0.31	*

Note: The 24-hour-average ambient standard for Lead is 10 mgs/m^3.
** No measure.*
Source: Department of Pollution Control.

Table 2.14 : Change in the Concentration of 1-hour-average Carbon Monoxide Level in Areas near Major Streets in Bangkok between 1992 and 1993

Unit: mgs/m^3

Permanent Monitoring Station	1992	1993	Change
Department of Case Enforcement	2.97	4.98	2.01
Bang Yeekhan Electricity Sub-station	3.63	6.18	2.55
Pratoonam	5.36	4.56	-0.8
Yaowaraj	8.17	5.18	-2.99
Bang Lampoo	*	2.51	*
Samsean Kindergarten School	8.68	7.43	-1.25
Rachapak Bansomdej Institute	*	4.19	*
Thai Military Bank	*	3.75	*
Saphan Khawai	7.83	5.67	-2.16
Bangkok Christian Hospital	8.49	9.04	0.55
Police Department	6.63	3.89	-2.74
Huamark Post Office	13.73	9.77	-3.96
Department of Land Development	*	3.2	*
Department of Domestic Animals	*	6.25	*

Note: The 1-hour-average ambient standard for carbon monoxide is 50 mgs/m^3.
** No measure.*
Source: Department of Pollution Control.

Table 2.15 : Level of Noise in Areas near Major Streets in Bangkok, 1992-1993

Unit: decibels

Point of Measure	1992	1993
Pho Po Ro Building in Chulalongkorn Hospital	77	71
Ministry of Science, Technology and Environment	72	72
Department of Land Transportation	76	78
Odian Circle	68	69

Source: Department of Pollution Control.

(g) Solid waste and hazardous waste

Solid waste has become a more serious problem of the urban environment since the last decade. At present, the Bangkok metropolitan areas alone generate about 6,634 tons of solid waste per day (Table 2.16). In addition to solid waste, there were also approximately 2 million tons of hazardous waste produced in Thailand per year (Table 2.17). Most of this hazardous waste is in the form of heavy metal sludge and solids and these are posing significant management and health problems to the society. At present, there is only a small hazardous-waste treatment center in the outskirts of Bangkok. The government has approved a plan to develop another four hazardous-waste treatment centers in the provinces

nearby Bangkok, but the plan has not been successfully implemented due to the NIMBY (or Not-In-My-Backyard) protests of the people in those provinces.

Table 2.16 : Quantity of Collected Solid Waste in Bangkok Metropolitan Area, 1980-1995

Unit: tons/day

Year	Quantity
1980	1,966
1982	2,527
1984	2,557
1986	3,738
1988	4,225
1989	4,085
1993	7,000
1994	7,050
1995	6,634

Source: Bangkok Metropolitan Authority.

Table 2.17 : Type and Volume of Hazardous Waste

Unit: tons

Waste	1986	1991	Annual Change (%)
Oil residues	124,194	219,467	15
Liquid organic waste	187	311	13
Organic sludge	3,737	6,674	16
Inorganic sludge	11,698	19,254	13
Heavy metal sludge	823,869	1,447,590	15
Solvent	19,738	36,163	17
Acid Waste	81,054	125,428	11
Alkaline Waste	21,952	34,235	11
Off-spec products	12	25	22
Aqueous organic waste	116	242	22
Photographic waste	8,820	16,348	17
Municipal waste	7,231	11,787	13
Infectious waste	46,647	76,078	13
Total	1,151,729	1,993,602	15

Source: Engineering Science Inc.

