REGIONAL TRAINING SEMINAR ON THE APPLICATION OF ENVIRONMENTAL IMPACT ANALYSIS IN APPRAISAL OF DEVELOPMENT PROJECT PLANNING

30th May - 11th June 1988
Bandung, Indonesia

LIST OF PAPERS

Jointly organized by

Institute of Ecology - Padjadjaran University
(IOE - UNPAD)
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LIST OF PAPERS

No.	N a m e	Tophics
1.	Brotoisworo, Edy	Application of environmental impact analysis in oil field development project planning: A case study
2.	Greene, George	Manpower development for environmental impact assessment
3.	Morrison, Robert G.	Monitoring the result of EIA Environmental Audits of Project
		Methods for scoping environmental impact assessment a review
4.	Kennedy, William V.	Environmental impact assesment in north America and western Europe: what has worked where. how and why?
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		Risk Assessment in urban planning and management a metropolitan example
		Design energy-concerning cities a new town example
		Intecol newsletter April '88
6.	Pierce, Barry C.	The role and impact of ICLARM
		Environmental evaluation in development project planning
7.	Poerbo, Hasan	Application of environment impact assesment in urban waste management planning
8.	Salim, Emil	Towards sustainable development
9.	Simons, Henk	Application of EIA to development of planning in fragile ecosystems
10.	Soemarwoto, Otto	Application of EIA in planning of hydroelectric projects the Saguling case

No.	N a m e	Tophics
		Application of IA in agricultural development
		Prediction of impact
		Human ecology as a basis for EIA: Imbedding EIA in the social-cultural fabric
		Identification of impacts
11.	Soeriaatmadja, R.E.	EIA application of resettlement (transmigration) program
		Institutional arrangement for carrying out EIA
12.	Soerjani, Mohamad	Environmental impact of acoalfired electricity plant (first phase) in west java, particularly on air quality
13.	Suprapto, Riga Adiwoso	Projecting socio-cultural change in impact assessment
14.	Suratno, Gunarwan	Application of EIA to sitting and contruction of industrial plan
		Urea fertiliser FAC in Cikampek, west java
		Adaptive environmental assessment and management (AEAM)
15.	Taylor, Margaret M.	Development and water quality guidelines
16.	Villamere, John	Environmental Impact Assessment Considerations For a Proposed Mining Project

APPLICATION OF ENVIRONMENTAL IMPACT ANALYSIS

IN OILFIELD DEVELOPMENT PROJECT PLANNING:

BINTUNI CASE STUDY*

edited by:
Edy Brotoisworo**

I. BACKGROUND OF THE PROJECT

Three companies are cooperated with the Indonesian State Oil and Gas Company (PERTAMINA) and has invested more than US$ 100 millions for drilling and other exploration activities. A number of 20 wells had been explored and investigated.

From these 20 wells, 3(three) of which are producing oil, i.e. The first productive well is Bintuni-1, The second one is Bintuni-2 was directionally drilled from the location of well Bintuni-1, and the third well is Bintuni-3 which was drilled about 750 meter west of the former wells. Presently the three well have been completed with wellhead and ready for the production.

Considering Indonesian Act No.4/1982 on Basic Provision on the Management of Living Environment, where in article 16 mentioning that " Every proposed projects which are considered to have significant impact on the environment should be completed with an Environmental Impact Analysis (EIA) which implementation is regulated by government regulation"; and also Government Regulation No. 29/1986 on Environmental Impact Analysis; and supplemented by the instruction of Director General Oil and Gas through his letter No. 294/DM/Migas/1986, dated 14 April 1986 to BKKA-PERTAMINA (Coordination Board to Foreign Contractors of PERTAMINA) that every oil and gas development project should be completed by EIA; so, oilfield development project in Bintuni is also subjected to carry out an EIA study, which document will be used as a tool for decision making process by the Ministry of Mining.

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* Paper presented at the Regional Training Seminar on the Application of Environmental Impact Assessment in the Appraisal of Development Project Planning. Held in cooperation between Institute of Ecology Padjadjaran Univ. and United Nation Environmental Programme. Bandung, May 30 - June 11, 1988.

** Staff members at the Institute of Ecology and the Faculty of Mathematic and Natural Sciences of Padjadjaran University.

AIMS OF THE STUDY:

The aims of the EIA study are: (a) to identify proposed activity which may generate impacts, (b) to identify baseline condition and system ecology of the area, (c) to identify significant impacts which may be generated by the proposed activity, to predict and evaluate the impacts, and (d) to suggest environmental management by reducing the negative impacts as minimal as possible and enhance the positive impact at the maximum.

STUDY APPROCHES:

Several approaches are taken for the EIA study in Bintuni oilfield development project. These approaches are used for formulating framework in the study.

(a) Holistic approach:

Holistic approach is an approach to the problems that actually consider that components in nature, whether they are biotic as well as abiotic, are interact with each other forming an ecological system which is called ecosystem. a system consists of component which work together as a unit; so there are interdependent relationship among the ecosystem components.

Project development placed in a certain place means that the project will become a component of ecosystem in that area. Being a component of an ecosystem, it will influence and being influenced by the oher component of the ecosystem. This means that in analyzing environmental impacts, we should carefully consider the ecosystem components in that place.

The location of the wells are close to the sea shore (about 3000 meter from coastline), and the oil will be flowing though a pipeline to the storage tanker about 5 km offshore. So, the ecosystem considered in the study is the coastal ecosystem.

(b) Development approach:

The aim of development is actually to enhance the living quality of the people. Besides, it is mentioned also that development should yield equitable distribution of benefits for all people. In every development process there are always risk, beside the expected benefit. Thus, efforts should be taken that we should not let some of the population (especially in the project area) suffer from the development.

METHODOLOGY:

The methodology used in the study is comprising of: (a) deliniation of the problems, (b) identification of potential impacts, and (c) data collection.

(a) Deliniation of the problems:

Deliniation the problems in space and in time is needed so that the study will be focused only on to the important aspects.

Deliniation of the problems in space:

This is used to limit the extent of the study area, decided by considering ecosystem approach. Impacts will spread in a certain distance. The distribution of impacts in space for different kind of activities and on different kind of environmental components are not similar. That is why the limit of space for the biophysical study will be different with that of social study.

Considering the project activities and system ecology of the area; biophysical studies will be carried out surround the project where the impact is likely will distribute, while the socio-economic and socio-cultural studies will be done in a kampong which is located about 2 km from the project site and also several other village along the Sebyar river, where the people have close interaction with the project area.

Deliniation of the problems in time:

To facilitate the study, the impacts are separated into three phases of development, i.e.: Pre-contruction phase, Construction phase, and Operational phase.

(b) Identification of potential impacts:

The method selected for the identification of impacts is the network of Sorensen (1973), Freeman (1974), and Munn (1975). The method is modified in some extent to make it more suitable for our purpose. By this method, it can show secondary, tertiary, and subsequent impacts, so it will be more easy in tracing and finding the relation of impacts.

Using this methodology, impacts are identify in each development phases (figure 1,2, and 3).

(c) Data collection:

Data collection (field study) was done in April and July, 1987, comprising the collection of primary and secondary data. After considering the probable significant impact through the flowchart, several aspects were selected for intensive studies, i.e. **physical environment** (climatic, water resource, marine environment, wind pattern, rainfall, and former evidence of earthquake), **biological environment** (mudflat, mangrove, estuarine, Nipa community, sago community, the fauna of the area, and aquatic ecology including plankton, benthos, and water quality standard), **socio-economic and socio-cultural environment** (general pattern of settlement in the area, demographical condition, socio-economic aspect, socio-cultural aspect).

The methodology of research in this EIA study is using the available methods in each discipline which are adjusted for this purpose.

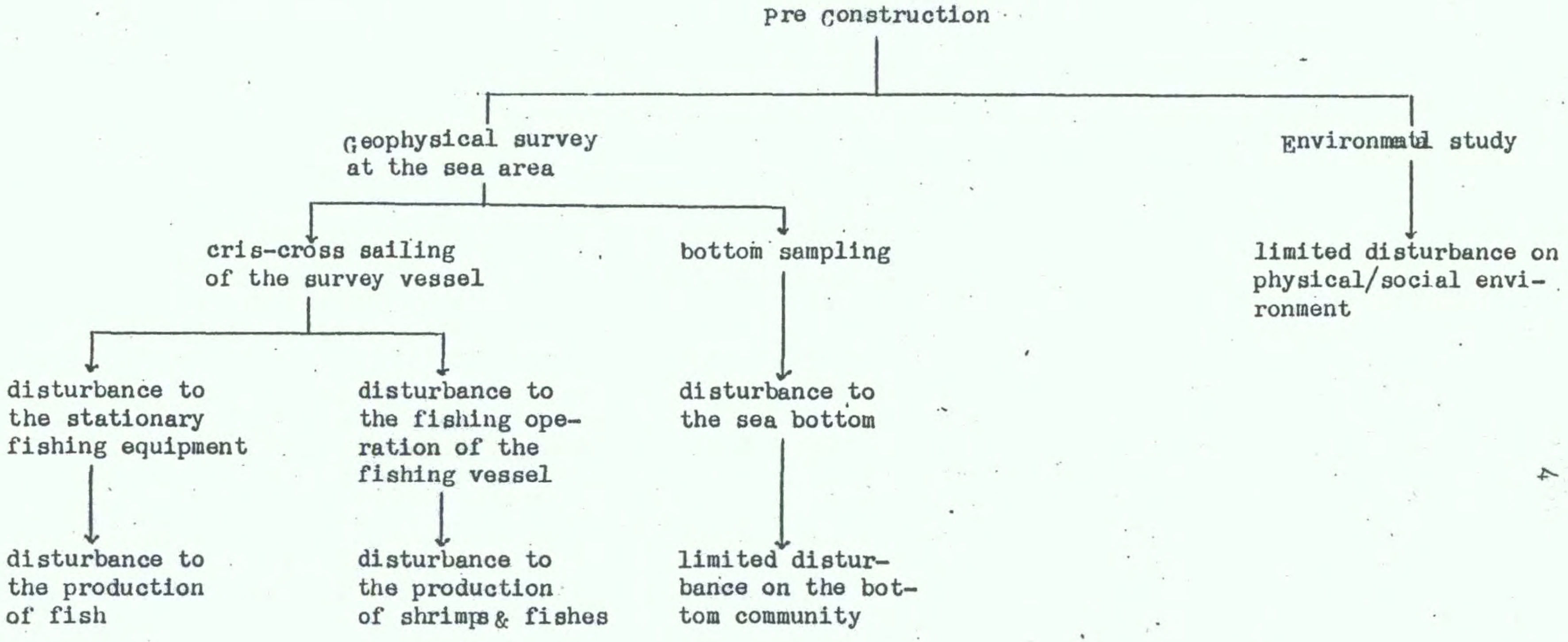


Figure 1. potensial environmental impact during pre-construction phase.

Figure 2. Potensial environmental impact during construction phase.

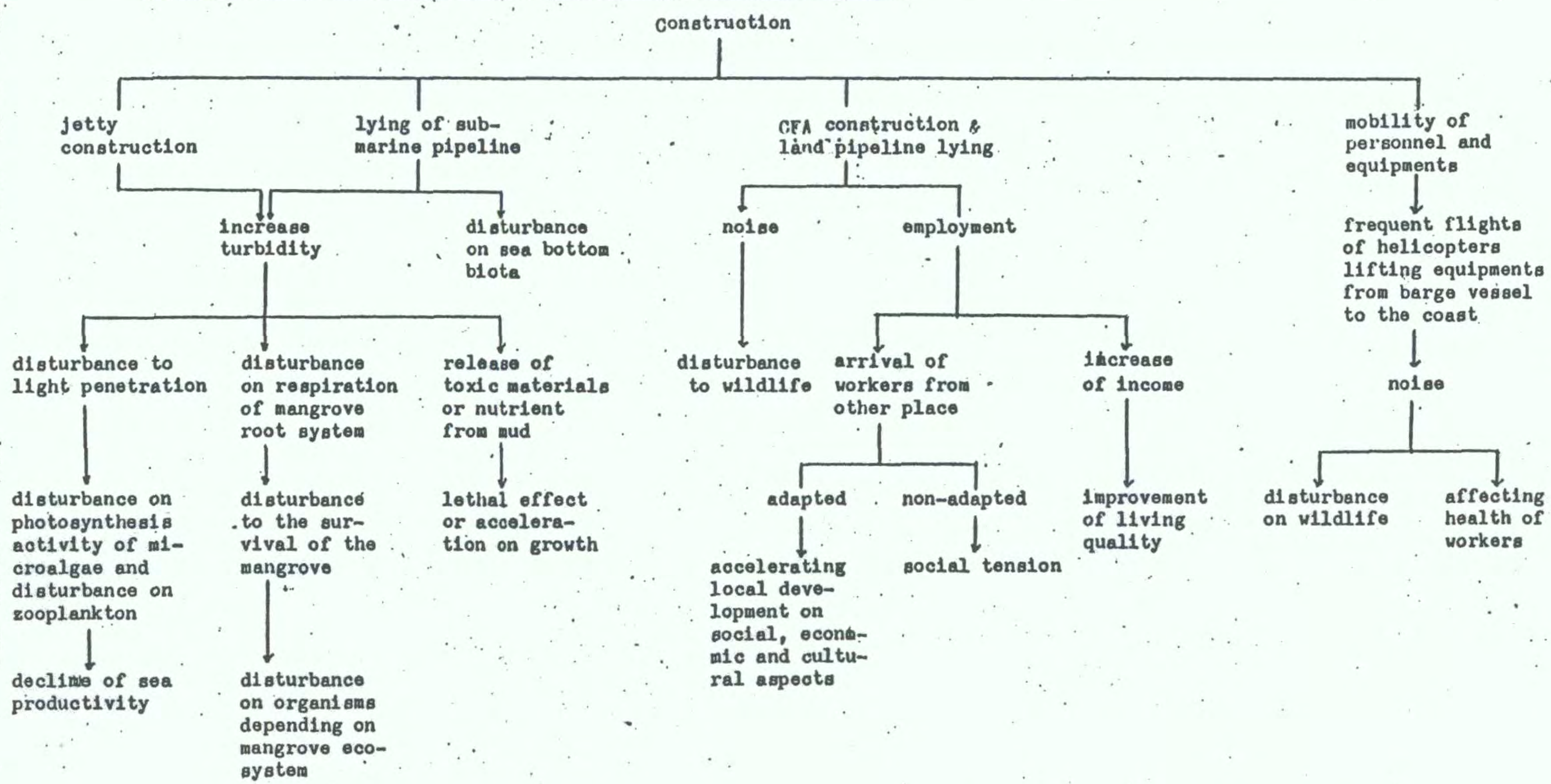
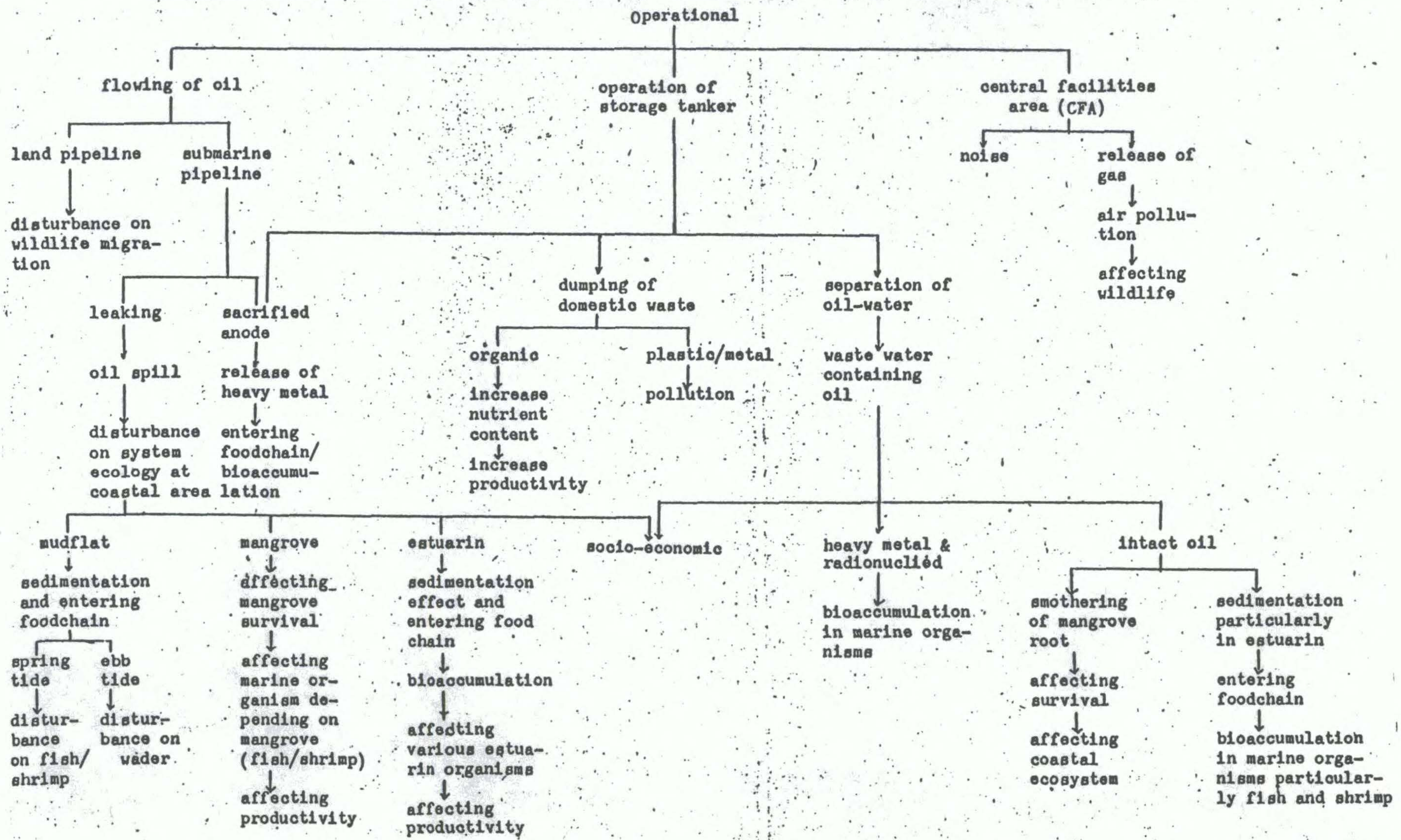


Figure 3. potensial environmental impact during operational phase.



II. PROJECT DISCRIPTION

Project Location:

The proposed project is located at the bay of Bintuni, at the southern part of the bird head area.

Project potential:

Bintuni oilfield , is presently having three productive wells, i.e.: Bintuni-1, Bintuni-2, and Bintuni-3. The reservoir fluids properties show that the crude oil is classified as a light crude with some other beneficial properties (table 1 & 2). The production of the three wells will be economically beneficial. Initial average production of 7,600 BOPD is expected from the three wells.

Bintuni oilfield is geologically cannot accumulate gas. This make that the gas produce from the reservoir is very low, i.e. about 6 SCF/barrel. It is suggested that the gas produced together with oil and water is vented into the air from a vent of 14 meters height, at a distance of 150 meters from the CFA which is completed with standard safety equipment such as "flame arrestor". Gas composition is presented in table 3. With gas discharge of about 6 SCF/barrel (oil production of 5000 - 7000 BOPD), 20 ppm of H2S concentration in a normal wind speed (2 feet/second), the gas will be dispersed into 4 ppm at a distance 150 meters at a height of 14 meters.

Project Facilities:

The development plan consist of onshore and offshore facilities (figure 4). The Central Facilities Area (CFA). is shown in the plot plan in figure 5, are mainly comprised of well manifold, tank and pump stations, operation doghouse and utilities center.

(a) Wellheads and flowlines:

Wellheads are provided in each well. Flowlines from well 1, 2, and 3 are selected as 4" Schedule 40 line pipe, screwed.

(b) Wellhead Manifold:

The wellhead manifold is a 6" Schedule 40 header receiving the three flowlines from well 1, 2, and 3.

(c) Surge Tanks:

The surge tanks have been sized so as to provide 25-50 minutes retention time between operating levels. There are 2 x 400 barrel tanks in the CFA. Both tanks are open to a remote vent.

(d) Transfer Pumps:

Three electrically driven centrifugal pumps, arranged in series, with a total capacity of 15,000 BOPD at 555 ft head. This pumps are used to drive the fluids from the surge tanks to the storage tanker.

Table 1. Reservoir Oil Properties

<u>Crude Oil:</u>	
Gravity, ^{o}API @ 60^{o}F	39.5
Pourpoint, ^{o}F	25
Crude viscosity, C St @ 100 ^{o}F	3.538
C St @ 122 ^{o}F	3.018
Flash Point "Abel", ^{o}F	165
Raid Vapor Pressure, psi @ 100 ^{o}F	4.6
<u>Water:</u>	
Specific Gravity, 60 ^{o}F/60 ^{o}F	1.0140
pH	6.32
Hydrogen Sulfide	Nil
<u>Gas:</u>	
Gravity, Air = 1,000	0.8723
Gross Heating Value, BTU/SCF	481
H_2S content, mole percent	0.22
CO_2 content, mole percent	15.53

Table 2. Chemical composition and their percentage distribution of the crude oil from Bintuni-1 well sample.

iso-Butane	(iC4)	2.43
normal-Butane	(nC4)	2.86
iso-Pentane	(iC5)	8.08
normal-Pentane	(nC5)	1.41
2,2-Dimethylbutane	(22DMB)	1.21
Cyclopentane	(CP)	0.88
2,3-Dimethylbutane	(23DMB)	2.22
2-Methylpentane	(2MP)	2.77
3-Methylpentane	(3MP)	5.78
normal-Hexane	(nC6)	3.79
Methylcyclopentane	(MPC)	4.64
2,2-Dimethylpentane	(22DMP)	1.35
Benzene	(Bz)	1.01
2,4-Trimethylbutane	(24TMB)	2.58
2,2,3-Trimethylbutane	(223TMB)	0.37
Cyclohexane	(CH)	5.34
3,3-Dimethylpentane	(33DMP)	0.67
1,1-Dimethylcyclopentane	(11DMCP)	2.00
2-Methylhexaze	(2MH)	3.18
2,3-Dimathylpentane	(23DMP)	4.36
1c3-Dimethylcyclopentane	(1c3DMCP)	2.88
3-Methylhexane	(3MH).	6.85
1t3-Dimethylcyclopentane	(1t3DMCP)	3.27
1t2-Dimethylcyclopentane	(1t2DMCP)	4.12
3-Ethylpentane	(3EP)	1.32
normal-Heptane	(nC7)	5.86
1c2-Dimethylcyclopentane	(1c2DMCP)	1.22
Methylcyclohexane	(MCH)	14.46
Toluene	(TOL)	3.09

Normal percentage of hydrocarbon C7

Normal	10.75
Branched	37.96
Cyclic	51.29

API at 60 ^{o}F = 39.5
Specific gravity at 60 ^{o}F = 0.8276
Viscousity Kinematic at 100 ^{o}F = 3.538 c ST
Flash point = greater than 150 ^{o}F

Table 3. Gas Analysis of the well.

Component	Mole Percent	GPM
Hydrogen Sulfide	0.22	
Carbon Dioxyde	15.53	
Nitrogen	38.11	
Methane	44.97	
Ethane	0.82	0.2059
Propane	0.16	0.0438
iso-Butane	0.05	0.0163
n-Butane	0.03	0.0094
iso-Pentane	0.04	0.0146
n-Pentane	0.00	0.0000
Hexanes	0.00	0.0000
Heptanes plus	0.07	0.0316
	100.00	0.3216

Calculated gas gravity (air = 1.000) = 0.8723

Calculated heating value = 481 BTU/SCF dry gas

Sampling date : September 8, 1981

Sampling condition : 100 psi max.

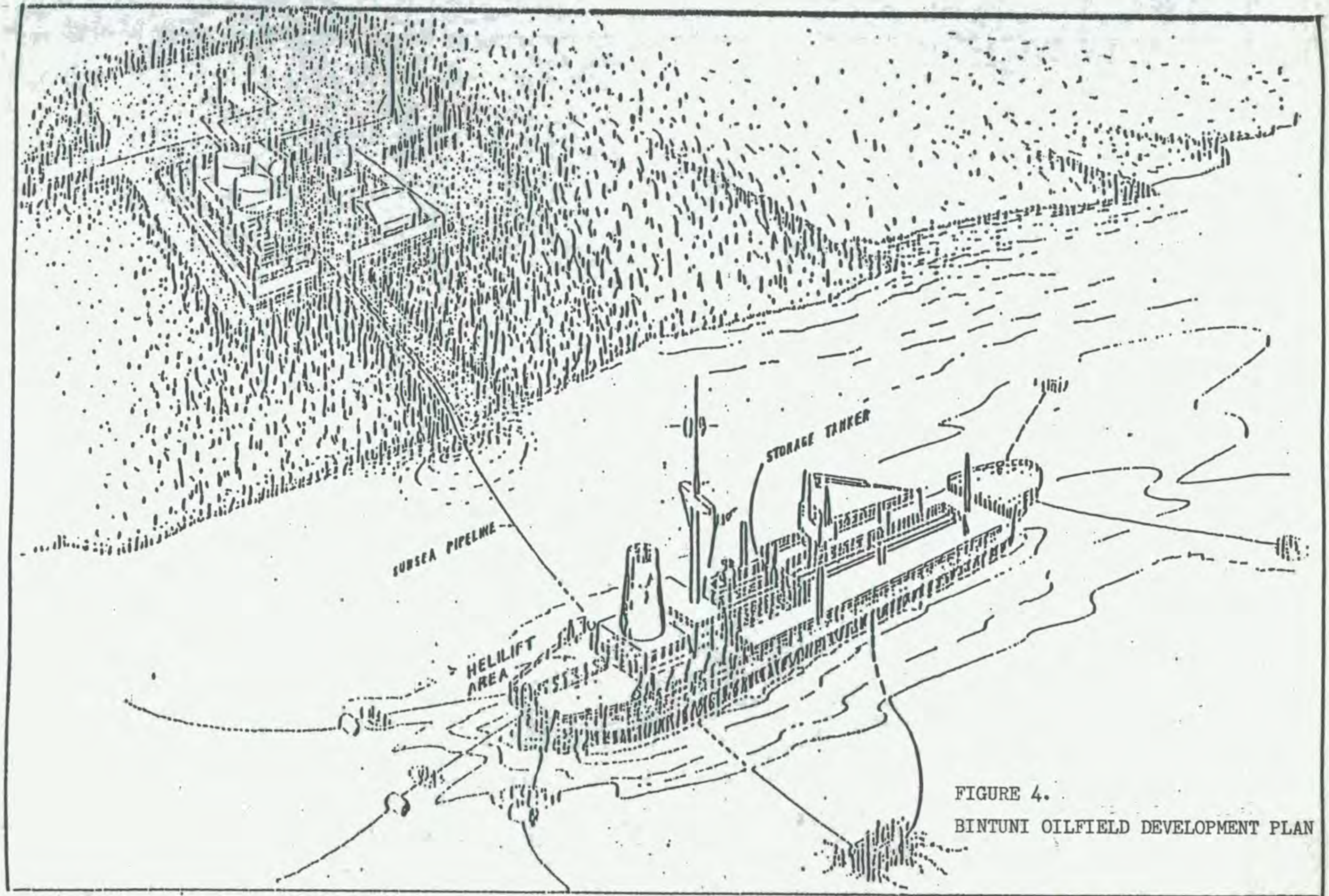
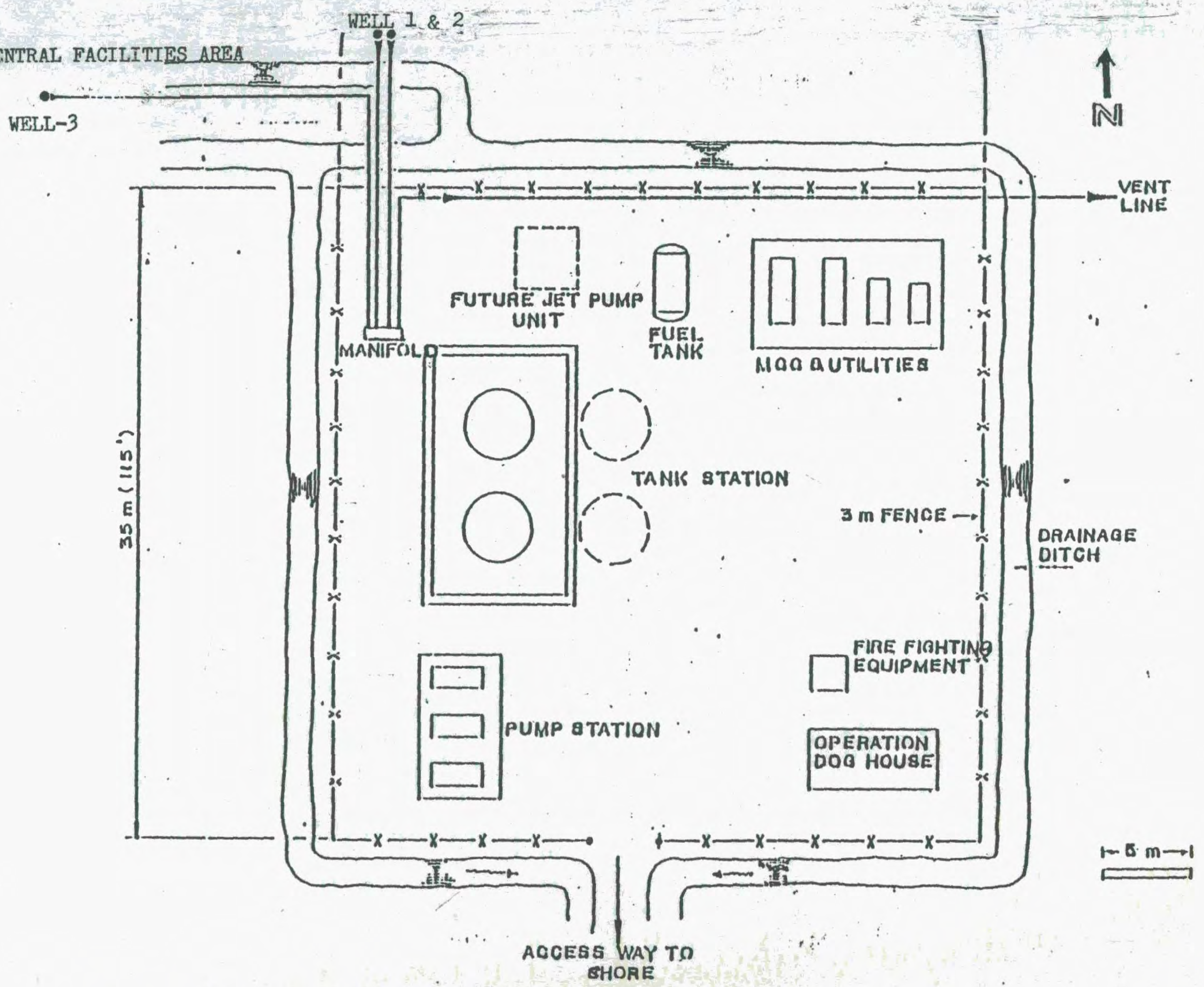


FIGURE 4.
BINTUNI OILFIELD DEVELOPMENT PLAN

Figure 5. CENTRAL FACILITIES AREA



(e) Export Pipeline:

The export pipeline consists of three distinct sections:

1. Land pipeline
2. Submarine pipeline
3. Pipeline End Manifold (PLEM)

The land pipeline is deliniated between the boundary limit of the CFA and the block valve near the shoreline. The pipeline will be burried under the access road over the full 3,200 meter run from the CFA due south to block valves at shoreline.

The submarine pipeline is deliniated between the block valve onshore and the spool piece to the PLEM at offshore end The pipeline lays on the sea bed from the shoreline to the PLEM located 5,280 meters offshore. Cathodic protection is provided by sacrificial anodes attached to the pipeline.

At the offshore end of the submarine pipeline is a pipeline end manifold (PLEM) the purpose of which is to ensure the safe and functional connection of the export pipeline to the export tanker.

(f) Storage Tanker:

The storage tanker is 30-35 MDWT with storage capacity is 20 days of peak production. It is spread anchored moored in 40 feet of water. The tanker receives the fluids from the PLEM through flexible rubber hose, 6" in diameter and 150 feet length. The tanker provides primary separation, storage, and export for produced crude.

The oil will be separated from the formation water by a simple method, i.e. gravitation (Figure 6). The water will be dumped into the sea, with oil concentration of 15 ppm maximum. The production of formation water which is separated from the production fluid with its oil content during 3(three) years is presented in table 4. In the export mode, production is shut in, the loading hose disconnected and the storage tanker is removed from the berth and put to single anchor about one mile further offshore. At this place the oil will be transfered into the export tanker. Upon completion of the export, the storage tanker is removed in the C.B.M. and production resumed.

In addition to storage the crude, the tanker serves as the full operation base for the Bintuni Field, providing accomodation, catering, werehouse and workshop facilities, diving support, fuel and lubricant supply, communications, safety, and medical services. The tanker meets current international regulations with regard to safety and pollution.

(g) Jetty Approach:

A jetty extending about 800 meters from the coastline will be constructed for personnel and material transport, particularly during the ebb-tide in operational phase.

FIGURE 6. SEPARATION OF OIL/WATER ON BINTUNI STORAGE TANKER

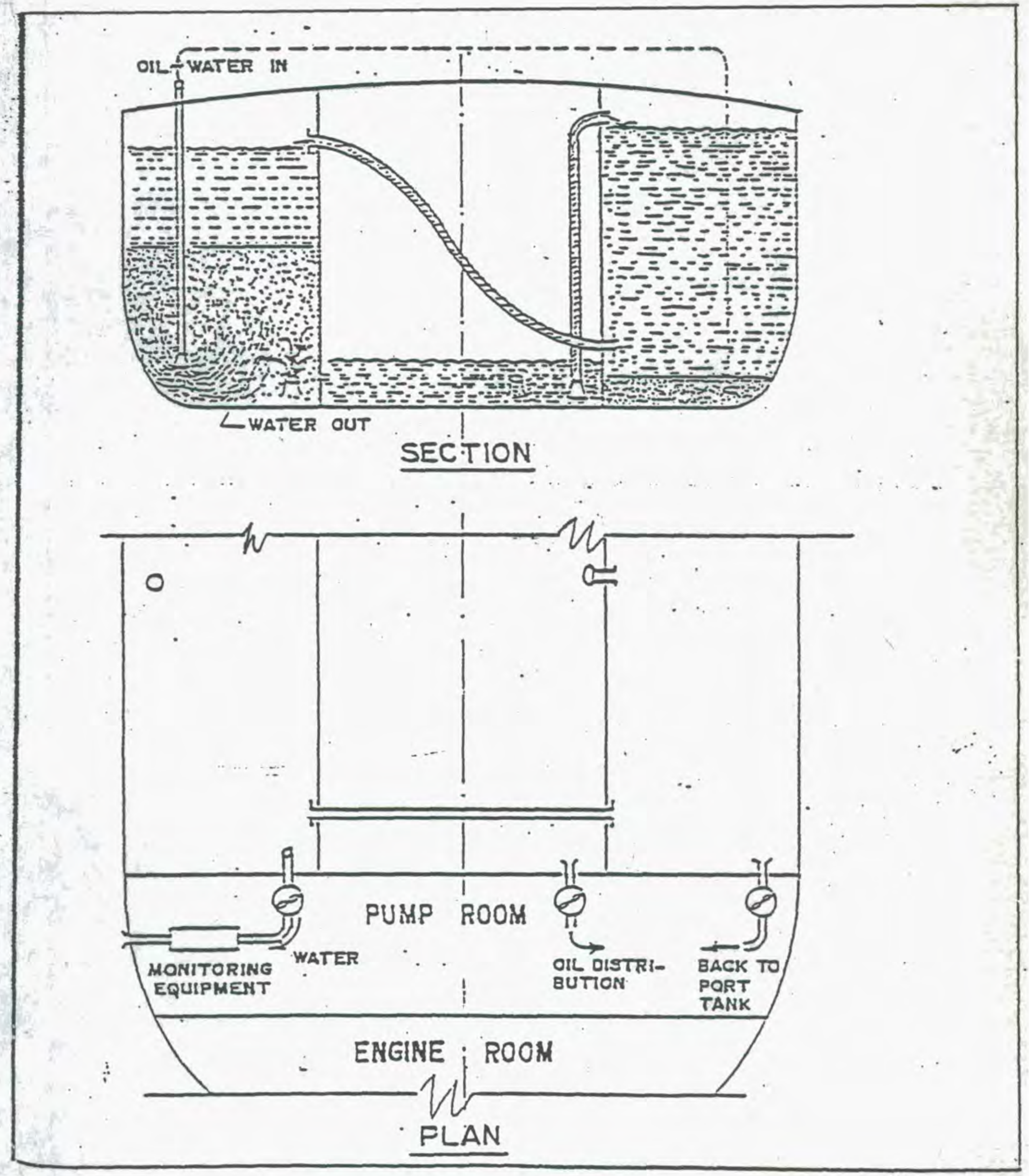


Table 4. Bintuni Production Forecast (3 well case) for the first 3 years, completed with calculation of waste water (formation water) and its oil content (based on 15 ppm oil in the dumping water).

	Quarterly Average				Waste	
Month	Rate	Oil Cut	Water Cut	Cum.Oil	waste w. (barrel)	oil cont. (liter)
Average Production from 3 wells: 7,600 BOPD						
3	6990	92	8	6430.8	607.8	1.687
6	5910	75	25	4432.5	1970.0	5.543
9	4990	63.5	36.5	3168.7	2868.3	8.194
12	4210	54.5	46.5	2294.5	3592.1	10.242
3	3550	46	54	1633.0	3588.6	10.247
6	3000	39.5	60.5	1185.0	4594.9	13.134
9	2540	34	66	863.6	4930.6	14.098
12	2140	28	72	599.2	5502.9	15.785
3	1810	24	71	434.4	3731.7	16.388
6	1535	20	80	307.0	6140.0	17.592
9	1280	15.5	84.5	198.4	6978.1	20.002
12	1085	11.5	88.5	124.8	8349.4	23.979

III. BASELINE CONDITION

The following description is a summary of the environmental condition of the area. Only important and prominent aspects will be described below.

1. Physical Conditions:

The proposed project is located at swampy area of tropical climate. It has average rainfall of 2932 mm, the annual temperatur e vary from 28 °C to 32 °C, while humidity ranging from 60% to 85%.

The physiographycal condition of the area is flat, inundated with water up to 1.00 meter depth, and still forested dominated by sago palm. Mangrove is fringing the coastal line. The coastal area is covered by mudflat. In the high-tide the mudflat will be inundated, while during the ebb-tide the mudflat may extended up to about 500 meter from the coastline. Surround the area there are several rivers, i.e. Wiriagar and Sebyar rivers at about 2 km and 3 km at the eastern side, and Kamundan river at the west. There is small settlement at the estuary of the Wiriagar river. The water rersource of the kampong is taken from the river, supplemented by rain water.

The project is actually located in a large bay, called Bintuni Bay. It is about 198 km extended into the inland area, and the width is vary from about 25 - 50 km, and the total area of the bay is about 8,200 km^2. The depth vary from 15 - 100 meters with an average of 40 meters. There are many rivers flowing its water into the bay area. The sediment load of the water seems to be high, indicated by its brownish water

Since its location is at the southern part of the equator, the major wind pattern is usually blowing from northwest to southeast during the sun located at the southern part of the equator, and reversely.

Indonesia is located near "the ring of fire" where earthquake are often happened. From the previous 80 years record (1897-1978) on earthquake evidence within the distance of less than 100 km from the proposed project location, there were 7(seven) evidence have beed recorded, the largest magnitude happened in November 1st, 1962, at 6.0 Reichter Scale.

2. Biological Environment:

Most of the the Irian Jaya is still undisturbed. Most of the land is still covered by rainforest, mangrove, swamps, and other kind of undisturbed habitat. The following description briefly explains the habitat types surround the project area.

a. Mudflat:

The flatness of the bay topography, the high erodibility of the soil, and the occurence of many rivers flowing its water into the bay facilitate the formation of extensive mudflat. This type of habitat is very rich and forming their own ecosystem. They have unique foodchain and ecological trophic. The first trophic layer consists of at least 13 species of diatomae, 4 species of Dinoflagellata, 8 species of phytobenthos, and detritus. At the second trophic layer consists of Copepoda, Mollusca, Zoobenthos, and lower Crustacea. At the upper trophic layer consists of higher crustacea such as Penaeus sp., crabs, bivalvia, predator fishes, and also wader and human. Thus, mudflat is a very rich ecosystem. This area is very essensial for the migrant birds (wader) as their wintering ground. The study in Bintuni was done in April and June, during which time most of the wader have return to their original place. But still, we found 5 species of wader, which most presumably will soon return to the northern hemisphere where they come from.

b. Mangrove:

At the study site, the mangrove is fringing the coastal area though not very thick. It is about 300 meter thick which consist of a number of zonation, i.e. Avicenia zone (20-30 meter), Bruquiera zone, and transitional zone, while Nippa association is only clear along the river side. The other zonation is not very clear, since the mangrove is relatively thin.

The function of mangrove vegetation is clearly very important, physically and biologically. The physical function is for coastal protection from wave and wind, and may also as sediment trap, etc. The biological function of the mangrove is wellknown. It may supply nutrient to the marine environment and form as one of the basic food in the foodchain. It may also function as spawning ground and nursery ground for various species of fish and shrimp. In fact, the area represents as one of the most important fishing zone, particularly shrimp.

c. Estuarine Environment:

This area is a place where a river meets the sea. Bintuni bay is a place where there are many large river discharging their water into the bay. The bay which is extends far inland makes the condition become more special. The project is located inbetween two large rivers, i.e. Wiriagar and Kamundan rivers, this means that the project is in estuarine environment.

The special characteristic of the estuarine environment is the occurence of circulation pattern and salinity distribution in the river mouth (Knox, 1980). This circulation has an important value in nutrient transport, distribute the plankton, fish larvae, and other invertebrates.

The estuarin environment has a high productivity in the form of organic matters as well as nutrient. This is due to the water current pattern which allow "nutrient trap effect", which subsequently result in a high productivity of the coastal area (Knox & Miyabara, 1984).

System ecology of the estuarin environment in surrounding of the project area is very special. They have also ecological trophic which components are almost similar with that of mudflat area, but the occurence of mixture of fresh and saline waters, and the richness of river water with nutrient carried from the upper watershed, makes that the productivity of the estuarin environment is much higher. The estuarin environment is also very essensial for organisms which part or all of their life cycle should be in estuarin environment such as Penaeus sp.

d. Sago palm community:

The area is still covered by vegetation which is dominated by Sago (Metroxylon rumphii). The sago palm is started to grow from 400 meter from the coastline, they grow very dense in a swampy area, and looks as homogen forest. Until 4000 meters from the coastline the vegetation starts changing to a mixture forest.