(h) Human resources

The process of rapid economic development affects human resources adversely through the impacts on general and occupational health. Agricultural products are increasingly contaminated with residuals of chemical pesticide (Table 2.18). Human health in general has been threatened by the worsening

Table 2.18 : Residuals of Chemical Pesticide in Agricultural Products

Type	Number of Sample	% of Sample with Residual	% of Sample with Over-dose Residual
1. Fruits			
Fruit with eatable peel	121	93	13
Fruit with uneatable peel	198	62	6
2. Vegetables	864	34	5
3. Cereals	105	2	-
4. Dry Beans	71	30	-
5. Animal Products	467	74	-

Source: Department of Medical Science, 1993.

conditions of ambient quality. Although the measured levels of many pollutants in the air and water have not exceeded the standards, they could have long term accumulative effects on human health. High incidence of health problems related to the respiratory system is already reported. In 1990, there were about 1 million cases of air-pollution-related respiratory diseases in Bangkok. At the same time, a survey conducted by the Department of Police found that traffic policemen suffered from health problems such as hearing impairment, high blood pressure, reduced lung function ability, and sinus inflammation (Boonthiam Khemaphirat et al. 1991). A survey conducted by Chulalongkorn University found that 82 per cent of the commuter boat operators in selected canals in Bangkok suffered hearing impairment from the noise generated by their engines, and all operators working longer than 15 years had irreversible hearing loss (TDRI 1987).

2.2 A Holistic View of the Problem

The changes in the state of the Thai environment during the past three decades reviewed in the previous subsections indicate that, along with the country's very successful economic growth, Thailand is currently plagued with complex environmental problems. Obviously, the emergence of natural resource depletion and environmental degradation in Thailand has a close linkage with rapid economic growth. The consequences of economic development and environmental change in Thailand are explained below .

Firstly, economic growth in Thailand has depended upon the exploitation of the natural resources base. The forest resources, fertile lands, water resources, and coastal areas have been heavily used as factors of production in the

agricultural and industrial sectors without or with inadequate conservation measures. This leads to rapid depletion and deterioration of most natural resources throughout the country.

Secondly, industrialization has been concentrated in urban areas, especially the Bangkok Metropolitan Region (BMR-Bangkok and the five surrounding provinces), due to the proximity to markets and ports. It has induced a large increase in demand for energy and raw materials, and also generated more wastes and pollution per unit of production than the agricultural sector that it is replacing. During the three decades of rapid industrialization in Thailand, the number of industrial factories has increased from a few hundred to over fifty thousand (Table 2.19). In 1990, the BMR accounted for over 50 per cent of the 52,000 factories and 23 industrial estates in the country, and generated 75 per cent of industrial waste. There are signs that some of the worst industrial polluters are moving out of the inner city district into its satellite provinces The manufacturing sector is by far the largest generator of hazardous waste, accounting for 90 per cent of all such waste in the country (Dhira Phantumvanit and Panayotou 1990).

Table 2.19 : Expansion of Industries in Thailand, 1969-89

Indicator	1969	1979	1989
Industrial GDP	37,578	83,709	195,444
% Share in GDP	24.14	29.29	34.03
No. of Factories	631	19,691	51,500

Note : 1) Industrial GDP is quoted at constant 1972 prices and in million baht.
2) Only factories registered with the Department of Industrial Works are reported.
Sources: Bank of Thailand and Department of Industrial Works.

Fourthly, industrialization has induced urbanization due to the availability of employment in industrial and service sectors. Urbanization further increases energy consumption and pollution. The population of the BMR is currently growing at twice the national average. Migration towards urban areas is likely to continue into the future and will probably accelerate. Major urban environmental problems include the deterioration of the ambient environment and the inability of the public to meet the rapidly growing demand for public infrastructures of the urban population. Air pollution in Bangkok and other large cities arises from increasing levels of industrial and vehicle emissions. Water pollution arises from emissions of untreated waste water from industries and households. Industries and household refuse are sources of hazardous and toxic wastes in

urban areas.

Finally, the expansion of economic activities involving the use of natural resources and public infrastructures is occurring much faster than the policy and legislative development for their control. This has created serious implications on the productivity of human resources and the whole economy. Furthermore, when most of the natural resource bases in the rural areas are degraded and depleted, poverty and a wider gap of income distribution between the rural and the urban sectors will intensify and complicate the problem.

3. THE ROLE OF THE THAI GOVERNMENT IN ENVIRONMENTAL MANAGEMENT

This section investigates how the Thai government has attempted to deal with the environmental sustainability problems after three decades of rapid economic growth. The analyses focus on the country's national development policies, legal and institutional arrangements, and resource management policies. The main reason for placing the role of the government in the forefront is that environmental problems are basically problems of market failure which, in principle, justified government intervention.

3.1 National Development Policies

Thailand formulated her first National Economic and Social Development Plan in 1961. The primary objective in the country's development was economic growth as formally indicated in the plan . At the time the country's rich natural resource base was viewed in terms of its economic potential and was treated as a limitless natural stock contributing to economic development and growth. In addition, the plan adopted a by-sector development approach. Each economic sector, i.e., agriculture, industry, transport, education, etc. was encouraged to do its best. The plan lacked strategies to integrate sectoral development plans for an overall balanced development (NESDB 1991).

Throughout the five year period (1961-1965) of the First Plan, development activities focused on the construction of infrastructure; particularly roads, railways, and large scale irrigation systems. The purposes were to improve access to rural areas, and accelerate the utilization of various natural resources. The government provided various incentives for agricultural land development, commercial logging, as well as mining. Timber and mining concessions were granted to both foreign and domestic private firms on generous terms.

The succeeding Second and Third Plans (1966-1976) continued to

promote growth and economic productivity in the short term like the First Plan. The long term ecological impacts of natural resource consumption received little attention. The general outcome was an expansion of cultivable areas and a rapid decrease of forest lands throughout the country. Although the government had a goal to conserve 50 per cent of the total land area of the country as forest land, this was not achieved.

After 15 years of natural resource exploitation for economic growth, depletion of forest resources, deterioration of soil quality, and shortages in water supply became noticeable. The sectoral development approach without integrated management plans for the system of natural resources and environment had created far reaching impacts on the natural system. The bureaucratic system of the government and the one-policy-for-all development strategy are not efficient in dealing with social and environmental problems. Various issues of environmental problems, while falling into the same category, vary in detail from one locality to another. Each area may require a separate treatment to ensure compatibility to local socioeconomic and cultural settings (Supachit 1994c).

The Fourth Plan (1976 - 1981) contained some resource protection and rehabilitation strategies. They were mostly preparations of groundwork for natural resource planning and management, i.e., problem analyses, compilation of data on natural resource utilization and environmental problems. The government also initiated a number of reforestation programs at various places in the country. However, the government still relied for all policy implementations on its organizations and officials. The bureaucratic nature of the governmental system and organizations prevented the government from carrying out the tasks successfully. Government officials usually cannot remain in the area long enough to identify and understand diverse local resource utilization and environmental problems. The use of a top-down policy and one-policy-for-all strategy to manage a problem which has complex local dimensions by the government caused failure in the implementation of its resource protection and rehabilitation plans during the Fourth Plan.

In the Fifth Plan (1981-1986), the government introduced an integrated approach to natural resource development with an aim to increasing the efficiency of natural resource utilization and restoration at the local level. The government implemented the idea by introducing a number of projects to improve productivity and welfare of the people in certain areas. Each project aimed at local socioeconomic development rather than short-term monetary income gain. The Fifth Plan made the government realize that the implemen-

tation of a handful of projects could not rescue the situation. Economic development and environmental protection need to be integrated first at the macro level to set a national development goal and a central mission of government operations. Development strategies are crucial if one recognizes that the problems have been increasingly intensified.

The Sixth Plan (1981-1986) marked a turning point in the government's economic development strategies on natural resources and environmental planning. The government realized that the intensified depletion and degradation of the resource base required a total revision of the development perception to one in which the resource base acts as a constraint to economic development. Natural resource conservation and environmental protection was therefore explicitly expressed as one major objective of the plan. The Sixth Plan emphasized the development of alternative non-agricultural sources of income to reduce forest encroachment and dependency of farmers on increasingly deteriorated soil in encroached forests. The government also attempted to decentralize natural resource management to the provincial level to promote a sense of ownership, participation, and awareness at the local level. To mitigate environmental impacts from development projects, both private and public organizations are required to submit environmental impact assessments for project consideration and wait for approval upon presenting plans to ensure effective impact mitigation.