Two vegetation transects were made during the study. The transect running for 3,200 meter with 10 plots of 20 x 20 sq.mt. in each transect. The distance between the two transects was about 750 meters. Within the plots, there have been determined 51 species of plants belonging to 35 families. The index diversity of transect 1 was 2,407 ± 0.006, and the transect 2 was 2.286 ± 0.06, while the index similarity of the two transect is 76.7%. The density of sago palm reaching 280 plants/ha, while the other species having lower densities.

e. The fauna:

The fish:

There were a number of 16 species of fishes and several species of shrimp had been identified during the study. Since the capture of fish only using simple net, so the result might be not complete. The fishes which have been identified among other, barred spanish mackerel (Scomberomorus commersonii), catfish (Arius thalassinus, Arius sp.), hammerhead shark (Sphyrna sp.), whitecheek shark (Carcarias sp.), giant threadfin (Eleuteronema tetradactylum), threadfin (Polydactylus sp.), spotted scat (Scatophagus argus), silver jewfish (Pseudosciaena sp.), long tons (Tylosurus sp.), mulet (Mugil sp.), gray catfish eel (Plotosus canius), snapper (Lutjanus sp.), Tongue sole (Cynoglossus sp.), herring (Clupea sp.), giant manta (Manta sp.). The shrimp species among other (Penaeus merguiensis). The shrimp represent as important export commodity for the region. For the Bintuni area the total capture in 1986 reaching 1,447 tons.

The bird species:

There are 53 species of birds have been identified in the area, 14 of which are protected species. It is important to note that 5(five) species of wader were identified in the area, i.e. common sandpiper (Actitis hypoleucos), mongolian plover (Charadius mongolus), eastern curlew (Numenius madagascariensis), whimbrel (Numeius phaeopus), and lesser golden plover (Pluvialis dominica). The observation is made in April, when the wader should have been returned to the north. The migration time is usually starting arround September and lasted in February. The occurence of 5 species of wader is an indication that the area used by wader as their wintering ground. So, during the winter, there should be much more species of wader will be occur in Wiriagar area.

The other animal species found during the study, i.e. Pteropus vampirus, Cervus sp., Phalanger sp., Sus sp., etc.

3. Socio-economic and Socio-cultural Environment:

The population living in the area is belonging to Sebyar tribe. They are distributed within an area of about 1,800 km^2, situated inbetween Sebyar and Kamundan rivers. The number of population when the study was carried out was 2099 people. The nearby kampong is administratively belongs to Aranday village which situated in Sebyar river. The kampong is mastered by kepala suku, which presently comes from Bau group. There are several lineage group (called as kerek) in project area, i.e. Bau, Haidom, Patiran, Kutangas, Sorowat, and Braweri; while in Aranday consists of several other lineage group, i.e. Bau, Kokop, Rumatan, Imbimbang, Kambori, and Innai. In the kampong, beside local people, there are also tribes coming from other places, i.e. Bugis, Ambon, Buton, and also Arabic. From total population of Aranday village, consists of 1068 male and 1031 female, about 1500 people are at working age, and 52% of which are male. The number of potensial working age population in the project area is 158 people.

Health:

Health condition of the population is fair. There is no public health facility center (Puskesmas) in the kampong. The closest health center is in Kokas district. The most dominant illness are intestinal deseases, respiratory infection, muscle disorder, skin deseases, and malaria.

Water resources for drinking, washing, and bathing, is from the river. Only several people trying to collect rain water. The people used to defecate in the bushes of mangrove swamp, though there were already 8 public toilets were available.

Interaction with other area:

The economic activity of the Bintuni bay area is centered in three cities, i.e. Bintuni (in the bay), Sorong (at the north-west), and Fakfak (at the southwest) which colect and also supply all socio-economic requirements for the population in the Bintuni bay area. The economic activity is dominated by Bugis-Makassar merchants. They also exploit the local resources for their trading activities.

Socio-economic and socio-cultural conditions:

Almost all of the population still live is subsistence level. They obtain their food from the forest, mangrove, sago, mudflat, sea, and also from agricultural field which is more or less resemble a shifting agriculture in the forest area.

From the forest (primary forest, sago forest, mangrove swamp) they may hunt on animal such as wildboar, deer, and harvested some plant product for their food, and also for various purposes, such as handicraft, construction materials, etc. Besides, they were also observed utilizing river, estuarine, mudflat and sea for various purposes. It seems that agricultural land has only minor function for their subsistence. The staple food is sago powder which is taken from the sago palm. The sago powder is kept in wet condition, or as baked sago which is baked on a fire and then put in the sun to make it drier. The baked sago is important in economical life of the people which is commonly used for barter. One pack of baked sago consists of 5 pieces, equal to Rp. 300.00

The introduction of project activities has alter their activity pattern. The male which formerly active in subsistence activities, become more interested working for the project, and this has affected their lifestyle.

III. PREDICTION, EVALUATION AND MANAGEMENT OF IMPACTS

The implementation of the proposed project may generate impact on the environment. The impact may be positive or negative The environmental impact can be differentiated into three phases, i.e. pre-construction, construction, and operational phases. The nature of impact in each phase is diferent due to the different activities of the project.

1. Pre-construction phase:

There were only limited activities within this phase, i.e. exploration, geophysical survey at the sea, and environmental study. Since the scale of the activities were relatively small and the duration is also short, so the impact generated is considered not significant.

2. Construction Phase:

The construction of the project will be about 6(six) months The major activities would be: (a) mobility of personnel and equipments, (b) project construction, and (c) jetty construction.

Mobilization of personnel and equipments, needs attention. There will be about 100 personnel are needed for the project construction, i.e. 15 experts, 30 skilled technical personnel, and 55 labour. So the project will absorb at least 60 local labour in succession manner. This will also cause the arrival of labours from other place. Such situation may cause positive as well as negative impacts. Negative impacts for instance social tension due to shifting of influence from formal and informal leader at the village to the supervisors in the project where the local worker maybe more obedient to the project supervisors. Such case should be avoided for instance by involving formal and informal leader in the project activity particularly which connected with the use of local resources.

Project construction comprises of 5 major activities, i.e. (a) pipeline from well-5 to CFA, (b) CFA, (c) land pipeline, (d) submarine pipeline, (e) tanker mooring facilities. The primary equipment will be used in the construction would be pipeline with a total length of approximately 9120 meters, supplied in 6 meter lengths joined together with screwed couplings. This means that a total of 1520 unit pipes plus their couplings and CFA equipments as have been explained should be sent onshore. All of the equipment will be carried by a vessel (barge) which will be anchored 3 miles offshore, and the equipments will be flown by helicopter. The primary impact of equipment transport will be noise which may affect the health of personnel. This impact can be overcome by using noise protector on ears.

The impact of CFA construction, lying of land pipeline from well-5 to CFA and from CFA to coastline is not significant, since it will be built in an area which presently has already been cleared from vegetation.

The impact of submarine pipeline lying should be considered. The length of submarine pipeline is 5,280 meters and will be lied on the seabed. Considering the bathymetri of the area which is not all flat, it may need slight dredging and filling and maybe damming. The possible problems would be the increase of sediment load, which may generate the following impacts: (i) obstruction on light penetration, (ii) smothering of mangrove root which may affect respiration,(iii) release of substances from the mud which may affect living organisms. But considering the duration and the scale of the activities, the impact generated might be not very important and only distributes locally, but still care should be taken in implementing the construction.

3. Operational Phase:

The impacts is differentiated into normal and abnormal operation of the project:

3.1. Normal Operation:

The activity components which may generate environmental impact consists of:

a. Operational of fluid transport from the wells through CFA to the storage tanker.
b. Operational of storage tanker where the oil will be separated from the water, and the latter is dumped into the sea.

So, the impact can be devided into impacts due to onshore activities and offshore activities.

a. Environmental Impact onshore:

The first impact of this activity would be the need of space for the facilities which totally about 18 ha, consists of mangrove (5 ha) and sago forest (13 ha).

Biophysical Impacts:

Hydrology:

The extent of forest clearing for the project is relatively small, and seems has only minor effect on physical environment, such as on hydrology (water ballance).

Plant and wildlife:

The diversity of plant in the area is relatively low, and the habitat looks like a homogen sago forest. Such condition make that the diversity of habitat types also low, and subsequently affect the diversity of wildlife. Beside lost of habitat, impact is also considered by looking at socio-ecological characteristics of the wildlife, particularly on territorial behavior of the affected animal species, and the occurence of similar habitat type with the affected one.

Considering the extent of affected habitat is relatively small, the diversity of plant and wildlife are also not high, while there is no animal species which has strict territorial behavior, and the habitat type surround the area are basically having high similarity; it is then predicted that the impact generated by the project is not significant.

Genetic resources:

Deforestation is often being related with the loss of genetic resource. The study revealed that among 51 plant species 53 bird species, and several other reptile and mammals, there were no unique and exclusive species of the area. Besides, the affected habitat also not unique, but commonly occured in the surrounding area. This means that the lost of one part of forest will not generate significant impact.

Gas emission from CFA:

The gas produced with the fluid is relatively small. This gas will be vented in to the air and not burned. The important component should be look upon is H_2S. The concentration of H_2S will be 22 ppm. Since the specific gravity of H_2S is 1.19 greater than the air, so the gas tends to be rapidly depossited surround the vent. As has been explained that in the normal wind speed, the gas will be dispersed becomes 4 ppm at a distance of 150 meter at 14 meters high. The closest settlement is situated at about 2 km from the project site. The threshold value of H_2S is 10 ppm. This means that the impact of exhausted gas is not important.

Sosio-economic and socio-cultural impacts:

The impact primarily due to the introduction of currency system (money), the possible of marine pollution, the arrival of labour from outside, new settlement, and the possible more open communication with other place.

The common evidence of a more consumtive way of living in surrounding project area is not an exceptional case for the Irian people at the project site. The money may be spent by the males, which may affect their usual social tradition, where the female family is commonly in charge of their properties. Such situation may cause tension between the female and male families, and subsequently disrupt their tradition. But, we need not worry on this matter, since every culture may have reselience in facing outside influence, and the culture always evolve and adapt to a new situation.

The arrival of labour from outside may reduce the chance of local people to work in the project. Besides, it may happened where the local labour obey more to the supervisors rather than to their formal and informal leader in the kampong/village. These may cause social tension. The different culture between the local people and the arriving labours may also cause incompatibility in their relation. If this is happened there will be social tension among them. But if they can adapt to each other, this may have positive impact, where development of local community can be accelerated.

b. Environmental impact at offshore:

Oil transport through the pipeline:

Transport of oil through the pipeline is safe as long as there is no accident which may cause the rupture or leaking of the pipeline. But if it is happened, the pipeline has been completed with "automatic emergency shutdown" which will make the spill can be limited at the minimum.

To avoid the pipeline from corrosion, several cathodic protection using "sacrificial anode" (mixture of Zn and Al) will be put along the submarine pipeline. The rate of release of the metal ion into the water is very slow. Considering the slow rate of ion release and the high dilution, the impact of sacrificial anode on the environment is considered not significant.

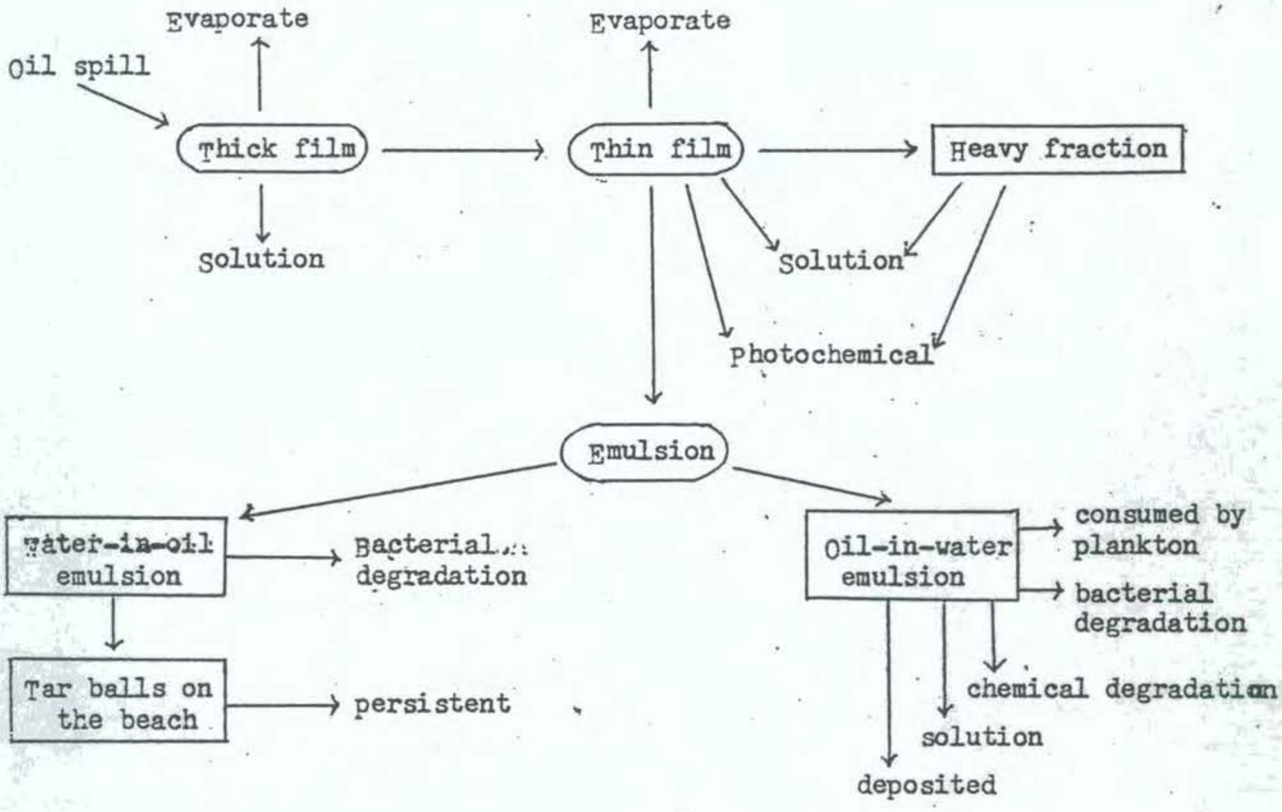
Impact of the storage tanker activity:

Operational of the tanker may generate following impacts, i.e. (i) sacrified anode used by the tanker, (ii) domestic waste, and (iii) effluent from oil separation activity.

The impact due to sacrified anode would be not significant. Domestic waste from the tanker which function also as accomodation of the staff would be organic waste (sanitary and kitchen origin) and plastic/metal waste from food or drink packings. Organic waste will have minor effect. Plastic/metal waste if not handled well may cause serious pollution. It is estimated that with 30 personnel in the tanker and 10 onshore, it will produce about 54,000 empty tin on the tanker and 18,000 onshore, which originated only from tin packed soft drink. These waste should not be thrown in the sea, but should be pressed, collected and dumped at a special place on land. It is suggested that the tanker is equiped with a pressing equipment for the tins

Separation of oil/water in the tanker may produce effluent with oil concentration of 15 ppm. But as presented in table 4, shows that the volume of formation water produced is increasing, which means that the total oil content dumped into the sea is also increasing by time. To evaluate the importance of impact of oil spill on marine environment should consider the behavior of crude-oil in the sea. Crude-oil spilled on the water will be floating, emulsified, diluted, sedimented, while light fraction will be evaporated (Figure 7).

Figure 7. Natural processes of oil in the marine environment.



Some factors affecting the importance of impact:

Mechanism of oil affecting living organism could be due to some processes, i.e. toxic influence, smothering of part or whole body, and tainting (Baker, 1983).

Wardley-Smith (1983) explained on factors which may affect the importance of impact, i.e.:

Volume of discharged oil:

The greater the volume of oil discharged the greater the potential damage. But, damage caused by the spill is more likely related to toxicity of the oil and type of biological community. Considering the rate of the production of effluent and the oil content in it (table 4), the present production plan of the project is about 3(three) years, and also the oil property (table 3), it is estimated that the environmental impact due to this activity is not very significant.

Type of discharged oil:

Different type of oil may have different toxicity. In general, this toxicity is associated with low boiling compounds and aromatics. There is experimental evidence that toxicity increases along the series alkanes (paraffins) - cycloalkanes (naphthenes) - alkenes (olefins) - aromatics. Within each series of hydrocarbons the smaller molecules are usually more toxic than the larger.

Based on the oil property which will be exploited (table 3) the crude oil is categorized as having low toxicity. This is due to the low aromatic concentration, i.e. 2.2%, while the other fraction are parafin (41.13%), naphtalene (26.6%) and asphaltic (30%), where the latter three compounds are not toxic. Beside the low aromatic concentration, the aromat is also monocyclic which also means having low toxicity.

Besides, looking at the other oil properties, i.e. (a) the low specific grafity (SG), which make that only a small fraction of the oil will be deposited, (b) the high API which make most of the fraction will easily evaporate, and this is accelerate by the high ambient temperatur (28-32 ^{o}C), and (c) difficult to burn, because of the flashpoint is above 150 ^{o}F. It is predicted that the impact of small amount of spill will be not significant.

Frequency of oiling:

The high frequency of oiling may seriously affect a fragile acosystem such as estuarine environment. Frequent spillage may cause the biotic community in the affected area may never have a chance to recover properly. For effluents which receive only primary treatment (gravity separation) such as in this proposed project may have this effect, since thin oil films may rise to the water surface and be left on the coastline (mangrove, mudflat) during the ebb-tide.

Considering the oil property will be produced, the oil which may reach the shore should be very minimal.

State of oil:

Effect of oil on organisms depends on the state of oil when it reaches the organisms. It could be in the forms of thin or also thick oil films and also water-in-oil or oil-in-water emulsions. Oil films may cause direct toxic effect and/or physically smothering effect. Oil-in-water emulsion may be disperse in the water and may have toxic effect, but such oil state is more readily degradable for instance by the activity of variety aquatic organisms.

Topography, hydrography and climate:

These factors are strongly influencing the dispersal of oil spill in the open aquatic environment, since those factors may affect tidal activities, wind direction, water current (Wisaksono 1987). If the refinery is located in a bay where hydrological condition does not permit rapid dispersal or dilution of the effluent, this may generate serious impact on the living organisms living in it. Climatic and weather condition may also influence evaporation rate (wind and temperatur), formation of emulsions (wind and wave), viscosity of stranded oil (temperature) and degradation rate of oil (temperatur and sunlight).

Considering the wind speed (arround 4 knots), temperature (vary between 28-32 ^{o}C), and the sunlight (have a long hours of sunlight in a day); and besides, considering also that there are many big rivers occur at the upstream side of the bay, so it is estimated that the dilution effect will be able to reduce the oil concentration in the water.

<u>Impact on the environmental components</u>:

<u>Impact on the mudflat environment:</u>

As shown in figure 7 that some part (heavy fraction) of the oil will be sedimented. This fraction might be left on the mudflat and cause pollution. The pollution may affect the living organisms in the mudflat. If the concentration is high it may cause mortality; but if it is low, the disturbance is limited to physiological disorder. But, the pollutant may be entering the foodchain and cause biological magnification at the upper trophic levels, such as fishes, shrimps, and even human.

The oil type of the proposed project is light oil with low specific gravity which make that only small fraction will be deposited. Besides, the tanker is located more than 5 km away from the coastline or about 4.5 km from the outer line of the mudflat. This makes that the impact on mudflat would not be very significant.

<u>Impact on the mangrove environment:</u>

The mechanism of oil pollution affecting the mangrove environment could be due to: (a) acting as physical barrier which may inhibit the gas exchange in the respiration of the roots, (b) direct toxic effect, and (c) affecting the soil property. The effect will be vary from physiological disorder until mass mortality of the mangrove. This effect depends on the concentration of the oil in the water.

As mentioned earlier that due to relatively low production of the well will cause the production of effluent will also low. Besides, the dilution and dispersion may reduce the oil concentration in the water; and these may cause that the impact of the operation of the project is considered not very significant. But still, care should be taken to prevent serious damage on the mangrove ecosystem.

Impact on the estuarine environment:

Estuarine is an ecosystem which have high productivity. This is due to the specific pattern of the water current which make the estuarine has the ability as nutrient trap. This characteristic is beneficial in one aspect, but on the other hand is very harmful, since it may also act as pollutant trap if once there is pollutant comes into the estuarine environment. This makes that estuarine environment becoming a fragile ecosystem. Pollutant entering estuarine ecosystem will be deposited and entering the foodchain. Estuarine environment is an essensial place in the life cycle of several species of shrimp and fish. This means that pollution on the estuarie environment may seriously affect the living organism in the area, especially shrimps and fishes.

There are 3 rivers located in the nearby of the project site, i.e. Wiriagar and Sebyar at the upstream, and Kamundan at the downstream. Most of the large rivers in the Bintuni bay is located at the upper stream of the project site, so it is not likely that the operation of the project may have serious impact on the extensive estuarine environment at the upstream side.

Impact on fishes, shrimps, and other marine organisms:

Impact could be due to physical or physiological processes. The oil films on the surface may reduce the oxygen deluted in the water, prevent light penetration, and may absorb sunlight and increase the surface water temperature. All of these physical factors may cause impact on the organisms. Physiological process is primarily due to oil toxicity. The degree of toxicity is vary depending on the chemical composition of the oil and biological status of the organisms at the time of contamination, e.g. species and stadia of development (Blumer et al, in Supomo, 1981) The oil production rate and the effluent discharge of the proposed project is relatively low. Such rate is considered not yet caused serious effect on the fishes, shrimp, and other marine organisms.

Impact on waders:

During the last decades, waders get more attention from many people. This is due to the frequent accidents of oil related activities (blow out, tanker accident, refineries effluent, etc) which affect sea birds due to pollution. For example, it was estimated that about 30,000 seabirds perished due to oil pollution caused by the "Torrey Canyon" incident; two spills in

February 1979 at the eastern coast of Canada caused the total kill of more than 12,000 ducks and seabirds; 100-200 tons of oil spills at the Dutch coastal area in Febuary 1969, has caused the death of about 40,000 birds, and still many other examples (after Baker, 1983).

The mechanisms of oil pollution affecting the birds could be due to physical as well as physiological processes. The most obvious effect particularly due to the damage on the plumage on which they are depend for their insulation and waterproofing. The birds may also be affected by inhaling the fumes and by preening themselves may ingest significant amount of toxic materials which may cause organs disorder. Stress and shock enhance the effect of exposure and poisoning.

It is thus the general impact of the operation of the proposed project which is planned for 3(three) years is not very significant. This is due to the amount of effluent and the oil content in it is relatively small and has not been able yet to generate significant impact on the environment, as far as the project operate normally.

But still, care should always be taken due to the following conditions: (a) always increasing volume of the effluent water, (b) the bay represents as an area with high production of fishes and particularly shrimps, (c) the influence of tide which may carry the spilled oil to the shore, and (d) there are fragile ecosystems surround the pollution source (mangrove, mudflat and estuarine environments).

The project is planned for 3(three) years operation, but during this time the well performance will be evaluated. If the oil reserve is still feasible to be produced, the operation will be extended. During this extended phase, the effluent is planned to be reinjected to increase the Vertical Lifting Performance or VLP, and this will reduce significantly the effluent in to the sea environment.

3.2. Abnormal Operation:

The abnormal operation could be in the form of accidents due to human error or natural disasters. Though the project has been planned in such a way that may ensure high safety, and completed with various equipments which can be used in emergency conditions which make that the probability of accident is small. But still, there are always chances of accident, for instance due to the pipeline rupture caused by the exceptional increase of pipeline pressure or may also due to earthquakes. Pipeline rupture between well-3 and CFA may cause the spill of about 37 barrel (6000 liter) oil, while rupture between CFA and PLEM may cause the spill of 915 barrel oil. This accident will be aggravated if it is happened during the course of high tide, where the spillage will be carried to the mangrove, mudflat and estuarine envirnments, while the human settlement who use open water for their daily requirement will also be affected. Accidents may also due to the extreem weather such as lightning and fire.

Contingency Plan:

The most important emergency situations are due to accident. The accident may be happened onshore or offshore.

a. Oil spill onshore:

The fate of oil spill onshore, partly will evaporate, some part will be deposited and in the soil, and the rest will flow into the available ditches and to the shore.

To avoid further impact, the following measure are suggested

= prepare with equipments which can prevent further spread of the spilled oil,
= prepare with containers readily used in the field,
= close the ditch when the spillage reaching the ditch.

b. Oil spill offshore:

The fate of oil in the sea is shown is figure 7. But if the spill is in large volume, it will rapidly spread.

To avoid further impact, the following measure are suggested

= well trained team to overcome the situation should be available at any time, which is completed with equipments, and has high mobility,
= suitable and adequate equipments used for pollution prvention, such as oil boom, oil skimmer, dispersant, etc.
= Use dispersant only if badly needed, since in most cases dispersant is more toxic than the oil itself.

The preparation of the pollution prevention for the Bintuni oilfield development project should be done more carefully, since the surrounding area of the project consists of fragile ecosystem

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MANPOWER DEVELOPMENT

FOR

ENVIRONMENTAL IMPACT ASSESSMENT

PRESENTED BY

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(it)

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MANPOWER DEVELOPMENT FOR ENVIRONMENTAL IMPACT ASSESSMENT

1. INTRODUCTION
2. ROLES OF PARTICIPANTS IN THE EIA PROCESS
3. APPROACHES TO MANPOWER DEVELOPMENT
4. SIA TRAINING - A SPECIAL CASE?
5. MANPOWER ESTIMATES TO MEET EIA REQUIREMENTS
6. LICENSING
7. THE ROLE OF DEVELOPMENT ASSISTANCE
8. CANADA: A CASE STUDY IN DEVELOPMENT OF EIA EXPERTISE
9. INDONESIA: A CASE STUDY IN DEVELOPMENT OF EIA EXPERTISE
10. EMDI PROJECT: A CASE STUDY IN DEVELOPMENT COOPERATION TO STRENGTHEN EIA CAPABILITIES

1. INTRODUCTION

- definitions
- manpower in place of human resources direct to a special purpose, in this case, the conduct of the EIA process
- not intended to play down role of women; in fact there is a need to take specific notice of gender-specific aspects of the conduct of EIA; however, I choose to use "manpower" because it is a more specific term than human resources
- major contents of this paper
- attempt to present from both developed country and developing country perspective, drawing heavily on the experience from:
- Canada as a country which has had extensive EIA experience dating from approximately 1972 (formally) and much earlier informally; and which has developed an extensive network of government and private-sector professionals, academics, and NGOs/reformers with EIA experience
- Indonesia as a country with a strong commitment to environmental management, dating back to 1972, but institutionally active since 1978; with strong policy and legislative/regulatory basis for EIA; but still in early-middle stages of developing the infrastructure and expertise to implement EIA extensively
- comparisons between the two countries, using as a vehicle the strong link between Indonesia and Canada through development cooperation, particularly through a long-term project called EMDI
- the models and approaches presented here are the responsibility of the author and do not necessarily reflect the position of the cooperating organizations in the EMDI Project: KLH, Dalhousie University, and CIDA
- however, it is hoped that the author has been able to capture the essence of what has been learned through this cooperative project

EIA = ENVIRONMENTAL IMPACT ASSESSMENT PROCESS (GOV'T ADMIN)
= THE ASSESSMENT OF IMPACTS, AS PART OF REPORT PREPARATION
EIS = THE MAJOR DOCUMENT PRODUCED DURING THE PROCESS

* Discussion during/following each section
* Discussion at end of lecture on manpower status, needs in each country

2. ROLES OF PARTICIPANTS IN THE EIA PROCESS

PARTICIPANTS CAN BE DIVIDED INTO:

- O THOSE WITH AN INTEREST IN THE PROJECT/EIA PROCESS
- O THOSE RESPONSIBLE FOR ADMINISTERING THE PROCESS
- O THOSE WHO PREPARE THE EIA STUDIES AND REPORTS

THOSE WITH AN INTEREST IN THE PROJECT/EIA PROCESS:

- o PROPONENT OR PROJECT DEVELOPER / OWNER
- o LOCAL COMMUNITY LEADERS / PUBLIC AT LARGE
- o UNIVERSITY ACADEMICS
- o PROFESSIONAL ASSOCIATIONS
- o NON-GOVERNMENT ORGANIZATIONS / SPECIAL INTEREST GROUPS

THOSE RESPONSIBLE FOR ADMINISTERING THE PROCESS:

- GOVERNMENT AUTHORITY RESPONSIBLE FOR EIA REVIEW PROCESS
- GOVERNMENT AUTHORITY RESPONSIBLE FOR PROJECT APPROVAL / PERMITTING / MONITORING / AUDIT
- OTHER GOVERNMENT AGENCIES WITH AN INTEREST

THOSE WHO PREPARE THE EIA STUDIES AND REPORTS:

- PRIVATE CONSULTANTS
- UNIVERSITY / RESEARCH INSTITUTE ACADEMICS

ROLES OF PARTICIPANTS IN THE EIA PROCESS

* <u>PROPONENT OR PROJECT DEVELOPER / OWNER</u>

ROLE:

- o AS INVESTOR MUST ENSURE THAT PROJECT MEETS ALL GOVERNMENT EIA REQUIREMENTS

- o MUST ENSURE THAT IMPACTS/DISBENEFITS TO THE ENVIRONMENT AND POPULATION IN THE PROJECT AREA ARE MINIMIZED

* <u>GOVERNMENT AUTHORITY RESPONSIBLE FOR EIA PROCESS</u>

ROLE:

- o ESTABLISH RULES AND PROCEDURE FOR EIA REVIEW

- o ENSURE ALL INTERESTED PARTIES ARE AWARE OF THE PROJECT AND THE EIA REVIEW PROCESS AND GIVEN FAIR OPPORTUNITY TO PARTICIPATE

- o MANAGE THE REVIEW AND APPROVAL PROCESS

- o CONDUCT TECHNICAL REVIEW OF EIA DOCUMENTS

- o ENSURE NECESSARY EXPERTISE IS BROUGHT INTO THE REVIEW AND EVALUATION OF THE EIA

* GOVERNMENT AUTHORITY RESPONSIBLE FOR PROJECT APPROVALS

ROLE:

- o PARTICIPATE IN TECHNICAL EVALUATION OF EIA
- o ENSURE MITIGATION MEASURES INCLUDING DESIGN AND OPERATING PROCEDURES ARISING FROM EIA ARE INCORPORATED INTO PERMIT CONDITIONS
- o ENSURE PROJECT PROPONENT / OWNER COMPLIES WITH ENVIRONMENTAL PROTECTION REQUIREMENTS
- o ISSUE PERMITS FOR PROJECT CONSTRUCTION AND OPERATION
- o MONITORING (PROJECT AND SURROUNDING ENVIRONMENT) OR ENSURING MONITORING IS UNDERTAKEN BY PROPONENT
- o CONDUCT ENVIRONMENTAL AUDIT AND ENSURE REMEDIES ARE IMPLEMENTED FOR IDENTIFIED PROBLEMS

* OTHER GOVERNMENT AGENCIES WITH AN INTEREST

ROLE:

- o PARTICIPATE IN TECHNICAL REVIEW OF ASPECTS OF EIA WHICH IMPINGE ON INTERESTS/MANDATE
- o PROVIDE TECHNICAL ADVICE ON HOW TO SOLVE CONFLICTS, REDUCE POTENTIAL IMPACTS

* <u>PRIVATE CONSULTANTS</u> (MANAGERS OF EIA / SPECIALISTS)

ROLE:

- o PREPARE EIA BACKGROUND STUDIES (EG. SITING, PROCESS DESIGN, WASTE TREATMENT DESIGN, ENVIRONMENTAL AND SOCIAL BASELINE)
- o CONDUCT ENVIRONMENTAL IMPACT ASSESSMENT (MANAGE THE PREPARATION OF EIS)
- o IDENTIFY (AND DESIGN) DESIGN AND OPERATIONAL MITIGATIVE MEASURES
- o PROVIDE EXPERT ADVICE TO PROPONENT
- o PROVIDE EXPERT ADVICE TO GOVERNMENT AGENCIES

* <u>UNIVERSITY ACADEMICS</u>

ROLE:

- o PROVIDE SPECIALIST ADVICE TO PROPONENT OR PARTICIPATE IN EIA PREPARATION
- o PROVIDE EXPERT ADVICE TO GOVERNMENT AGENCIES AS PARTICIPANTS IN EIA EVALUATION
- o PROVIDE EXPERT ADVICE TO THE PUBLIC
- o CRITIC OF EIA PROCESS, TO FOSTER IMPROVEMENTS

* PROFESSIONAL ASSOCIATIONS

ROLE:

- o PARTICIPATE IN EIA REVIEW AS KNOWLEDGEABLE MEMBERS OF THE PUBLIC

- o PROVIDE EXPERT ADVICE TO GOVERNMENT AGENCIES

* NON-GOVERNMENT ORGANIZATIONS / SPECIAL INTEREST GROUPS

ROLE:

- o PARTICIPATE IN EIA REVIEW AND MAKE PRESENTATIONS OR INTERVENTIONS

- o ADVISE COMMUNITY LEADERS ON POTENTIAL ENVIRONMENTAL IMPACTS

- o KEEP PUBLIC INFORMED

- o REPRESENT CERTAIN NATIONAL, SUB-NATIONAL OR LOCAL ENVIRONMENTAL OR SOCIAL INTERESTS

* LOCAL COMMUNITY LEADERS / PUBLIC AT LARGE

NEED TO RECOGNIZE THE:

- o IMPORTANCE OF BUILDING STRONG PUBLIC SUPPORT FOR EIA PROCESS IN GENERAL
- o IMPORTANCE OF A WELL-INFORMED PUBLIC WITH RESPECT TO SPECIFIC PROJECT

ROLE:

- o REPRESENT THE COMMUNITY INTEREST
- o PARTICIPATE IN CONSULTATIONS, REVIEW PROCEEDINGS

3. APPROACHES TO MANPOWER DEVELOPMENT

<u>TARGET GROUPS FOR TRAINING/AWARENESS BUILDING:</u>

1 GENERAL PUBLIC

2 INDUSTRY + GOVERNMENT SENIOR MANAGEMENT; SPECIAL INTEREST GROUPS

3 EIA SPECIALISTS

4 EIA TEAM LEADERS + MANAGERS; GOVERNMENT REVIEWERS + EVALUATORS

5 EIA TRAINERS

<u>TYPES OF EIA TRAINING REQUIRED</u>

1. <u>AWARENESS BUILDING</u>

- o FOR GENERAL PUBLIC; SENIOR MANAGEMENT; SPECIAL INTEREST GROUPS
- o NO SPECIAL BACKGROUND NECESSARY
- o GENERAL, NON-FORMAL, AWARENESS BUILDING FOR GENERAL PUBLIC
- o TARGETTED AWARENESS BUILDING FOR SENIOR MANAGERS, SPECIAL INTEREST GROUPS

2. INTENSIVE TRAINING IN CONDUCT OF EIA

o FOR:
- EIA SPECIALISTS
- GOVERNMENT EIA EVALUATORS
- EXPERT EIA REVIEWERS
- MEMBERS OF EIA PREPARATION TEAMS
- SELECTED SPECIAL INTEREST GROUPS

o FOCUSED ON EIA PRINCIPLES AND PRACTICE, APPLICATION OF DISCIPLINARY SKILLS TO EIA

o SPECIAL COURSES, TRAINING PROGRAMS

o STRONG TECHNICAL BACKGROUND IN THE RELEVANT TECHNICAL/PHYSICAL, BIOLOGICAL OR SOCIAL SCIENCE OR ENGINEERING

o EXAMPLE OF SPECIALISTS NEEDED IN EIA ARE*:

- ECOLOGIST
- TOXICOLOGIST
- CHEMICAL / PROCESS ENGINEER
- ENVIRONMENTAL ENGINEER
- HYRDOLOGIST
- GEOLOGIST
- RESOURCE ECONOMIST
- DEMOGRAPHER
- SOCIOLOGIST
- ENVIRONMENTAL PSYCHOLOGIST

* THIS LIST IS INDICATIVE OF THE BROAD RANGE OF EXPERTISE NEEDED; EACH DIFFERENT TYPE OF PROJECT UNDERGOING EIA WILL HAVE SPECIFIC REQUIREMENTS

- UNDERSTANDING OF HOW THE PARTICULAR DISCIPLINARY EXPERTISE IS RELATED TO ENVIRONMENTAL STUDIES

- SPECIFIC KNOWLEDGE OF THE PARTICULAR ENVIRONMENTAL SETTING, ECOSYSTEM, PROJECT TYPE OR SOCIAL/ CULTURAL SETTING UNDER STUDY

- ACADEMIC LEVEL, USUALLY MINIMUM BACHELOR'S AND PREFERABLE MASTER'S OR PHD. DEGREE

3. <u>INTENSIVE TRAINING IN MANAGEMENT OF EIA</u>

- FOR:
  - GOVERNMENT MANAGERS OF EIA PROCESS
  - EIA TEAM LEADERS/MANAGERS
  - EIA TRAINERS

- FOCUSED ON DESIGN, COORDINATION, AND MANAGEMENT OF EIA STUDIES

- MAY NEED SEPARATE APPROACHES FOR TEAM LEADERS AND GOVERNMENT MANAGERS

- MAY NEED SEPARATE TRAINING FOR TRAINERS

- ACADEMIC BACKGROUND CAN BE FROM MANY DIFFERENT DISCIPLINES

- EXPERIENCE HAS SHOWN CERTAIN DISCIPLINES TO PRODUCE MAJORITY OF EIA GENERALISTS:
  - URBAN AND REGIONAL PLANNING
  - ARCHITECTURE AND LANDSCAPE ARCHITECTURE
  - ECOLOGY
  - ENGINEERING
  - GEOGRAPHY
  - SOCIOLOGY
  - COMMUNICATIONS

- ACADEMIC LEVEL, USUALLY MINIMUM BACHELOR'S AND PREFERABLE MASTER'S DEGREE

- CERTAIN SKILLS ARE ESSENTIAL TO EFFECTIVE MANAGEMENT OF EIA PREPARATION
  OR TO
  MANAGEMENT OF THE EIA PROCESS:
  - SOLID TECHNICAL, ACADEMIC BACKGROUND BEFORE BECOMING EIA MANAGER/GENERALIST
  - ABILITY TO SYNTHESIZE INPUTS FROM MANY DISCIPLINES AND INTERESTS
  - STRONG INTER-PERSONAL SKILLS
  - GOOD VERBAL AND WRITTEN COMMUNICATIONS SKILLS
  - EMPATHY FOR THE PUBLIC

FORMS OF TRAINING

o FORMAL EDUCATION/ DEGREE TRAINING

- EIA COURSES AS PART OF A DISCIPLINARY OR ENVIRONMENTAL STUDIES GRADUATE PROGRAM
- THESIS FOCUSED ON EIA TOPIC

o SPECIAL INTENSIVE COURSES / SEMINARS

ALTERNATIVES

- GOVERNMENT SPONSORED, FIXED CURRICULUM
- UNIVERSITY NON-DEGREE
- PRIVATE-SECTOR, MARKET-ORIENTED
- REGIONAL TRAINING SEMINARS

o INTERNSHIPS

- IN-COUNTRY, STRONG/WEAK AGENCY LINKAGE
- GOVERNMENT/INDUSTRY EXCHANGES
- OVERSEAS IN GOVERNMENT, INDUSTRY, CONSULTING FIRMS

- o ON-THE-JOB TRAINING
    - DESIGNED EIA TRAINING AS PART OF REGULAR WORK FOR EIA PRACTITIONERS; ASSIGNMENT OF FULL-TIME EIA TRAINERS
    - AS PART OF EIA CONTRACTS, ON-THE-JOB TECHNOLOGY TRANSFER
    - STRUCTURED TRAINING SESSIONS AS PART OF WORK ASSIGNMENTS
    - CAN BE PROVIDED BY LOCAL UNIVERSITIES AND TECHNICAL SCHOOLS; EXPERIENCED CONSULTANTS; EXPATRIATE TECHNICAL ADVISORS
- o LEARNING BY DOING
    - IN NORTH AMERICA, MUCH OF THE EIA EXPERTISE HAS BEEN DEVELOPED "ON-THE-JOB"
    - PERHAPS LESS TIME EFFICIENT, BUT EFFECTIVE
- o SELF-STUDY / READINGS
- o AWARENESS BUILDING
    - PUBLIC SEMINARS
    - ADVERTISING
    - MEDIA CAMPAIGNS

REPRESENTATIVE LIST OF INSTITUTIONS

OFFERING ENVIRONMENTAL MANGAGEMENT TRAINING

ASEAN REGION

<u>THAILAND</u>	
MAHIDOL UNIVERSITY	* ENVIRONMENTAL BIOLOGY GRADUATE PROGRAM
<u>MALAYSIA</u>	
UNIVERSITY SAINS MALAYSIA	* POLLUTION STUDIES
<u>PHILLIPINES</u>	
UNIV. PHILIPPINES, LOS BANOS	* HUMAN ECOLOGY PROGRAM
<u>INDONESIA</u>	
BOGOR AGRICULTURAL UNIV.	* ENVIRONMENTAL SCIENCE GRADUATE PROGRAM
<u>REGIONAL PROGRAMS</u>	
ASIAN INST. OF TECHNOLOGY	*ENVIRONMENTAL ENGINEERING GRADUATE PROGRAM
BIOTROP-SEMEO, BOGOR	*APPLIED ECOLOGY NON-DEGREE COURSES IN INTEGRATED PEST MANAGEMENT

Source: Adapted from: Hanson, A.J. 1984. "Producing Skilled Environmental Professionals". Presented at WEC Conference on "Environmental Development: the Future for Consulting Firms in Asia". Singapore, 14-17 February, 1984.

4. SIA TRAINING - A SPECIAL CASE?

<u>ISSUES</u>

o CAN SIA TRAINING BE INCORPORATED IN EIA TRAINING?