A change in economic development strategy introduced in the Sixth Plan to mitigate adverse development impacts on the natural environmental system has not, however, been matched by effective implementation. At the conclusion of the Fifth Plan, the inability of the government to effectively monitor, control, and regulate its own public sectors to follow the new economic development strategy, particularly natural resources and environmental management, was noted. The operations of the public sector has not been in alignment with principles of sustainable development. The requirement of environmental impact assessments for development projects has been only a rubber stamp for project approval. A number of large scale development projects started construction before the projects were approved. Similarly, many development projects, including those undertaken by the public sector, created far-reaching environmental problems in their operation processes despite their soundly proposed mitigation plans. Project follow-up, monitoring, and enforcement have not been undertaken in practice.

In the Seventh Plan (1991-1996), the government explicitly stated that the country's rapid economic growth during the past decades had

exploited much of the country's resource base and in the absence of effective resource management and environmental protection efforts, the depletion and degradation of the resource base are now intensified to an alarming level. The government realized the necessity to revise its former development perception to one in which the resource base is viewed as limited and might constrain economic development. More efforts must be made to allow socioeconomic policies accountable for their environmental effects, and a systematic framework of environmental policy must be formulated. The formulation of the Seventh Plan had a broad-based participation. It was based on the cooperative effort of all sectors, including government agencies, state enterprises and universities, the private sector, and non-governmental organizations. As a result, the policy contents of the Seventh Plan reflected a liberalization process in many respects.

The Seventh Plan had three principal objectives. First, to sustain the country's economic growth at an appropriate level, with stability. Second, to promote more equitable income distribution and rural development. Third, to improve the quality of human resources, life, natural resources and the

Table 3.1 : Government Budget Allocated to the Departments In Charge of Environmental Policy in the MOSTE

Unit: mil. baht

Department	1992	1993	1994	1995	1996
Policy and Planning	85.1	1,078.7	1,226.5	15,691.5	19,160.8
Pollution Control	91.9	200.0	408.9	844.9	101.6
Environmental Quality Promotion	80.1	116.3	171.7	52.1	153.8

Source: Ministry of Science, Technology and Environment (MOSTE).

Table 3.2 : Government Budget Allocated to Environmental Protection by Ministry

Unit: mil. baht

Ministry	Allocated Annual Budget				
	1992	1993	1994	1995	1996
Agriculture	5,621.6	7,164.3	9,052.2	16,020.9	2,905.7
Public Health	71.4	242.5	352.2	229.5	46.0
Industry	395.5	274.2	562.7	593.9	941.1
University Affairs	11.9	2.8	21.9	43.7	0.0
Science	5,253.6	5,587.8	6,436.9	29,139.0	31,694.1
Interior	3,132.9	6,151.9	8,703.4	32,273.4	7,074.3
Education	115.1	143.6	177.4	333.4	138.4
Total	14,602.0	19,567.1	25,306.7	78,633.8	42,799.6

Source: Ministry of Science, Technology and Environment.

environment. Policies on natural resource utilization and environmental protection differed from those in the previous plans on a number of counts. Fundamentally, the plan focuses on five major areas of environmental management policy: natural resource management, environmental quality, energy and environment, industry and environment, and urbanization and environment. The Seventh Plan set definite targets for these plans to ensure the effectiveness of improving the quality of natural resources and the environment throughout the country. Examples included targets on the rehabilitation of water quality of the lower Chao Phraya and Tha Chin Rivers, management of industrial hazardous waste, control of air pollution along major streets in Bangkok, protection of forests in watershed areas, reforestation, conservation of coastal areas, and the protection of tropical coral reefs. In addition, the plan recognized that these tasks are beyond the scope of the government alone. All programs have various forms and methods of drawing contributions from all sectors of the economy. On environmental quality management, pollution control and waste treatment projects must be paid for by polluters and generators of waste based on the "Polluter-Pays Principle" rather than be subsidized through the use of national tax revenues. The amount of government budget allocated to environmental protection activities and plans of various ministries has also increased (Tables 3.1 and 3.2). At the same time investments in environmental facilities have been initiated. At present, there are at least 7 units of central sewage treatment plants under construction in Bangkok areas (Table 3.3). In the area of natural resource management, local people will be called to take part in the management of terrestrial and mangrove forests, biological diversity, land, and water. Non-governmental organizations will be encouraged to assist the government in this endeavor by mobilizing rural people to participate in natural resource management programs.

The above review of Thailand's development policy and efforts in gearing the economy toward ecologically sustainable development indicates that over the first three national development plans, the Thai government has been very successful in guiding the economy toward economic growth and modernization. Natural resources were treated as unlimited in terms of quantity and quality. A sectoral development approach was employed without any integrated management plans for the system of natural resources and environment. Economic growth during the period thus created far reaching impacts on the natural system. Political centralization, the bureaucratic system of the government, and the one-policy-for-all development strategy are not efficient in dealing with complex social and ecological problems. These,

Table 3.3 : Central Sewage Treatment Plants in Bangkok Metropolitan Areas

Project	Year Completed	Area Covered (m^2)	Capacity (m^3/d)	District Covered
See Phraya	1996	2.6	30,000	Samphanthawong
Ratanakosin	1995	4.0	25,000	Phranakorn
Central System I	1996	37	350,000	Pomprab, Samphanthawong
Lumpini	N.A.	N.A.	180,000	Prathumthani, Rachathewi
BMA	N.A.	N.A.	170,000	Phranakorn, Dusit, Phrayathai, Huikwaung
Yannawa	N.A.	28.5	200,000	Yannawa, Sathorn, Bangrak, Bang Kholeam
Nongkham-Phasee Chareon	N.A.	40	157,000	Nongkham, Phasee Chareon
Ratburana	N.A.	41	7,000	Ratburana

Note: BMA stands for Bangkok Metropolitan Authority.

Source: Division of Policy and Plan, Bangkok Metropolitan Authority.

altogether had apparently intensified the problems. In the latter plans, although the government has recognized the problems and attempted to improve the plans by incorporating several treatments for the problems of natural resource depletion and environmental deterioration, most treatments were ad hoc, segmented, and insufficient to deal with the intensified problems. During the last decade, the government has undergone several philosophical shifts on natural resource planning and policy. Unfortunately, these shifts have not been matched by implementation. The Seventh Plan provided more responses to the ecological sustainability problems. Some of the changes in policy and management of natural resources and environmental quality appeared promising in terms of their effectiveness in alleviating the problem. Of note are mandates to promote public awareness and public participation in pollution abatement and natural resource conservation. The principle of "polluter pays" has been used as a mean to enforce environmental standards. The plan, however, lacks a number of effective pollution control mechanisms. Mitigation of environmental impacts from economic development activities is still on a project level approach. Industrial hazardous waste control still focuses on end-of-pipeline control rather than waste minimization in the production process. In addition, the polluter-pays principle has been adopted without clear enforcement strategy. If the government determines to play a better role in

implementing more effective economic policy measures to guide the economy towards sustainable development in both the public and private sectors, the idea of sustainable development issues must be fully integrated into the decision making structures of the government and the main policy arena of macroeconomic policy, sectoral, and project levels.

3.2 Legal and Institutional Arrangements

The political system in Thailand is still a centralized one. The governor of each province must be appointed from the central government in Bangkok. Decision making on development policies, implementation strategies, as well as institutional arrangements all come from the cabinet and the bureaucratic system of the government. Government agencies are responsible for policy implementation which includes information collection, data compilation, monitoring, control, and enforcement. Although the concept of decentralization and privatization have been accepted by a number of government organizations, the process of changes has been slow in almost every organization.