- SOCIAL ASPECTS NEED TO BE INTEGRATED INTO EIA

- SPECIAL METHODOLOGIES NECESSARY / NEED SOCIAL SCIENCE BACKGROUND

5. MANPOWER ESTIMATES TO MEET EIA REQUIREMENTS

o DEMAND FOR TRAINED MANPOWER IN EIA POTENTIALLY

VERY LARGE

o PRE-CONDITIONS:

* DEMAND CREATED BY EIA REGULATIONS, ENFORCEMENT

* RAPID NATIONAL DEVELOPMENT

INDONESIA AS AN EXAMPLE

1984-1989*	ESTIMATED REQ'T	ACHIEVED
INTRODUCTORY	1000	2600
ADVANCED	600	300

* source: Beanlands, Gordon. 1982. A Review of Environmental Impact Assessment Training Needs in Indonesia. Institute for Resource and Environmental Studies, Dalhousie University, Canada

o IN TERMS OF REAL EIA PRACTIONERS, FAR FEWER

EXIST, DESPITE TRAINING NUMBERS

1989 - 1994

	TYPE OF EIA TRAIN.	EST. REQ'T CENTRAL	EST. REQ'T PROVINCIAL
GOV'T. SR MGT.	INTRODUCTORY	`20	20
GOV'T. EIA TECH.	ADVANCED	50	100
EIA STUDY MGR.	ADVANCED MGT.	70	50
EIA STUDY SPEC.	ADVANCED	500	300
EIA TRAINERS	ADVANCED MGT.	50	50

TOTALS: SENIOR MANAGEMENT	40
EIA TECHNICAL SPECIALISTS	950
EIA MANAGERS	220

6. LICENSING

- IMPORTANT TO ENSURE THAT AN ACCEPTABLE LEVEL OF QUALITY IS ACHIEVED IN EIA STUDIES / EIS REPORTS
- CAN THIS BE ACHIEVED WITHOUT LICENSING EIA PRACTITIONERS?
- ALTERNATIVE TO ISSUANCE OF LICENCE TO PRACTIONERS IS TO LET THE MARKET DECIDE COMPETENCE
- EXPERIENCE IN CANADA HAS BEEN THAT THIS HAS WORKED SATISFACTORILY WITHOUT LICENSING
- INDONESIA IS ATTEMPTING TO INTRODUCE LICENSING SYSTEM

LICENSING OPTIONS

- o LICENSE CAN BE ISSUED TO:
  - COMPANIES

    OR
  - INDIVIDUAL PROFESSIONALS

- o LICENCE GIVEN ON THE BASIS OF:
  - SUCCESSFUL COMPLETION OF PRESCRIBED COURSE
  - WRITTEN EXAMINATION
  - EXPERIENCE IN A DEFINED SET OF EIA PROJECTS UNDER DIRECTION OF LICENSED PROFESSIONAL
  - EQUIVALENCE IN GRADUATE STUDY INCLUDING EIA COURSES OR IN EXPERIENCE

- o REGARDLESS, EIA LICENCE SHOULD BE GIVEN ON BASIS OF SOME MEASURE OF ABILITY TO MANAGE EIA STUDY / PREPARATION OF EIS

7. THE ROLE OF DEVELOPMENT ASSISTANCE

- o DONOR AGENCY POLICIES
- o OPPORTUNITIES FOR RECIPIENT COUNTRIES

<u>DONOR AGENCY POLICIES</u>

- o MOST MULTILATERAL AND SOME BILATERAL DONORS HAVE RECENTLY ADOPTED AN ENVIRONMENTAL MANAGEMENT POLICY
- o MAJOR ELEMENT OF POLICY IS REQUIREMENT FOR ENVIRONMENTAL SCREENING / ASSESSMENT OF PROJECTS DURING PROJECT PLANNING AND APPROVAL
- o WORLD BANK POLICY INCLUDES REQUIREMENT THAT:

  THE PROJECT REVIEW PROCESS INCLUDE EFFORTS TO " ANTICIPATE THE COMPLEX ECOLOGICAL AND BEHAVIOURAL CONSEQUENCES THAT MAY STEM FROM LARGE SCALE DEVELOPMENT PROJECTS"

- OECD (ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT) INCLUDING U.S., CANADA, AND EUROPEAN BILATERAL DONORS

- OECD POLICY STATES:

  " DEVELOPMENT ASSITANCE PROJECTS AND PROGRAMS WHICH BECAUSE OF THEIR NATURE, SIZE AND/OR LOCATION, COULD SIGNIFICANTLY AFFECT THE ENVIRONMENT, SHOULD BE ASSESSED AT AS EARLY A STAGE AS POSSIBLE AND TO AN APPROPRIATE DEGREE FROM AN ENVIRONMENTAL STANDPOINT"

  in addition it recommends that:

  THE PARTICULAR LEGISLATIVE AND SOCIO-ECONOMIC SETTING AND ENVIRONMENTAL CONDITIONS IN THE HOST COUNTRY BE TAKEN INTO ACCOUNT"IN THIS ASSESSMENT

- ESSENTIAL THAT DONOR REQUIREMENTS, STANDARDS FOR EIA NOT INTERFERE WITH HOST COUNTRY LAWS AND REGULATIONS BEING MET

OPPORTUNITIES FOR RECIPIENT COUNTRIES

- o TECHNICAL ASSISTANCE IN DEVELOPMENT OF PROCEDURE AND GUIDELINES FOR EIA PROCESS IMPLEMENTATION

- o TRAINING OF GOVERNMENT PERSONNEL RESPONSIBLE FOR ADMINISTRATION OF EIA PROCESS (CENTRAL OR PROVINCIAL ENVIRONMENT AGENCY OR BOARD)

- o TRAINING OF GOVERNMENT PERSONNEL RESPONSIBLE FOR ENSURING PROJECT COMPLIANCE WITH ENVIRONMENTAL PROTECTION CONDITIONS (CENTRAL OR PROVINCIAL SECTOR OR LINE DEPARTMENTS)

- o GRANTS, LOANS TO INCORPORATE ENVIRONMENTAL MANAGEMENT MEASURES IDENTIFIED IN EIS

8. CANADA: A CASE STUDY IN DEVELOPMENT OF EIA EXPERTISE

- o THE DEVELOPMENT OF OPPORTUNITIES FOR EIA EXPERTISE
- o GOVERNMENT RESPONSE
- o UNIVERSITY RESPONSE
- o PRIVATE - SECTOR RESPONSE

<u>THE DEVELOPMENT OF OPPORTUNITIES FOR EIA EXPERTISE</u>

- o 1970 ESTABLISHMENT OF CENTRAL DEPARTMENT OF ENVIRONMENT: ENVIRONMENT CANADA
- o EARLY - MID 1970's ESTABLISHMENT OF PROVINCIAL ENVIRONMENT DEPARTMENTS
- o EIA REQUIREMENTS INTRODUCED BY 1974 FOR CENTRAL GOVERNMENT PROJECTS
- o EIA REQUIREMENTS INTRODUCED BY MOST PROVINCES FOR PROVINCIAL GOVERNMENT AND PRIVATE-SECTOR PROJECTS BY 1978

- o GROWING AWARENESS THROUGHOUT 1970's AMONG GENERAL PUBLIC
- o GROWING AWARENESS AMONG PRIVATE INDUSTRY EVIDENT IN "ENVIRONMENT COORDINATION" UNITS AND IN INDUSTRY/TRADE "ENVIRONMENT COMMITTEES"
- o DEVELOPMENT BOOM 1970's: SIMILAR TO DEVELOPING COUNTRIES
- o ALL THIS CREATED RAPID RISE IN DEMAND FOR ENVIRONMENTAL EXPERTS

GOVERNMENT RESPONSE

- A LARGE NUMBER OF PROFESSIONALS FROM RELATED DISCIPLINES JOINED THE NEW INSTITUTIONS:
  - WATER RESOURCES ENGINEERS
  - SANITATION / POLLUTION CONTROL ENGINEERS
  - FORESTERS
  - FISHERIES AND WILDLIFE BIOLOGISTS
  - CHEMISTS
- STRONG POOL OF PROFESSIONALS FROM RELEVENT DISCIPLNES WITH APPROPRIATE EXPERTISE EXISTED
- NEEDED TO LEARN HOW TO ADAPT KNOWLEDGE, SKILLS TO INTER-DISCIPLINARY APPROACHES
- ACHIEVED THROUGH LEARNING ON THE JOB, PRIVATE READINGS, AND RE-ENTRY TO UNIVERSITY
- GOVERNMENT UNITS BEGAN TO BE STRENGTHENED BY MID 1970's WITH RECENT "ENVIRONMENTAL SCIENCE AND STUDIES GRADUATES

UNIVERSITY RESPONSE

o BY MID 1970's SEVERAL UNIVERSITIES BEGAN TO ESTABLISH GRADUATE PROGRAMS IN ENVIRONMENTAL SCIENCE, ENVIRONMENTAL STUDIES AND NATURAL RESOURCE MANAGEMENT

o CHARACTERISTICS OF THESE PROGRAM:

- INTERDISCIPLINARY APPROACH TO PROBLEM - SOLVING FOR ENVIRONMENTAL AND RESOURCE MANAGEMENT

- FOUNDED ON SPECIFIC TECHNICAL BACKGROUND AND KNOWLEDGE (eg WILDLIDE ECOLOGY, FORESTRY CHEMICAL ENGINEERING)

- A SENSITIVITY TO LOCAL ENVIRONMENTS AND PEOPLE, AND ABILITY TO ADAPT TO LOCAL CONDITIONS

o BY LATE 1970's AND CONTINUING, A TOTAL OF 10 SUCH PROGRAMS WERE EACH PROVIDING BETWEEN 5 -15 GRADUATES PER YEAR

o CREATED A POOL OF SEVERAL 1000 YOUNG ENVIRONMENTAL PROFESSIONALS WHEN COMBINED WITH ENTRANTS TO FIELD FROM OTHER DISCIPLINES

PRIVATE - SECTOR RESPONSE

- o INDUSTRY - ENGINEERS, CHEMISTS AND OTHER PROFESSIONALS BECAME THE FIRST "ENVIRONMENTAL PROFESSIONALS"
- o CONSULTING - BROAD SPECTRUM OF CONSULTING BUSINESSES DIVIDED INTO 6 CATEGORIES:
  - INTEGRATED ENVIRONMENTAL CONSULTING FIRMS
  - SPECIALIST ENVIRONMENAL CONSULTING FIRMS
  - MULTIDISCIPLINARY ENGINEERING COMPANIES
  - URBAN / REGIONAL PLANNING CONSULTING FIRMS
  - SINGLE-SECTOR NATURAL RESOURCE CONSULTANTS
  - INDIVIDUAL (FREELANCE) CONSULTANTS
- o FIRMS ESTABLISHED OR ENTERED ENVIRONMENTAL BUSINESS ACROSS COUNTRY, IN ALL PROVINCES
- o THROUGH "BOOM" PERIOD, 100's OF COMPANIES WERE FORMED OR EXISTING COMPANIES ENTERED FIELD
- o PERIOD OF COMPETITION, RATIONALIZATION OCCURRED
- o AS DEVELOPMENT BOOM IN CANADA SUBSIDED, BUSINESS OPPORTUNITIES SHIFTED OFFSHORE

SUMMARY OF THE CANADIAN EXPERIENCE:

- o INDIVIDUAL SHIFT TO ENVIRONMENTAL PROFESSION IN GOVERNMENT AND PRIVATE-SECTOR
- o RAPID ESTABLISHMENT OF UNIVERSITY PROGRAMS
- o MARKET-DRIVEN ESTABLISHMENT OF LARGE ENVIRONMENTAL CONSULTING BUSINESS
- o FEW SPECIALIZED COURSES IN EIA OUTSIDE OF UNIVERSITY GRADUATE COURSES
- o SEMINARS, WORKSHOPS USED TO BUILD EXPERTISE
- o IN-HOUSE EIA TRAINING BY GOVERNMENT, INDUSTRY

o OTHER COUNTRY RESPONSE DIFFERENT BOTH IN EUROPE AND IN ASIA

9. INDONESIA: A CASE STUDY IN DEVELOPMENT OF EIA EXPERTISE

- o THE DEVELOPMENT OF OPPORTUNITIES FOR EIA EXPERTISE
- o GOVERNMENT RESPONSE
- o UNIVERSITY RESPONSE
- o PRIVATE - SECTOR RESPONSE

<u>THE DEVELOPMENT OF OPPORTUNITIES FOR EIA EXPERTISE</u>

- o 1972 INITIAL RAISING OF ENVIRONMENTAL ISSUES
- o 1974 FIRST EIA PRODUCED WITHOUT REGULATION
- o UNTIL LATE 1970's FOREIGN EXPERTISE MOSTLY USED
- o 1978 MINISTRY OF STATE FOR DEVELOPMENT SUPERVISION AND ENVIRONMENT ESTABLISHED

- 1982 MINISTRY OF STATE FOR POPULATION AND ENVIRONMENT

- 1982 ACT NO. 4 CONCERNING PROVISIONS FOR MANAGEMENT OF THE LIVING ENVIRONMENT

- CREATED SMALL DEMAND FOR EIA SPECIALISTS IN GOVERNMENT, UNIVERSITY AND PRIVATE-SECTOR

- 1986 GOVERNMENT REGULATION NO. 29 REGARDING ANALYSIS OF ENVIRONMENTAL IMPACTS (AMDAL)

- DEMAND FOR EIA PROFESSIONALS NOW RISING QUICKLY AS CENTRAL SECTOR DEPARTMENTS AND PROVINCIAL GOVERNMENT RESPOND TO NEW REGULATIONS

- ENVIRONMENTAL AWARENESS BUILDING, WITH EMPHASIS ON IMPORTANCE OF EIA

GOVERNMENT RESPONSE

- o INITIALLY SMALL NUMBER OF SENIOR PROFESSIONALS IN RELATED DISCIPLINES RECRUITED INTO ENVIRONMENT MINISTRY:

  - ECOLOGY
  - NATURAL RESOURCES MANAGEMENT
  - COMMUNICATIONS / SOCIAL SCIENCE
  - POPULATION

- o SUPPLEMENTED BY JUNIOR PROFESSIONALS FROM BIOLOGY, CHEMISTRY, PLANNING, FORESTRY

- o STILL DIFFICULT TO ATTRACT GOOD PROFESSIONALS TO ENVIRONMENT FIELD IN THE SECTOR DEPARTMENTS AND PROVINCIAL GOVERNMENTS

- o STRONG EFFORT TO PROVIDE OVERSEAS GRADUATE TRAINING FOR JUNIOR AND SENIOR ENVIRONMENTAL PROFESSIONALS

UNIVERSITY RESPONSE

- o ESTABLISHMENT OF NETWORK OF ENVIRONMENTAL STUDY CENTRES, (ESC's) BEGINNING IN 1972 WITH UNPAD INSTITUTE OF ECOLOGY

- o NOW APPROXIMATELY 50, ALTHOUGH ONLY PERHAPS 15 OPERATING AS VIABLE ENTITIES

- o RESEARCH WORK AND TRAINING EFFORTS OF ESC's FOCUSSED ON EIA WORK BECAUSE OF OPPORTUNITIES

- o 4 UNIVERSITIES NOW HAVE GRADUATE-LEVEL ENVIRONMENTAL STUDIES PROGRAMS

- o GOVERNMENT-SPONSORED EIA TRAINING PROVIDED BY 13 ESC's:
    - 2-WEEK BASIC AMDAL A (EIA) COURSE
    - 2.5-MONTH INTENSIVE AMDAL B COURSE

o OVER 2300 NOW HAVE TAKEN AMDAL A; APPROX. 300 NOW HAVE TAKEN AMDAL B

o PARTICIPANTS FROM CENTRAL GOVERNMENT, PROVINCIAL GOVERNMENT, UNIVERSITIES, INDUSTRY, CONSULTANTS, NGO's

o STILL TOO FEW GOVERNMENT AND PRIVATE-SECTOR PROFESSIONALS WITH SOLID UNDERSTANDING OF EIA AND ABILITY TO PREPARE AND EVALUATE

PRIVATE - SECTOR RESPONSE

o SMALL NUMBER OF INDUSTRIES HAVE TAKEN INITIATIVE ON EIA, WELL PRIOR TO G.R. 1986 ON EIA:

- OIL AND GAS
- PETROCHEMICAL
- ELECTRICAL GENERATION (MAINLY HYDRO)

o EXPERTISE MAINLY DRAWN FROM UNIVERSITIES, LOCAL CONSULTANTS, WITH TECHNICAL INPUT FROM FOREIGN CONSULTANTS

- o SMALL NUMBER OF PRIVATE-SECTOR CONSULTANTS NOW ESTABLISHED WITH EIA EXPERIENCE (15-20)

- o ALMOST ALL IN JAKARTA; ALMOST NO EIA EXPERIENCE, EXPERTISE IN THE PROVINCES

- o CONSULTING FIRMS IN DOING EIA MOSTLY FROM:

  - ARCHITECTURE
  - REGIONAL PLANNING
  - ENGINEERING
  - MANAGEMENT / ECONOMIC DEVELOPMENT

- o NO SPECIALIST ENVIRONMENTAL CONSULTANTS TO DATE, ALTHOUGH POSSIBILITIES EXIST IN POLLUTION CONTROL

SUMMARY OF THE INDONESIAN EXPERIENCE:

o FEW INDIVIDUALS SHIFTED TO ENVIRONMENTAL PROFESSION IN GOVERNMENT AND PRIVATE-SECTOR

o VERY LARGE NEED FOR EIA PROFESSIONALS, BUT HUMAN RESOURCE DEVELOPMENT CAPACITY TO MEET DEMAND LAGGING BEHIND

o RAPID ESTABLISHMENT OF UNIVERSITY ESC's BUT ONLY FEW GRADUATE PROGRAMS AND COURSES

o ENVIRONMENTAL CONSULTING BUSINESS HAS RESPONDED ONLY SLOWLY TO DEMAND, BECAUSE:

* UNCERTAINTY OF ENFORCEMENT OF REGULATION
* CONSULTING SECTOR STILL DEVELOPING AS A WHOLE

- EMPHASIS ON EIA TRAINING THROUGH FIXED CURRICULUM, GOVERNMENT-SPONSORED COURSES

- EMPHASIS ON GENERAL PUBLIC, AND INTEREST GROUP AWARENESS BUILDING

- USE OF DONOR ASSISTANCE TO STRENGTHEN EIA TRAINING AND TECHNICAL ASSISTANCE IN EIA CONDUCT

10. EMDI PROJECT: A CASE STUDY IN DEVELOPMENT COOPERATION TO STRENGTHEN EIA CAPABILITIES

- ENVIRONMENTAL MANAGEMENT DEVELOPMENT IN INDONESIA

- COOPERATIVE PROJECT OF MINISTRY OF STATE FOR POPULATION AND ENVIRONMENT, INDONESIA
  AND
  DALHOUSIE UNIVERSITY, CANADA

- FUNDING BY CANADIAN INTERNATIONAL DEVELOPMENT AGENCY AND GOVERNMENT OF INDONESIA

- COOPERATIVE ARRANGEMENT SINCE 1983, NOW IN 2ND PHASE (1986-1989); THIRD PHASE IN DESIGN

- <u>PHASE I</u> EMPHASIS WAS ON MANPOWER DEVELOPMENT, WITH OBJECTIVE OF INCREASING INDONESIAN EIA AND OTHER ENVIRONMENTAL MANAGEMENT CAPABILITIES

- PHASE I ACTIVITIES RELATED TO EIA STRENGTHENING:

  1. 4- AND 6- WEEK INTENSIVE EIA COURSE IN CANADA FOR SENIOR UNIVERSITY AND GOVERNMENT OFFICIALS

     MAIN ACHIEVEMENT WAS RAPID INCREASE IN KNOWLEDGE IN EIA OF SENIOR EIA LECTURERS

  2. IN-COUNTRY LECTURES AND SEMINARS WITH INVITED SPECIALISTS IN EIA FOR LARGE PROJECTS, SOCIAL IMPACT ASSESSMENT, RISK ANALYSIS, REGIONAL IMPACT ASSESSMENT

  3. GRADUATE-STUDY FELLOWSHIPS IN ENVIRONMENT STUDIES, AND ENVIRONMENTAL LAW

  4. CURRICULUM DEVELOPMENT

  5. LONG-TERM JUNIOR RESEARCH TRAINERS AT UNIVERSITY ENVIRONMENTAL STUDY CENTRES WITH EMPHASIS ON FIELD, LAB AND REPORTING TECHNIQUES FOR EIA

6. ASSESSMENT OF PRIVATE-SECTOR EIA CAPABILITIES AND OPPORTUNITIES

7. EIA TRAINING FOR NON-GOVERNMENT ORGANIZATIONS

- <u>PHASE 2</u> EMPHASIS HAS CONTINUED ON MANPOWER DEVELOPMENT, BUT WIDENED INTO INSTITUTIONAL STRENGTHENING

- PHASE 2 ACTIVITIES RELATED TO EIA STRENGTHENING:

  1. LONG-TERM EIA ADVISOR IN MINISTRY OF STATE FOR POPULATION AND ENVIRONMENT:
     - ASSIST WITH DEVELOPMENT OF GUIDELINES FOR IMPLEMENTATION OF EIA REGULATIONS
     - PROVIDE ADVICE TO DEPARTMENTS AND PROVINCIAL GOVERNMENTS RESPONSIBLE FOR EIA REVIEW COMMISSIONS
  2. SHORT-TERM ADVISORS IN SELECTED SECTOR DEPARTMENTS:
     - ASSIST DEVELOPMENT OF TECHNICAL GUIDELINES FOR EIA STUDIES

- ADVISE ON INSTITUTIONAL ARRANGEMENTS AND PROCEDURES FOR OPERATION OF REVIEW COMMISSIONS

3. LONG-TERM ADVISOR AND LOCAL ADVISOR TO NATIONAL ASSOCIATION OF CONSULTANTS:
   - ASSESSMENT OF CAPABILITIES AND TRAINING NEEDS
   - DEVELOPMENT OF CURRICULUM AND TRAINING OF TRAINERS TO PROVIDE EIA COURSES ON THE MANAGEMENT OF EIA STUDIES
   - STRENGTHEN ROLE OF CONSULTANTS IN EIA

4. SPONSORSHIP OF TEXTBOOKS, MANUALS AND OTHER EIA MATERIALS

5. GRADUATE-STUDY FELLOWSHIPS IN CANADA, WITH SEVERAL THESIS PROJECTS ON EIA AND SOCIAL IMPACT ASSESSMENT

o FUTURE NEEDS TO BE ADDRESSED BY EMDI COOPERATION:

1. CONTINUED ASSISTANCE TO MINISTRY OF STATE FOR POPULATION AND ENVIRONMENT IN GUIDING THE IMPLEMENTATION OF EIA REGULATION
2. SHORT- AND LONG-TERM ADVISORS TO SECTOR DEPARTMENT EIA COMMISSIONS, WITH SHIFT TO LATTER END OF EIA PROCESS: ie. ENVIRONMENTAL MANAGEMENT PLANS, MONITORING
3. SHORT- AND LONG-TERM ADVISORS TO SELECTED PROVINCIAL EIA COMMISSIONS, IN SETTING UP EIA PROCESS
4. CONTINUED ASSISTANCE TO PRIVATE SECTOR
5. IMPROVEMENT OF AMDAL (EIA) TRAINING CURRICULUM AND COURSES

MONITORING THE RESULTS OF EIA

ENVIRONMENTAL AUDITS OF PROJECTS

Prepared for

**Regional Training Seminar
on the Application of
Environmental Impact
Analysis in Appraisal
of Development
Project Planning**

Bandung, Indonesia

**Dr. Robert G. Morrison
Advisor, Impact Assessment
Environmental Management Development
in Indonesia**

ENVIRONMENTAL AUDITS

AGENDA

1. DEFINITIONS
2. PURPOSE OF AUDITS AND EVALUATION
3. DECISION PROTOCOL - EIA DEVELOPMENT

DEFINITIONS

ENVIRONMENTAL AUDIT

* VERIFICATION OF COMPLIANCE AND COLLATION OF MONITORING RESULTS

ENVIRONMENTAL EVALUATION

* THE EXAMINATION AND INTERPRETATION OF PROCEDURES CARRIED OUT IN PROJECT DEVELOPMENT AND OF RESULTS PRODUCED IN SATISFYING ENVIRONMENTAL OBJECTIVES AND RESPONSIBILITIES

* INCORPORATES COMPLIANCE AND EFFECTS MONITORING AND AUDITING

PURPOSE OF AUDITS AND EVALUATION

ENVIRONMENTAL EVALUATION - WHY ?

1. MECHANISM BETWEEN PROJECT IMPLEMENTATION AND THE ASSESSMENT AND REVIEW PROCESS
2. FEEDBACK - ONE PROJECT TO ANOTHER
3. DECISION INFORMATION - PROJECT PLANNING AND IMPLEMENTATION
4. INFORMATION - THROUGH FEEDBACK - TO IMPROVE IMPACT PREDICTION AND ASSESSMENT CAPABILITY
5. MAKES ENVIRONMENT ASSESSMENT AND REVIEW PROCESSES MORE EFFICIENT AND EFFECTIVE

IMPROVEMENT OF MANAGEMENT PRACTICE

1. SYSTEMATIC IDENTIFICATION OF CONSEQUENCES OF PROJECT ACTIONS
2. IDENTIFY AND CORRECT UNIDENTIFIED IMPACTS
3. MORE APPROPRIATE AND EFFICIENT ALLOCATION OF RESOURCES
4. SETTING OF REALISTIC MONITORING REQUIREMENTS
5. MAINTAINING PROPONET ACCOUNTABILITY
6. REFINING FUTURE PROJECT DESIGN

IMPROVEMENT OF EIA PROCESS AND PRACTICE

1. REDUCE TIME AND RESOURCE COMMITMENTS TO EIA
2. REFINE PREDICTIVE CAPABILITY AND ASSESSMENT METHODS
3. ENHANCE QUALITY
4. INCREASE EFFECTIVENESS OF PUBLIC CONTRIBUTION
5. INCREASE CREDIBILITY
6. SEPARATE IMPACTS OF ONE PROJECT FROM OTHER PROJECTS
7. IDENTIFY DEFICIENCIES IN DATA AND KNOWLEDGE
8. DEVELOP DATA BASE - FUTURE EIA's

SELECTION OF METHODOLOGIES - ENVIRONMENTAL EVALUATION

* NO STANDARD METHODOLOGIES
* NOT ALL PROJECTS REQUIRE ENVIRONMENTAL EVALUATION
* CRITERIA FOR SELECTION OF PROJECTS
    1. PROJECTS WITH MAJOR EVIRONMENTAL OR SOCIAL IMPACTS
    2. PROJECT UNCERTAINTY IN ACCURACY OF IMPACT PREDICTIONS OR NO CLEAR PUBLIC POLICY CONTEXT
    3. OBSERVED IMPACTS DEVIATE FROM PREDICTED IMPACTS
    4. PROJECTS WHICH OFFER POSSIBILITY FOR ADVANCEMENT OF PREDICTIVE CAPABILITY IN EIA

* CURRENT APPROACHES
    1. INTERVIEWS OF KEY PROJECT PARTICIPANTS
    2. REVIEW OF PROJECT CORRESPONDENCE
    3. REVIEW OF PROJECT ASSESSMENT AND MONITORING REPORTS
    4. DIRECT MEASUREMENT OF ENVIRONMENTAL PARAMETERS

EVALUATION TOPICS

1. IMPACT PREDICTION
2. MONITORING AND MITIGATION
3. PUBLIC INVOLVEMENT
4. MANAGEMENT PROCEDURES

EVALUATION - IMPACT PREDICTION

* POOR IMPACT PREDICTIONS RESULT IN INADEQUATE DESIGN OF MITIGATION MEASURES AND MONITORING PROGRAMS

* REQUIREMENTS
  - IMPACT PREDICTIONS SHOULD BE STATED AS TESTABLE HYPOTHESES OF CAUSE AND EFFECT

  - VERIFICATION OR REJECTION BY ENVIRONMENTAL EVALUATION AND MONITORING

EVALUATION - MONITORING AND MITIGATION

* NEED TO OPTIMIZE MONITORING AND MITIGATION PROGRAMS TO MAKE THEM MORE EFFECTIVE

* EVALUATION IS A MEANS OF IMPROVING EFFICIENCY AND EFFECTIVENESS

* NEEDS AND OBJECTIVES OF EVALUATION MUST BE EXPLICITLY CONSIDERED IN THE DEVELOPMENT OF THE MONITORING AND MITIGATION PROGRAMS

EVALUATION - PUBLIC INVOLVEMENT

* HAS DRIVEN THE DEVELOPMENT OF INNOVATIONS IN PRACTICE AND PROCEDURES OF IMPACT ASSESSMENT
* EVALUATION OF PUBLIC INVOLVEMENT - IMPROVEMENT IN THE EFFECTIVENESS OF THE PROCESS
* SHOULD INCORPORATE SOCIO-ECONOMIC MONITORING

EVALUATION - MANAGEMENT PROCEDURES

* DEVELOPMENT OF CONTINUITY BETWEEN IMPACT ASSESSMENT AND IMPACT MANAGEMENT

* ESTABLISHMENT OF EXPLICIT FEEDBACK MECHANISMS TO :

  - LINK POST EVALUATION WITH ENVIRONMENTAL ASSESSMENT PROECESS

  - LINK POST EVALUATION WITH PROJECT PLANNING AND EXECUTION

A DECISION PROTOCOL FOR EIA DEVELOPMENT

Confidence Levels	Data Set Ratings	Process Knowledge	Approach Permitted	Approval	Terms and Conditions of Implementation	Follow-up Activities
Objective	Sufficient	Proven cause-effect relationships	Statistical prediction	Unqualified	Normal standards	Surveillance
Subjective	Insufficient	Evidence for hypotheses	Quantitative simulation	Qualified	Special regulations	Monitoring Performance audit
Intuitive	Unreliable	Postulated linkages	Conceptual modelling	Conditional	Stringent controls Projects as experiments	Comprehensive evaluation of research and management findings
Unknown	Non-existent	Speculation	Professional opinion	Deferral	Pilot project Special studies	All above activities

CONCLUSIONS

1. RECOGNITION THAT LACK OF FOLLOW-UP EVALUATION REPRESENTS A MAJOR CONSTRAINT ON THE ADVANCEMENT OF ENVIRONMENTAL ASSESSMENT

2. POST-AUDIT AND EVALUATION PROVIDE SYSTEMATIC FEEDBACK TO IMPROVE PROCESS

3. ENVIROENMENTAL AUDIT INVOLVING VERIFICATION OF COMPLIANCE AND COLLATION OF MONITORING RESULTS DEPENDENT ON APPROPRIATE BASELINE, EFFECTS, AND COMPLIANCE MONITORING

4. ENVIRONMENTAL EVALUATION WHICH INCLUDES ENVIRONMENTAL AUDIT, INCORPORATES CONCEPTS OF INTERPRETATION OF RESULTS AND VALUE JUDGEMENTS

5. NO STANDARD METHODOLOGIES FOR ENVIRONMENTAL EVALUATIONS EXIST. COMMON, WELL-DEFINED METHODOLOGIES ARE REQUIRED

6. EVALUATIONS SHOULD ADDRESS :

* IMPACT PREDICTION
* MONITORING AND MITIGATION
* PUBLIC INVOLVEMENT
* MANAGEMENT PROCEDURES

METHODS FOR SCOPING ENVIRONMENTAL IMPACT ASSESSMENTS

A REVIEW

Prepared for

Regional Training Seminar
on the Application of
Environmental Impact
Analysis in Appraisal
of Development
Project Planning

Bandung, Indonesia

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Advisor, Impact Assessment
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AGENDA

* Provide an overview of environmental scoping
* Develop an approach to scoping
* Discuss three groups of scoping methods
* Discuss the organization and communication of issues

OVERVIEW OF ENVIRONMENTAL SCOPING

* What problems does scoping address ?
* How is scoping defined ?
* What are the benefits of scoping ?

WHAT PROBLEMS DOES SCOPING ADDRESS ?

Problems addressed

1. Unnecessarily comprehensive data
2. Significant or key issues have not been addressed
3. Irrelevant or insignificant issues have not been eliminated
4. EIS organized around scientific disciplines or standardized chapter headings – becomes focussed on information
5. Examination of issues and choice of alternatives completed outside of public view.
6. Serious lack of attention to temporal or spatial boundaries

Causes of Problems .

1. Belief that to be adequate an EIS must be comprehensive
2. Significant or Key issues have not been identified
3. Often easier to describe and analyse every possible issue than to prepare a concise analysis
4. Government guidelines
5. Specialization, agency or scientist, can lead to retention of irrelevant issues
6. Fear of commiting oneself to a defined list of issues
7. Peripheral issues
8. Financial incentives to inflate the breadth of the proposal.

HOW IS SCOPING DEFINED ?

* Scoping is a process for defining what the issues are and how they will be studied
* No consensus on how scoping should be defined
* Working definition of scoping :
  1. Identification of concerns of the public and scientists about a proposed project or action
  2. Evaluation of these concerns to determine the key issues for the purposes of the EIA
  3. Organization and communication (focussing) of these issues to assist in the analysis of issues and decision making

WHAT ARE THE BENEFITS OF SCOPING ?

BENEFITS :

* It helps to ensure that real problems are identified early and studied properly
* Helps shape the planning of the project
* Reduces the size of the EIS
* Ensures research efforts not wasted on insignificant issues
* Reduces the liklihood of overlooking important issues
* Diminishes the chance of protracted conflicts and delays in project reviews
* Helpful in structuring the work of conducting an EIA

Ingredients Important to Success

* Commitment
* Participation
* Communication
* Information
* Flexibility

INCREASING VARIETY
THE BROAD IDENTIFICATION OF CONCERNS

* Identify the broadest possible range of issues and concerns
* Requires methods that encourage creative thinking and insight
* Judgement and evaluation are deferred
* Goal – to be comprehensive

DECREASING VARIETY
THE EVALUATION OF ISSUES

* Highlighting of significant issues for further assessment
* Requires :
    - methods that are evaluative and judgemental
    - Placing values of concerns
    - Exercise of professional judgement by assessor
* Goal - to decrease variety

FOCUSSING
THE ORGANIZATION AND COMMUNICATION OF ISSUES

* Organize issues to provide a coherent, integrated view of the issues
* Allow the development of appropriate scientific studies
* Requires methods that integrate and synthesize
* Goal – to impose order on the issues

SCOPING METHODS

* EIA METHODS
* PUBLIC PARTICIPATION METHODS
* GROUP PROCESS METHODS

EIA METHODS

* Examination of similar projects
* Checklists
* Matrices
* Networks
* Overlays
* Evaluation Techniques
* Environmental modelling
* Adaptive methods

EXAMINATION OF SIMILAR PROJECTS

FEATURES

* Examination of similar projects
* Involves the review of :
  - Environmental Impact Assessments and reports
  - Post Audit Studies

COMMENTS

* Provides a basic list of issues
* Provides a rapid overview
* Each project requires examination on merits
  - Impact predictions may not be transferable
  - Scoping criteria may not be relevant

CHECKLISTS

FEATURES

* Comprehensive list of environmental effects and impact indicators
* Ease of use
* Useful for the identification function of scoping
* Batelle system (Dee et al, 1973) most commonly known
  - weight-scaling & factors to evaluate importance
  - scalars based on value judgements
* Programmed text approach (Bradley, 1980)
  - consists of a set of filter questions
  - depth and scope of assessment designed to suit project

CHECKLISTS

COMMENTS

* Useful for the identification function of scoping
* Limited usefulness in the evaluation of impacts
* Impacts not on list may be ignored
* Use is subjective and qualitative
* Assumes assessors are skilled in all situations
* Does not consider underlying systems

MATRICES

FEATURES

* Two dimensional checklists
* Identification function of scoping
* Relate project actions to environmental components
* Simple format gives overview of potential effects
* May incorporate scoring

COMMENTS

* Evaluation techniques not well developed
* Requires many subjective judgements, including design of matrix
* May be too detailed and cumbersome
* Often fail to identify all important effects

NETWORKS

FEATURES

* Identification function of scoping
* Flowcharts which trace project effects from project actions to end effects
* Based on existing knowledge and past experience
* Relies on knowledge of network designer

COMMENTS

* Provides a picture of the system of cause-effect relationships
* Can trace first, second and higher order impacts
* Social and aesthetic effects not addressed well
* Important effects may be missed

OVERLAYS

FEATURES

* Transparent overlays, environmental and social components
* Highlights overlaps or conflicts between project and environmental factors
* Evaluation tool to define spatial extent of impact

COMMENTS

* Not a comprehensive method for identifying impacts
* Requires considerable data, expensive to produce where data not available

EVALUATION TECHNIQUES

FEATURES

* Primarily useful for the evaluation of issues
* Class of methods developed to improve the quality of value jusdgements
* Uses techniques of rating, ranking and weighting
* Large number of often complex techniques described in literature
* Simple technique described by Naug et Al (1986b)

COMMENTS

* Not designed for the identification of issues
* Some evaluation techniques excessively quantitative
* Quantification of public comments/preferances may not be feasible

ENVIRONMENTAL MODELLING

FEATURES

* Simplified representation of an environmental system
* Conceptual or quantitative
* Useful – identification, evaluation and focussing of issues
* Model develops cause–effect relationships
* Should contain testable hypotheses on predictions

COMMENTS

* Less useful – identification and evaluation of socio-economic issues
* Model simplification of real word system requires the incorporation os testable hypotheses

ADAPTIVE METHODS

FEATURES

* Combination of procedures, concepts and approaches
* Common theme of recognizing uncertainty as the main concept of environmental issues
* Adaptive environmental assessment and management (Holling, 1978)
  - matrices, EIA method used to identify issues
  - simulation model developed as a prediction tool
  - interactive workshops – simulation model design

COMMENTS

* Issues identified – interdisciplinary team
* Simulation model and expert judgement to evaluate issues

PUBLIC PARTICIPATION METHODS

* Public meetings and hearings
* Open houses
* Networking
* Hotlines
* Responsive publications and surveys
* Advisory councils
* Content analysis

PUBLIC MEETINGS AND HEARINGS

FEATURES

* Useful forum for public to raise concerns about project
* Identification of issues
* May not achieve consensus on issues
* Inexpensive and easy to organize
* Can reach a large audience, provides a written record of concerns and issues

COMMENTS

* Useful for the identification of issues
* Not as useful for the evaluation of issues

OPEN HOUSES

FEATURES

* Scheduled opportunity – public discussion of project
* Project information – handouts and displays
* Feedback – recorded comments and questionnaires

COMMENTS

* Effective method of developing two-way communicqtion
* Provides information on issues
* Provides public input to scoping workshops

NETWORKING

* Field workers/community liason staff placed in community-information
* Important where society is consensual and information exhange is informal

HOTLINES

* Advertiosed special phone number – used to take public comments

RESPONSIVE PUBLICATIONS AND SURVEYS

* Uses an open-ended document that provides information about the project and invites comments, suggestions and questions.

* Valuable method of identifying public concerns

ADVISORY COUNCILS

* A forum for identifying and evaluating issues
* Obtains information/input from a wider community
* Appears to have limited use in scoping issues

CONTENT ANALYSIS

* Technique to systematically analyse the content of documents
* Proven and useful for identification of Public concerns
* Assists in the evaluation function of scoping

GROUP PROCESS METHODS

* Interacting group meetings
* Brainstorming methods
* The Delphi method
* Nominal group technique
* Mediation
* Model building workshops

INTERACTING GROUP MEETINGS

FEATURES

* Formal or informal meeting with Chairman
* Effectiveness dependent on :
  - management of meeting
  - quality of the interaction
* Requires
  - careful selection of meeting chairman
  - careful selection of the team
  - training in group interaction skills
* Dominant and most common method for issue evaluation

COMMENTS

* Problems to be addressed
  - bandwagon effect
  - strong position of high profile participants
  - lack of effective concentration on task
  - variability in leadership and group skills.

BRAINSTORMING METHODS

FEATURES

* Issue identification, not effective for evaluation
* Fundamental principle – judgement deferred
* Process–ideas put forward and recorded
* Four rules :
    1. Criticism is ruled out
    2. Free–wheeling is welcomed
    3. Quantity is wanted
    4. Combinations and improvements sought

COMMENTS

* Focus is on the generation of ideas
* Bandwagon effect may occur

DELPHI METHOD

FEATURES

* Systematic solicitation and collation of judgements
* Useful for identification and evaluation
* General sequence of events :
  1. Idea generation
  2. Synthesis
  3. Feedback
  4. Final synthesis

COMMENTS

* Potential method for scoping
* Method well developed in other fields
* Does not resolve conflicts nor develop consensus
* Member selection may bias results

NOMINAL GROUP TECHNIQUES

FEATURES

* Structured group meeting
* Periods of non-interaction and interaction in a controlled sequence
* Process
  1. Silent idea generation
  2. Group round-robin listing of factors
  3. Discussion and clarification of listed factors
  4. Silent individual written voting on priorities
  5. Discussion of voting results
  6. Final, silent individual written voting
* Builds group consensus
* Effective for both the identification and evaluative functions of scoping
* Effective in the scoping of socio-economic issues

NOMINAL GROUP TECHNIQUES

COMMENTS

* Strong method for scoping - identification and evaluation
* not a spontaneous technique nor flexible while in progress
* Cautions:
  - Poor selection of group can bias results
  - High status or aggressive persons may dominate
  - Divergent backgrounds may cause mis-understandings

MEDIATION

FEATURES

* Directly addresses opposing positions
* Focusses on the antagonistic positions of participants
* Mediation narrows and focuses the differences
* Potential value for the identification and evaluation of issues

COMMENTS

* Not a complete method of issue identification
* Negotiation is the basis for the evaluation of issues
* Strong parties may dominate

CATEGORIZATION AND CLUSTERING

* Typical EIS organization – catalogue format
* Problems
  - categories difficult to use in a public forum
  - environmental systems not organized in terms of academic disciplines
  - standard approach fragments both analysis and report
* Alternatives
  1. Issues orientated approach – public perspective
  2. Link categories to visible ends of human action – preservation of life, health, security and justice
  3. Cluster impacts into categories based on both social and scientific criteria

MODEL BUILDING WORKSHOPS

FEATURES

* Uses workshops to design a conceptual or simulation model
* Goal – to achieve a multi-disciplinary integrated view of issues using a model as a focus
* Workshop process described by Holling (1978) and Jones and Greig (1985)
* Associated with Adaptive Environmental Assessment and Management

COMMENTS

* Experts look at issues in a systematic and multi-disciplinary manner
* Strength – conceptual way of evaluating issues
  – integrated view of issues by experts

FOCUSSING

* The organization and communication of issues to provide a coherent, integrated view of the issues
* Information conveyed in an EIS should be reflect the needs of the end-users. -public and decision makers
* Three aspects of focussing :
    1. Categorization and clustering
    2. Defining Issues
    3. Designing a study strategy

DEFINING ISSUES

* Raising questions, not supplying answers, is one predominate purpose of scoping
* Before Key issues can be addressed they must be clearly stated
* Alternative approaches to defining issues
    1. Question format (Sachs and Clark, 1980 ; Wolfe, 1982b)
    2. Worksheets (Haug et al, 1984a; 1984b)
    3. Development of impact hypotheses (Beanlands and Duinker, 1983)

DEFINING A STUDY STRATEGY

* Clear well-defined study strategy important to the quality of the EIA
* Bridges scoping and impact assessment
* Leads to effective use of time and resources
* Study strategy should identify
    1. the questions to be answered
    2. the studies required to provide the answers
    3. the persons who should do the studies

CONCLUSIONS

* Scoping consists of three functions :
    1. Identification of concerns
    2. Evaluation of concerns to focus on key issues
    3. Organization and communication of issues

* No single method can adequately scope environmental reviews for all projects
* Evaluation of concerns inevitably involves value judgements
* Significant attention should be directed to evaluation and the organization and communication of issues.