Almost all programs of natural resource rehabilitation and environmental protection in Thailand fall into the hands of the government. The shortcomings of the market in promoting economically optimal (efficient) or socially desirable (equitable) outcomes when technological externalities are present has justified public policy intervention in many countries including Thailand. The management of land and forest resources, water resource, as well as various aspects of environmental quality in Thailand are mostly handled by government agencies. Land and forest resources are typical examples in this regard.

There are currently 11 laws that directly or indirectly govern the management of land resources in Thailand. They are: (1) the 1941 Forest Act, (2) the 1954 Land Code, (3) the 1960 Wild Animal Reservation and Protection Act, (4) the 1961 National Park Act, (5) the 1964 National Forest Reserves Act, (6) the 1968 Land Settlement Act, (7) the 1974 Land Consolidation Act, (8) the 1992 Improvement and Conservation of National Environmental Quality Act, (9) the 1975 Town and Country Planning Act, (10) the 1975 Agricultural Land Reform Act, and (11) the 1983 Land Development Act. Several government agencies dealing with land administration in Thailand operate under different ministries. The government land agencies have been operating without adequate coordination due to the lack of a national land policy. This creates difficulties in law enforcement which may arise from the conflicts among the acts and the responsible governmental agencies themselves (Supachit 1994a).

In addition, most of them are facing similar problems in administration, i.e., lack of funds, manpower and government support. There is a need for the reorganization and restructuring of the land administration system in Thailand to improve administrative efficiency and coordination among the responsible agencies.

The Seventh Plan had introduced a major change in legal and institutional arrangements governing environmental protection. A new comprehensive environmental law was recently enacted. The law empowers policy and planning agencies with enforcement authority and decentralizes environmental authority to provincial and local government. The law recognizes the public's right to know and to participate in environmental affairs and the role of the private sector and non-governmental organizations in environmental rehabilitation. The law also established three organizations of departmental level in the Ministry of Science, Technology and the Environment which are responsible for the nation's natural resource and environmental management policies. Apart from the national environmental law, three other major laws on environmental related issues were also enacted. These include laws on public health, industrial firms, and hazardous waste. The presence of these new laws is important to ecologically sustainable development although they need more time to develop enforcement strategies.

3.3 Resource Management at the Sector Level

Resource management at the sectoral and project levels by government agencies create much stress on natural resource stock and environmental quality. Of noted are forest resources, energy, and tourism. Difficulties in defining the property rights over the resources and the environment have contributed to the emergence of externalities in these resource and economic sectors. Rapid economic growth has also intensified the problem. The government is facing serious problems in allocating and protecting the country's limited forest lands for environmental quality control. Major obstacles of solving the deforestation problem in Thailand lie in the management of government agencies as described above. The rapid increase in energy production and consumption has resulted in air pollution in many urban areas (see Supachit 1993b and 1994a). In the energy sector, a true cost pricing has not been implemented. This resulted in inefficiency in both resource allocation and pollution reduction. Thailand's tourism development policy without environmental protection is evidently a costly policy (Supachit 1992).

4. TOWARD SUSTAINABLE DEVELOPMENT

Thailand's recent changes in development policy described above indicate the government's commitment to more sustainable development policies in the future. Nevertheless, the government still has a number of important things to do before it can efficiently and effectively address environmental and development concerns simultaneously in planning and policy making. Three suggestions are offered below.

Firstly, the country must have an account of information on changes in quality, quantity, and value of natural resources and the environment over time. The concept and framework of Natural Resource and Environmental Accounting (ENRA) can play a major role in this regard. Obviously, the interest of using this approach to correct real national income or reflect environmental costs and concerns exist among responsible officials although serious attempt and plan have not been initiated. They recognize that environmental and natural resource accounting provides the means by which resource depletion and degradation may be tracked and evaluated and the true cost of development programs can be better estimated. At the moment, direct ENRA research projects in Thailand have not been initiated; there are only ENRA related studies in Thailand. These studies are relatively small and mainly academic and theoretical in nature (Supachit 1993a and 1994b).