SCOPING CRITERIA

* Standards by which an assessor can judge whether an environmental issue or impact is important

* Scoping criteria :
  1. Legal and Policy criteria
  2. Functional Criteria
  3. Normative Criteria
  4. Controversy

APPENDIX A

SCOPING CRITERIA

Appendix A

SCOPING CRITERIA

Scoping criteria are standards by which an assessor can judge whether an environmental issue or impact is important. This appendix reviews some of the criteria proposed in the literature.

1. LEGAL AND POLICY CRITERIA

Government policies for resource management are stated in legislation, regulations and policy statements. These policies often include regulatory standards for water quality, effluent discharge, noise disturbance, air pollution emissions, and similar environmental matters. (Haug et al., 1984b) National environmental standards and policies are sometimes stated in regulations. Government policies provide one criterion for evaluating the importance of issues.

2. FUNCTIONAL CRITERIA

Functional criteria are based on the premise that if natural environmental systems are not maintained, the environment upon which people depend for air, water, food, and livelihood will eventually become permanently degraded and less productive. This may result in declines in overall environmental quality and losses of renewable economic resources to the detriment of present and future generations. (Haug et al., 1984b)

Functional criteria thus consider factors which relate to how much environmental systems are changed by project actions. Functional criteria include the magnitude of the effect (how large it is), geographic scope or extent of the effect (how large an area it affects), duration (how long the effect lasts), frequency (how many times it happens), intensity (how severe the effect is on the environmental system), risks (what the chance is of the effect occurring), mitigation (whether there are ways to reduce or avoid the effect) and reversibility (whether the environmental system may eventually recover and how soon). (FEARO, 1978: 6; Ahmad and Sammy, 1985: 11-12; Henshaw, 1984)

Functional criteria are often difficult to establish, since environmental systems behave differently. Some areas or resources may be especially sensitive to the effects of development. These may include biologically unique areas (e.g. sensitive bogs, erodible alpine tundra, scenic deep forests); or functionally important areas (e.g. forest edges, riverside habitat); or economically important areas (e.g. the habitat of hunted deer, merchantable forests). (Henshaw, 1984) Environmental sensitivity may also differ regionally, e.g. air pollution is a major concern in large cities; erosion is a serious issue in the Sudano-Sahel. (Ahmad and Sammy, 1985: 11-12)

There are complications in the application of functional criteria. First, it is difficult to judge how large a change in the environment must be before it should be considered serious. Second, there are major difficulties in measuring how much change is actually occurring in the environment, given natural variations. (Matthews, 1975; Baker et al., 1977: 93-96; Beanlands and Duinker, 1983)

Despite these qualifications, functional criteria are useful when considering the importance of the effect. Whenever judgments must be made about environmental impacts, variables such as suggested by functional criteria must be part of the analysis. Thus other types of criteria depend on functional analyses.

3. NORMATIVE CRITERIA

Normative criteria are based on the values society places on certain environ- mental features or qualities. People often hold clear values about what levels of impact would be acceptable. These values are often highly subjective and individual, and may not necessarily relate to functional considerations such as those discussed above. They are often based on social or economic concerns. (Haug et al., 1984b) Because scoping is partly a socio-political process, consideration of normative criteria will be important in scoping processes. Normative criteria can be expressed as (a) general principles, (b) specific community environmental goals or (c) publicly valued environmental components.

a. General Principles

General principles state what aspects of a project should be considered important based on the society's values. For example, Beanlands and Duinker (1983: 45) and Duffy (1986: 16) indicate that society may be most concerned about those features of a proposal which would:

a) . 'fect human life, health or safety,

b) undermine or eliminate the way people earn a living,

c) cause the lifestyles of people to be modified,

d) affect recreational, aesthetic, educational, scientific or historical features and the preservation and conservation of natural areas,

e) involve conflicting alternatives for the use of land, and

f) affect the balance between the supply and demand of resources and their development within a local, regional or national context.

These criteria can be compared with the effects of a project to determine if these effects are significant.

b. Community Environmental Goals

Community environmental goals are explicit statements about the positive features of the environment that a community wishes to maintain. They become criteria for project planning: proponents can use their ingenuity in designing projects to accomplish them. This approach has been tried with success in land use planning, where rigid standards and zoning codes have been replaced in some jurisdictions by "performance criteria". (Veitch, 1978: 55-60)

Larwin and Stuart (1976) describe an example of the use of community goals in the planning of a highway. A set of 10 goals and objectives was developed through a participation process involving citizens living along alternative highway alignments. The goals and objectives were used in a planning and assessment program for the identification of key environmental issues.

Andrews et al. (1977) argue that efforts should be made to identify national environmental values and goals for environmental decision-making. Scoping decisions could be improved if national environmental policies were stated in a form that would assist in developing scoping criteria for evaluating issues.

c. Publicly Valued Environmental Components

"Publicly Valued Environmental Components" (PVECs) are environmental ends or goals that the public would like to see maintained or enhanced, such as beautiful landscapes, unspoiled recreational resources, rising property values, and healthy work and home environments. They are thus very similar to community environmental goals. A PVEC indicates both a specific component of the environment and the socially-desired attributes of that component. PVECs are identified through a "social scoping" or public involvement process. (Maclaren and Whitney, 1985) PVECs can be both socio-economic and biophysical components of the environment.

PVECs are an extension of the "valued ecosystem components" (VEC) concept developed to assist with biophysical studies. A VEC is a biophysical component of an ecosystem (important species or biophysical process) that is valued by society. VECs are chosen through a social scoping exercise. (Beanlands and Duinker, 1983: 65-67; Truett, 1979) Once identified, VECs become the focus of subsequent environmental investigations. Scientists develop environmental models to help determine how VECs could be affected by a project. Thus the VEC becomes a focusing point, or criterion, for deciding which issues are significant.

4. CONTROVERSY

There is some debate about whether an issue should be considered important because it is controversial. Some advocate that if an issue is controversial or a source of conflict between various individuals, advocacy groups, or organizations, it should be considered important whether or not it is significant for other reasons. (Haug et al., 1984b; Rau and Wooten, 1980) Others argue that controversy may or may not be a reason to judge a concern as significant; rather, controversial concerns must be listened to and weighed by the assessor. (Baker et al., 1977: 93-96; Mygatt, 1984)

Controversy may relate to the type of project or impact being evaluated: some projects (e.g. nuclear, landfills) are inherently controversial. Controversy may develop because people do not want a project built; in such cases, controversy may mean normative criteria are violated by the development.

Controversy can also arise because scientific analysis are in dispute, or the nature and quantity of environmental effect is uncertain. Scientific analyses may be unanimous in concluding, for example, that a certain effect will not occur; the public may not accept these conclusions.

APPENDIX B

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APPENDIX C

SELECTED REFERENCES - SCOPING METHODS

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. Methods

1.1. Examination of Similar Projects

Ahmad and Sammy, 1985
Andrews et al, 1977
Armour, 1979
Baker et al, 1977
Beanlands and Duinker, 1983
Falk and Muller, 1983
Hitchcock, 1977
Johnston, 1981
Leistritz and Murdock, 1981
Richardson, 1983
Rigby, 1985

1.2. Checklists

Bradley, 1980
Dee et al, 1973
Dickert, 1975
Duffy, 1986
Greenberg et al, 1979
Jain et al, 1977;
Lee and Koumjian, 1978
Munn, 1979
Rau and Wooten, 1980
Rees, 1976
Shopley and Fuggle, 1984
Warner and Preston, 1974
Westman, 1985

1.3. Matrices

Dickert, 1975
Duffy, 1986
Holling, 1978
Jain et al, 1977

Lee and Koumjian, 1978
Ministry of Environment, 1985
Rau and Wooten, 1985
Rees, 1976
Shopley and Fuggle, 1984
Westman, 1985

1.4. Networks

Bisset, 1980
Gilliland and Risser, 1977
Lee and Koumjián, 1978
Rau and Wooten, 1980
Rees, 1976
Shopley and Fuggle, 1984
Warner and Preston, 1974
Westman, 1985

1.5. Overlays

Jain et al, 1977
McHarg, 1968
Munn, 1979
Veitch, 1978

1.6. Evaluation Techniques

Bakus et al, 1982
Finsterbusch, 1983
Haug et al, 1984b
Holling, 1978
Hyman et al, 1984
Maclaren, 1985
McAllister, 1980
Shopley and Fuggle, 1984
Westman, 1985

1.7. Environmental Modelling

Beanlands and Duinker, 1983
Bisset, 1980
Fritz et al, 1980
Holling, 1978

Munn, 1979
Rees, 1976
Shopley and Fuggle, 1984
States et al, 1978
Valiela, 1984
Westman, 1985

1.8. Adaptive Methods

Beanlands and Duinker, 1983
Everitt et al, 1986
Holling, 1978
Jones and Greig, 1985
Shopley and Fuggle, 1984
Sonntag, 1983
Westman, 1985

2. Public Participation Methods

2.1. Public meetings and Hearings

Bureau of Land Management, 1984
Council on Environmental Quality, 1981
Duffy, 1986
Grima, 1985
Marshall and Wolfe, 1986
Ross, 1986
Sachs and Clark, 1980

2.2. Open Houses

Connor, 1982
Ross, 1986

2.3. Networking

Preister and Kent, 1981
Waiten, 1981

2.4. Hotlines

Council on Environmental Quality, 1981

2.5. Responsive Publications and Surveys

Connor, 1982
Whitney and Maclaren, 1985

2.6. Advisory Councils

Grima, 1985
Lang, 1981
Sachs and Clark, 1980

2.7. Content Analysis

Beaufort Sea Panel, 1984
Connor, 1982
Grima, 1985
Marshall and Wolfe, 1986
North et al, 1963
Wolf, 1983

3. Group Process Methods

3.1. Interacting Group Meetings

Delbecq et al, 1975
Duffy, 1986
Greene, 1986
Van de Ven, 1974

3.2. Brainstorming Methods

Osborn, 1953
Roper, 1986

3.3. The Delphi Method

Bakus et al, 1982
Delbecq et al, 1975
McDougall, 1982
O'Riordan and Weibe, 1984
Reith, 1982
Van de Ven, 1974

3.4. Nominal Group Technique

Bakus et al, 1982
Delbecq et al, 1975
Greene, 1986
Roper, 1986
Sachs and Clark, 1980
Van de Ven, 1974

3.5. Mediation

Dorcey, 1985
Emond, 1985
Greene, 1986
Grima, 1985
Marshall et al, 1986
Pease and Smardon, 1984
Thompson, 1986

3.6. Model Building Workshop

Holling, 1978
Jones and Greig, 1985

ENVIRONMENTAL IMPACT ASSESSMENT IN NORTH AMERICA AND WESTERN EUROPE:

WHAT HAS WORKED WHERE, HOW AND WHY?

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ENVIRONMENTAL IMPACT ASSESSMENT IN NORTH AMERICA AND WESTERN EUROPE

WHAT HAS WORKED WHERE, HOW AND WHY?

1. INTRODUCTION

A joke which circulated among U.S. federal agencies in Washington, D.C. in the early nineteen-seventies had it that, when Moses asked God to part the Red Sea for the Children of Israel, he got both good news and bad news in reply. The good news was that the Almighty would agree to part the waters. The bad news was that first Moses would have to prepare an environmental impact assessment!

The message of this story was that an environmental impact assessment (an "EIA") is "bad news," a bothersome bit of paper work that must be done before going ahead with a major (and beneficial) undertaking. This view has persisted despite the changes that have been made in the way EIA is implemented in its country of origin, the United States, as well as the very different approaches that have been taken to it in other countries.

The purpose of this paper is to look at those developments in an attempt to discover if, almost two decades after it was first embodied in U.S. legislation, environmental impact assessment is still "bad news".

2. THE DIFFERENCE BETWEEN AN EIA AND AN EIS

Environmental Impact Assessment (EIA) can and has been defined in numerous ways depending on the national context in which it is applied. No two countries have defined it in exactly the same way. The term EIA, however, is recognised as the generic shorthand term to describe the process of examining an activity for its environmental effects prior to making a decision in its implementation. Viewing EIA in this way (i.e. as a process) means that is should not be used interchangeably, although it often is, with the term EIS, which stands for environmental impact statement. An EIS is a document or report which contains an analysis of the information gathered through carrying out an EIA. As such, an EIS is a single, albeit often the most visible, element in the more far-reaching EIA process which begins with the early identification of the environmental impacts associated with an activity and continues past the preparation of an EIS, or other documentation, to include monitoring and other follow-up activities.

This broadly worded definition implies that despite national differences, one can view EIA everywhere in two complementary ways -- as a planning tool and as a procedure for decision-making. Put in another way, it can be said that EIA has a "hard" and a "soft" side; that it is both "science" and "art".

EIA as a "science" or a planning tool has to do with the methodologies and techniques for identifying, predicting and evaluating the environmental impacts associated with particular development actions.

EIA as "art" or procedure for decision-making has to do with those mechanisms for ensuring an environmental analysis of such actions and influencing the decision-making process. Both characteristics reflect an understanding of EIA as an "anticipate and prevent" strategy for environmental protection, and as such, see EIA as going beyond the first generation of environmental policy instruments which were aimed at "reacting to and curing" environmental problems (e.g. the setting of emmission and ambient quality standards).

There is nothing inherent in the concept of environmental impact assessment which would necessarily determine the object (i.e. the type of decision) to which it is brought to bear. That is to say, EIA can, in principle, be applied to both individual projects -- a highway, a power plant, an irrigation scheme -- as well as the overall economic sectors under which such projects are implemented, i.e. transportation, energy and agricultural policies. In practice, however, EIA has been most often applied at the project level and, whereas many would argue that EIA in its broadest sense can promote the integration of economic development and environmental policies, other instruments such as administrative reorganisation and economic incentives appear to have greater advantages than EIA as strategies for bringing about better economic-environmental integration at the policy level. At any rate, in this paper, the concept of EIA will be discussed in terms of its applicability to the project level of decision-making.

It was this project level of decision-making which was the focus of a special United Nations task force which recently completed a cross national comparative analysis of experience with EIA in the United States, Canada, the Federal Republic of Germany, the Netherlands, Norway and Finland. The overall recommendation of that task force stated that:

> "EIA should be viewed as an integral part of the project planning process beginning with an early identification of

project alternatives and the potentially significant environmental impacts associated with them and continuing through the planning cycle to include an external review of the assessment document and involvement of the public." (UNECE, 1987)

The key word in this recommendation is integral. EIA needs to be integrated from the very beginning of the project planning cycle. Although this is the way EIA should be seen, it has unfortunately rarely been applied in this way. In the past, the prime concern of EIA practitioners has been with the document itself rather than the purposes to which it might be put. In addition, the "concern for the document" has been more often based on its compliance with the rules, regulations and other procedureal requirements than with its scientific or methodological integrity.

Greater attention has recently been paid to the role of EIA in overall project management. There is still, however, a tendency in most countries to see the making of a decision on a particular course of action as the end of the process.

All of this is to point out that looking at EIA (in North America and Western Europe) provides more lessons about the need for viewing EIA as an integrative management tool than good examples as to how it can actually be used in that way.

3. APPROACHES TO EIA: FORMAL-EXPLICIT AND INFORMAL-IMPLICIT

Since the passage of the U.S. National Environmental Policy Act of (NEPA) which incorporated a requirement for assessing the environmental impact of "major federal actions significantly affecting the quality of the human environment", the idea of environmental impact assessment has spread throughout the world. Though no country has exactly duplicated NEPA or American procedures for EIA, many have followed that general approach by enacting new specific legislation with formal requirements regarding the how, when and where of carrying out an EIA. Other countries, particularly those with well established land-use planning procedures, have responded to the need for EIA in a more flexible manner by adapting existing legislation and planning procedures to give greater attention to the assessment of environmental impacts.

These two basic ways of viewing EIA can be termed formal-explicit and informal-explicit approaches.

The U.S. NEPA process, the Dutch legislation on Milieu-effect-rapportage and, to a large extent, the Canadian Federal Environmental Assessment Review Process are examples of the formal-explicit approach.

The formal-explicit approach is one in which:

-- environmental impact assessment requirements are specifically codified in legislation (general or sectoral) or legally binding regulations (e.g. as part of permitting and licensing procedures;

-- environmental impact statements or reports are prepared in which the environmental effects of development projects are assessed; and

-- authorities are accountable for taking EIA into consideration in decision-making (e.g. through administrative or judicial review).

The United Kingdom, the Federal Republic of Germany and most of the Scandanavian countries have adopted the informal-implicit approach.

The informal-implicit approach is one in which:

-- EIA is modified or adapted to the needs of individual situations and proposals (e.g. an *ad hoc* application based on the nature of the proposed action: major scope, controversial, etc.) and/or forms a part of other planning laws (e.g. a *de facto* part of land use planning);

-- an environmental impact statement as such is not prepared; and

-- authorities are not accountable for taking EIA into consideration in decision-making.

As stated above, it is generally recognised that, for EIA to be successful, it must be integrated into the project planning process. One could say, therefore, that if EIA is integrated; it works; if it isn't integrated it isn't working. On the surface, there is no reason to assume that either the formal-explicit or the informal-implicit approach would have any advantage over the other in achieving that integration. Experience has shown, however, that, generally speaking, EIA is only integrated in decision-making (i.e. it only works) when it is applied in a formal-explicit way.

The following sections look at the experience in applying EIA through both approaches in a number of contexts and draw some conclusions concerning its effectiveness. These are followed by a description of those elements which are necessary to ensure that it is integrated in decision making.

4. THE EFFECTIVENESS OF EIA

The central question in examining experience with EIA centers around effectiveness and whether or not environmental impact statements, reports or other documentation associated with an EIA have been useful in supporting and influencing decision-making.

There are two general approaches to determining EIA effectiveness. The first and ultimate test is to analyse the way in which actual projects submitted to EIA are implemented. Do they reflect the assessment's findings, e.g. were the predictions accurate; were mitigation measures carried out, etc.?

The second approach involves reviewing documentation which has been prepared (e.g. EIS's) to determine the way they were prepared and reviewed as well as their content (e.g. the number and types of alternatives addressed, mitigation measures, etc.).

The first approach, or "post-audit" monitoring, has been given very little attention by national or provincial level governments which have adopted EIA and represents one of the most pressing research needs in the field of environmental impact assessment. The second approach of studying EISs themselves has been undertaken both in and outside government in a number of countries and various studies have looked specifically at EIA effectiveness in terms of predicting impacts, the time and costs involved in implementing EIAs and their observable benefits.

4.1 Predicting Impacts

The monitoring of environmentally assessed projects either during construction or upon project completion, has not been required by any government. The monitoring that has taken place, therefore, has been on an ad hoc basis due to the particular nature of an individual project (e.g. its controversial nature) or, in a more general way, through the studies of academics investigating the effectiveness of a particular EIA system. An example of the latter was recently carried out in the United States which compared the predictions made in EISs with the actual outcomes of the projects (Culhane, Friesma and Beecher, 1987). The investigative team examined a biological, physiographic, social and economic prediction in each of 29 EISs. Extensive field investigations and data gathering at each of the 29 sites were conducted to evaluate the concurrence against the predictions. The result, according to the chief investigator, pointed out that, "Perhaps the kindest thing that can be said about most predictions in EISs is that they are not clearly wrong. But the reason they are not clearly wrong is that the predictions themselves tend to be so vague and general that it would be very difficult for them to be clearly wrong!" (Friesma, 1987)

This finding -- that the scientific quality of most EISs which have been prepared is poor -- is substantiated by earlier studies carried out on EIAs in Canada and the United Kingdom which found that predictions, when they are made at all, tend to be vague generalisations about the likelihood of certain conditions prevailing during and after construction, as opposed to quantified forecasts which could be subject to verification (Beanlands and

Duinker, 1983; Bisset, 1984).

Such findings of post audit EIA studies related to predicting environmental impacts are all the more surprising when one realises that a great deal of the literature on EIA has to do with methodologies and techniques for identifying, predicting and assessing the environmental impacts of development actions. Hundreds of techniques have been developed to help determine in advance of taking an action (for example, the building of a highway or a dam) what the effects of that action could have on such environmental components as air quality, water quality, noise, ecosystem stability, etc. No national EIA system, however, requires the utilisation of a particular method or technique for making such predictions and there is no universally accepted list of "approved methodologies". There is also no generalised recognition on the part of practitioners as to which, if any, predictive techniques are better than others.

It was for this reason that the aforementioned UNECE Task Force on the "Application of EIA" was particularly interested in acquiring information on the methods used to predict environmental impacts.

In carrying out its analysis of 11 case studies of EIAs on highway and dam projects in six countries, the task force looked specifically at the number and type of methodologies which were used for prediction. Its findings showed that in all cases, the fundamental basis for predicting environmental impacts was "best professional judgement" and/or "experience with previous (similar) projects". This was the finding for projects carried out under a formal-explicit as well as through an informal-implicit approach to EIA. It was for this reason that the task force recommended that in those cases where best professional judgement and previous experience were the main methods for prediction, their underlying assumptions and judgements be made clear.

4.2 Time and Costs

Critics of environmental impact assessment often claim that any benefit which might be associated with the EIA process is outweighed by the delays to project planning and the increased costs which it brings with it. As there are examples of projects which have been delayed because of an EIA and which have cost millions of dollars to carry out, the criticism is not totally groundless. On the other hand, the planning of many projects has been accelerated by an EIA and resulted in cost-savings.

For a variety of reasons, no specific figures can be given on the average cost of an EIA or the time needed to carry it out. For example:

-- The time needed is linked to the particular planning procedure for the type of projects being assessed. These procedures vary from country to country;

-- The time needed also depends on the availability of information. When, for example, the necessary environmental baseline data is on hand, an EIA can be carried out more quickly than when field surveys need to be conducted and data gathered to identify, predict and assess impacts;

-- When an EIA is integrated with other planning activities (for example, engineering, feasibility or cost- benefit analyses) the time needed is less than when it is conducted separately and after other studies have been completed.

The case study information gathered by the UNECE Task Force showed that the average amount of time needed from the initial environmental assessment to the completion of the EIS ranged from one to one and a half years. Even this amount of time, however, can be insignificant if it results in the construction of a project that is found acceptable by both decision-makers and those affected by it.

This fact is borne out by research that was carried out comparing the environmental assessment of three pairs of similar highway projects in the United States and the Federal Republic of Germany (Kennedy, 1986). The three types of projects were (1) an urban by-pass, (2) a road through a predominantly agricultural area and, (3) a road affecting a unique environmental resource. In 1978-1979 each pair of cases in the comparison was analysed by examining the EIS or other planning documents and through interviews with planning officials to determine the differences in the formal-explicit approach to EIA followed in the United States versus the informal-implicit one practiced in the Federal Republic of Germany. Follow-up interviews and additional research were carried out in 1985.

Specific measurements of the time required to carry out the various stages of an environmental impact statement in the U.S.A. or the corresponding environmental analysis in the FRG was not a specific focus of this research. Nonetheless, the findings showed that although the planning for the three highway pairs examined began at approximately the same time (early 1970s), by 1985 planning for the three American projects had been completed and construction nearly finished, whereas only one of the German projects had reached the construction phase. Of the remaining two, one will not be built as a four-lane autobahn and the future of the other is unknown. Such findings would seem to indicate that a formal-explicit approach to EIA can accelerate the project planning cycle.

As with time, no general statements can be made on the absolute or relative (i.e. percentage of total investment) costs of EIA. Information on the actual costs of EIA documents are difficult, if not impossible, to obtain. This is particulary true in countries which have taken the informal-implicit approach to EIA. Where no EIS, as such, is prepared, the "cost of an EIA" becomes that percentage of overall costs of a project planning document or process which are devoted to assessing environmental impacts. That percentage is usually impossible to determine.

However, even where formalised EISs are prepared such as in the U.S.A, Canada and in the Netherlands, it is difficult to arrive at an exact "dollar and cent" figure. The cost for the preparation of EISs in Canada, for example, rests with the proponent and neither the Federal Environmental Assessment Review Office (FEARO) nor provincial environmental ministries monitor the costs of EIS preparation nor do they require such information to be filed.

A number of independent studies of EIA costs have, nonetheless, been carried out and most tend to show that they are relatively small in comparison to overall project planning costs, usually averaging between 0.1 to 1.5 per cent of the total. Other studies have indicated that an EIA can bring about savings in originally planned investments. One of the most systematic of these was undertaken by the U.S. Environmental Protection Agency on EISs it prepared on wastewater treatment facilities (U.S. EPA, 1980). In analysing the cost effects of 52 EISs, the average EIS caused a cost increase of six million dollars from project delay and EIS preparation, but also resulted in cost reduction of over six million dollars. The latter was caused by changes in project plans required by the EIS, such as capacity reduction or limitation of service area. The net effect of the average EIS was, therefore, a reduction in total project cost.

4.3 Observable Benefits

Despite the often poor quality of predictions contained in them and the cost and time overruns they can cause, it is generally held that EIAs result in observable environmental benefits. The U.S. EPA study mentioned above, for example, pointed out that, over 70% of the EISs on wastewater treatment facilities resulted in more protection of surface water quality than would have been afforded by the originally proposed projects.

There are numerous, individual examples of "EIA success stories" throughout the world and particularly in those countries where EIA is carried out in a formal-explicit way.

The case studies analysed by the UNECE Task Force, for example, showed how:

-- the plans for a flood control dam in West Virginia, U.S.A, were modified to result in the construction of a "dry" dam (no permanent pool of water behind it) which reduced adverse impacts on water quality, air quality, archeological historic sites and wetlands:

-- an interstate highway in New Hampshire, U.S.A., was tapered to a two-lane individual parkway in the most sensitive environmental areas of a national park and designed in such a way as to minimise changes to streams and existing drainage patterns, provide noise abatement and control soil erosion during construction:

-- the design for a highway through Banff National Park (Canada) was changed to provide for special mitigation measures for dealing with impacts on mountain sheep, fish and other wildlife.

If, however, (as appears to be the case) the scientific (i.e. predictive) quality of environmental impact assessment is not particularly high, how can one account for the environmental benefits in the form of improved decisions which occur? The answer is that, as pointed out in the introduction of this paper, the "scientific" or "hard" analysis of environmental impacts is only one part of the EIA process. The other side, the "soft" side, concerns mechanisms for influencing the decision-making process. It deals with such aspects as screening, scoping, external review and public participation. These are the aspects which have been the key elements in integrating EIA in the project planning process and making it work.

5. MEASURES FOR INTEGRATING EIA IN THE PROJECT PLANNING PROCESS

5.1 Screening

Much of the early dissatisfaction with EIA concerned the fact that it was applied indiscriminately to all kinds of projects, many of which, because of their very size or nature, had little or no adverse effect on the environment. In response to this criticism, most countries - and particularly those which have taken the formal-explicit approach -- instituted a process for screening those types of projects which are most in need of EIA.

Some countries, such as France, Japan and the Netherlands, have done this through establishing a positive (or negative) list of specific project types which must always (or need never) be submitted to EIA. Other countries, such as Canada, Australia and the United States, have established screening criteria or guidelines which are applied to projects on a case-by-case basis to determine which ones should undergo an EIA. The number and type of criteria vary from country to country but they usually seek to determine the significance of such issues as alteration of the natural, physical or social environment, pollution, cumulative effects, endangered species, sensitive ecosystems, level of controversy, etc.

In both cases -- list and criteria -- the attempt has been made to cover major developments which because of their size, nature and location could significantly affect the quality of the environment. The resultant project types (i.e., those included in lists or which have emerged over time as a result of being "screened") include:

-- Large industrial projects;

-- Large infrastructure projects (highways, airports, pipelines, transmission lines);

-- Exploitation of hydraulic resources (power generation, irrigation);

-- Other power plants (including nuclear);

-- Extraction of fuels and hard minerals;

-- Production, use and storage of chemicals and hazardous wastes;

-- Waste-water treatment;

-- Urban expansion;

-- Forestry management;

-- Tourism and recreation.

5.2 Scoping

Scoping is a somewhat technical sounding word for a relatively simple process for structuring an EIA so that it can be carried out quickly and in a cost-effective manner. It was "invented" in the United States and grew out of the failure of the government in the early years of NEPA to issue effective guidelines to federal agencies on how to prepare environmental impact statements. Two factors were responsible for this failure.

First, in the early 1970s the concept of giving consideration to the environmental aspects of a project or programme was new, and its impact on federal agencies' decision-making processes was unforseen.

Some agencies, instead of using EISs to improve decision-making, wrote lengthy, encyclopedic documents or ones that were excessively narrow numbering five to ten pages. Consequently, in many cases, opponents of a project, or other outside groups and agencies that were neglected when an agency prepared an EIS, could successfully challenge the adequacy of the EIS in court. These challenges often added costs or stalled projects for a long time.

Second, U.S. Federal agencies did not regard the initial guidelines as binding. As each agency implemented NEPA according to its own interpretation of the act, a set of inconsistent practices developed. This impeded efforts to coordinate NEPA implementation and resulted in confusion for those outside the government to understand and participate in the EIA process.

In response to these and other problems, the U.S. Council on Environmental Quality issued new NEPA regulations in 1978 which mandated that "there shall be an early and open process for determing the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process should be termed scoping...." (CEQ, 1987)

Scoping usually takes place during a one-day "scoping meeting". Although they can sometimes involve large numbers of people and resemble full-fledged public hearings, more often they are small, informal gatherings of five to ten people representing the various actors involved in the decision (e.g. a proponent, lead agency, environmental agency, state and local agencies, environmental (citizen groups, etc.). They come together to decide on the scope of the EIA. In other words, they decide upon the number and type of alternatives together with the number and type of impacts to be assessed.

Since it has been in effect, scoping has generally been called a success in terms of accelerating and opening up the EIA process and making its findings more acceptable to all concerned. There are, however, two lessons which have emerged from experience with scoping which could give cause for concern. They have to do with <u>elimination</u> and <u>significance</u>.

Although the main purpose of scoping is to identify the significant issues and eliminate the insignificant ones, experience has shown that environmentalists rarely agree to eliminate issues. As a result, more issues often result from scoping than those which were originally considered by project proponents. Secondly, experience has shown that the criteria being used to determine the significance of an impact or an alternative are extremely subjective. "Public concern", for example, is a frequently cited factor in determining significance.

Despite these drawbacks, international experience has shown that where scoping does not take place, delays often occur along with extra costs because of time spent in assessing impacts that were not identified "early on" and eventually proved "significant".

5.3 External Review

The application of an outside or independent review of the environmental impact statement after it has been "scoped" and prepared is a crucial element in a sucessful EIA process. The review itself can take a variety of forms. In the United States, for example, it takes place through a formalised inter-agency review process in which the U.S. Environmental Protection Agency plays a leading role. In Canada, it is conducted by panels of independent experts. In the Netherlands, EIA review is the responsibility of a special Commission on EIA. In most Scandinavian countries it is carried out by steering groups consisting of representatives of the various agencies involved in the planning of a particular project.

Statistics tabulated by U.S. Environmental Protection Agency over a

12-year period provide one of the best indices of the effectiveness of independent review.

In 1975 the EPA set up a rating system for the review of draft and final EISs. The review of a draft EISs addresses both the environmental impact of the action and the adequacy of the information presented in the draft EIS. In addition to written comments, the EPA designates each EIS with two notations:

-- Categories LO (Lack of Objections), ER (Environmental Reservations) or EU (Environmentally Unsatisfactory) which signify an evaluation of the environmental impact of the proposed action; and categories 1 (Adequate), 2 (Insufficient information) or 3 (Inadequate) which signify an evaluation of the adequacy of the draft EIS. (Thus, a comment may be designated LO-1, LO-2, ER-1, ER-2, etc.)

Some draft EISs are categorised simply as "3" ("inadequate") without any LO, ER or EU designation. An EIS which fails to provide information to permit an evaluation of the impacts is categorised in this way.

Comments given by the EPA to final EISs are accompanied by a singled number notation or ranking from 1 to 5 a follows:

No Comment	1
Comments Sent to Agency/No Objections Expressed	2
Environmental Reservations Comments Referred to Agency	3
Environmentally Unsatisfactory	4

Comments Referred to CEQ	
Unresponsive Final Impact Statement	5

In 1984, the EPA revised its policy and procedures for reviewing EISs and in so doing created somewhat different review categories. Basically the change involved eliminating the category of ER for Environmental Reservations and refining it into two new and more specific categories -- EC for Environmental Concerns and EO for Environmental Objections. At the same time, it eliminated the 1 to 5 notation for final EISs, and now ranks final EISs with the same notation as drafts. The basic ratings scheme, however, has remained.

Table I provides an overview of the ratings on all draft and final EISs reviewed by the EPA from January 1, 1975 through December 31, 1984 uunder the "old rating system". Table II provides the same information for the period 1984 through the end of 1986 under the "new rating system". (In 1984, the transition year, some EISs were reviewed under the old system and some under the new. Statistics for that year are correspondingly included in both tables.)

TABLE I

Table I: EPA Ratings of Draft and Final Environmental Impact Statements
1975-1984

(old rating system)

	Draft EISs										Final EISs					
	LO1	LO2	ER1	ER2	ER3	EU1	EU2	EU3	3	total	1	2	3	4	5	total
1975	233	319	15	294	4	1	18	2	51	937	465	260	24	2	6	757
%	24.9	34.0	1.6	31.3	0.4	0.1	1.9	0.2	5.4	100	61.4	34.3	3.1	0.2	0.7	100
1976	203	316	13	235	5	2	14	2	50	840	502	248	47	2	24	823
%	24.1	37.6	1.5	27.9	0.6	0.2	1.6	0.2	5.9	100	60.9	30.1	5.7	0.2	2.9	100
1977	201	228	12	171	4	1	11	3	33	664	387	261	40	3	16	707
%	30.2	34.3	1.8	25.7	0.6	0.1	1.6	0.4	4.9	100	54.7	36.9	5.6	0.4	2.2	100
1978	189	210	14	145	5	1	15	4	31	614	306	179	34	3	12	534
%	30.7	34.2	2.2	23.6	0.8	0.1	2.4	0.6	5.0	100	57.3	33.5	6.5	0.5	2.2	100
1979	156	195	6	214	11	3	13	2	13	613	198	258	36	1	12	505
%	25.4	31.8	0.9	34.9	1.7	0.4	2.1	0.3	2.1	100	39.2	51.0	7.1	0.1	2.3	100
1980	135	154	9	141	5	4	4	1	29	482	120	252	42	2	17	433
%	28.0	31.9	1.8	29.2	1.0	0.8	0.8	0.2	6.0	100	27.7	58.1	9.6	0.4	3.9	100
1981	151	143	22	102	1	0	5	0	7	431	86	334	49	1	18	488
%	35.0	33.1	5.1	23.6	0.2	0	1.1	0	1.6	100	17.6	68.4	10	0.2	3.6	100
1982	142	127	6	69	1	1	1	0	3	353	106	256	15	0	6	383
%	40.2	35.9	1.6	19.5	0.2	0.2	0.2	0	0.8	100	27.6	66.8	3.9	0	1.5	100
1983	95	122	3	64	3	0	3	1	5	296	42	230	27	1	7	307
%	32.0	41.0	1.0	21.0	1.0	0	1.0	0.3	1.6	100	13.6	74.9	8.8	0.3	2.3	100
1984	56	54	6	68	2	2	5	0	2	195	21	116	28	0	1	166
%	28.7	27.6	3.1	34.8	1.0	1.0	2.6	0	1.0	100	12.6	70.0	16.9	0	0.5	100
TOTAL	1564	1868	106	1503	41	15	89	15	224	5425	2233	2394	342	15	119	5103
%	28.8	34.4	1.9	27.7	0.7	0.3	1.6	0.3	4.1	100	43.7	46.9	6.7	2.9	2.3	100

Source: US Environmental Protection Agency, Office of Federal Activities, Washington, D.C.

TABLE II

Table II: EPA Ratings of Draft and Final Environmental Impact Statements 1984-1986

(new rating system)

	Draft EISs											Final EISs										
	LO	EC1	EC2	EO1	EO2	EO3	EU1	EU2	EU3	3	total	LO	EC1	EC2	EO1	EO2	EO3	EU1	EU2	EU3	3	total
1984	27	3	27	0	7	0	0	0	0	0	64	50	2	7	0	3	0	1	1	0	0	64
%	42.0	0.5	42.0	0	11.0	0	0	0	0	0	100	78.2	3.1	11.0	0	4.7	0	1.5	1.5	0	0	100
1985	97	7	146	1	29	3	0	1	3	4	291	179	20	46	3	13	1	0	0	3	0	265
%	33.3	2.4	50.2	0.4	10.0	0.1	0	0.4	0.1	1.4	100	67.5	7.5	17.4	1.1	4.9	0.5	0	0	1.1	0	100
1986	61	13	97	2	41	3	0	4	2	5	228	152	21	53	1	8	0	0	0	1	3	236
%	26.8	5.7	42.5	0.9	18.0	1.3	0	1.7	0.9	2.2	100	64.4	8.9	22.5	2.1	3.4	0	0	0	2.1	1.3	100
TOTAL	185	23	270	3	77	6	0	5	5	9	583	381	43	106	4	24	1	1	1	4	3	568
%	31.7	3.9	46.3	0.5	13.2	1.0	0	0.8	0.8	1.5	100	67.0	7.6	18.7	0.7	4.2	0.2	0.2	0.2	0.7	0.5	100

Source: US Environmental Protection Agency, Office of Federal Activities, Washington, D.C.

Although the statistics on the EPA ratings of EISs seem to point to a positive response regarding agencies' procedural compliance with NEPA, there are several reasons why no firm conclusions can be drawn on the basis of this data.

(1) The EPA's review of EISs takes place on several levels. The first or "principal" review is done by one of EPA's ten regional offices. (For example, an EIS prepared by the Federal Highway Administration on a proposed highway in Wyoming is initially reviewed by the EPA's EIS review staff in the Region VIII office in Denver, Colorado. A similar EIS on a highway in Florida would be reviewed by EPA's Region IV in Atlanta, Georgia.) The official EPA response to another federal agency's EIS comes from headquarters in Washington which for the most part, however, concurs with the regional appraisal.

Although EPA has established agency-wide guidelines for the review of EISs, the actual comments and rating an individual EIS receives can vary from region to region. Some regions, for example, are noted for being more stringent in their reviews than others. A breakdown of EPA reviews by region, therefore, would probably show a greater range of percentages of ratings.

(2) The tables provide figures on the total number of EISs in EPA categories over the twelve-year period. What it does not show (nor is it monitored by EPA) is the number of draft EISs in a particular category for a particular year which "improve" in terms of the rating they receive at the final EIS stage. For example, it is not known how many of the 102 draft EISs rated ER-2 in 1981 were rated 1, 2, 3, 4 or 5 at the final EIS phase.

Indeed, no correlations between draft and final EISs can be drawn from the Table. It is not known (for all actions submitted to EIA) how many drafts even reached the final stage. Agencies have been known to "drop" or "shelve" projects based on the findings of the draft.

Despite these constraints and the fact that the number of EISs in each category fluctuated over the twelve-year period, one can, nonetheless, detect certain trends in the way U.S. federal agencies have complied with EIA requirements since 1975. For example, the percentage of EISs in the category LO (the best category) rose from 58.9% of all drafts submitted in 1975 to 76.1% of all drafts submitted in 1982 only to fall to 26.8% in 1986. At the other end of the scale, the EISs in the categories EU-2, EU-3 and 3, while representing 7.5% to 8% of drafts filed between 1975 and 1978, dropped to 1% by 1982 only to rise to 4.8% in 1986.

What could account for such fluctuations? One might assume that agencies would have learned over time how to adequately prepare an EIS and that, in response, EPA ratings would have correspondingly improved. The fact that this is not the case may be due to the changed political climate in the early 1980s which represented, in some ways, a backlash to the environmental fervor of the seventies. As a result, many agencies became less stringent in their interpretation of NEPA and "poorer" EISs were produced.

Assuming that this was the case, the EPA was not the only "EIA watchdog" which noticed the change. Environmental groups and public interest law firms over the same period reacted with the ultimate form of EIA review in the United States -- litigation.

During the first 13 years after NEPA's enactment (January 1, 1970 through December 31, 1982) 70 federal agencies prepared approximately 16,000

EISs. During that 13 year-period 1,602 NEPA law suits were filed. This represents approximately 10% of all federal proposals for which an EIS was prepared. The number of cases peaked in 1974 (189 cases) and dropped steadily thereafter until 1982. In that year the filing of law suits based on NEPA grounds increased by almost 50% from the previous year! Although the number of filings per year has decreased since then, it has still not returned to the low levels which had been reached in the late 1970s.

Unlike the U.S. NEPA process, EIA decisions in other countries are not subject to judicial review. There is also no agency at the Federal or provincial level in such countries as Canada or the Netherlands which have adopted a formal-explicit approach, which plays a role in the review of EISs such as that performed by the Environmental Protection Agency in the United States. One cannot, therefore, turn to "EIS ratings" or litigation statistics for an indication of how agencies in other countries have responded to EIA requirements.

Both the Netherlands and Canada have established independent review mechanisms and, although their experience with them has not been as great as in the United States, the evidence that is available indicates that the review process in those countries plays an important role in the EIA process. In both countries, independent panels of experts are formed for each, individual project submitted to an EIA. These panels not only issue guidelines for the preparation of the EIS, they also review it once it has been prepared by the proponent. The main advantage of such a system over the U.S. approach is that both the preparation of the EIS and the review of it are "tailor made" to the specific project at hand. Consequently, the review which takes place is likely to be more thorough.

The disadvantage of these systems (and particularly the Canadian) lies in the steps preceeding the actual prepartion of an EIS. The legal requirements on Federal agencies in the U.S. to document their EIA decision-making process makes it more "transparent" (i.e. one can determine which projects have been submitted to EIA and which have not). The Canadian Environmental Assessment Review Process (EARP) is a "self-assessment" process. The decision, for example, as to what constitutes "significance" under the Canadian Federal EIA process rests with the agency initiating the project or program. This means that the decision to submit or not submit a particular project to an EIA takes place behind closed doors and is not easily monitored. It is not known how many federal projects have been "screened out" and for what reasons. It would seem safe to say, however, that there have proably been more than thirty federal projects in Canada over the past fifteen years with "significant" impacts although EIAs have been prepared only on that number. (The Canadian Federal Environmental Assessment Review Process was initiated by a Cabinet decision in 1973.)

5.4 Public Participation

As with outside review of EIA, the involvement of the public in the process is a key element in its successful implementation. Public participation can take place through informal public meetings, formalized public hearings, the possibility of submitting written comments on the EIS and combinations of the three. As with outside review, public participation often results in suggestions for new alternatives to be considered or the identification of key impacts to be studied.

The UNECE task force on the "Application of EIA" discovered that where the public is involved early and in a meaningful way in decision-making, the EIA process is accelerated and final project decisions enjoy broad public support.

The consequences of not involving the public, and particularly environmental groups, in the early stages of project decision-making, were revealed in the aforementioned comparative study on EIA and highway planning in the U.S.A. and the Federal Republic of Germany.

Formal citizen participation in the Federal Republic of Germany is limited to the final stage of highway planning: the Plan Approval Phase. At earlier stages, where the need for the project itself and the consideration of alternative routes are discussed, individual citizens or citizen groups are not involved.

In the U.S.A. citizens are involved much earlier in the planning process, beginning with scoping. The first public hearing often takes place even before the preparation of a draft EIS and always after its completion. A second hearing is conducted when the final EIS is completed. Public participation, however, is not limited to hearings. The formation of citizen advisory groups, the distribution of questionnaires and polls, and other participation strategies often accompany the formal public hearing process. In addition, under the U.S. Freedom of Information Act, American citizens have the right of access to all planning documents. In the Federal Republic of Germany, certain documents are presented and distributed. Highway agencies, however, are not required to make other documents available including specially commissioned environmental studies.

Lastly, in the U.S.A, citizen action groups have the advantage of being able to sue federal agencies if it appears that the EIS was inadequately prepared. In France, similar actions can be brought by a limited number of environmental groups which have been officially recognized by public authorities. In Germany, however, such class action suits are not common and, generally speaking, only individuals whose health or property rights are threatened can take legal action.

6. FUTURE TRENDS

A number of actions, both on the national and international level, are currently underway to broaden and strengthen existing EIA processes. One of the most important or these is the Directive of the Council of the European Communities (EEC) on "the assessment of the effects of certain public and private projects on the environment." (Official Journal of the European Communities, 1985)

The Directive applies to projects in the ten Member States which are to have significant effects on the environment. Such projects are identified in two lists, which appear as Annex I and Annex II to the Directive. The distinction which is made between Annex I and Annex II is the following: projects of the classes in both annexes are likely to have significant effects on the environment. Those in Annex I are always expected to have significant effects whereas those in Annex II may or may not have significant effects depending on the circumstanes. This distinction lead to a difference in the provisions relating to the annexes. Projects of the classes listed in Annex I are made subject to a full assessment in accordance with specific Artricles of the Directive; those in Annex II are to be assessed "where Member States consider that their characteristics so require."

Member States are required to take the measures necessary to comply with the Directive by 3 July 1988. The Directive does not require a Member State to set up a new authorisation procedure superimposed on the existing development control procedure. It provides that EIA "may be integrated into existing procedures for consent to projects in the Member States or, failing this, into other procedures or into procedures to be established to comply with the aims of this directive."

Some EEC Member States, such as the Netherlands and France, have already enacted specific legislation for EIA and will be relatively unaffected by the Directive. Most of the others, however, will have to establish new, or adapt existing procedures in order to accomodate it. The United Kingdom, for example, will probably keep to its <u>informal-implicit</u> approach to EIA in implementing the Directive by amending the Town and Country Planning Act of 1971 (which would cover most of the types of projects listed in the Annexes) together with amendments to other existing legislative provisions governing agriculture, transport, energy and coastal zone protection. In the Federal Republic of Germany, on the other hand, a more <u>formal-explicit</u> approach is being taken in accomodating the Directive through the enactment of new, separate legislation for EIA together with changes in sectoral planning laws.

Another area that is receiving increased attention vis a vis EIA is bi-lateral development assistance to Third World countries. Under the auspices of the Environment and the Development Assistance Committees of the Organisation for Economic Co-operation and Development (OECD) a programme of work on environmental impact assessment and development assistance resulted in two OECD Council Recommendations which are currently being implemented by OECD Member country aid agencies (OECD, 1986). The Recommendations list those types of development aid projects most in need of EIA as well as suggesting: (1) an approach for establishing an EIA process as a part of aid agency project/programme planning cycles and (2) steps for improving the capabilities of developing countries to conduct EIAs themselves.

7. CONCLUSION

The title of this paper asks the question, "what has worked where, how and why?" Given the differing approaches that have been taken to EIA in various national contexts it is difficult to provide a short or simple answer to this question. Generally speaking, however, it would appear that EIA works best when it is instituted in a formal-explicit way. That is to say, it works when there is a specific legal requirement for its application, where an environmental impact statement is prepared and where authorities are accountable for taking its results into consideration in decision-making.

In addition, for EIA to be successfully integrated in the project planning process, it would appear that procedures for screening, scoping, external review and public participation need to be a part of it.

Of course, environmental impact assessment does not have to be a formal-explicit procedure. Ideally, it can and should happen automatically so that environmental values are taken into account in decision-making. However, experience in countries where it has been applied shows that it is rarely put to use unless political pressures demand it.

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APPLICATION OF EIA IN URBAN DEVELOPMENT PLANNING

- A NEW TOWN EXAMPLE -

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Paper presented at a Regional Training Seminar on the Application of Environmental Impact Analysis in Appraisal of Development Project Planning for the ESCAP Region from 30 May to June 11, 1988, Bandung, Indonesia

APPLICATION OF EIA IN URBAN DEVELOPMENT PLANNING

- A NEW TOWN EXAMPLE -

KWI-GON KIM

Introduction

Policy Making and the Need to Study the Environmental Impacts of New Town Development

The creation of new towns is undeniably one of the best examples of man's ability to modify both his physical (built) and socio-economic environments. A new town not only has a physical presence with buildings, streets, and open spaces, which have immediate tangible and visual impacts, but also contains people who use these facilities and generate waste and pollution, the disposal of which creates other impacts often of a wide-ranging nature. There has been increasing public concern in most industrialized and industrializing societies since the late 1960s about environmental quality, and in particular about the wider and long-term effects on the environment and on local communities of such major urban and industrial developments (Turner and O'Riordan, 1982). Today, in most countries, the environmental consequences of almost any proposed industrial or large-scale building projects are taken into account, along with other assessment criteria, by policy makers.

It is becoming increasingly desirable, therefore, to be able to establish the impacts and to measure the relevant gains (social benefits) and losses (social opportunity costs) which may result from any given project or course of action. Two of the better-known sets of analytical techniques available to do this are cost-benefit analysis (CBA) and environmental impact assessment (EIA). CBA procedures attempt to evaluate and compare the costs and benefits which might accrue from the given project or action. EIA, on the other hand, is specifically designed to look at the nature and distribution (the social spread, timing, and effects on particular groups or areas) of impacts which can result from a particular action or policy. Therefore, EIA often deals with effects which are not readily quantifiable nor easily included in a conventional cost-benefit balance sheet (Turner and O'Riordan, 1982). This paper illustrates how the numerous and varied potential impacts of the development of a new town in Korea

Note: This paper originated from the author's UNEP report (Kim, 1983), and thanks are due to United Nations Environment Program — UNEP — which helped to finance the study. The author would like to thank Patricia Keefe for her invaluable comments on the manuscript.

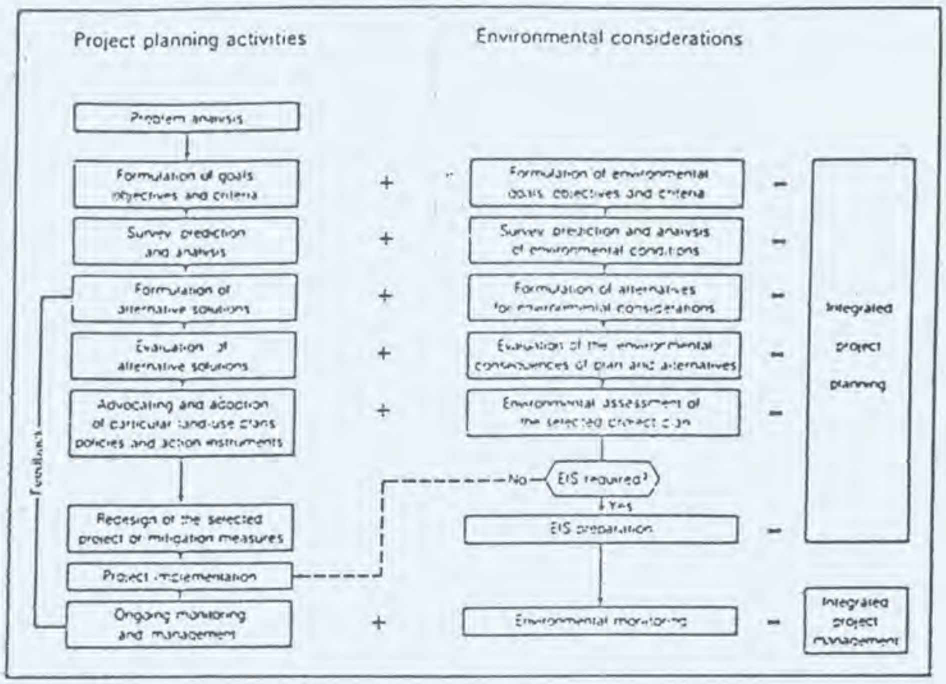
can be assessed and, by means of an extended cost-benefit analysis (ECBA), incorporated into an evaluation with a wide base of predicted and assessed impacts.

The case study attempts to show how ECBA and EIA can provide policy makers with valuable assistance in estimating at the planning and design stage the potential impacts, costs, and benefits of new town development. Not only can the impacts, costs, and benefits of various courses of action be estimated, but the economic effectiveness and, perhaps, the social desirability of implementing various mitigation measures so as to counter undesirable impacts, can also be estimated. Moreover, alternatives to any proposed developments or components of a new town can be evaluated insofar as individual factors can be identified. The actions of developers — for example, the provision of new residences, utilities, drainage, open spaces, or streets — can be indicated as having certain positive or negative effects which range from major to minor. The costs and benefits of actions and the feasibility of avoiding or mitigating these impacts can therefore be assessed.

The incorporation of various types of CBA or EIA into new town planning is not totally new, but research in the past has often been restricted to assessment of the impact of certain components or features. Giles (1978), for example, provides a useful discussion of the impact year by year of new urban development on agricultural land and farm labourers; other studies might focus on the effects of pollution or transport. In this chapter, the case study tries to show the value of a wider analysis. The environmental impacts of new town development are varied and can be as important as the social consequences (such as the provision of services, housing, and employment) which are featured in other chapters of this book. The provision of buildings and infrastructure has impacts which affect the quality of life of residents both in and around a new town. If planners and policy makers are able to assess these effects prior to development, then it may be possible to identify alternative ways of proceeding which will enhance the eventual functioning of the new town.

The case of Gwachŏn new town illustrates how new town developments can provide the maximum benefit using the resources which are available. The initial high costs of the analyses can almost certainly be recouped from the savings accruing from the prevention of mistakes in development. The creation of new towns is expensive and, as suggested, it provides one of the most obvious examples of man's ability to modify his environment. Some form of CBA and EIA is therefore not only appropriate but also probably essential to the sensible planning of such developments. It is widely recognized that the success of environmentally sound development projects depends on the understanding of social needs and opportunities as well as of environmental characteristics (Munn, 1979). The case study illustrates how socio-economic factors, personal evaluation, and other matters can be complementary to more conventional environmental impact assessment, and how they might provide policy makers with a better and more potent yardstick than is usually available to predict and modify the effects of new town development.

Fig. 1 New Town Planning and Design — Environmental Assessment Sequence



Source: Kim (1984).

The Integration of EIA and the Planning of New Town Development

EIA methods can be integrated with the planning procedures for new town projects. This is relatively simple where the planning procedures and mechanisms are well established and clear. It is perhaps less easy to integrate the two when planning is more piecemeal, weakly developed, or without a strong legal basis.

If proper integration is achieved, environmental impact statements will help to detect, at an early stage, negative environmental effects which may occur and they can help to avoid costly later plan changes and delays. More importantly, perhaps, the final plans should be more sensitive to all of the needs — social, cultural, and physical — of the people who will live in and around the new town.

Figure 1 shows how the sequences of new town planning and design and environmental assessment might be integrated and how links between professionals at various stages can be made explicit (Kim, 1984). The basic aims of impact identification, assessment, and evaluation are to provide feedback for improving plan and design, to assist in making a choice between alternatives, and to suggest mitigation measures (to reduce adverse environmental impacts). Measures which are designed specifically to mitigate the often inevitable adverse environmental impacts of new urban development and to enhance environmental quality should be given special attention in environmental assessment.

Although the stages and links indicated in Fig. 1 may appear to be logical and relatively straightforward (for example, the concurrent formulation and evaluation of alternative plans and their environmental consequences), there are impediments to the implementation of impact assessments and thus to the achievement of integrated project planning (Kim, 1984). In Third World countries in particular, poverty puts a premium on short-term, income-producing activities to the detriment of the long-term protection of natural systems. The technical, economic, and administrative personnel and expertise necessary for the planning and implementation of environmental management programmes may be inadequate. There may be minimal participation or interest in environmental quality planning, either on the part of the government agencies or the public in any particular country. Data problems may beset the sophisticated calculations necessary for EIA: environmental, economic, and social data may be deficient or non-existent, and there may be little knowledge of past trends and baselines, which inevitably limits the quality and scope of the analysis. Finally, if a wide diversity of cultural values exists, it may be difficult to evaluate the social significance of certain effects on environmental quality. This may also be important when international comparisons are being made between various impact analyses.

In addition, various practical impediments which may hinder the implementation of EIA methodologies, even where they are desired, should be borne in mind. Corruption, group conflicts, a shortage of skilled personnel, administrative weaknesses, the lack of information and consultation, and poor communications and co-ordination can all prevent implementation.

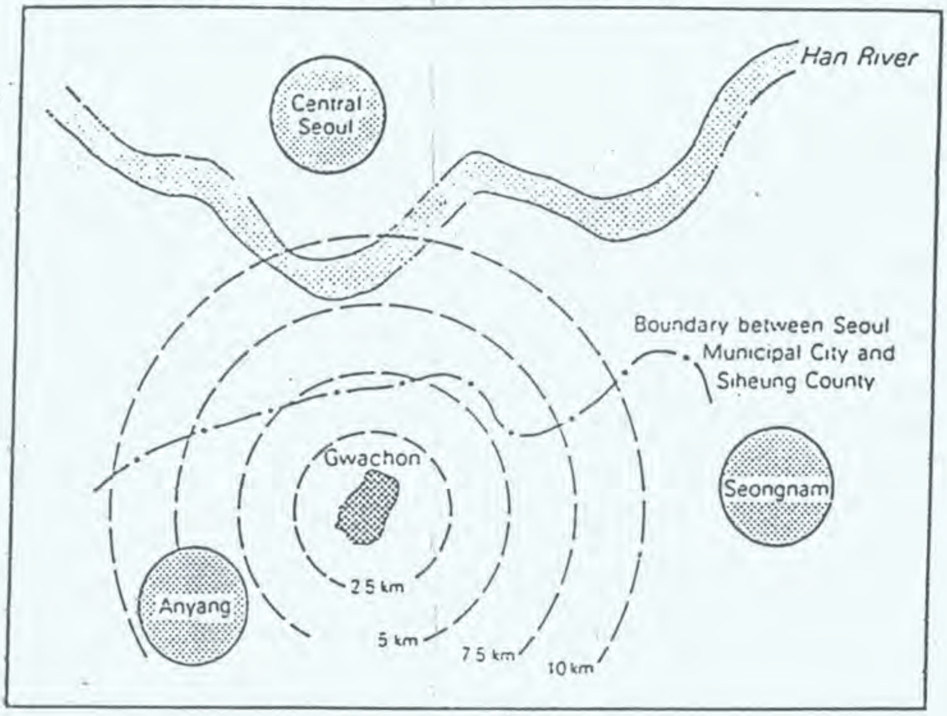
Korean Responses

In response to the problem of the deterioration of environmental quality associated with rapid industrialization and urbanization during the last two decades, the Korean Government has taken legal and administrative actions to meet the challenge of environmental pollution. An important move in coping efficiently with environmental problems (some of which may be associated with new town development) was the promulgation of the *Environmental Preservation Law* in 1977. An environmental impact assessment system was adopted and, in 1980, the Office of Environment was established.

Despite substantial progress in environmental impact assessment, existing procedures and methods of assessing the impacts of new town development have been found to be inadequate. In other words, the conventional approach to project appraisal and development planning has contributed to the development of new towns, but the undesirable environmental and socio-economic consequences of new town developments are beginning to demonstrate the demand for a new, sound approach to evaluation (see, for example, Kelly, 1975; McAllister, 1980; Bisset, 1984).

The principal aim of this study (which was carried out in 1982–3) was to improve understanding of the impacts which the development of a new

Fig. 2 The Regional Setting of Gwachon New Town



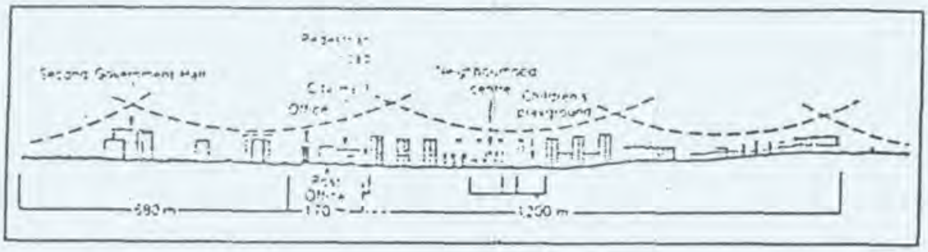
town creates and to develop an assessment methodology which would work in practice in the Korean setting. The extended cost-benefit analysis (ECBA) model is a practical form of assessment for application in new town schemes. Its application in the specific case of Gwachon new town is considered below.

Environmental Impacts: The Case of Gwachon New Town

As noted earlier , strong national new towns policies, including new towns legislation (such as the *New Towns Act* of 1946 in Britain), have not emerged in Korea. In the absence of an explicit new towns policy, the importance of economic influences can be clearly seen when changes over time in the new towns programme in Korea are assessed. However, it is still very relevant to look at the application of ECBA/EIA in this context, as the case of Gwachon illustrates.

Construction of the new town of Gwachon commenced in 1979, in an area five kilometres south of the municipal boundary of Seoul (Fig. : .2). The town was planned to accommodate 63,000 residents during the period 1979–84 and to house the Second Government Hall. It is a project in phases, numbered I to IV. The developments for phases I and II have been completed, and grading for phase III was in progress at the time the study was carried out. The Second Government Hall will be developed by the Ministry of General Affairs and the new town (the hinterland of the Second Government Hall) will be developed by the Korea National Housing Corporation.

Fig. 3 Cross-section of Gwachon New Town



According to the construction plan for the Second Government Hall, Gwachon will be developed as an administrative new town in order to disperse administrative functions agglomerated in downtown Seoul and to relieve the overcrowding in that city. The facilities designed for the new town include a transport system, high quality housing, sufficient living space, and a comfortable urban environment. Figure .3 illustrates in cross-section the layout of some of the main features of Gwachon new town. Some principles which are to be applied in its spatial organization are:

(a) the creation of a convenient living environment through effective and rational spatial organization which takes into account the visual, functional, and environmental aspects of facilities;

(b) the creation of communal space in which people feel a community identity;

(c) the creation of imaginative skyline and spatial patterns which maximize the east-west and north-south axes and related site requirements;

(d) a mixture of high, medium, and low-density housing areas;

(e) the achievement of visual and functional relationships between higher density housing areas and adjacent design components (such as relationships with the central areas, major arterial roads, parks, and open space).

Table .1 shows the land-use plan for the proposed new town project; a summary of the proposed housing development plan is provided in Table .2. The project covers the construction of 696 single detached dwellings, 644 attached dwelling units, and 12,860 apartments on the 1.06 square kilometres of residential area, which comprises 46 per cent of the total area. The figure for single detached dwellings includes 18 solar-heated houses.

Extended Cost-benefit Analysis and Environmental Impact Assessment

A cost-benefit analysis (CBA) attempts to assess the benefits accruing from certain levels of expenditure and costs, including environmental impacts (often called 'social costs') (Canter, 1977; Pearce, 1983b). Such impacts accompany any new physical development. However, this project was particularly appropriate for the application of extended cost-benefit analysis (ECBA) for a number of reasons. First, the area in which the

Table 1 Land-use Plan, Gwachon

Total	Residential	Commercial/ Business	School	Road	Park
100 (%)	46	6	6	19	23
2,298,540 (sq.m.)*	1,060,103	138,704	132,100	426,023	541,610

Note: * This figure does not include the Second Government Hall site (660,500 sq.m.), without which the total indicated here equals 77.7 per cent of the entire area.

Source: Korea National Housing Corporation (January 1983).

Table 2 Proposed Housing Development Plan, Gwachon

		Types of Housing			Remarks
		Detached	Attached	Apartment	
Total	14,200	696	644	12,860	Apartments:
Stage 1	1,290*	228	204	840	5 storeys 9,550 dwelling units
Stage 2	6,075	235	—	5,840	14 and 15 storeys 3,310 dwelling units
Stage 3	5,537	233	264	5,040	Solar-heated houses 18 units
Stage 4	1,316	—	176	1,140	

Note: *This figure includes 18 solar-heated houses.

Source: Korea National Housing Corporation (January 1983).

new town is to be sited is located within Seoul's green belt. The project would therefore have a significant impact on an existing populated area (if largely agricultural). As a consequence, an important environmental quality problem is involved. This problem is of course quite common in many new town developments in other countries.

Secondly, the project would involve various types of environmental effects which permit the application of ECBA so that the usefulness of the technique can be examined. Thirdly, the project has been fully planned and is still under development. Accordingly, there is good pre-development documentation, including data on actual development costs and benefits, and the actual environmental effects of the project. Consequently, many environmental impacts can be evaluated as costs or benefits by looking at environmental settings before and after the development, with sufficient precision for the application of the methodology suggested in this study.

Method for ECBA

This section outlines the main features of ECBA as a form of environmental impact assessment (EIA). As a technique, ECBA focuses on the incorporation of the CBA tool into EIA techniques for various types of projects. Much of the criticism directed at existing decision making procedures has come from those who argue that environmental restraints on, and consequences of, urbanization have been ignored.

'Simple' CBA is of limited usefulness in aiding decisions which result in significant environmental impacts. An important reason for this is that CBA does not systematically consider impacts which cannot be described appropriately in monetary terms (Ortolano, 1984). In the traditional literature, the concept of CBA is market-oriented, where goods and services are sold at a price. The approach required of CBA in the future could be called non-market-oriented, with the increased public awareness of externalities and social costs, which are not always directly attributable to specific activities and often not directly quantifiable. Another shortcoming of CBA is its failure to account for equity considerations. The emphasis is on aggregate economic effects, not on the question of which groups gain and lose if a project is (or is not) implemented. Such issues pose important questions in new town planning in East and Southeast Asia because the developments often occur in already populated locations.

The limitations of CBA have encouraged efforts to extend the approach and to make it applicable to a wider range of evaluation problems and particularly to the assessment of environmental effects. The ECBA developed in this study considers not only profit maximization and economic costs, but also encompasses and measures the physical, chemical, and biological effects of development activities. This evaluation approach to new town development recognizes that most public policy decisions have multiple objectives and embrace social goals which are much broader than mere economic efficiency.

Another criticism of traditional CBA is that it conceals very considerable value judgements behind a facade of value-free objectivity. The ECBA makes provision for the achievement of a wider basis of value judgements and political acceptability. Enlargement of the CBA in this way may enable developers and decision makers to weigh environmental impacts against social and economic demands more realistically than is possible with earlier methods.

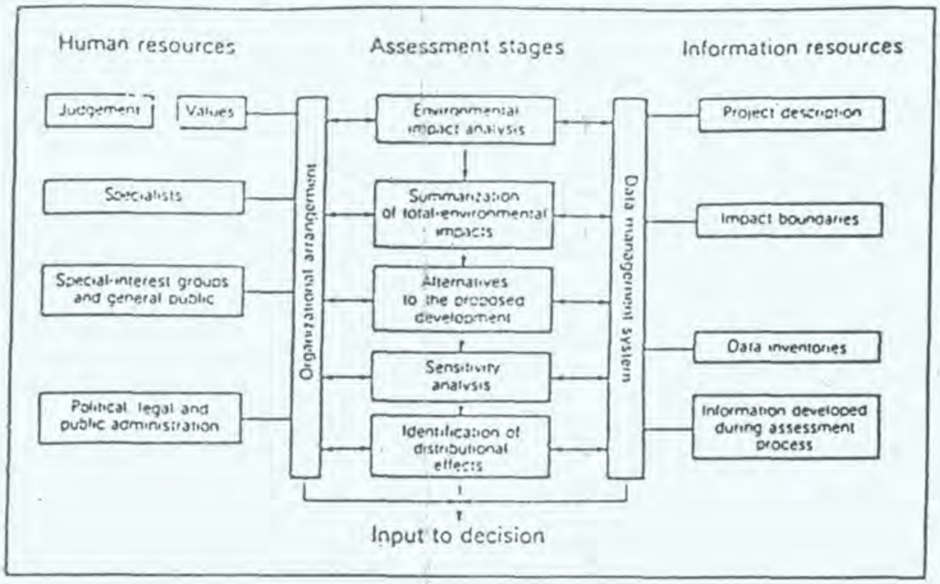
A Framework for Environmental Assessment

The ECBA aims to provide policy makers with information which will help them to make a rational decision about a specific project. In principle, the analytical procedure can be divided into six steps or stages:

(a) analysis of baseline data;
(b) summary of total environmental impacts;
(c) suggestion of alternatives to the proposed development;
(d) sensitivity analysis;
(e) identification of distributional effect;
(f) submission of the finished ECBA report and results to the policy makers.

Figure 4 presents the same steps, together with human and information resources or requirements in diagrammatic form. The hypothetical impacts

Fig. 4 The Analytical Procedure for the Extended Cost-benefit Analysis (ECBA)



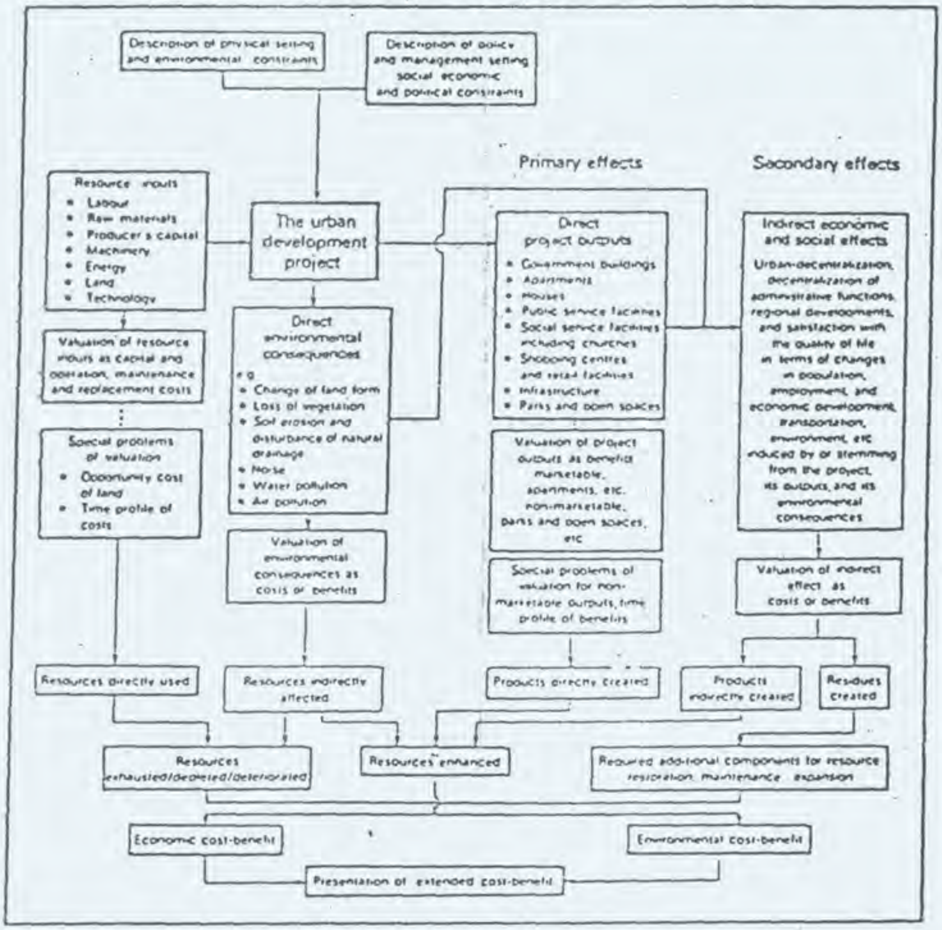
of the urban development project and the presentation of results is shown in Fig. 5. It will be seen that there are direct and indirect effects identified for any urban development project, and that many direct environmental consequences (such as pollution and erosion) are of the more 'traditional' type of impact.

The ECBA model developed in this study differs from some of the earlier applications of EIA. It internalizes the costs of mitigation measures in an enlarged cost-benefit balance sheet, extending EIA to value judgements, whilst restricting quantification to those areas where it is well based. It develops CBA and conventional EIA as complementary analytical techniques, and includes the effects of government intervention on the urbanization process through the use of established standards relating to urban development.

Pearce (1976) suggests that it is more important to know the costs of abatement than to estimate pollution damage in monetary terms, and that research should therefore be expanded into the costs of abating pollution. In the ECBA model, the costs of mitigation measures, as surrogates for monetary environmental costs (which are considered necessary in this study), are included in the ECBA (measurable). The assumption is therefore made that these mitigation costs will actually be paid. The cost of mitigation measures which have been incorporated in the approved project plans is included in the item of economic cost-benefit in order to avoid double counting.

This study recognizes that an EIA will inevitably entail some subjective judgements. Because objective measures cannot fully describe environmental settings and cannot completely assess all the impacts of the new town, they are supplemented by indicators of residents' attitudes towards the new town and the displacement of (in this case) a village. The data for the subjective evaluation of impacts derive from two social surveys

Fig. 5 Hypothetical Impacts of the Urban Development Project



employed in this research project. These surveys include one of the village which was to be displaced and one set in the new town itself.

It is hoped that the example here will provide an illustration of the ways in which an ECBA can be applied in other circumstances. So as to enable the reader to interpret the results in the light of individual experience and to make an informed opinion on the desirability of this new town project, as suggested by Nash *et al.* (1973), the results of the environmental CBA are presented here in a disaggregated form. Qualitative descriptions show clearly how the environmental costs and benefits (measurable and non-measurable) of each factor involved in the total project are determined. An enlarged cost-benefit presentation of economic cost-benefit and environmental cost-benefit will be of use only to those who are familiar with the value judgements, including a single net present value figure (8 per cent), used in the study. Obviously, a person with different value judgements will achieve a different final result as different importance will be attached to the various components. The key point with regard to EIA methodologies is that their results must be interpreted using varying value sets over time and also probably in different national settings.

To the extent that the CBA and EIA techniques are regarded as complementary, the ECBA technique can be a valuable aid to policy analysis and policy makers. The clear understanding of the nature of the actions and reactions of any specific measure implemented requires the use of such environmental management tools as EIA, which should be considered a prerequisite for the effective application of ECBA.

At the present time, the effects of government intervention on the urbanization process are so great that governments and other public institutions arguably play a vital role in the political, decision-making context. Land-use planning, zoning controls, and environmental review procedures have often been the major determinants of urban development. In an environmental context, for example, three categories of government action to manage residuals/emissions can be distinguished: direct regulation, using standards to control discharges; economic regulation, using incentives such as subsidies; and government construction and operation of facilities to collect, treat, and dispose of residuals (Ortolano, 1984). In this study, direct regulations to limit discharges (which involves effluent or emission standards) are utilized to compare predicted impacts with established environmental quality standards.

An outline follows of the stages for conducting an ECBA, as illustrated diagrammatically in Fig. .4 on page 134. These generalized stages are then discussed with specific reference to Gwachon.

Environmental Impact Analysis of Specific Impact Areas

The basic steps associated with impact analysis in specific impact areas include the description of the environmental setting, impact prediction and assessment, and determination of mitigation or control measures. Environmental factors considered in this study are topography, hydrology, climate and meteorology, air quality, noise pollution, energy and utility services, vegetation, animal life and habitat, land use and zoning, dislocation of people and villages, transportation, demography and community identity, recreation and parks, attractiveness of townscape, and regional development.

Description of the Environmental Setting

The environmental setting gives the baseline information against which prediction and assessment can be made. Here, the study focused on both qualitative and quantitative data sources for major environmental factors. For those impacts which are susceptible to quantitative measures, the sources of information were field observation, personal contact, printed materials, assessors' experience, and specific studies. For those impacts which cannot be adequately described or accurately assessed, the data were derived from the two social surveys referred to earlier.

The objectives of the social survey of the village to be displaced were to provide information on some personal and domestic details, business organizations and other behaviour in the village, and residents' attitudes and plans. The objectives of the social survey of the new town were to provide information on the characteristics of newcomers, their activities, the status of households and dwellings, and the attitudes, opinions, and beliefs of new residents. In order to analyse the qualitative data for the new town, various cross-tabulations of 37 questions asked in the survey questionnaire were compiled, using a standard social science computational package.

Impact Prediction and Assessment

Impact prediction and assessment were approached in different ways depending on the environmental factors under consideration. For example, scientific approaches and models were used to predict impacts on the air and noise environment. Although predictions of impacts on some socio-economic factors have technical bases, the results of the two social surveys already described were used more subjectively to understand the issues of social impacts associated with displacement of the existing villages and people, as well as for rating attractiveness of the townscape, and for identifying existing and potential problems.

For impact assessment, this study made comparisons with established quality standards, urban planning and design standards and guide values, professional judgement, and ratings from the survey of citizens. An effort was made to gather quantitative and qualitative standards which are in use today in Korea. The most important criterion for the selection of standards was that they should reflect planning control principles and practices in this country. Therefore, it is possible to consider this case study in the more general context of what is acceptable and expected in urban development in modern Korea.

The selected assessment standards and guiding values, including predictive demand and land-use conversion ratios, are available from the author. Since many possible standards and guiding values of neighbourhood and community development can be devised, the bases of the established standards and their assumed validity may be a source of disagreement amongst proponents of competing standards and guide values. Indeed, such standards will be the subject of a future study.

Mitigation Measures

Impact prediction and assessment provide the basis for recommendations as to how to reduce or remove the most serious of the impacts measured and socially perceived. In this study, mitigation measures were divided into measures incorporated into the original design of the project by the public authorities responsible for the development of Gwachon, and other measures which were considered necessary in this study in order to further reduce adverse impacts. For example, with regard to smoke pollution, the increase in the stack height from 30 to 60 metres is suggested to reduce concentrations at ground level and at different receptor heights.

It is important to note that the costs of enforcing mitigation measures were taken into account in this study, and were internalized later in an enlarged cost-benefit balance sheet. The implicit assumption is that those

Table 3 Suggested Environmental Assessment Guidelines for New Town Development Projects (Natural/Physical Factors Only)

Factor	Environmental Setting	Assessment Questions	Analysis Methods	Evaluation of Impacts	Mitigation Measures
Physical site suitability	Soil characteristics and surface and bedrock geological conditions which will have a direct influence on site suitability for development of buildings, sewers, and underground utility trenches	(1) Is there any visible evidence of soil and foundation support problems, etc.? (2) Is there evidence of high side seepage potential when underground utility collectors are to be installed?	(1) Field observation (2) Sources of published information: soil maps and geological survey information (3) Contacts: local authorities, federal and state planners, and engineers	If there are no problems with soil or bearing capacity, there is 'no impact'. If there are problems, whether minor or not, which will be solved by mitigation measures or modified design, there is a 'minor impact'. If there are major problems which cannot be solved, there is a 'major impact'	(1) Installation of drainage facilities in low areas to make the soil stable for construction (2) Alteration of foundation design, by using pilings, or increasing the bearing areas of spread footings (3) Replacement of problem soil with more satisfactory fill (4) Installation of approved perforated pipe and gravel subdrains to prevent seepage potential (5) Possible alternative site land-use configurations

Factor	Environmental Setting	Assessment Questions	Analysis Methods	Evaluation of Impacts	Mitigation Measures
Topography	Delineation of the major and minor drainage basins along with their characteristics: slope, elevation, natural and artificial drainage nets, erosion, and deposition	(1) Would the proposed project result in substantial modification of the terrain? (2) Is erosion control included as part of the new town development plan? (3) Is there any visible evidence of sedimentation problems on the site?	(1) Field observation (2) Sources of published information: topographic maps, soil survey maps, erosion potential maps (3) Further study: conduct a detailed site soils analysis	No impact: an existing erosion or sedimentation problem is demonstrably corrected as part of the project proposal or erosion or sedimentation problems are not present Minor impact: erosion or sedimentation problems are present only to a very small degree Major impact: erosion or sedimentation problems are present and severe, or the proposed project will increase the potential for erosion and sedimentation problems, and inadequate mitigation measures are proposed to correct these conditions	(1) Phase grading to expose only those areas necessary at each phase in order to limit extent and exposure time of disturbed soils (2) Break up slope lengths on steep slopes to reduce runoff; terrace downhill slopes (3) Collect and re-use all top soil beneath proposed cut and fill areas

Factor	Environmental Setting	Assessment Questions	Analysis Methods	Evaluation of Impacts	Mitigation Measures
Hydrology	Description of the relevant surface water bodies and ground water aquifers	(1) Is there evidence that supplies are adequate and free from pollution? (2) Will the project involve discharge of sewage effluent into surface water bodies? (3) Will the project involve a substantial increase in impervious surface area?	(1) Field observation (2) Source of published information: storm drainage maps (3) Contacts: the county engineer or other local officials who are familiar with the area	No impact: the project will have no significant effect on either the quantity or quality of water entering the groundwater stratum. A finding of 'minor impact' or 'major impact' will be based on results of the required inter-agency co-ordination procedures	(1) Inclusion of runoff control measures in site design (2) Design of underground spaces to withstand provision to pump out seepage in locations with high water problems
Vegetation, animals, and habitat	Indication of those species which have been designated rare or endangered. Description of wildlife habitat or portion thereof which might be affected by the project	(1) Will the project damage or destroy existing plant communities listed as rare or endangered species? (2) Will the project damage or destroy existing wildlife habitats?	(1) Field observation (2) Sources of published information: existing lists of endangered species (3) Contacts: if an endangered species or habitat may be affected, further co-ordination with the Fish and Wildlife Service is required	Major impact: (a) Grading, cutting, or filling will take place on locations of protected species or critical habitats (b) Species or vegetation population dependent on the site or pre-empts a critical habitat	(1) Altering project plans to avoid impact on critical habitat areas (2) Setting aside the critical habitat area as a park or natural area

mitigation costs will be paid by the Korea National Housing Corporation. Table 3 provides some examples of selected factors which may be assessed in EIA of specific areas and illustrates some suggested mitigation measures to reduce impacts. The full details are available in Kim (1983).

Summary of Total Environmental Impacts

After the baseline inventory and mitigation measures have been conducted, it is necessary to assess collectively the results of these specific impact assessments in terms of an overall or summary evaluation. The basic incorporation of the CBA tool into EIA summation techniques consists of the following five elements:

(a) tables of benefit-cost (B/C) ratios which provide planners with guidance on how beneficial the development is to the developer in terms of economic CBA;

(b) tables of CBA for development of direct services, implemented by other public agencies concerned;

(c) tables summarizing economic cost-benefit analyses (a) and (b);

(d) tables showing measurable and non-measurable environmental costs and benefits of the project;

(e) tables of the enlarged cost-benefit balance sheet which incorporate the results of economic costs and benefits and the measurable environmental costs and benefits associated with the new town project.

Table 4 shows the reduced format for presentation of the environmental CBA. The table allows qualitative descriptions to be made of non-measurable environmental costs and benefits. It therefore accommodates unmeasured impacts alongside impacts which are financially assessed. It also shows how elements are valued so that readers might subjectively interpret the results and give their own weight to the various factors. This is important as individuals might reach different conclusions as to the desirability of a project (as discussed below in the section on sensitivity analysis). The disaggregated impact information may also help to clarify the trade-offs of environmental factors against economic and other considerations. (For discussion of these topics, see also Lichfield, 1968; Lichfield and Chapman, 1970; Lichfield *et al.*, 1975.)

Alternatives to the Proposed Development

In an ideal EIA, the proposed action should be selected only after consideration of the factors associated with alternatives which might meet the project's needs. For example, alternative land uses may change completely the findings of the extended cost-benefit study. However, if any benefit is to be gained from alternatives, they should be based upon proposals which are realizable in practice, rather than those which are possible but impracticable.

The development and comparison of alternatives are usually presented in order to show the reason for the selection or rejection of specific

Table 4 The Reduced Format for Environmental Cost-benefit Analysis (Measurable and Non-measurable)

	Cost						Benefit			
Resources Indirectly Affected			Residues Created		Resource Restoration Input		Indirect Output Without Extra Cost to the Original Project		Resource Restoration Outputs With Extra Cost to the Original Project to Mitigate Adverse Impacts Under a Modified Project	
Physical/natural factors	Description	Quantity	Description	Quantity	Nature	Value	Nature	Value	Nature	Value
Topography										
Hydrology										
Climate and meteorology										
Vegetation, animals, and habitat										
Air quality										
Noise										
Energy conservation										
Sanitary sewers										
Solid waste										

alternatives. The consideration of alternatives in this study contains a systematic development of alternative land uses for the solution of the identified new town development problems; and a rational comparison of the alternatives, including the identification of critical differences leading to the selection of one (or more) alternative over another.

Sensitivity Analysis

Perhaps the only certain aspect of evaluation is its inherent uncertainty. As a result, the assessment technique described so far will have produced a meaningless answer if no investigation of the associated uncertainty is conducted. Uncertainty in the overall assessment has two components: uncertainty about the accuracy of assessment of the overall project impacts at present, and uncertainty about changes in the overall project impacts in the future. This overall uncertainty depends, in turn, on the uncertainties in the discount rates and the underlying value judgements, including changes in tastes and aspirations from one generation to another, policy changes, and developments in technology.

In order to overcome the problem of the unquantifiable nature of some environmental impacts, the study does not attempt to render all values in money terms, and it attempts to make clear the bases on which judgements may be made. It is the decision maker's responsibility to combine, weigh, and judge the information presented to him and details should therefore be presented as fully as possible.

Distributional Effects

Traditionally, conventional EIA methods have been used to minimize aggregate adverse environmental impacts and to maximize aggregate benefits, regardless of the groups to whom benefits and costs accrue. Consequently, full consideration of the 'losers' from projects has not been adequately documented in most environmental impact statements. The priority has usually been to evaluate the project in the interests of the community as a whole. If new towns are to be provided as a benefit both to nations and to individual residents, the 'winners' and the 'losers' in any circumstances have to be considered. The concept of fairness (or justice) is therefore relevant to decisions affecting environmental quality because the individuals who enjoy the benefits from such decisions are often different from those who pay the costs.