A feasibility study on integrated environmental and economic accounting for Thailand has been initiated in 1992 as part of broader efforts of the World Bank to assess the sustainability of economic growth and development in Thailand (Bartelmus and Tardos 1992). The objectives of the mission were: (1) to assess the feasibility of integrated environmental accounting in Thailand; (2) to compile tentative estimates of the system of integrated and environmental accounts (SEEA) for Thailand for the period 1970-90; and (3) to make suggestions on how to establish a country project on the implementation of the SEEA in Thailand. The study took only a combined 5 weeks in Thailand for the task but the mission was able to accomplish a considerable amount of work. It identifies potential sources of data and information needed for implementing an integrated environmental and economic accounting for Thailand and made rough estimations of some necessary information in order to assess the feasibility of the future plan. The report pointed to the problem of insufficient data and discussed major drawbacks of the obtained data set. Nevertheless, the research team anticipates the feasibility of conducting a country project for Thailand and suggested some ideas to carry it out.

Secondly, the principle of economic efficiency has not been adequately taken into account in the design and adoption of policies and measurements for natural resource rehabilitation and environmental improvements. Most decision making in this area is still dominated by scientific and technological considerations alone. A recent study on pricing of non-leaded gasoline shows that the government should be able to control air pollution in Bangkok with more efficient alternatives (Supachit and Pitrachat 1993). In some instances, for example in the case of water pollution control in the Lower Chao Phraya River and air pollution control for the power plants in Mae Moh, Lampang Province, the government has not attempted to identify a least-cost alternative for the problem. Since resources are limited, the government will have to pay more attention to choosing the most efficient or least-cost alternative of remedy so that the portion of resources saved can be allocated to other necessary development activities and policies.

Thirdly, although one principal justification for public policy intervention lies in the area of market failure, this rationale is only a necessary, not a sufficient, condition for policy formulation or for government intervention. It does not follow that whenever laissez faire falls short government interference is expedient; since the inevitable drawbacks of the government may, in any particular case, be worse than the shortcomings of private enterprise. Policy formulation in this area requires that the realized shortcomings of market outcomes be compared with the potential shortcomings of non-market efforts to provide remedies. In addition, there may be other institutional arrangements more capable of coping with the problems. In general, the supply of non-market activities is characterized by several distinctive attributes that may also lead to non-market failures. Non-market outputs are often difficult to define and measure as to quantity or to evaluate as quality. An absence of sustained competition to government authority further contributes to the difficulty of evaluating the quality of non-market outputs. In addition, there is no effective bottom-line and termination mechanism for the performance of the government agencies. In the areas of natural resource management and environmental protection, a large number of parties and individuals involved in the problems indicate the presence of a considerable amount of transaction cost of intervention. Experience in Thailand and elsewhere shows that in many cases, the private sector, non-government organizations, and local communities can manage the problem more cost-effectively (see Supachit 1995). This fact well explains the recent movement toward people participation and the use of economic incentive approaches in natural resource management and pollution control respectively. Choosing a least-transaction cost implementation strategy is therefore crucial to the success of the intervention.

5. CONCLUDING REMARK

This paper attempted to show that economic development and the quality of the environment are closely related to each other. Economic development without concern for the environment and without proper planning and investment in environmental protection will certainly result in an unsustainable social and economic system. Although in the past the Thai government was not able to respond to the problem effectively due to a number of factors analyzed in this paper, the situation has improved. Judging from its latest national development plan, it is evident that the role of the Thai government in recent years has become one which increasingly devotes its attention to reducing environmental degradation, preventing further environmental damage and promoting conservation of natural resources and environmental sustainability. The main problems, however, lie with the lack of political will to implement such environmental policy, the conflicts of interest among policy-makers and various sectors in the economy, and the difficulties in enforcing many old and new environment laws. It is, however, expected that the improvement will become even greater in the future when public awareness of the issue of environment and economic development increases and many public policies regarding the environment have come under much public scrutiny and evaluation.

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