Two main components of distributional analysis can usually be distinguished (Abelson, 1979). One is the analysis of the incidence of costs and benefits on selected community groups (sometimes called incidence analysis). This involves determination of what data are required in addition to those collected in order to calculate the net present value (NPV); of which groups are involved; and of how costs and benefits are borne or passed on between groups. The second and more controversial component of distributional analysis consists of the identification of how the incidence of costs and benefits might affect the project decision and its final form.

Table .5 Some of the Main Results from the Assessment of Selected Impact Areas, Gwachon

Factor	Environmental Setting	Impact Prediction and Assessment	Mitigation or Control Measures
Topography	(1) Elevation between 40 and 125 m above sea level (2) Slopes ranging from 0 to 20 per cent (3) Soils containing varying amounts of clay, silt, sand, and gravel, with some organic matter	(1) Altering moderately the existing terrain of the site (2) Significant effects of the change in the orography on the existing local wind flow pattern (3) Removal of the existing soil mantle	(1) Stage grading (2) Collection and re-use of topsoil (3) Planting all fill and cut slopes
Air quality	(1) The specific topography preventing crosswind ventilation (2) High frequency of low-level temperature inversions (3) Low precipitation during most of the year	(1) The estimated sulphur dioxide concentration (12 ppb in 1986) within air quality standards for sulphur dioxide in Korea (2) Significant sulphur dioxide concentrations at major downwind directions of heating plant stacks (3) Effects on sensitive vegetation such as conifers and visibility impairment from air pollution	(1) Increasing the stack height from 30 to 60 m (2) Construction of a mound along the bypass road planted with trees or bushes (3) Traffic light system control
Dislocation of people and villages	(1) 6,840 people (the 1978 population of Gwachon) and 1,556 households (2) 842 dwelling units and 359 business leases to be affected	(1) Replacement of existing village and people (2) Disruption of community cohesion (3) Creation of community resentment (4) Uncertainty about the future due to the loss of employment	(1) Compensating displaced people for their property and business leases (2) Providing an economic base for displaced people (3) Publicizing fully and well in advance the details of development and compensation

Examples of Results from the Gwachon Case Study

Assessment of Specific Impact Areas

Some examples of the main results of the assessment of the selected impact areas are summarized in Table ..5, which describes environmental setting, impact prediction and assessment, and mitigation or control measures. An example of one type of information which may be forthcoming from an ECBA is air quality, which is discussed below.

Environmental Setting and Air Quality

The specific topography of a new town is of considerable importance in influencing its air quality. Gwachon's site is characterized by mountains to the north and south which prevent crosswind ventilation, and there is a high incidence of low-level temperature inversions in conjunction with low precipitation during most of the year. The site therefore has great potential for air pollution. It is part of the Seoul-Inchon metropolitan airshed, which causes higher background concentrations of sulphur dioxide and particulates, for example, than are observed in other rural areas outside the airshed.

Impact Prediction and Assessment of Air Quality

The estimated emission rates and the results obtained from the Smeared Concentration Approximation Method (SCAM) model suggest that the concentrations of the criteria pollutants are within safe limits and will not exceed ambient air quality standards after completion of the new town.

Concentrations at major downwind locations of heating plant stacks, predominantly in the cold winter months, cause some concern, however, particularly in conjunction with relatively high particulate concentrations exceeding the 24-hour annual maximum concentration (150 ug/m^3) of the secondary US standards. It is anticipated that the particulate concentrations will decrease as soon as all construction activities are completed. Adverse effects on public health due to air pollution are therefore not expected. However, the effects on sensitive vegetation, such as conifers, and visibility impairment resulting from air pollution cannot be entirely excluded. This illustrates the need for awareness of impacts which will accrue even if international standards are not exceeded.

Mitigation Measures Related to Air Quality

In general, it is suggested that the stack height of major single sources — for example, central heating plant stacks or stacks of public bath-houses, where considerable amounts of fuels are burned — should be 2.5 times higher than the surrounding buildings. This requirement is not satisfied in Gwachon because of the high-rise nature of development. The 15-storey apartment buildings are higher than the 30-metre high stacks of six local heating plants. Therefore, it is recommended either that fuels containing less sulphur should be used or that the stack heights should

Table 6 Summation of Economic Cost-benefit Analysis in Million Won,* Discounted to 1982 at 8 per cent

Capital Cost		Benefit		Net Balance	B/C Ratio
Item	Value	Item	Value		
The new town development	246,177	The new town development	258,696	+12,519	1.05
The Second Government Hall construction	55,000	The Second Government Hall construction	55,262	+262	1.005
Direct services development	31,163	Direct services development	—	−31,163	
Total	332,340	Total	313,958	−18,382	0.945

Note: *The exchange rate used is Won 800 = US$1 (1982 prices).

be considerably increased. The latter measure has to be carefully assessed with regard to the topographical conditions, characterized by high mountains to the north and south which are covered with sensitive vegetation. This situation emphasizes the need to consider the total environment in any new town setting.

The planting of trees or bushes so as to create wide buffer zones along roadsides may be recommended. An additional refinement is control of the traffic light system to ensure a smooth traffic flow at reasonable speeds throughout the whole new town area, particularly at major arterial roads, so as to avoid excessive concentration of vehicle fumes. This type of forward planning, in conjunction with traffic circulation design, can enable a new town to minimize atmospheric pollution by vehicle emissions. This is difficult to achieve in existing urban areas.

Summary of Total Environmental Impacts

The results of the summary of the total environmental impacts may be presented in the form of the enlarged cost-benefit balance sheet. Table 7.6 summarizes the economic CBA, and Table .7 provides an ECBA, incorporating measurable environmental costs and benefits.

Gwachon is being developed in phases and these tabulations allow any changes to be shown in benefit-cost (B/C) ratios as a new town grows. For example, when the fourth stage development is completed and new apartments and other facilities such as shopping centres are sold, the enlarged B/C ratio will be higher than 0.934 as of mid-stage construction (Table 7), because most direct services development will already have been completed. In addition, the result may be more positive if an attempt is made to evaluate as far as possible the non-measurable secondary and tertiary benefits.

The study found that, although the extra costs of the mitigation measures (Won 3,961 million) were added to the original project costs (Table 7), the project is justified because the high cost of land and other properties

Table 7 Enlarged Cost-benefit Analysis (Measurable) in Million Won at 1982 Prices

Item	Costs	Benefits	Net Balance	B/C Ratio
Economic cost-benefit*	332,340	313,958	−18,382	0.945
Environmental cost-benefit (measurable)	3,961	—	−3,961	0
Enlarged cost-benefit	336,301	313,958	−22,343	0.934

Note: * The cost of mitigation measures which have been incorporated in the approved project plans is included in the item of economic cost-benefit in order to avoid double counting.

make these measures economically feasible. It is assumed that these mitigation costs will be borne by the Korea National Housing Corporation.

The costs of mitigation measures can be calculated and totalled (Won 3,961 million, approximately US$4.95 million). They include such costs as the collection and re-use of fertile topsoil, the reclamation of new agricultural lands equalling the area of lost land, the extension of bicycle roads, an increase in the stack heights of heating plants from 30 to 60 metres, landscaping of the buffer zone, and the construction of a noise protection wall.

Alternatives to the Proposed Development

It is assumed that land-use and transportation alternatives have already been formulated and evaluated as part of the decision-making process, since their selection was made prior to the environmental assessment. This section therefore takes account only of the possible consequences of alternative uses of the sites and adjustments to the intensity of residential development. Four feasible alternative land uses are discussed in this study. These alternatives include a 'no project' alternative, a change in the intensity in the new town plan, a change to a different type of land-use, and the adoption of alternative sites. After taking these into account, the ECBA model can be used to reach a decision on the mixes of land uses and locations.

Sensitivity Analysis

A standard feature of this type of analysis is an estimate of its sensitivity to financial fluctuations. In this study, an 8 per cent discount rate and a six-year evaluation period from 1979 to 1984 were used. All measurable costs and benefits were discounted to 1982 values at 8 per cent. The present value of benefits from the Second Government Hall project was derived by dividing rent (p) by the rate of discount 'R' (8 per cent) in perpetuity. The ECBA results, calculated with different discount rates and value sets, are not included here, but such results with differential rates would obviously be important in any full analysis.

Table 8 Distributional Effects in Million Won at 1982 Prices

Organization	Capital Cost	Benefit	Balance
Korea National Housing Corporation (KNHC)	250,138*	258,696	8,558
Ministry of General Affairs (MOGA)	55,000	55,263	263
Displaced people	NA**	76,300†	Displaced people may not have been the true beneficiaries of the development area policy
Local government	None	15,700	15,700
Ministry of Construction	24,858	—	−24,858

Notes: * This figure includes Won 3,961 million for mitigation measures.
** Precise cost figures are not available.
† This figure includes payments for compensation and special land sale price.

Resource inputs released for economic investment as a result of alternative technology and energy development, which in turn may be an environmentally induced cost reduction in the environmental cost-benefit table, have not been credited in the economic cost-benefit table. It has been presumed that alternative technology and energy sources are providing a base for economically efficient urban development as well as environmentally sound activity. For example, the net cost of alternative energy may be less than the released cost induced by, say, coal, which is used as fuel in a substantial number of houses (3,100) in Gwachon new town. Moreover, the identification of precise outcomes from the application of the sensitivity analysis with changes in tastes from one generation to the next is as yet beyond the capability of this research. The limited scope of existing research cannot enable the prediction of future demands and requirements and permits no more than suggestions of possible developments in the field (Pearce, 1983a; Haveman, 1983).

Some Distributional Effects

Table 8 shows distributional effects in terms of the Korea National Housing Corporation, the Ministry of General Affairs, displaced people, local government, and the central government. It is important to note that a municipal government of Gyonggi Province will take over from the Korea National Housing Corporation the public assets of Gwachon new town after completion of the development, and will therefore be responsible for the management and administrative supervision of the town. The current Gwachon Office of the Gyonggi Provincial Government does not provide for any capital cost, due to the lack of financial resources and an inadequate institutional mechanism. Total local government benefits were estimated at Won 15,700 million (Table 8). In Gwachon, the

Ministry of Construction will pay for bypass road construction and central main road enlargement, whilst the costs of a new sewage plant have been included in sale prices of houses.

One possible conclusion to be drawn from this case study is that, through the development of Gwachon new town, people who live in the new town will be much better off environmentally than the population residing in congested Seoul. Indeed, a social survey of the households which have already moved into the Gwachon new town showed that a large number of people claimed a more acceptable quality of environment since moving to the town from the congested capital city. Nevertheless, based on the findings of the study, the Office of Environment has requested that the Ministry of Construction take the necessary actions to implement mitigation measures identified in the study so as to reduce environmental impacts. These measures will ensure that environmental standards and quality are maintained as much as possible as Gwachon grows. However, in terms of the apportionment of costs, a population migration from Seoul to Gwachon would cause the transfer of the costs for items such as solid waste disposal and sanitary sewage treatment from Seoul to Gwachon new town. Therefore, some transfer of funding may become necessary to provide equity and balance.

Implications of the Gwachon ECBA Study for New Town Planning and Development

The first step of the study was to develop a general EIA methodology applicable to other countries as well as Korea. The methodology was then applied to a specific new town development, the town of Gwachon, Seoul metropolitan area, Korea. Environmental impact assessment is a valuable aid in the selection of which alternatives are to be preferred and/or is an effective tool for determining, in the production of development plans, the acceptability of proposed actions. However, because of the totality of new town construction, the EIA of the creation of such projects requires somewhat different methodological approaches than are necessary in the case of smaller or piecemeal developments.

This study has developed an ECBA model to determine the acceptability of a single proposed plan. It can be used for determining final project design and for allocating limited resources to selected projects so as to obtain the maximum overall social benefits with minimum overall social costs, by employing integrated new town project planning and development. Mitigation or control measures which are specifically designed to reduce adverse environmental impacts, to enhance environmental quality, and to help the optimal use of resources can reduce the total social costs by anticipatory rather than remedial actions. This is, of course, very important in many new communities in attracting population and in maintaining an economic base.

The need for the incorporation of environmental considerations into the planning stage of new town projects was discussed earlier. The

Gwachon case study illustrates that, in integrated project planning, after all of the alternatives to the proposed development have been taken into account, the ECBA model can be used to help in reaching a decision and to obtain feedback for improvement of planning and design. It can assist in making a choice between alternatives and it can help to suggest mitigation measures. However, the method employed in the case study is not designed to identify large differences between plans at the *strategic* level. It depends heavily on detailed planning and design of developments at the *local level*. At this level, the method makes it possible to assess adequately many vital aspects of the plans. Therefore, while ECBA is adequate for local plans, it may not be suitable for strategic plans. This is because, by their very nature, the effects of many mutable aspects of development are often relatively localized.

Although the ECBA is specifically designed to determine the acceptability of a proposed plan, it can be a valuable aid to the selection of 'socially preferred' alternatives, to the extent that traditional plan evaluation methodologies and the ECBA technique are regarded as complementary. In brief, in the Gwachon case, the following impacts were amongst those identified:

(a) Adverse impacts include traffic problems, loss of agricultural land, cumulative degradation in air quality, short and long-term noise impacts, disruption of existing community cohesion, non-achievement of self-containment and socially integrated, balanced communities because of cross-movement and turnover of population, and higher population than planned resulting in pressure on public services. Land acquisition and compensation, initial site clearance, grading, and construction had major negative impacts in this project.

(b) Beneficial impacts include factors such as the availability of new housing, the Second Government Hall, additional park land, employment during grading and construction, increased tax revenues, and decentralization of the urban base.

A summary of the total environmental impacts showed that the project would be economically sound, and supplementary subjective evaluation of the new town showed that a large number of people had a better quality of life since moving to the town from the capital city, Seoul. However, the authorities responsible for the development of Gwachon should consider controlling growth in the area surrounding the town by maintaining the green belt policy, incorporating mitigation measures, adopting an area-wide approach, encouraging public involvement, and monitoring changing conditions. When control or mitigation measures which are essential conditions to the planning approval are implemented, the overall benefits of the proposed project would exceed the overall social costs. The results of this study have already led to government measures to alleviate some of the adverse impacts of the new town development project.

In conclusion, the ECBA developed in this study provides for more efficient new town development than was possible under existing methodologies. In addition, the ECBA methodology may usefully be applied in other contexts, in developed as well as developing countries. However, an important limitation is data availability and, in general, countries which adopt ECBA must be aware that its application requires considerable resources and the availability of well-trained personnel. Such resources are often in limited supply in Third World countries, but it should be appreciated that the timely application of these methodologies can save considerable future remedial expenditure or help to prevent losses from poorly designed projects.

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RISK ASSESSMENT IN URBAN PLANNING AND MANAGEMENT : A METROPOLITAN EXAMPLE

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RISK ASSESSMENT IN URBAN PLANNING AND MANAGEMENT: a metropolitan example

Kwi-Gon Kim

Risk assessment has become a major issue to widen the horizons of urban planning and management to meet new goals. Of great significance in such assessments is the prediction and evaluation of existing and potential human health effects due to energy sources and usage. In this article, the author presents the main findings of of a MAB project in Seoul, which was conducted as a third phase of ecological studies of Seoul Urban Systems, under the auspices of the National MAB Committee of the Republic of Korea, with the financial support of Unesco-MAB. He argues that by better understanding of the cause and effect relationship between energy utilization and environmental health and by integrating urbanism and risk issues through the planning process-a process of integration, cities can be planned and managed for greater safety.

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Introduction

A related symptom of rapid urban growth in many of the Third World's largest cities has been the tendency of a single city to dominate a country, creating serious social and economic imbalances. Air, water, noise, and solid waste production are increasing rapidly. A growing number of inhabitants suffer from preventable, environmentally based diseases.

The risk issues associated with urbanization appear to have received relatively little attention, and there seem to be few examples of the application of risk assessment methods to urban planning and management by planners, managers and decision-makers. Using Seoul in the Republic of Korea as a case example, studies were undertaken to demonstrate the concept and mechanics of the risk assessment methods in analysing the relationship between SO_2, Nox, CO, TSP exposure and the related increase in respiratory diseases and mortality.

This paper first reviews various approaches employed in risk assessment in general, and then introduces the analytical approach developed for the study of risk assessment in specific which should be considered in dealing with the urbanization issues. Main findings of the assessment exercise are summarized and their policy implications for the planning and subsequent development of the city are discussed. The paper concludes by focussing on the guidelines and difficulties that have arisen in Seoul in terms of the integration of risk factors into the overall urban planning process.

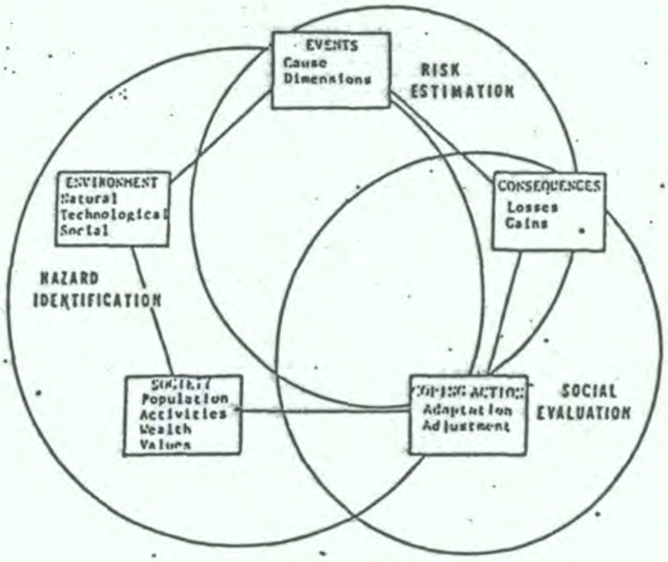
Approaches to Risk Assessments

The literature on risk assessment has grown over the past decade (Lave and Seskin, 1977; Kates, 1978; Wadden, 1978; Environmental Resources Limited, 1985, Wilson and Crouch, 1987). Figure 1 shows risk assessment in coping with environmental hazard (Kates, 1978, p. 14).

There are certain features common to most cases studies.

(1) Most studies have been based upon experiences of risk assessment associated with the oil, chemical and nuclear industries. (Environmental Resources Limited, 1985, p. 1983). Increasing attention has been paid to the prevention of human health damage from toxic chemicals.

Fig. 1. Risk assessment in coping with environmental hazard quoted in Kates (1978, p. 14)



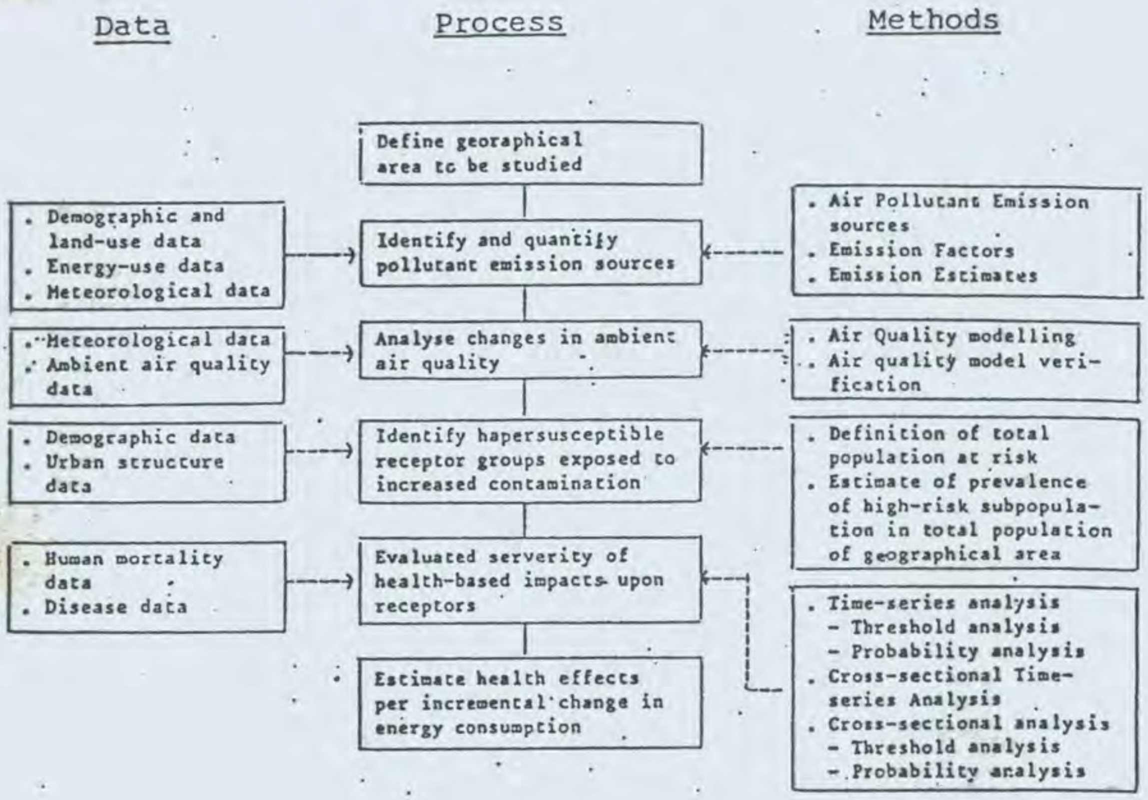
(2) The research efforts have been heavily biased toward refinement of the estimates of risk rather than the application of risk assessment to improving the design, operational practices and maintenance programmes of the installation or operation.

(3) Many studies have utilized formal, quantitative techniques risk assessment. There are limited studies of risk perception to understand how people think about and respond to the environmental risk.

(4) Risk analysis has enlightened environmental policy-making and medical decision-making. However, little appropriate researches dealing with risk assessment in urban decision making caused in the process of urbanization have been carried out actually.

In the Seoul MAB project, therefore, a more comprehensive analysis of energy utilization and human health risk was undertaken to aid urban plan-making and management. A study on the risk perception in Seoul was the subject of 1987 Seoul MAB Programe. In this research work, statistical analyses, including time series and cross-sectional analysis, were used to understand the risk to human health due to energy sources and usage. The overall framework for risk assessment in Seoul is shown in Figure 2.

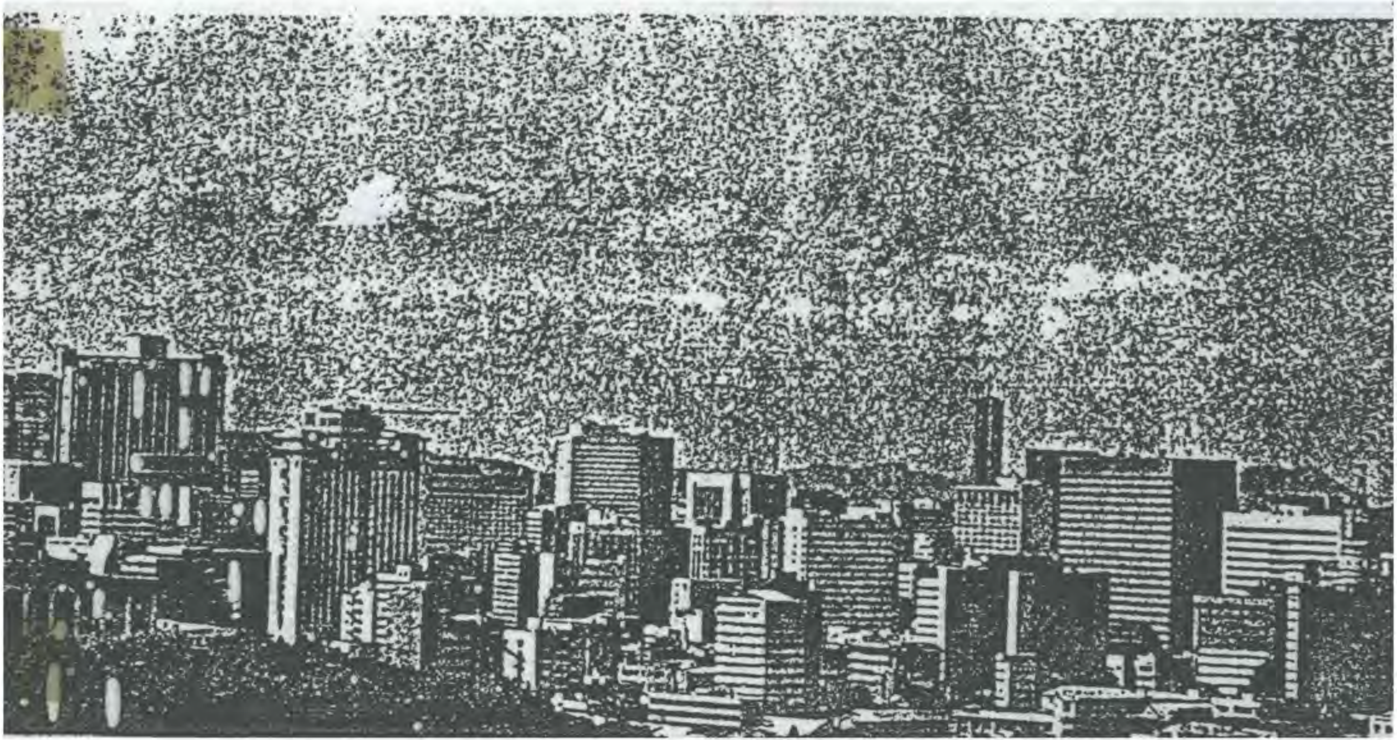
Fig. 2. Model for Quantitating and Predicting Health Risk of Fuel Use



Risk assessment in urban planning and management: an application

Having spent some time reviewing the approaches to risk assessment as well as identifying the basic stages through which the assessment proceeds, this study will now present the main findings of the assessment exercise in Seoul as a case study and by doing so, test the validity of the conceptual model. Before two key questions should be answered, consideration is given to any public policies which might influence the risk to human health due to urbanization. These are:

- What are the characteristics of a city which affects its demand for energy and accompanying environmental risk?
- How can all relevant risk aspects be considered in the urban planning process?



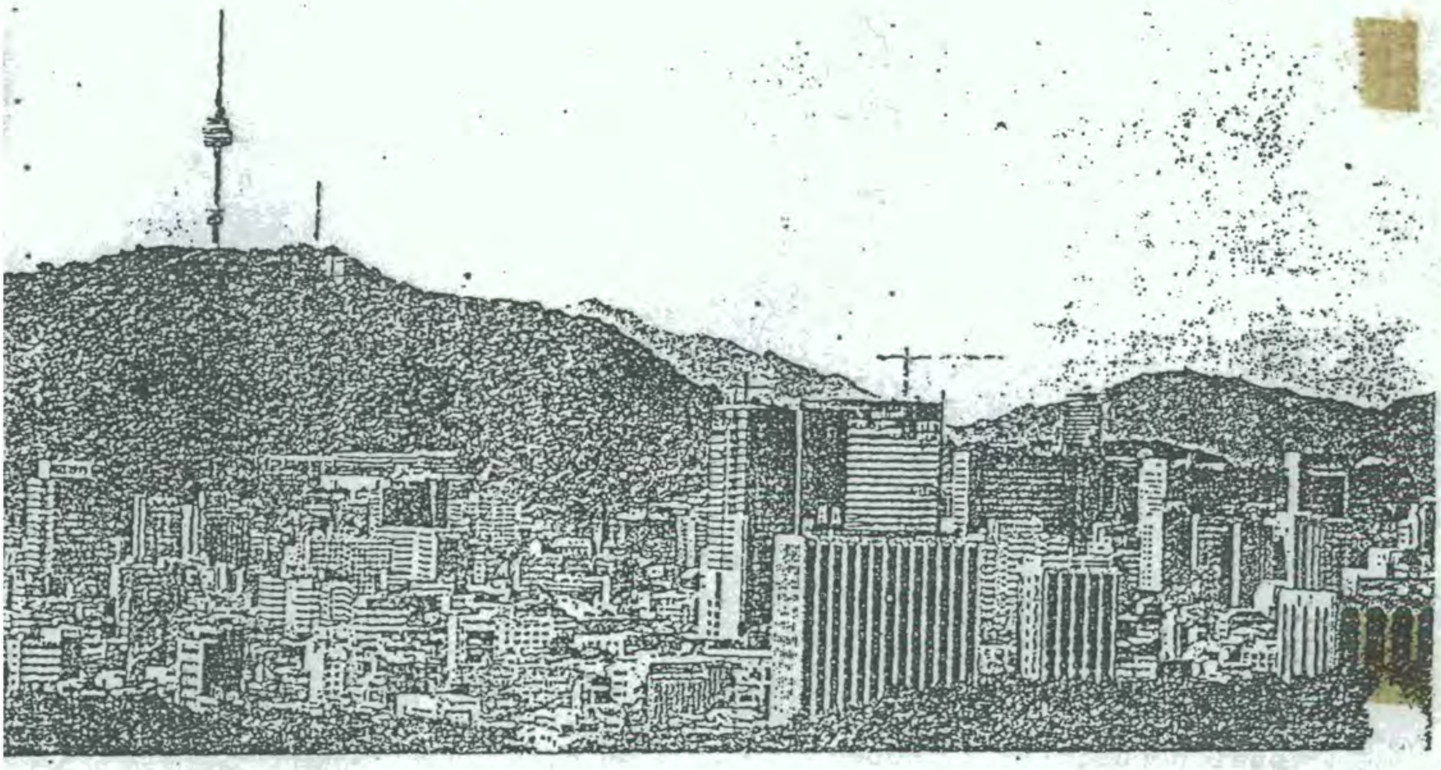


Fig. 3. Aerial view of Seoul

The study area

Urbanization in Korea has progressed in close parallel with the growing national economy. Seoul, the national capital city, has experienced a tremendous population growth. This rapid Seoul-ward trend has posed many urban problems such as disorderly urban sprawl, traffic congestion, housing shortages and overcrowding, outmoded urban infrastructures and resulting environmental pollution and risk. In terms of physical/spatial structure, located on the west-central part of the Korean Peninsula, Seoul sits in a basin virtually surrounded by scenic mountains (Fig. 3). It can be said that there is a great potential for air pollution in Seoul with two main reasons: (1) the City lies in the valley; and (2) comparably high frequency of inversions with low level mixing heights and calm periods are observed in Seoul. The change in urban structure from mono-nucleus to multi-nuclei may encourage an energy-efficient lifestyle, and thus alleviate urban environmental risk to human health. Figure 4 depicts the changes in urban structure of Seoul by decade. This figure includes the scheme for reorganizing the urban structure in the 2000s.

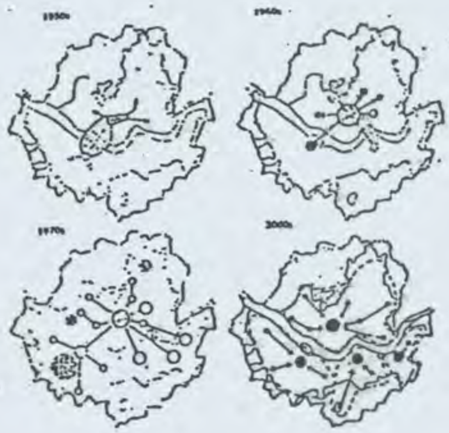


Fig. 4. Changes in urban structure of Seoul by decade quoted in Seoul Metropolitan Government (1980)

As of November 1, 1986, the population of Seoul stood at 9,798,542, which means that more than one-fifth of the total population of Korea lived on an area that accounts for no more than 0.63 percent of the whole national territory. The number of house-holds stood at 2,428,173 with the average number of family members per household being 4.0. As in the description of physical and spatial structure of Seoul, a knowledge of the geographical variation in population i.e., population density, is necessary for some purposes such as risk assessment. The levels of population density by ward (Gu) are shown in Figure 5.

Unit: Thousand persons/km^2

Fig. 5. Population density by Gu (as of the end of December, 1985)
Source: Statistics of Economic Planning Board (1986)

Identification and Quantification of Pollutant Emission Sources

In this case study, an attempty was made to estimate air pollutant emissions on the basis of fuel combustion. Fuel combustion is calculated using population statistics in conjunction with land-use data. (Table 1). Then the energy use data was superimposed on a current land use map by a 2.5 - 2.5 km grid system. Emission factors developed by the U.S. EPA were used to estimate gross pollutant emissions. The resulting SO_2 and TSP emission map for 1984 is shown in Figures 6 and 7.

Table 1. Energy consumption in Seoul (1984)

Unit: Kl, MT

	Domestic	Industry	Car	Truck	Total
Gasoline (Kl)	7,868	168,144	154,590		330,602
Kerosene (Kl)	1,562	432,158			433,720
Diesel (Kl)	0.4*:83,245 1.0:98,818	0.4:941,506 1.0:451,012		0.4:597,977 1.0:123,323	2,295,881
Bunker-C (Kl)	1.6:207,819 4.0:110,291	1.6:1,253,641 4.0: 191,381			1,763,132
Butane (Kl)	18,744	434,011			452,755
Propane (Kl)	66,434	81,400	146,774		294,608
Light Residual Fuel(Kl)	416,792	171,233			588,025
Anthracite(MT)	7,875,095	336,683			8,211,778
TOTAL	8,886,668	4,461,169	301,364	721,300	14,370,501

* indicates sulfur content (%).

Unit: Kg/hr

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.72	14.76	8.83	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.88	24.82	4111.07	15.04	0.00	0.00	0.00
0.00	0.00	0.00	0.00	4.50	11.72	3.56	8.51	306.26	50.02	14.20	6.71	0.00	0.00
0.00	0.00	0.00	0.00	27.79	36.14	12.77	30.63	140.18	58.91	55.41	15.29	0.00	0.00
0.00	0.00	0.00	0.00	63.17	83.73	52.41	61.43	154.43	85.89	125.45	54.54	0.00	0.00
25.74	29.19	8.19	17.74	93.50	89.41	116.43	145.58	157.07	146.16	199.75	83.19	0.13	0.00
29.88	152.04	190.78	23.92	117.19	106.91	325.89	263.26	342.43	151.10	183.59	25.29	63.62	56.32
6.22	42.91	97.14	114.26	221.94	66.04	225.86	162.81	139.16	142.43	155.03	68.81	157.20	28.64
0.00	30.48	110.01	132.86	257.96	137.94	113.75	73.85	150.05	152.41	59.49	122.66	247.13	0.00
0.00	158.86	184.81	213.29	236.17	57.59	171.03	133.43	141.66	118.27	104.81	44.91	69.38	35.63
0.00	20.41	18.57	74.13	55.44	80.60	50.40	94.71	82.57	94.97	94.62	62.40	14.85	0.00
0.00	0.00	0.00	0.00	113.35	10.17	14.96	0.00	0.00	89.49	57.16	0.00	0.00	0.00

Fig. 6. 1984 SO_2 emission

Unit: Kg/hr

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.63	5.25	4.69	10.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	8.20	394.93	18.32	0.00	0.00	0.00
0.00	0.00	0.00	0.00	1.48	4.77	0.82	1.49	1765.55	21.09	18.47	1.40	0.00	0.00
0.00	0.00	0.00	0.00	13.54	17.37	1.98	10.96	69.70	27.35	24.76	5.95	0.00	0.00
0.00	0.00	0.00	0.00	33.47	41.45	17.62	19.01	73.49	37.28	62.40	23.92	0.00	0.00
8.38	9.94	1.05	7.32	45.77	38.06	36.04	49.88	71.73	67.44	63.00	16.57	0.00	0.00
5.94	19.95	41.26	9.04	54.42	45.64	92.42	67.93	103.97	47.03	65.26	6.01	25.09	13.54
1.02	18.03	41.77	33.36	36.86	23.45	14.70	40.99	36.16	38.82	55.82	21.22	69.03	9.49
0.00	3.50	47.11	36.56	74.77	43.54	31.64	22.64	41.63	40.82	22.11	49.65	120.87	0.00
0.00	25.08	36.90	52.88	80.36	30.27	64.79	45.01	34.79	24.95	20.92	15.24	20.40	13.62
0.00	3.62	2.59	19.66	17.94	42.32	25.72	21.50	9.77	14.79	11.75	8.73	1.96	0.00
0.00	0.00	0.00	0.00	40.82	4.15	6.84	0.00	0.00	8.81	5.79	0.00	0.00	0.00

Fig. 7. 1984 TSP emission

Analysis of Changes in Ambient Air Quality

An increase in emissions would, of course, yield an increase in overall air pollution concentrations. The extent of the increase is dependent on many factors such as the stability of the atmosphere; horizontal wind speed and direction; the natural topography of the area as well as shape and location of man-made structures; the geometry of the area from which the increase in emissions is generated; and background levels of the pollutants already in existence.

For this case study the Hanna and Gifford model was used. Results of applying the Hanna-Gifford model to the conditions of Seoul are shown in Tables 2 and 3.

Table 2. Calculated SO_2 concentrations for Seoul in 1984 (annual averages)

Unit : ppm/hr

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-0.000000	0.000000	0.005794	0.011731	0.009053	0.008317	0.007169	0.001678
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005236	0.017778	2.736151	0.703877	0.575566	0.267950	0.212009
0.000000	0.000000	0.000000	0.000000	0.002990	0.008572	0.004680	0.007566	2.133078	0.558507	0.374388	0.221893	0.171286	0.142213
0.000000	0.000000	0.000000	0.000000	0.018445	0.028551	0.016860	0.027428	0.102992	0.068573	0.064056	0.037698	0.022003	0.017101
0.000000	0.000000	0.000000	0.000000	0.065295	0.066765	0.054564	0.061180	0.176096	0.098709	0.123719	0.086797	0.067538	0.031872
0.017105	0.023571	0.012495	0.017565	0.068915	0.079537	0.106001	0.152790	0.152060	0.154150	0.105183	0.098307	0.058625	0.065408
0.019854	0.105902	0.154248	0.067487	0.109971	0.113422	0.263771	0.761065	0.376093	0.773169	0.730778	0.176938	0.178856	0.118814
0.004155	0.029527	0.072105	0.095998	0.177825	0.098921	0.194856	0.176762	0.164520	0.167681	0.179118	0.126966	0.175731	0.100729
0.000000	0.020252	0.078073	0.108556	0.204736	0.154110	0.136359	0.108878	0.158793	0.167697	0.112250	0.144086	0.753786	0.097867
0.000000	0.105554	0.148735	0.186039	0.218540	0.115650	0.173752	0.161159	0.167617	0.135726	0.165777	0.106990	0.111617	0.088307
0.000000	0.013561	0.015671	0.054105	0.051897	0.071474	0.058116	0.087149	0.087726	0.098541	0.103709	0.085406	0.051613	0.033815
0.000000	0.000000	0.000000	0.000000	0.075515	0.025265	0.021695	0.010582	0.007710	0.065716	0.057911	0.021956	0.014955	0.011933

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Table 3. Calculated TSP Concentrations for Seoul in 1984 (annual averages)

Unit : $ug/m^3/hr$

0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.096	10.777	6.077	-7.471	1.677	1.263
0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.355	16.140	753.866	221.514	110.678	77.997	61.690
0.000	0.000	0.000	0.000	2.696	9.717	4.153	4.683	3353.577	865.016	495.123	339.480	264.987	220.491
0.000	0.000	0.000	0.000	25.705	39.290	15.306	28.416	143.052	91.724	85.281	47.388	28.373	22.166
0.000	0.000	0.000	0.000	63.537	94.299	61.798	60.953	165.249	173.173	169.038	109.669	55.156	41.260
15.908	22.779	8.762	18.822	95.686	98.152	101.403	152.547	186.776	194.096	195.065	112.752	65.767	50.852
11.276	40.643	89.142	47.566	122.515	175.445	223.107	207.972	276.718	197.086	215.479	109.778	122.470	98.511
1.956	36.705	87.965	87.585	99.596	80.559	176.518	157.175	128.483	151.529	166.153	110.771	191.990	97.759
0.000	6.815	91.105	92.292	171.631	135.940	113.295	93.787	176.077	137.188	100.875	147.863	294.150	104.777
0.000	47.610	81.768	125.977	191.176	118.750	175.550	152.719	155.176	111.900	99.596	85.151	90.681	77.588
0.000	6.872	6.605	39.450	44.546	94.707	77.525	70.547	48.442	53.677	48.611	41.950	27.466	19.801
0.000	0.000	0.000	0.000	77.490	26.920	25.304	11.689	8.391	25.495	20.842	9.957	7.550	6.375

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Identification of Hypersusceptible Receptor Groups Exposed to Increased Contamination

Certain populations are known to be more susceptible to the adverse effects of pollutants than other groups. For example, people with respiratory problems generally are more sensitive to ozone pollution than are normally healthy individuals. Young children are sensitive to all pollutants because of their high metabolic rate. (Hankett, 1978, p. 169).

Tables 4 and 5 summarize the populations of hypersusceptibles considered to be at risk from the pollutants studies.

Table 4. Some population groups at high risk to pollutant exposures.

Unit : Person

Susceptible Group	1980	1981	1982	1983	1984	1985
Total Population	8,366,756	8,676,037	8,916,481	9,204,344	9,501,413	9,645,932
Children under 5 years old	989,173	1,028,905	1,061,259	1,022,327	1,063,118	
Female over 30 years old	1,497,581	1,557,580	1,605,613	1,637,942	1,688,921	
Respiratory Disease	674*	661	817	823	944	1,064
Bronchitis	68	87	36	28	31	32
Chronic Bronchitis	1	0	24	28	47	38
Emphysema	8	9	11	10	37	41
Asthma	218	235	283	266	291	356

* Based on the Korea Medical Insurance Corporation Statistics.

Table 5. Children under 5 years old by Ward of Seoul (1984)

Unit : Persons

Ward	Children	Ward	Children
Chongro-gu	25,897	Kangso-gu	75,283
Chung-gu	21,773	Yongsan-gu	33,172
Songdong-gu	79,721	Kuro-gu	76,249
Tongdaemun-gu	98,324	Yongdungpo-gu	49,297
Songbuk-gu	63,718	Tongjak-gu	44,102
Tobong-gu	91,587	Kwanak-gu	63,386
Unpyung-gu	42,136	Kangnam-gu	59,787
Sodaemun-gu	42,287	Kangdong-gu	74,544
Mapo-gu	45,287		

Evaluation of Severity of Health-based Impacts upon Receptors

Here an attempt was made to assess the relationships between environmental quality and human health to which the predicted changes in air quality can be applied by different statistical analyses of health risks of air pollution.

The following methods were used to test the validity of the various models for risk evaluation coming into use, using source data in Seoul.

A Visual and Quantitative Estimate

This method illustrates the populations of hypersusceptibles exposed to different levels of the pollutant. The isopleth exposed lines of calculated environmental concentrations were overlaid on the density maps of total population and children under 5 years old.

Figure 7 shows the spatial relationships between SO_2 concentrations and populations of children under 5 years old as an example in Seoul.

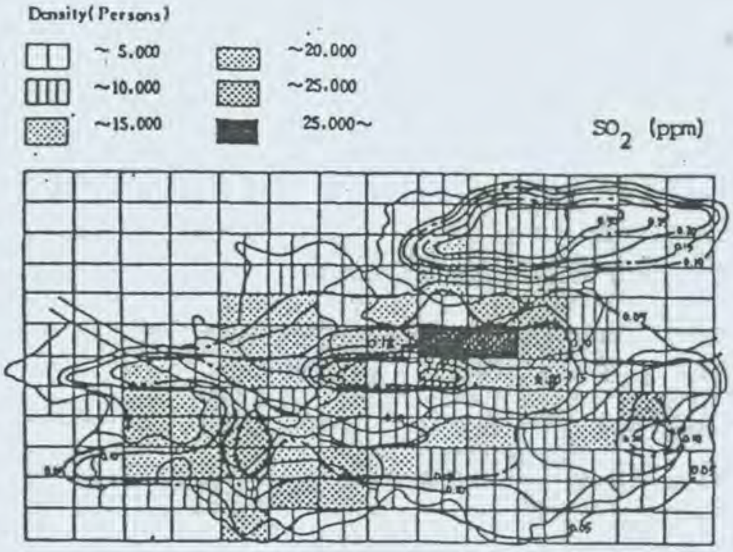

Figure 7. Children under 5 years old exposed to different calculated levels of SO_2 in Seoul, 1984

A Cross-sectional Analysis

The cross-sectional analysis was used for seventeen districts of Seoul. In order to examine the influence of air pollutant concentrations on mortality and morbidity, Pearson correlation coefficients of the monthly mean concentrations from September to October, 1984 were calculated for the mortality and morbidity.

Table 6. shows the correlation coefficients between air pollutant concentrations, mortality, and morbidity. The analysis indicates that the frequency of chronic bronchitis is correlated with monthly levels of SO_2, TSP and, SO_2 and TSP mix (STP), although the correlation is not statistically significant.

Table 6. Correlation coefficients between air pollutants (SO_2, TSP, CO, NOx, STP) concentrations and mortality, and morbidity in the districts of Seoul (September - October, 1984) (N = 17)

	General Mortality	Respiratory[2] (460-519)	Bronchitis[3] (490)	Chronic Bronchitis[4] (491)	Emphysema[5] (492)	Asthma[6] (493)
SO_2	0.2764 (P=0.298)	-0.1649 (P=0.377)	-0.2604 (P=0.309)	0.2889 (P=0.289)	-0.2036 (P=0.348)	-0.2089 (P=0.346)
LSO_2[1]	0.2732 (P=0.300)	-0.2524 (P=0.315)	-0.1225 (P=0.409)	0.1760 (P=0.369)	-0.2580 (P=0.311)	-0.2469 (P=0.319)

A Time-series Analysis

This analysis shows the correlation between environmental (SO_2) concentration and death cause rates during the period from 1980 to 1985. For illustration purposes, an attempt to determine the relationships between SO_2 concentration and general mortality was made for each year separately in graphic form (Figure 8.)

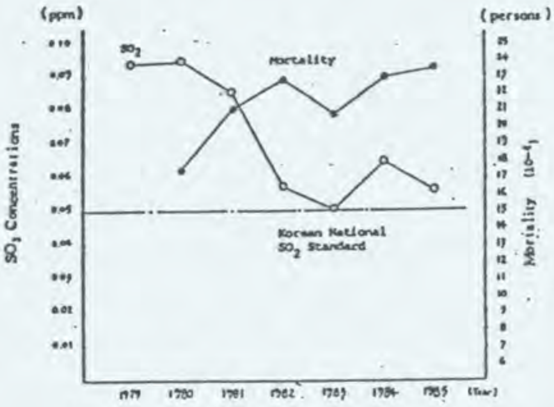

Fig. 8. SO_2 and mortality trends in comparison with the Korean national SO_2 standard .

Then, in order to examine the influence of SO_2 concentration on the rates of death cause, Pearson correlation coefficients of the annual mean SO_2 concentration were calculated for the rates of death cause. The resulting correlation coefficients are shown in Table 7.

Table 7. Correlation coefficients between SO_2 concentrations and rates of death cause in Seoul, 1980-1985 (N=6)

	General Mortality	Respiratory[2] (460-519)	Bronchitis[3] (490)	Chronic Bronchitis[4] (491)	Emphysema[5] (492)	Asthma[6] (493)
SO_2	0.2764 (P=0.298)	-0.1649 (P=0.377)	-0.2604 (P=0.309)	0.2889 (P=0.289)	-0.2056 (P=0.348)	-0.2089 (P=0.346)
LSO_2[1]	0.2732 (P=0.300)	-0.2524 (P=0.315)	-0.1225 (P=0.409)	0.1760 (P=0.369)	-0.2580 (P=0.311)	-0.2469 (P=0.319)

Note : 1) indicates SO_2 concentrations transformed by an exponential.

2)-6) used the mortality from respiratory disease, bronchitis, chronic bronchitis, emphysema and asthma derived by dividing the number of deaths from each disease by total population.

Regression between air pollutant emission and mortality during the period from 1975 to 1984 in Seoul.

In this analysis, emissions from fuel consumption was used as a surrogate for pollution. Data on emissions and the total mortality rate used in this analysis were annual values during the period from 1975 to 1984. Air pollutant emissions were calculated from annual energy consumption based on the Seoul Statistical Yearbook. The results of applying the previously discussed emission factors are presented in Table 8. In an attempt to determine the relation between air pollutant emissions and mortality, multiple regression analysis was performed for Seoul, using case I of Table 8. In the following equation mortality rate was regressed on CO and SO_2 in Seoul.

$$\text{Mortality} = -0.29065 \times 10^{-5} \times CO\ (kg) - 0.39953 \times 10^{-5} \times SO_2\ (Kg) + 4.96441$$

The multiple regression results explain more than 58% of the total variations $R^2 = 0.58297$ in mortality. The F value by analysis of variance is 3.49475, but it is not significant (SIGNIF F = 0.1123). The results of linear multiple regression analysis are not encouraging in that they are not consistent with the hypothesis that air pollution increases the mortality rate. Mortality rates presumably reflect the influence of technology (e.g. medical improvement), a great many environmental and time factors. However, this analysis does not account for factors other than pollution.

Policy Implications

Seoul has been promoting environmental programs with a view to better preparing for the 1986 Asian Games and the 1988 Olympics and more thoroughly preserving the environment for the 2000s. The situation described in the previous sections illustrates how sound environmental planning objectives can be frustrated by uncertainty in related areas of public policy-making. Nevertheless, some of the basic considerations in incorporating environmental risk concerns in the formulation of public policy can be suggested using some specific data from this case-study as follows:

Table 8. Air pollutant emission by year with population and death (Cases I and II)

Unit: Metric Ton (MT)

	Population	Death	Case I				Case II			
			SO_2	TSP	NOx	CO	SO_2	TSP	NOx	CO
1975	6,889,502	25,715	160,069	37,642	17,273	307,357	62,052	35,552	17,273	307,357
1976										
1977										
1978	7,823,195	29,301	278,803	47,646	30,859	332,250	110,250	41,111	30,859	332,250
1979	8,114,021	29,532	277,653	45,579	31,398	310,576	110,571	38,877	31,398	310,576
1980	8,366,756	30,887	263,412	46,630	29,601	335,251	104,389	40,989	29,601	336,799
1981	8,676,037	30,990	267,816	46,550	32,266	336,799	114,185	41,316	32,266	336,799
1982	8,916,461	31,498	255,290	43,004	31,219	306,919	110,243	38,095	31,219	308,919
1983	9,204,344	32,016	292,691	46,231	35,392	320,343	124,986	40,140	35,392	320,343
1984	9,501,413	30,569	315,672	52,010	38,519	372,939	133,843	46,051	38,519	372,939

Note:

1) Data are missing in 1976 and 1977

2) Sulfur Content (%)

	Gasoline	Kerosene	Light Residual Fuel	Bunker -C	Anthracite	Others
Case I	0.1	0.22	1.0	4.0	0.8	1.4
Case II	0.1	0.22	0.4	1.6	0.3	1.4

- The change in urban structure from mononucleus to multi-nuclei may encourage an energy-efficient life style of self-contained communities and function in an energy efficient manner. At issue here is the trade-off between air pollution averages and variations.

- "Risk Zoning" is potentially applicable to the Seoul area as an urban management tool. To insure its implementation, a strong, coordinated working relationship between the central and local air pollution agency and the Seoul Municipality is necessary.

- Air quality objectives were not fully taken into account in the process of designating five major areas of Seoul. The guidelines for risk assessment in urban planning and management, suggested in the author's UNESCO/MAB report (Kim, 1987), can be widely used in Korea as well as in other countries (Figure 9).

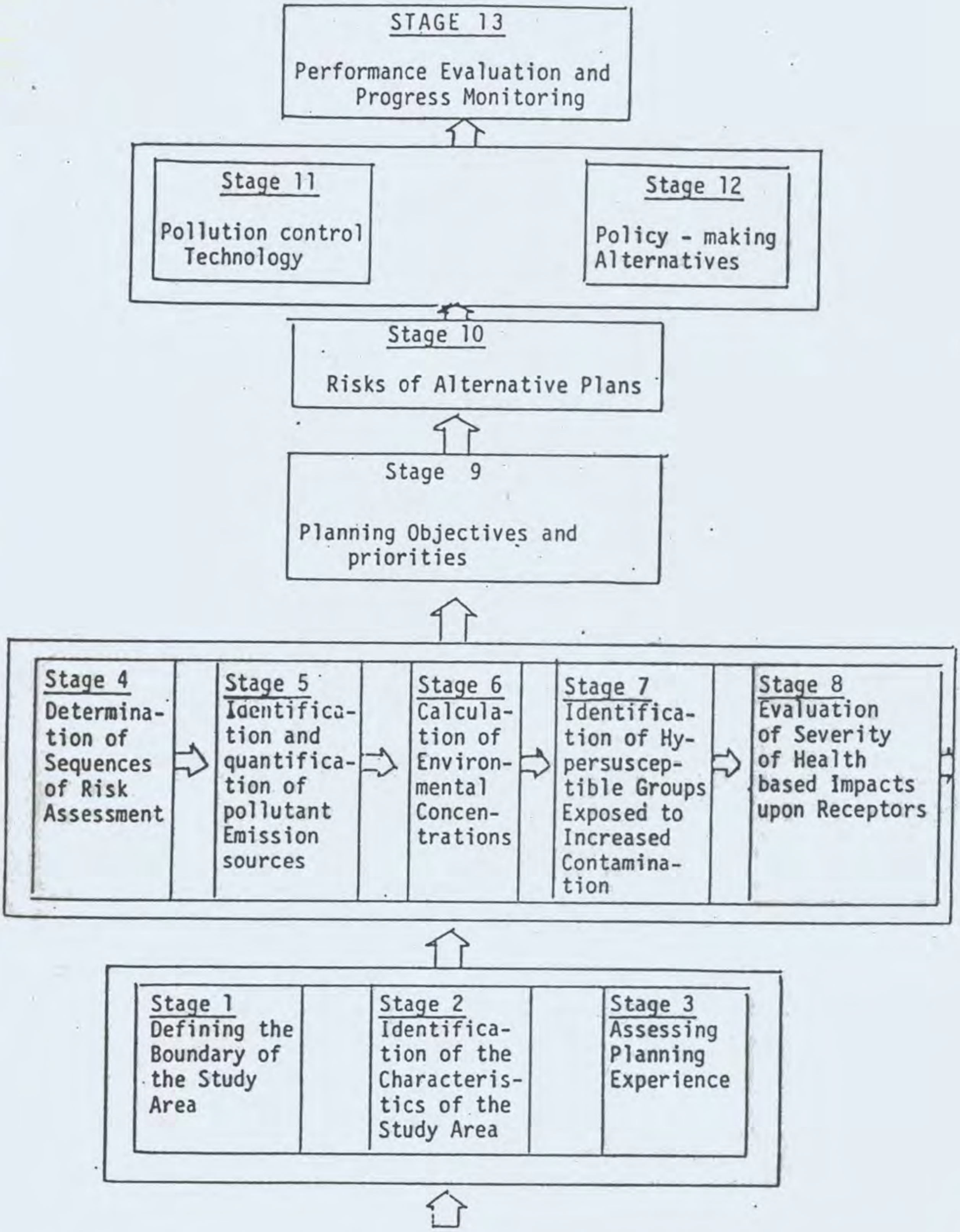

Fig.9. The framework for risk assessment in urban planning and management

Conclusion

The purpose of this paper is to explain and demonstrate assessment methods that can be used to incorporate human health considerations into the urban planning process. Most methods used in this case study are useful for making risk analysis when no long-term observed ambient data exist. When data on emissions and ambient air quality are both available, the mapping package in the risk model will give insight into the spatial relationships of the two.

In Seoul, it may be difficult to draw general conclusions based on the findings of each analysis since most of the source data to be used is not sufficient. Some of difficulties that have arisen in Seoul in terms of the integration of environmental risk issues into the overall urban planning process can be listed as follows:

- Lack or inadequacy of awareness of the importance of risk assessment;
- Choice of risk assessment methods;
- Continual tension between the dual goals of economic development and environmental pollution control;
- Lack of environmental health information and environmental quality data.

Finally, it is important to note that the validity of the 'statistical' approach is limited when human/or material resources are limited to accumulate long-term daily source data. Therefore, it is suggested that all knowledge of science and technology, and societal perceptions, attitudes or values has to be utilized to improve risk assessment in urban planning and management. For example, society must weigh the benefits and cost of achieving improved air quality to determine its importance relative other national and local priorities.

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Design for energy-conserving cities: a new town example

Kwi-Gon Kim

Energy conservation has become a major tenet of the environmental ethic, especially since the energy crisis of the early 1970s. At the same time, energy consumption in the world's cities continues to rise. In this article, the author presents the findings of a MAB project in Gwachon New Town, which was conducted by an interdisciplinary research team including both natural and social scientists, under the auspices of the National MAB Committee of the Republic of Korea, in co-operation with the Korea Science and Engineering Foundation and with the support of Unesco-MAB. He argues that by better understanding the relationship between city form and energy and by analysing the energy demands of alternative designs, cities can be designed and organized for greater energy efficiency.

Introduction

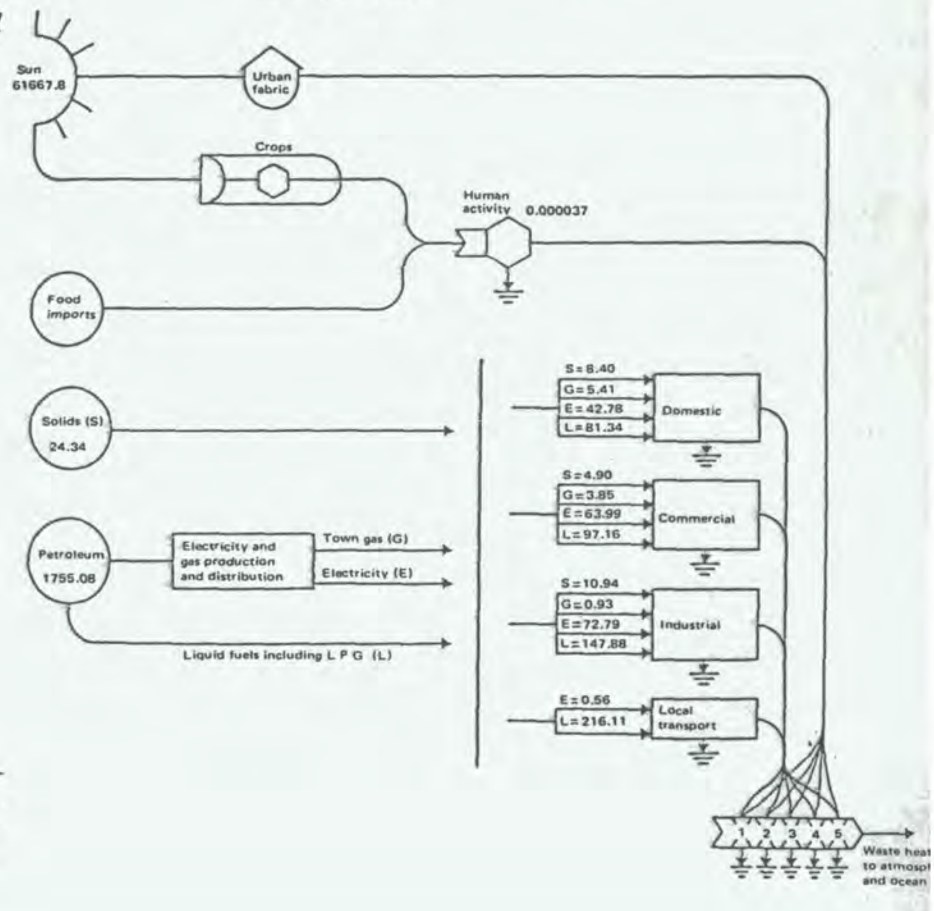
One image of the city is as a voracious consumer of energy. Many studies have been undertaken of energy flows in cities to find ways to reduce energy use, shorten energy paths and to encourage energy conservation. Despite these efforts, the general trend of urban energy consumption is upwards.

Less attention has been paid to the design of cities to be energy-efficient. Traditionally, throughout the world, the sites for homes and farms were carefully selected with respect to climate and geography. Factors such as sunshine, shade, wind, cold and cloud were taken into consideration. In a less-populated world, houses and settlements were often linked by energy-efficient, least-distance routes.

To some extent, to design the energy-efficient city is to rediscover the experience of the past. But cities also pose new challenges to the designer; they are high-density, complex socio-economic, political and physical systems. Using Gwachon New Town in the Republic of Korea as a case example, studies were undertaken to evaluate the energy-saving implications of alternative urban designs.

Previous studies have generally focused on the distribution of energy. As an example, Figure 1 shows the flows of energy in Hong Kong (Douglas, 1983). Knowledge of energy flow patterns is not enough to design more energy-efficient cities. In the Gwachon New Town MAB project, therefore, a more comprehensive analysis of energy use, and particularly the energy efficiency of alternative urban designs, was undertaken. The overall framework for this analysis is shown in Figure 2.

FIG. 1. Flow of energy in the Hong Kong ecosystem (based on data in Newcombe, 1976) quoted in Douglas (1983).



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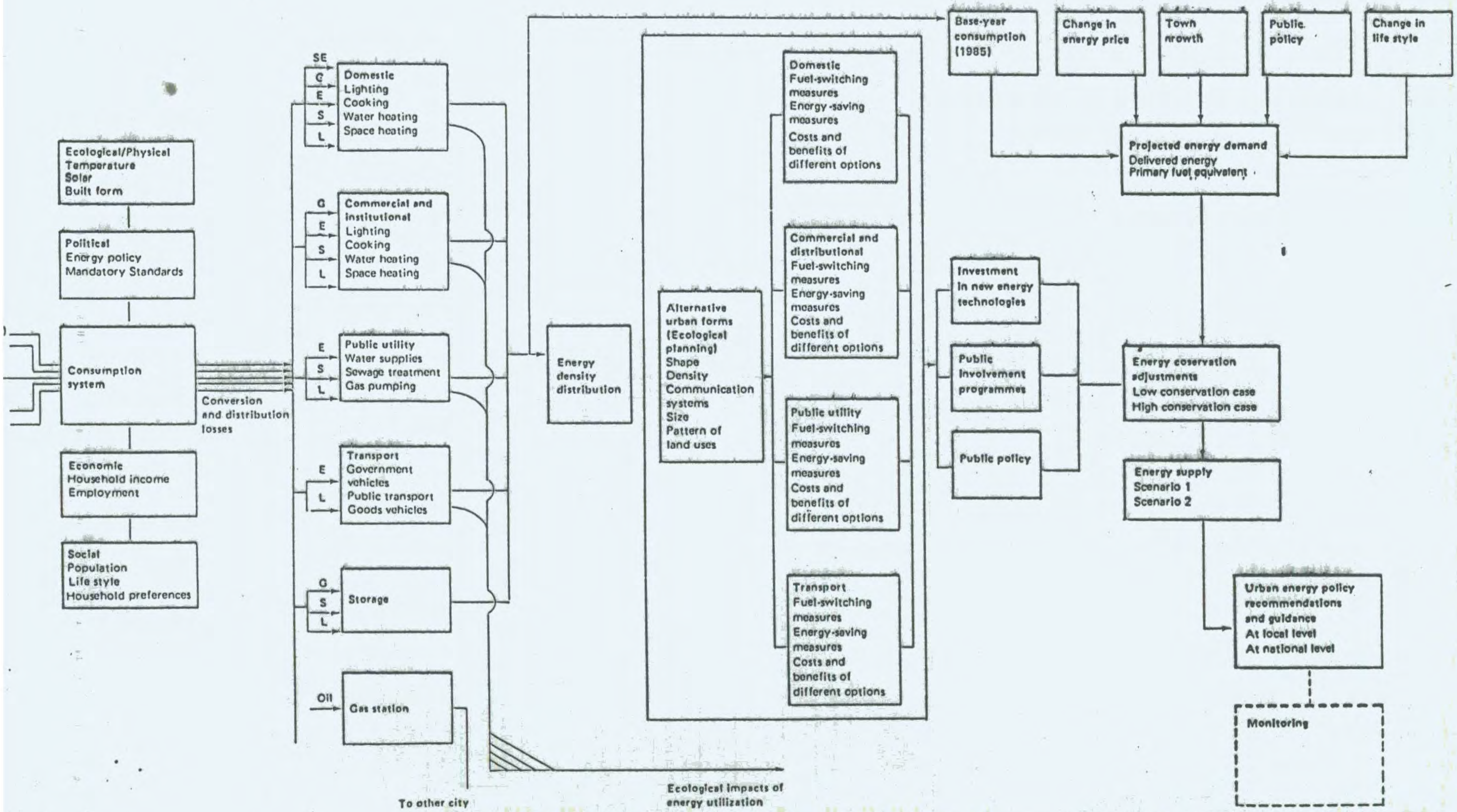

FIG. 2. A framework for energy analysis in Gwachon New Town: Gwachon energy modelling and scenario assessments.

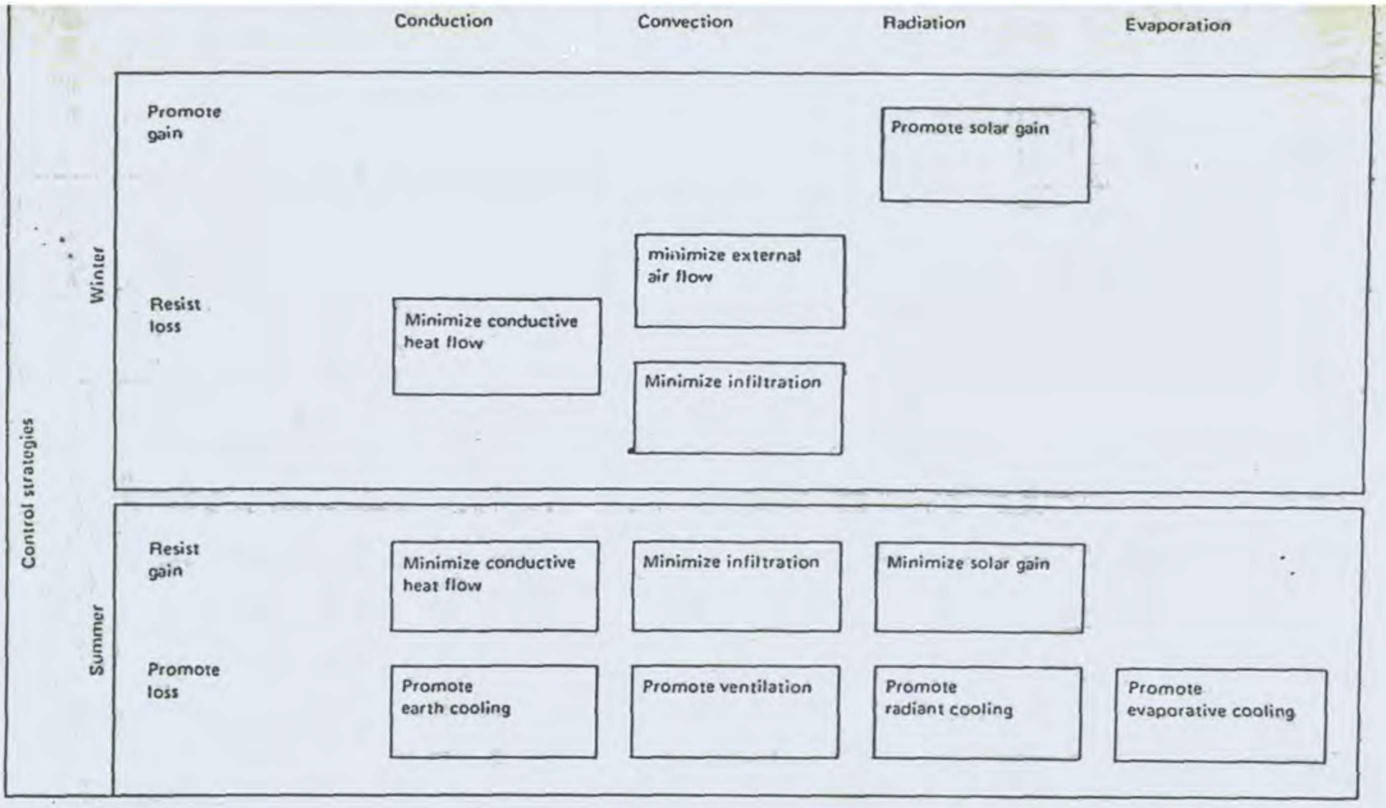

FIG. 3. Summary of the principles and strategies of climatic design (Watson and Labs, 1983).

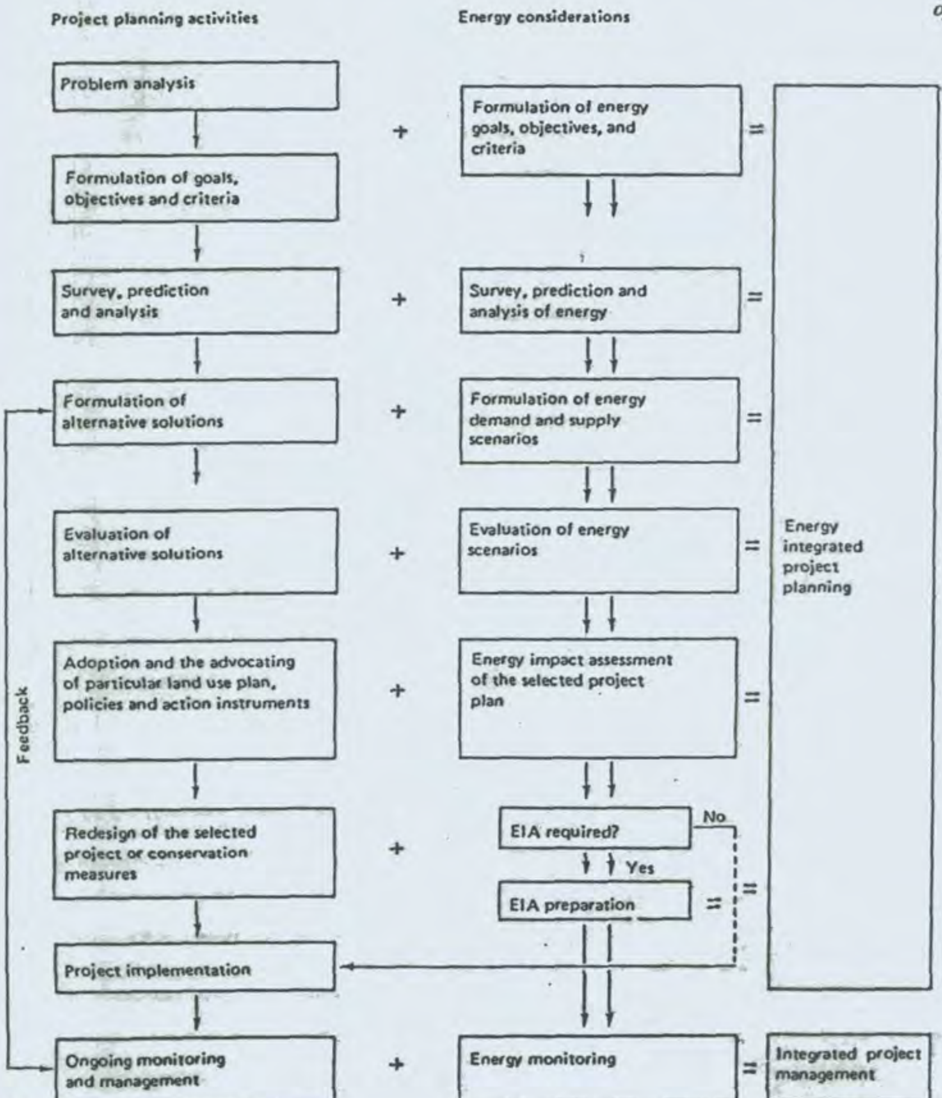

FIG. 4. Integrating urban planning and energy.

Approaches to the identification of energy-efficient cities

Much can be done to conserve energy merely through good design, on both the large and small scale.

Two complementary approaches to the identification of energy-efficient land-use patterns may be distinguished (Owens, 1984). The first is a deductive approach in which alternative spatial structures are investigated to identify those with low-energy requirements. This approach was used by Manohar (1982) to identify an energy-efficient land-use pattern for the redevelopment of the Perth metropolitan area in south-west Australia.

The second approach is more normative; it starts with energy-saving principles (for example, promotion of combined heat and power (CHP) generation) and from these, appropriate spatial structures are then devised. This approach of design in relation to climate characterizes the whole history of building and architecture (Watson and Labs, 1983). However, climatic design means different things in winter and summer. In winter, the objective is usually to resist loss of heat from the building interior and to promote gain of solar heat, such as directly through south-facing windows. In summer, depending on the latitude, these objectives are reversed; to resist gain of solar heat, such as through sun-shading, and to promote loss of heat from the building interior. To achieve these objectives, Watson and Labs (1983, p. 5) also suggested nine practical climatic design principles (Fig. 3).

Once a designer understands the local climate from analysis of weather data, the set of climatic design principles appropriate to that climate can be elaborated and climatic design choices compared. 'Energy-integrated' planning and design in the context of a highly urbanized area should mean the integration of the basic energy considerations in the entire site selection, planning and design process (Fig. 4).

In the Gwachon case-study, it was recognized that both deductive and normative approach would need to be employed in any truly 'energy-integrated' planning process.

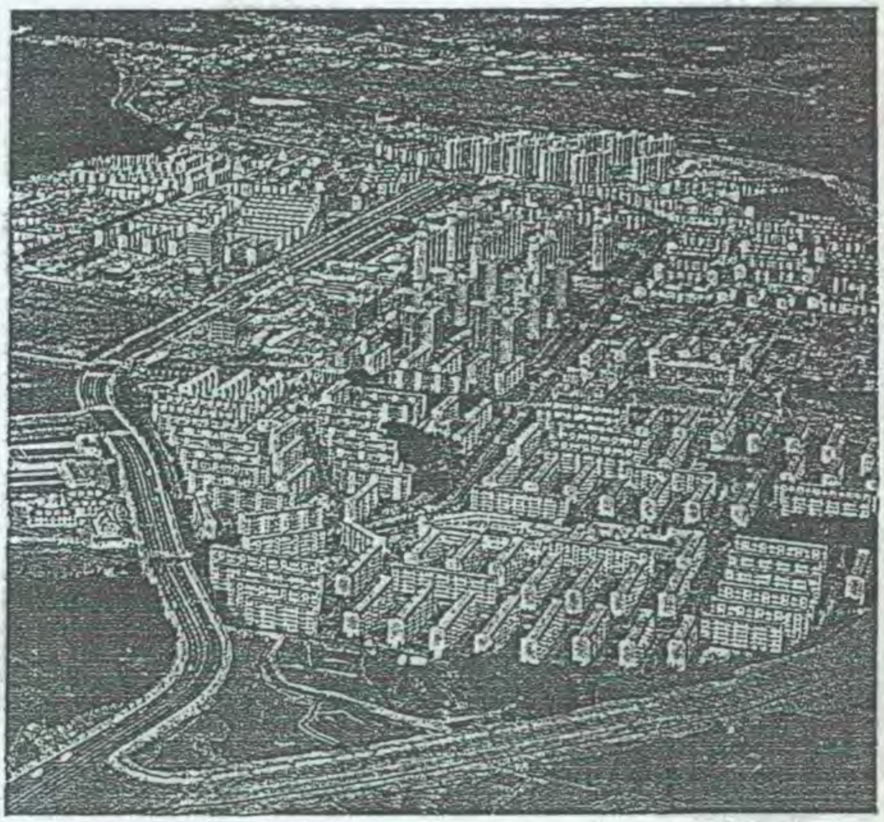

FIG. 5. Aerial view of Gwachon New Town.

Design for energy-conserving cities: an application

Here an attempt is made to show how 'energy-integrated' planning and design concept can be applied to an actual urban area and integrated with site specific data. It was envisaged that knowledge of the relationships between energy, land use and climate in town planning and building design could reduce energy demand, and thus alleviate many of urbanization's adverse effects and urban environmental risk to human health, plants and animals.

The study area

Construction of Gwachon New Town commenced in 1979, in an area 5 kilometres south of the municipal boundary of Seoul. It lies in the valley situated between Gwanak Natural Park and Chyongge Natural Park (Fig. 5). The town was planned during the period 1979 to 1984 to be built in four phases to accommodate 63,000 residents and to house the second Government Hall. The initial plans for the town were not based on maximizing energy efficiency, so that the results of the MAB project were able to indicate to the planners, more energy-efficient alternatives.

Energy density

For energy planning purposes, a knowledge of the geographical variation in energy usage, i.e. energy density, is necessary. For example, feasibility studies for combined heat and power (CHP) require the preparation of heat load density maps. Other applications relate to assessing the effects of artificial heat release in urban areas on weather and climate, or to the environmental implications of energy-use patterns. Various approaches have been used to produce energy or heat load density maps. Most use land-use data in some form.

In Gwachon, the energy-use data were recorded in the form of net heat density on a land-use map (Fig. 6). The land-use map was then superimposed on a net heat density map using a 100-metre grid system. The resulting energy density map for the town is shown in Figure 7.

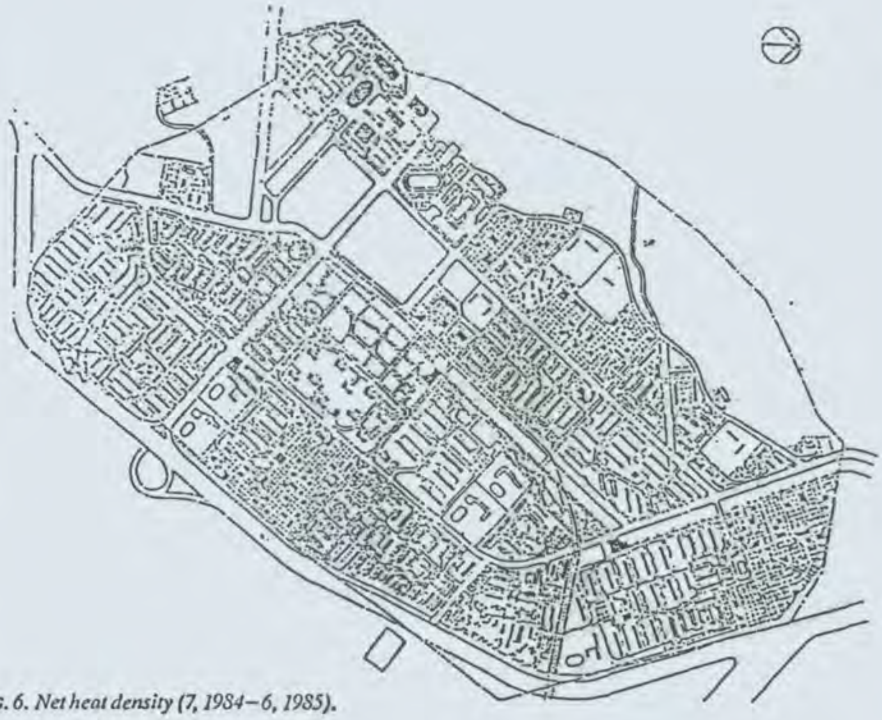

FIG. 6. Net heat density (7, 1984–6, 1985).

Details of the key for Figs. 6, 8 and 9 may be obtained from the author at the address on page 20.

Urban form

Urban form includes building density, land use and the pattern of transportation routes and other infrastructures. Since the density of Gwachon New Town was already decided, the study concentrated on evaluating possible alternatives in terms of transport, mixture of uses (activities), design and infrastructure (energy supply). These alternatives were then used as a vehicle for a general discussion on energy efficient urban forms. Figures 8 and 9 show the existing urban form in terms of land use and layout and an alternative, more energy-efficient urban form.

The two plans show how land uses and buildings in Gwachon might have been rearranged to take into account the six main findings of the project that:

- Defined routes be planned for public transport.
- Attractive routes for cycleways and pathways be planned.
- Higher housing densities be planned in the city centre (central business district).
- A majority of houses be oriented towards the south.
- Landscape planting for energy conservation be planned.
- A possible combined heat and power/district heating (CHP/DH) system be introduced.

The energy-saving implications of some possible alternatives in light of energy-efficient land use are discussed in the following.

FIG. 7. Current land-use and heat-load density (7, 1984–6, 1985).

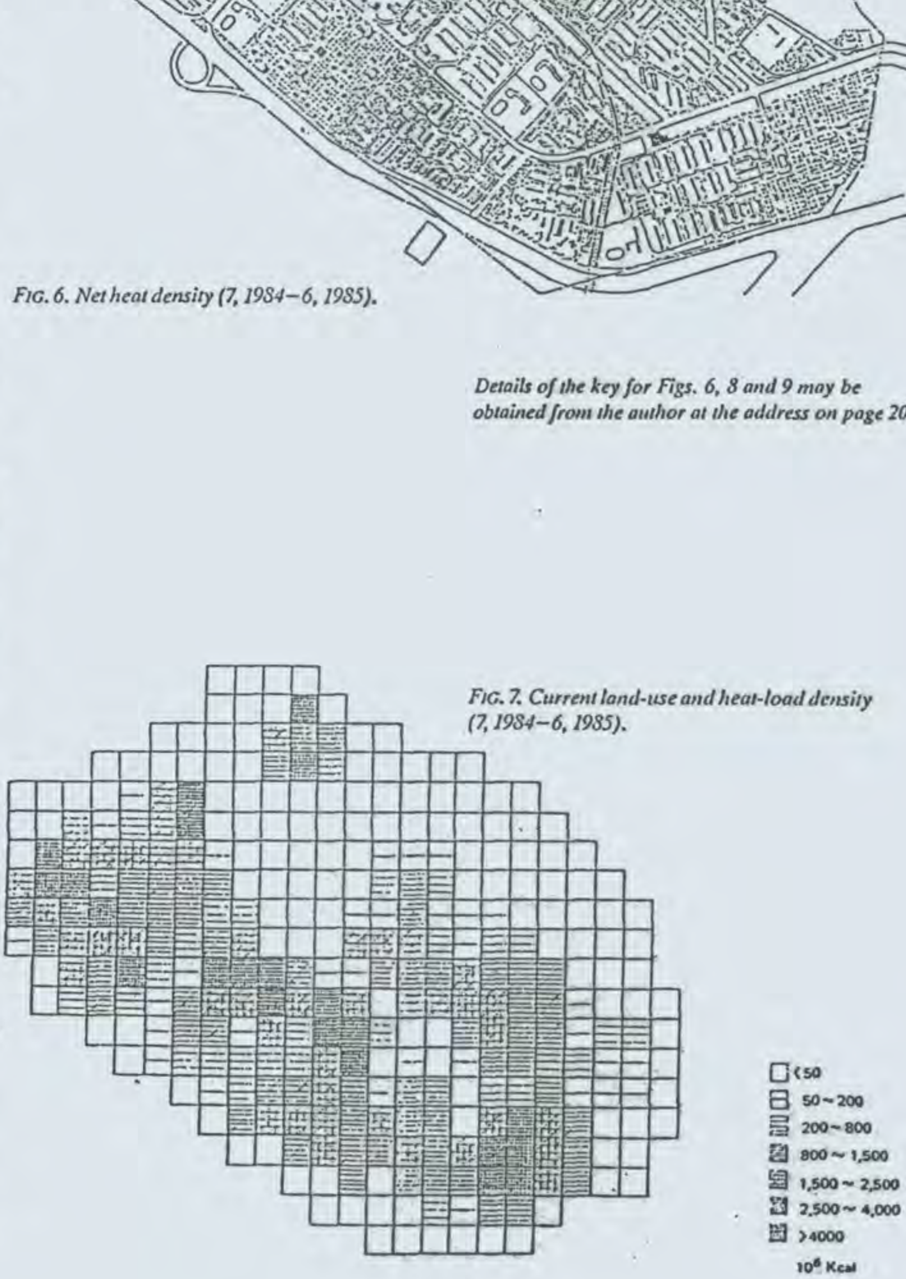

FIG. 8. Current urban form.

FIG. 9. Alternative urban form.

Transport

In considering transportation, which is a major reason for urban energy consumption, attention was paid to:

1. The energy-saving implications of non-rectilinear street plans,
2. Facilitating greater use of energy-efficient modes: walking and cycling, and an efficient public transport system.

One important finding was that curvilinear streets are a useful way to save energy. In Figure 10, a possible subdivision of site 9 in Gwachon is shown as a rectilinear pattern *(left)* and curvilinear pattern *(right)*.

Similar non-rectilinear street plans were applied to other residential (single detached) housing areas. The comparisons showed that only 2,745 metres of streets are needed for the curvilinear layouts compared with call for 3,287 metres for rectilinear grids. Thus, curvilinear street plans have shorter loads and utility lines and thus can reduce travelling distances and car usage for private trips.

In the proposed alternative street plans for Gwachon, bicycle roads and footpaths provide convenient links between residential streets and the town centre, where the existing bicycle and footpath system offers segregated routes. The alternative provides comparatively safe and continuous bicycle roads and footpaths. It has other advantages. It reduces dependence on motorized transport which is a feature of the present design of Gwachon. It also helps to create within the area a sense of extra space; it connects one block of apartments to another. Finally, the proposed layout provides access to key community facilities such as schools and hospitals.

FIG. 10. Existing (single detached housing area

Alternative

TABLE 1. Orientation analysis by site

Site	Block				The ratio of blocks <±40° to total blocks (%)
	Total	<±40°	±40°	>±40°	
1	37	3	21	13	8.1
2	38	1	19	18	2.6
3	68	1	23	44	1.5
4	10	–	–	10	0.0
5	7	–	–	7	0.0
6	47	–	29	18	0.0
7	35	12	10	13	34.3
8	12	12	–	–	100.0
9	17	10	–	7	58.8
10	26	5	5	16	19.2
11	16	2	5	9	12.5
12	5	3	–	2	60.0
Total	318	49	112	157	15.4

Design

The study also considered how more attention to climatic aspects of design, particularly orientation and shading with respect to sun and wind, could influence energy consumption.

An important consideration is building orientation. Based on the work of the Housing Layout Study, and the Great Linford and Pennyland projects in Milton Keynes (1982) (United Kingdom), houses should face south ± 40°, be reasonably unshaded and have high insulation standards, to be most energy-efficient.

Table 1 shows the basic data resulting from orientation analysis.

In Gwachon, an orientation analysis of apartments was carried out to evaluate the potential for passive solar heating systems. From the analysis, the effects of over-shadowing on the reduction in solar radiation passing through a south-facing window during a heating season can be determined.

It was found that 49 blocks of apartments in Gwachon are oriented south less than ±40°, 112 blocks, ±40°, which still take advantage of solar gains, and 157 blocks more than ±40°. The proportion of apartment blocks oriented to take advantage of passive solar heating is only 50.6 per cent.

To illustrate how the other blocks might have been rearranged, an alternative layout for one area is shown in Figure 11, thus enabling us to estimate solar gains through re-design of the apartment blocks (Table 2).

The proposed alternative layout would increase the solar radiation received by about 30 per cent (67,865×100 Kcal per day). If it is assumed that all the 157 blocks oriented south more than ±40° could be realigned to face south ±20°, the increase in solar radiation received would be valued at 1,522,115×100 Kcal per day for all 157 blocks.

It can be seen that by considering site selection, building orientation and spacing, urban systems can be made more energy-efficient in the order of 30 per cent increase of insolation.

TABLE 2. Comparison of existing layout for an area of apartment blocks (site 9) and its more energy-efficient alternative

	Existing layout		Alternative layout	
Orientation	10 blocks:	oriented south ±20°	17 blocks:	oriented south ±20°
	7 blocks:	oriented south ±70°		
Distances between Apartment blocks		1.4 h		1.4 h
Solar radiation on walls and roof	Sun data		Sun data	
	Altitude:	37,57°	Altitude:	37,57°
	Season:	winter solstice	Season:	winter solstice
	Apartment block data		Apartment block data	
	Length:	50 m	Length:	50 m
	Height:	13.3 m	Height:	13.3 m
	Radiation:	225,164 (1) × 100 Kcal/day	Radiation:	293,029 × 100 Kcal/day

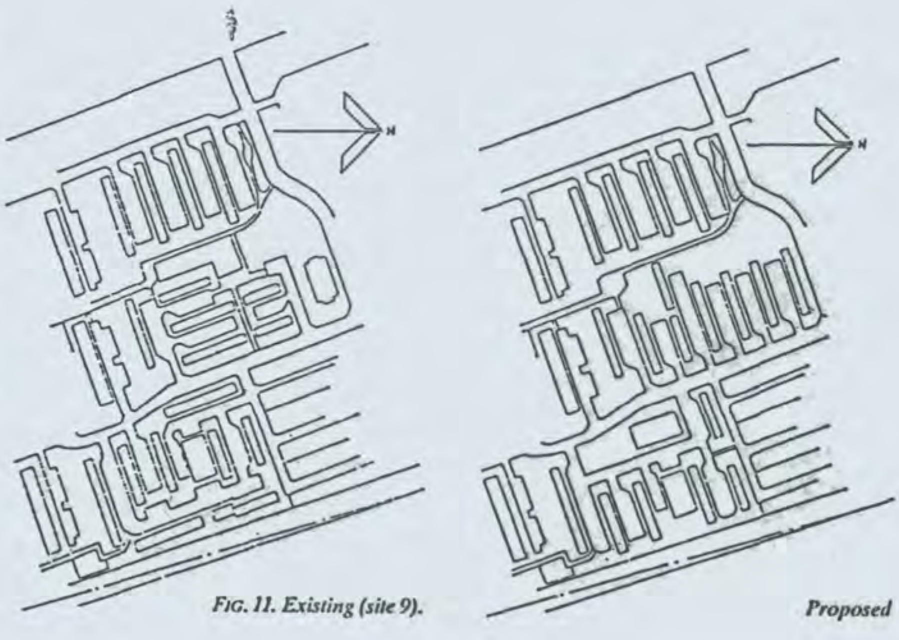

FIG. 11. Existing (site 9). *Proposed*

Landscaping

Proper landscaping has also a quantifiable impact on energy use, although the amount of heat varies according to the climate (Harwood, 1977). It has been suggested that by careful shelter planting and landscaping techniques and selection of appropriate tree species energy demands of buildings can be reduced by up to 10 per cent (Department of Environment, 1985).

Figure 12 illustrates how landscaping can allow solar rays to penetrate during the winter and to shade homes from sun in summer. It also illustrates how landscaping protects houses from cold north-west winds in the winter and channels cooling south-east winds toward buildings in the summer. Solar 'shadow prints' were drawn up showing the solar-based site-planning process.

In order to take advantage of solar heating, it is necessary to obtain data on the dynamics of the sun's apparent movement for a given latitude.

Some of the basic considerations in the landscape planning for energy conservation can be generalized using some specific data from this case-study as follows:

- Deciduous trees should be used for summer sun shading effects and for winter sun penetration.
- Coniferous (needled evergreen) trees provide shade but generally do not perform as well as canopy plants or shade trees.
- Provide shade for dwellings and outdoor living areas through the use of high deciduous trees.
- Tall evergreen trees on the south and south-west should be avoided in the cool or temperate regions.
- Windbreaks should be used against winter winds and should be placed close to the structure or area being protected.
- Lawns and grassy materials should be used in the immediate area of the dwelling structure since grass is a material capable or keeping a relatively even temperature throughout the day.

Conclusion: impediments in design for energy conserving cities

It is important to note that the extent to which a project design process includes energy analysis depends on the political style, the stage of economic development, and the environmental and climatic conditions of each country. Nevertheless, it is possible to make some brief and general indications of what may be the most significant areas facing developing countries:

1. There are at present no standard design methods for integrating energy considerations into urban planning but as the present article indicates, there are ways to incorporate these new ideas into urban design.
2. There is generally minimal participation in energy planning, by the general public or by interest groups and governmental agencies. Lack of wide participation usually reduces the effectiveness of implementation.
3. There is generally no political mandate to impose special requirements relating to energy conservation such as energy impact statements for 'urban design'.

Because energy consumption and especially urban energy consumption is a major financial burden for national governments, particularly in developing countries, it is perhaps surprising that more consideration has not been given to energy efficiency design in urban planning (Barret, 1982). As this case-study shows, relatively simple changes in street patterns, and the spacing and orientation of buildings can produce energy savings of 30 per cent or more. The resulting urban environment is also a more pleasant one to live and work in, and is likely to produce indirect benefits through greater work productivity, less absenteeism, and lower health costs.

It is recommended that energy conservation should be an explicit objective in urban design, and planning courses should include training in techniques of energy-efficient design. At the same time, appropriate meteorological measurements and monitoring data should be collected for urban areas. Although the amount of energy savings will vary from site to site, depending on both climatic and urban characteristics, it is clear that the energy demands of most cities can be reduced by better urban design, particularly when areas are redeveloped or newly planned. ■

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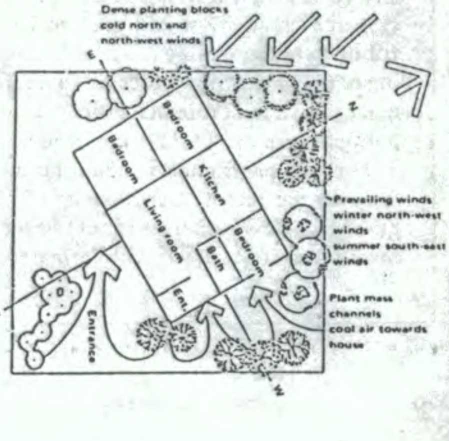
FIG. 12. Solar-based site planning process (functional composite).



Bulletin of the Man and the Biosphere Programme

MAB Bureau meets in Paris

The Bureau of the International Co-ordinating Council for the Man and Biosphere (MAB) Programme met at Unesco headquarters in Paris on 24–25 April 1986 to hear the reports of the General Scientific Advisory Bureau and the Scientific Advisory Panel for Biosphere Reserves set up by authorization of the MAB Council at its eighth session in December 1984; and to make recommendations for the development of the MAB programme.

Report of the General Scientific Panel

The General Scientific Panel had the task of reviewing the scientific programme of MAB and making recommendations on ways and means to disseminate and implement new criteria, concepts, techniques and methods throughout MAB activities, the objective of maintaining a good and credible scientific programme – the strengthening of scientific and regional networks within MAB and the provision of general scientific advice.

According to the Panel, the overall focus of MAB research should emphasize the actions of mankind as part of biosphere processes and give special attention to ecosystems and functions that have been degraded or enhanced by human activities. Four research themes are identified; the first three ecosystem functioning under different intensities of human impact, management and restoration of human-impacted resources, and human investments and resource use – are for development. A fourth theme, on human response to environmental stress, is to be developed as and when interest opportunities and budget make it possible.

The above themes draw upon the particular research arrangements and methods that are unique to MAB and include pilot projects, comparative studies and basic research undertaken at biosphere reserves. Each provides a particular and distinct advantage for furthering and integrating the studies within each theme. The pilot studies provide the way to organize intensive analyses that can integrate more than one of these themes. The comparative studies provide the way to develop collaborative efforts leading to a broad synthesis within and between key bio-geographical systems. And, finally, the biosphere reserves provide an extensive network of laboratories for research, monitoring, conservation of research findings and application. A diversity of research techniques and paradigms so essential to research creativity would need to be used in studies contributing to these three research instruments. A strengthening of the peer review process and mechanisms for screening and evaluation of research projects contributing to the international core of MAB are envisaged.

Training programmes should be upgraded to capitalize fully on the recent strengthening of MAB's research programmes. New initiatives should be focused around MAB's most successful projects with formal training increasingly at centres of academic excellence in ecological regions where the activities are taking place.

The Bureau approved the Panel's report and ascertained, among other things, that programmes designed under such a concept would move MAB research into topics concerning current and emerging environmental policies; would connect it to the most active of ongoing research and scholarship in the natural and social sciences, and would draw upon the unique research arrangements that MAB had developed and tested. The council members recalled that MAB was a worldwide programme that had attracted considerable support from countries with different needs and priorities and at various stages of scientific development, and that it was crucial to ensure that all countries could find their place to contribute to the new research programme. Among the recommendations by the Bureau are that:

(a) an expanded report of the panel's deliberations be published in the MAB report series; and
(b) the secretariat use the Panel's report and recommendations as the basis for preparing working documents for consideration by the MAB Council at its ninth session in October 1986.

Report of the Scientific Advisory Panel for Biosphere Reserves

The Scientific Advisory Panel's report was appreciated by the Bureau, which recognized, among other things, the recommendations of measures for the implementation of the Action Plan for Biosphere Reserves, especially since the concept was not easy to understand or executed in the field, thus moving from the traditional notion of a protected area to that of a dynamic, multifunctional biosphere reserve with man and the interaction of man with nature as its rationale. The Bureau emphasized that the Action Plan for Biosphere Reserves was giving a new opportunity to MAB National Committees to improve the overall quality of the international network.

The Bureau emphasized that biosphere reserves can help to conserve traditional cultures in a dynamic, positive manner, which takes account of the needs and aspirations of the people concerned. They also provide a means to maintain specific desirable features of such cultures, for example the use of ancient, hardy breeds of domestic livestock or crops that would otherwise be 'lost'.

The Bureau suggested that there may be useful link-up with the work of the International Hydrological Programme (IHP), which had reviewed questions of representativity and comparability arising from its programme, now terminated, on identifying 'representative hydrological basins'.

The Bureau recognized that a great effort had to be made to train biosphere reserve managers and middle-level technicians, particularly to provide appropriate interdisciplinary training to avoid a continuation of a sectoral protectionist approach on the management of existing biosphere reserves,

eosphere-Biosphere bservatories

he international network of biosphere es comprises an as yet underused tool ollaborative research. Exploring pos- research links between the biosphere e network and the geosphere- here observatories proposed within International Geosphere-Biosphere ramme (IGBP) of ICSU provided one e for a small technical meeting held SU Headquarters in Paris on 8-10 ry 1987.

he meeting was organized as a joint e of UNESCO-MAB, the Scientific mittee on Problems of the ronment (SCOPE), the International n of Biological Sciences (IUBS) of , and the U.S. MAB National mittee. The meeting objective was to de a first consideration of the rvatory concept, linking it to similar pporting concepts, and to provide mendations about next steps.

he results of this January 1987 ing is a recent publication (Dyer, F. di Castri, and A.G. Hansen, eds. phere-Biosphere Observatories. Their ition and Design for Studying Global ge. *Biology International, Special* 6. IUBS, Paris, 40 pp. [English]). report reviews the concept of phere-biosphere observatories as ding key locations for research and toring within IGBP and as validation for modelling and remote sensing rammes. Several types of such rvatories would seem to be needed: a large, centralized observatories for pth examination of ecological esses, a larger number of lesser centres large-scale coverage of critical global ge processes, and sites useful for ation studies needed for remote ing and extrapolation of models.

n addition to observatories, transects also be required across sensitive areas, even whole continents, to increase the ibility of detecting relevant global ges and for monitoring their inherent of change. 'Microtransects,' which t range from tens to perhaps hundreds kilometres, could be useful across ition zones distributed among coastal and inland areas of the world. 'Megatransects,' which might be thousands of kilometres long, would range across continents. Within these transects, specific observatories would be located to help focus the research needed to determine global change phenomena.

The report suggests that many of the geosphere-biosphere observatories could be derived from the higher-quality sites within the biosphere reserve network. It also makes some tentative suggestions on the possible locations and objectives of transects that might be considered within the IGBP, and discusses the relations between research questions, approaches, and facilities. A principal aim of this report is to stimulate further indepth consideration and discussion on the approaches that might be explored in investigating global change. In this regard, the report sets out a number of conclusions and recommendations, including broad terms of reference for possible follow-up working groups and workshops.

This special issue report is available from the *MAB Secretariat* or *IUBS, 51 Bd. de Montmorency, 75016 Paris, France.*

Studies of the Seoul Urban Ecosystem

In the Republic of Korea, as in many other countries, urbanization has progressed in close parallel with the growing national economy. The national capital city, Seoul, has experienced a tremendous increase in population, and this rapid trend has posed many problems--disorderly urban sprawl, traffic congestion, housing shortages and overcrowding, outmoded urban infrastructures, and resulting environmental pollution.

One response to these problems has been the organization of a series of ecological studies on Seoul and its suburbs and satellite towns, sponsored by the MAB National Committee and coordinated by Prof. Kwi-Gon Kim of Seoul National University. With a view to ecological considerations becoming incorporated into the planning and management activities, five broad areas of enquiry have been identified: ecosystem analysis, risk assessment and indicators, green space, social aspects and perceptions, and land use patterns and management. Some 22 research activities have been identified, ranging from land use change in the green belt of the Seoul metropolitan area to the evaluation of flooding risks.

Initial work, between 1983 and 1986, comprised three main components: environmental impact assessment of a new town development project (Gwachon New Town); energy flow and conservation, with plans to formulate practical "energy integrated" guidelines for planners and decision makers; and risk assessment in urban planning and management. Risk perception formed a major focus of work during 1987. The 1988 programme includes studies on the relationship between climate, urbanization, and green space in the Seoul metropolitan area.

The main aspects of past and proposed work on urban systems in the Republic of Korea have been summarized in a 16-page illustrated, bilingual (Korean/English) booklet entitled *Ecological Studies of Seoul Urban System,* which can be obtained from the *MAB Secretariat* or the coordinator of the Seoul study: *Prof. Kwi-Gon Kim, Dep. of Landscape Architecture, Seoul National Univ., Seoul 151, Republic of Korea.*

Canada/MAB Biosphere Reserves Action Plan

In response to the call for mobilizing the full potential of the international network of biosphere reserves through the launching of national strategies for biosphere reserves, the Canadian Commission for UNESCO recently published the *National Action Plan for Biosphere Reserves in Canada.*

According to Richard Bill, International Programs Officer for Environment Canada, who prepared the booklet for Canada/MAB, this plan may serve as a guide to other countries by demonstrating that "biosphere reserves can help in practical ways in relating the environment to the economy, and vice versa."

Copies of this booklet (in English and French) are available upon request as long as supplies last. Enq: *Canada/MAB, Canadian Commission for UNESCO, 99 Metcalfe St., P.O. Box 1047, Ottawa, Canada.*

8, pages 24-25). The proceedings contain individual contributions dealing with such issues as the services and products provided by tropical forests, land use, ecosystem functioning and processes, spatial variability, interrelations between forestry and agriculture. Case studies report on research, land planning and resource management in Rondônia (Brazil), Suriname, Taï (Côte d'Ivoire), Kali Konto (Indonesia). Enquiries to the Programme Director of Tropenbos (Dr. M.S. Ross), Galvanistraat 9, 6716 AE Ede (Netherlands).

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The role and impact of ICLARM

The International Center for Living Aquatic Resources Management (ICLARM) is a new, small research organization, working in fisheries and aquaculture in the developing countries. The Center has four programmes: (1) traditional fisheries in which socioeconomic studies have had wide impact in the literature and have resulted in legislative change; (2) resource development and management, the principal accomplishment of which has been compilation of new microcomputer and calculator programmes for tropical stock assessment and their adoption in 12 countries to date; (3) aquaculture, with major biological and economic research being carried out in integrated farming systems, and on the most important tropical culture commodities, tilapias and carps; (4) education and training, in which major thrusts in new educational materials and specialized training are planned.

In 1973 a small group of fisheries scientists working under the aegis of the Rockefeller Foundation settled to the task of addressing a broadly perceived need in relation to tropical aquatic resources. This need was the inadequacy of the research base upon which to build sound aquatic resources management and aquacultural practices in the tropical developing world. It was recognized that, in spite of the numerous large and expensive development programmes oriented towards fisheries, the inadequacy of technical information often stood as an impediment to rapid development and wise utilization of aquatic resources. The planners also recognized that a centre assigned a set of tasks not presently being executed would probably have to be different organizationally and functionally from existing fisheries research organizations.

This group, with the active support of the Rockefeller Foundation, founded the International Center for Living Aquatic Resources Management (ICLARM). It became an independent, non-profit research centre incorporated in the Philippines in 1977, and has since taken its place among the International Agricultural Research Centres, most of which, unlike ICLARM, belong to the Consultative Group on International Agricultural Research.

ICLARM's broad objectives are:

(1) To conduct, stimulate and catalyse research on fish production, management, conservation, distribution and utilization to assist peoples of the world in meeting their nutritional and economic needs.
(2) To improve the efficiency of culture and capture fisheries through coordinated research, education and training, linked with appropriate development and extension programmes.
(3) To upgrade the social, economic and nutritional status of people in less developed areas by improvement of small-scale fisheries.
(4) To encourage labour-intensive and low-energy input systems where appropriate.
(5) To publish and disseminate research findings in support of the Center's objectives.
(6) To organize and conduct conferences, forums and workshops to discuss current problems and exchange research results.

The Center's research is oriented towards the goal of improving the condition of the poor in developing countries by improving incomes, employment opportunities and productivity through the wise use of aquatic resources. These are also the stated objectives of many assistance organizations, including the World Bank[1] and the Asian Development Bank[2] in this sector. However, while these two Banks provided over $500 million in development loans between 1967 and 1980, and other donors provided additional large sums for development, very limited research was initiated to underpin the development projects.

ICLARM's research is designed to complement the work of existing national and international organizations which do not have the capability or mandate for conducting certain essential research, particularly of a long-term applied nature. The Center's non-governmental status frees it from objectives determined by political expediency.

ICLARM has now been functioning for six years in a fashion that is unique among fisheries research institutions. It conducts research entirely in a cooperative mode with developing country institutions, usually in the facilities of those institutions. ICLARM has no research facility of its own: only a central office in Manila. This approach has enabled the Center to operate on a relatively small budget, and to use its funding effectively because it makes only minimal expenditures for facilities and maintenance. In addition, the approach has important 'spin-offs', such as strengthening the research capabilities of cooperating institutions and training developing country scientists. Often underutilized research facilities have been made available for execution of joint research projects.

Independent

The Center's autonomous, non-governmental, international characteristics have enabled it to hire a highly competent, international staff selected on a competitive basis from a wide range of talent. These features have also permitted the ICLARM staff, Board of Trustees and Program Advisory Committee (the last two are also international in character) to plan research programmes that address carefully selected topics deemed critical for development of tropical fisheries. This freedom to select research topics on the basis of broad international scientific needs rather than in response to short-term, highly changeable governmental interests is one of ICLARM's unique and most important strengths.

Four specific and overlapping programme areas have been selected for primary emphasis: traditional fisheries; aquaculture; resource development and management; and education and training. Scientists with expertise in economics, sociology, stock assessment, aquaculture and other specialties have interacted extensively in joint execution of research projects. This multidisciplinary approach is another unique feature related to ICLARM's small staff size and scientific freedom; it has proved to be a force working contrary to the usual compartmentalization of research interests in developing countries.

New and small

In terms of the history and expenditures of research institutions, ICLARM is both new and small, with a permanent scientific staff of seven and an annual budget of US$1500000. Nevertheless, its impact has been surprisingly large and the model provided is worth careful scrutiny, both from the standpoint of possible replication in other fields and with a critical eye towards improving its effectiveness.

ICLARM's research in traditional fisheries has a socioeconomic focus, because the major problems facing small-scale fishermen in most parts of the world appear to be non-technical in nature. The attitudes of government fisheries planners are strongly ingrained, and their attitudes on needs for more and larger vessels and gear continue to receive support from development banks and international development agencies. These trends are often in direct opposition to stated objectives of increased employment, more equitable distribution of incomes, and improved incomes for poor fishermen. Because decision making tends to be highly centralized at national levels, few location-specific refinements to solving the low-income problem have developed. Programmes tend to be national in scope, short-term in nature, and to overlook local differences.

ICLARM's research in traditional fisheries began with a study of the problems of the sector and a review[3] of the kind of research necessary. By any measure, this report has had wide impact. One reviewer stated that the work 'should contribute to a fundamental revision of the concepts and policies so far adopted and implemented by national administrations and international organizations, both bilateral and multilateral'.[4]

The next step was a series of country reviews of existing knowledge of traditional fisheries as required in the framework described in the study above. The first has been published,[5] on Philippine traditional fisheries – 'this most interesting ICLARM report (has) highlighted the really important areas of research needed when a fishery is to be the subject of a development plan'.[6] Other country reviews are in preparation.

These reports pointed to the need for clarifying alternative development and management choices available to policy makers, and in doing so highlighted research areas not being adequately addressed by other organizations.

Multidisciplinary

One such area is the adoption of a multidisciplinary approach. ICLARM joined with the University of the Philippines in the Visayas (UPV) to conduct a three-year study of a large Philippine fishery. The first study of its kind in Asia, this project addressed the major issues of stock assessment, allocation of use rights, distribution of benefits, marketing efficiency and occupational and geographic mobility of fishermen to assess the need for managing this multispecies, multigear fishery. Options that might be considered by local and national policy making bodies were identified and discussed.[7] The study has already precipitated legislative change in the fishery and the methodology is attracting attention in other research institutions.

The identified need for long-term applied socioeconomic research with management implications prompted the question of who would perform this research. Now, the International Development Research Centre (IDRC) of Canada has joined with ICLARM in the initiation of a Fisheries Social Science Research Network which addresses this need in Southeast Asia.[8] One major accomplishment of the network to date is the offering of an MSc in Resource Economics (Fisheries Specialization) and a five-month non-degree short course in the same topic by Universiti Pertanian Malaysia. These are the first such courses in Southeast Asia. The major training institution in the network, Universiti Pertanian Malaysia, and donors IDRC and ICLARM, believe this approach will provide the necessary core of researchers to continue research and university education in this field.

Lack of information

ICLARM's tropical stock assessment research is designed to address the present lack of biological information on fisheries management in developing countries. The thrusts of the programme since its inception in 1979 have been the elaboration of the theories relevant to the assessment and management of tropical multispecies, multigear fisheries, the development and dissemination of appropriate stock assessment methodologies, and the training of young fisheries scientists.

In stock assessment, as for traditional fisheries, ICLARM's involvement began with a review, in this case one that questioned the applicability of temperate-water stock assessment research to the tropics.[9] The review led directly to simple calculator- and computer-based stock-assessment techniques[10] which are currently being evaluated and adopted in both tropical and temperate countries. The Food and Agriculture Organization is distributing information on the methods in several languages[11] and a manual is being prepared for their use on programmable calculators.

The major accomplishment has been compilation of five length-based stock assessment programmes (collectively called ELEFAN)[12] for microcomputers and the integration of these programmes into a wider systems approach to the assessment of multispecies, multigear fisheries that constitute the majority of tropical fisheries. Some have already been translated into a variety of programme languages for micro- and mainframe computers (see Table 1).

That initial review[13] also led to an international conference on the theory and management of tropical fisheries[14] which consolidated existing knowledge and has provided directions for future research. Meanwhile, dissemination of the new stock-assessment techniques has been sponsored by organizations such as FAO and DANIDA[15] in the form of lecture courses for senior developing country biologists and support for an international network of tropical fisheries scientists, including a Newsletter[16] for members. The network aims to overcome the isolation of these scientists, some of whom, from Papua New Guinea, the Philippines and Burma, have already applied the new stock assessment techniques during visits to ICLARM headquarters. The Newsletter (*Fishbyte*) has been well received, and so far drawn membership of over 300 in 62 countries.

The aquaculture programme is oriented towards improvement of technology for use with low-priced commodities, such as tilapias and carps, identified by the CGIAR's Technical Advisory Committee as principal targets for aquacultural development, with emphasis on the small-scale producer. Recent events have crystallized ICLARM's research on tilapias. These events include the shift towards tilapia culture in almost all developing countries, their adaptability to a wide range of environmental conditions, ready acceptance by consumers, and ease of culture.

ICLARM has researched and published reviews,[17] proceedings of special conferences[18] and reports of its tilapia research on arid-land culture,[19] saline water culture,[20] nutrition[21] and genetics, as well as on tilapia use in integrated agriculture–aquaculture farming systems.[22]

Relevant information has been consolidated on integrated farming systems,[23] mullet propagation[24] and aquatic weeds[25]. Ongoing reviews and research include genetics of food fishes; controlled reproduction of important food fishes; and improvement of carp hatchery/nursery systems.

A major component of the aquaculture programme is economics. ICLARM has seven separate economics projects, including studies of the economics of integrated farming; the Taiwanese tilapia industry; the Philippine tilapia and milkfish industries;[26] the snakehead (mudfish) and catfish industries in Thailand;[27] and a broad study of the mollusc industry in Thailand. A series of studies entitled 'Aquaculture trends and development prospects: country case studies' is underway (studies have been completed for Taiwan and Israel, which are already facing aquaculture development constraints). The broad issues of aquacultural economics research in Southeast Asia were the subject of a recent IDRC–ICLARM conference.[28]

ICLARM's education and training programme is growing slowly. However, training has been an important part of all programmes and the Information Service (see below). This has included training courses at various universities and participation in FAO training programmes, supervision of graduate student research and the training of research assistants.

Elements of training are usually included as a major objective in projects. For example, the stock assessment research project has included the training of a number of nationals of various countries in the use of new methodologies at ICLARM headquarters, while the management-oriented fisheries research project brings these methodologies to the countries concerned, where a multiplier effect can be expected. This is accomplished through in-country training and placement of microcomputer hardware and software.

Networking has been found to be a most effective method of information transfer. Stock assessment scientists are reached through the Network of Tropical Fisheries Scientists noted earlier; social scientists are beneficiaries of the Fisheries Social Science Research Network of several universities in Southeast Asia. This Network seeks to strengthen national research capability and includes post-graduate and non-degree educational programmes.

During their research, ICLARM personnel have become more aware of the lack of suitable textbooks, manuals and other educational material in the tropics. Almost all books in use depict mainly temperate ecosystems or conditions and most are quite inappropriate, some even misleading or erroneous. ICLARM has begun to prepare and plan a wide array of educational material appropriate to tropical systems, and is seeking assistance in this much-needed but neglected field.

ICLARM has an Information Service, primarily a support group for the research programmes with its own editorial and publications section. Research results have been published in one or another of ICLARM's five technical publication series, which are produced specifically to transfer critic-

Table 1. Examples of the application of ICLARM's ELEFAN microcomputer programs for stock assessment.

Country	Application
Australia	Stock assessment research in several universities.
Denmark	Used as a basis for further research on stock assessment.
FRG	University research on changes in North Sea fisheries.
Indonesia	Reanalysis of existing data for stock assessment purposes.
Kuwait	Routine fisheries stock assessment.
Papua New Guinea	Assessment of baitfish stocks.
Peru	Assessment of pelagic resources.
Philippines	South China Sea Programme research on stock assessment of tuna; reanalysis of existing data for assessment of demersal stocks; analysis of survey data by German bilateral aid project.
Seychelles	FAO stock assessment project.
Solomon Islands	Assessment of baitfish resources.
USA	Coral reef fish assessment in Hawaii; various research uses in other states.

al research results to developing country users. During the four-year publishing history of ICLARM, more than 26000 of these publications (excluding newsletters and reprints) have been distributed worldwide and demand is steadily increasing. ICLARM's quarterly *Newsletter*, over 80000 copies of which have been distributed to date, provides reports on research results, new publications, training opportunities, development project results, commentaries and other information of interest to developing country fisheries scientists.

The Information Service is also involved in the broad problems of information retrieval and dissemination in developing countries. Joint organizational, training and planning work is in progress with other institutions at both national and international levels.

In May 1983, ICLARM invited a group of senior scientists from the region to discuss the idea of a regular forum and society for fisheries scientists. There is apparently a great deal of enthusiasm for this kind of activity and a Foundation Council for the Asian Fisheries Forum has been set up to organize the first meeting in 1986.[29]

Any discussion of the impact of an organization would be incomplete if it overlooked the shortcomings of the organization or the changes needed to improve its performance.

ICLARM's image, coupled with incomplete understanding of its role, have been troublesome. People tend to categorize ICLARM as a consulting firm, a governmental body, an intergovernmental body or a funding organization when they are incompletely aware of its functions and role.

ICLARM sometimes experiences unwillingness on the part of national institutions to collaborate. Most often, this is the result of differences of opinion concerning research needs, and the nature of the research required to solve existing problems. Given ICLARM's orientation toward conducting research of types not already being executed and of broad importance throughout the tropics, such differences in viewpoint should be expected. The values and merits of collaboration and exchange of information are also viewed differently by scientists with different experience and backgrounds.

The idea that national scientists are necessarily better able to address their country's needs than are foreign scientists is often encountered. It is also difficult for developing country scientists to shift from traditional research areas into new areas which may be perceived as too academic or too basic in relation to their own view of needed work.

It may be difficult for a research director with a shiny new building and a staff of freshly graduated scientists to see potential benefits from collaboration. ICLARM researchers have, nevertheless, encountered many underutilized and understaffed fisheries research faciltiies in developing countries where scientists are eager to expand their activities and capabilities through collaborative research.

Finance

The most serious shortcoming of ICLARM is that its founding fathers did not secure for the organization a long-term base of financial support. As a strictly non-governmental organization it has no political base and its constituency, the poor fishermen and fish farmers of the developing world, can offer little assistance with funding. The Consultative Group for International Agricultural Research (CGIAR) was formed in 1971 to address the need for special long-term commitments to support such international centres. However, during the present funding slump related to the worldwide recession, the CGIAR is unable to accommodate new members and new international research centres, such as ICLARM, must search independently for funding.

A closely related issue is that donors are willing to contribute large sums to fisheries demonstration and extension projects even though they have only a mediocre record of follow-on success. The logic followed is that short-term technology transfer is so urgently needed that research cannot be afforded. Unfortunately, these donors do not seem to recognize that, in fisheries as opposed to agriculture, this mediocre record is often due specifically to the absence of the required knowledge base, because of inadequate research.

We believe ICLARM is an important element in developing-country oriented fisheries research. Others share this view. The World Bank singled out ICLARM as having a significant role to play in this field;[30] the US Agency for International Development sees the Center becoming 'an increasingly useful channel for supporting regional fisheries development';[31] while another reviewer has described the Center as 'undoubtedly admirable and its accomplishments commendable'.[32]

The potential role of the Center has been best summarized by the US Ocean Policy Committee:

> ICLARM is unique among fisheries research and development agencies. It is a private organization (unlike UN agencies, for example, which must answer to member governments) and may be able to address problems of living resources management and exploitation with minimal political interference. This is particularly important at this time when governments and industry everywhere are trying to grapple with problems of zones of extended jurisdiction and management of marine resources within such zones. Potentially, ICLARM provides a neutral agency through which project funding from a number of sources could be channelled and coordinated.[33]

Although relatively new, ICLARM's record of performance is good, and operating costs relative to impact are modest. The Center's staff are working continuously to improve its effectiveness and to find new modes of interaction with development-oriented institutions of all types. Problems, with the exception of funding, have not been serious. The special elements of ICLARM are not new and have been patterned after those of existing organizations. However, the combination of these special features in a fisheries organization is new, and successful.

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BARRY

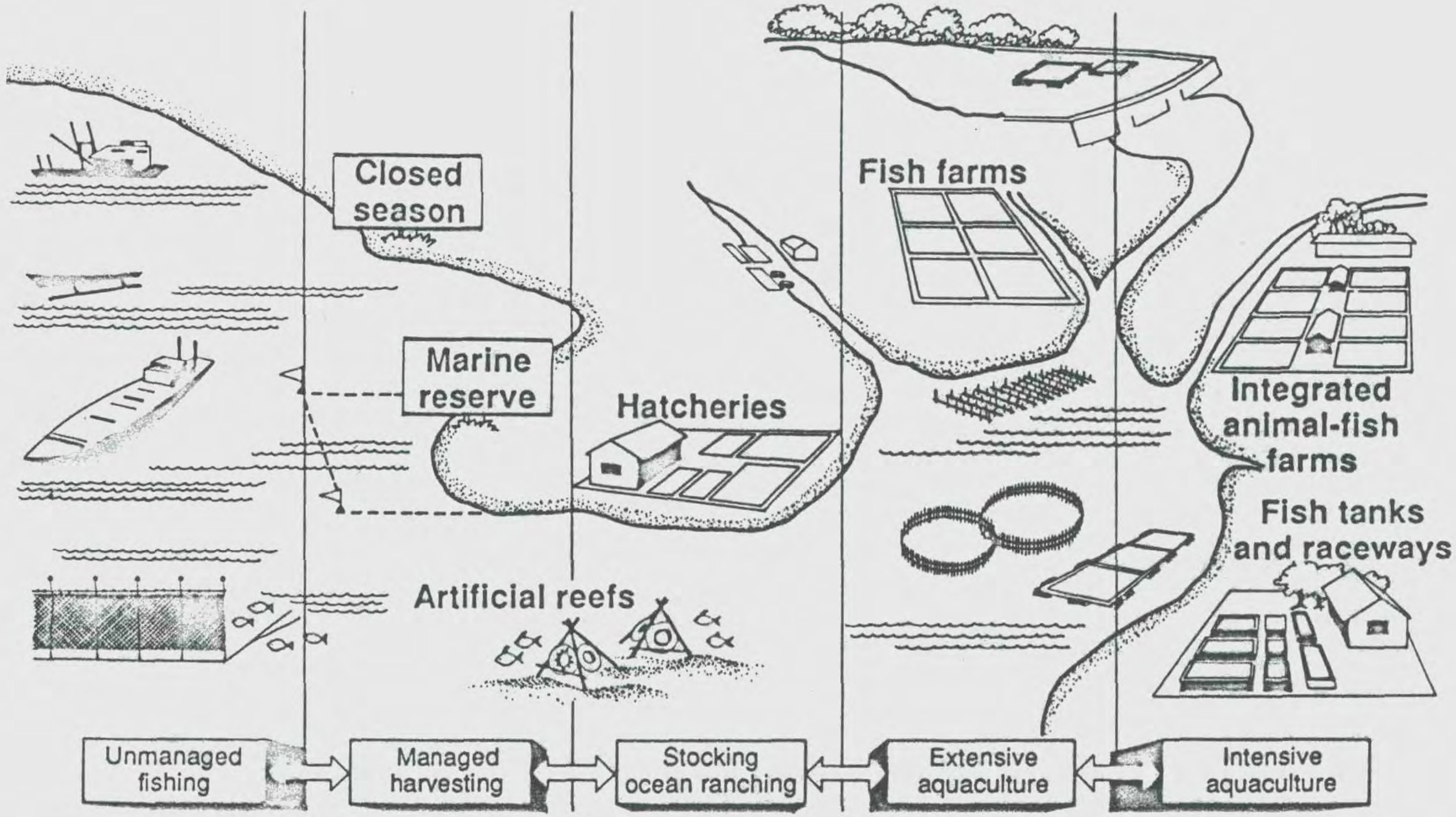


Fig. 2. Utilization of aquatic resources: a continuum of activities requiring a comprehensive, interdisciplinary approach to research such as has been initiated by ICLARM.

ENVIRONMENTAL EVALUATION IN DEVELOPMENT PROJECT PLANNING

1 Introduction

1.1 Singapore evaluates the environmental impact of all major development proposals especially from the air pollution, water pollution and public health points of view. I will therefore, explain how we evaluate the effects that project proposals may have on our environment.

1.2 In Singapore, due to the need for a central authority to specifically handle environmental issues related to national development, the Ministry of the Environment was set up in Sept '72. Prior to this, the role of guardian for protecting and improving the environment was shared by the Ministry of Health and the Ministry of National Development.

1.3 The Ministry of the Environment performs the above role by planning, developing, operating sewerage, drainage, solid waste disposal facilities and by providing public health services. Furthermore, the Ministry also liaise closely with other government authorities to assess project proposals like land development and industrial development.

2 Vetting Process of Project Proposals

2.1 Land Development

2.1.1 General

2.1.1.1 In Singapore, semi-government agencies like the Jurong Town Corporation as well as the Housing and Development Board and private developers normally initiate development proposals. The assesment of these project proposals starts as early as the land development stage.

2.1.2 Planning Approval

2.1.2.1 Any developer will have to submit, at an early stage, their proposal to the Planning Department of the Ministry of National Development (MND). The purpose is to seek MND's planning approval, as required under the Planning Act.

2.1.2.2 The Planning Department of MND exercises jurisdiction over the land use or land development. Acting as co-ordinator, MND will channel the proposal to all relevant authorities like the Ministry of Environment to obtain their clearance. At this stage then, can the Ministry of the Environment appraise whether the proposed development is environmentally compatible with other developments in the vicinity or with the use intended for the land in the surrounding area.

2.1.2.3 Only after all the relevant authorities provide the clearances, will MND then issue the planning approval for the development project.

2.1.3 Building Plan Approval

2.1.3.1 After the planning approval is given, the developer has to submit the more detailed building plan to the Building Control Division (BCD) of the Ministry of National Development for approval.

2.1.3.2 Likewise, acting as co-ordinator, the BCD will refer the detailed building plan to the relevant government authorities who will look into the plan in greater detail, so that all technical requirements imposed are complied with.

2.1.3.3 For the Ministry of the Environment, we will ensure, among other things, that the appropriate pollution control facilities are incorporated so that all wastes generated from the development are properly treated or disposed off. Technical requirements as laid down for example in the Trade Effluent Regulations and the Clean Air (Standards) Regulations must be satisfied so that the effect on the environment can be controlled.

2.1.3.4 Once all the government authorities release their clearances, will the BCD issue the Building Plan approval to the developer.

2.2 Industrial Development

2.2.1 Under this heading, I like to highlight that the Jurong Town Corporation (JTC) and the Housing and Development Board (HDB) are active in developing sites for industries. As in land development, JTC and HDB will have to obtain planning and building plan approvals from Planning Department and BCD respectively.

2.2.2 One consideration taken in approving such development of industrial site is whether the proposed industries are located in the appropriate industrial zone. This is to ensure that adjacent factories are compatible with one another.

2.2.3 Before the allocation of JTC or HDB factory premises for new industrial activities, JTC and HDB, on behalf of the industrialist, will have to consult the Pollution Control Department of the Ministry of the Environmental regarding water pollution control as well as air pollution control and the Environmental Health Division. Only when the Ministry of the Environment has no objection to the proposed new industrial activities, can JTC or HDB allocate their factories to the interested parties.

2.2.4 By doing so, the Ministry of the Environment can ensure that all industries are equipped with adequate control facilities to abate environmental pollution or health hazzards.

3 Other Means of Evaluation

3.1 This refers to the role that the various licensing sections in the Ministry can play in environmental evaluation before the issuance of licences.

3.2 The areas in which licensing become necessary include the following:-

a. dangerous trade premises such as refinery plants;

b. premises storing toxic substances;

c. premises operating offensive or obnoxious trades;

d. food factories etc.

3.3 The means of licensing will indirectly alleviate some of the possible environmental problems arising from the activities above.

4 Conclusion

4.1 The established procedure in evaluating development project proposals do take into account environmental factors to prevent or reduce any likely impact on the environment.

APPLICATION OF ENVIRONMENTAL IMPACT ASSESSMENT IN URBAN WASTE MANAGEMENT PLANNNING

by : Hasan Poerbo
June 10, 1988

1. Introduction

There is practically no country in the world which is not being faced with the problem of increasing urban populations, and with it also an increasing volume of urban waste to get rid of. For small towns, the problem of environmental degradation caused by urban waste is not yet serious, and urban waste management is not really planned. It is practiced and improved over time through trial and error. The larger cities, and especially metropolitan cities, cannot afford to do so without risking a deterioriation of their urban environment. Thus it is now becoming more and more common practice that in these cities urban waste management is consciously planned.

Many developing countries are being faced with a dilemma in this regards. On the one hand, their big cities are producing more and more waste, but on the other hand their economies are not yet strong enough to finance a waste management system which by and large needs always to be subsidized. With limited budgets, local governments are usually facing difficult options in prioritizing urban development objectives, and urban waste management may easily be ranked lower than economic and infrastructural development, education and other needs. But these constraints make urban waste management planning the more urgent : how to get a healthy and clean environment with less investment in equipment, manpower and land, and with less subsidies.

There are basically two alternative waste management systems which can be developed in dealing with urban waste. One is the ordinary system of collection - transportation - dumping which is generally practiced everywhere. The other one is a waste management system based on recycling, which is conceptually exciting, but operationally still controversial even for industrially advanced and rich countries.

The purpose of this paper is to discuss the concept of the application EIA in urban waste management planning, its role in the determination of choice of waste management system and technology, and the organization of EIA in project planning and management.

Urban waste management deals basically with four types of waste : solid domestic waste, liquid domestic waste, solid industrial waste and liquid industrial waste. Management of gasseous and particulate industrial wastes are ordinarily the responsibility of the industrial plants producing them.

Integrated urban waste management encompassing all types of urban waste is theoritically interesting, but practically still far from operational. Therefore in this paper we limit ourselves to the management of solid domestic waste, which usually forms the bulk of urban waste to be dealt with and where a specific organization has been established in every large city to take the responsibility for its management.

2. The Need for Planning of Urban Solid Waste Management

Urban domestic solid waste, hereafter called urban waste, includes waste from households, markets, shopping centers, offices, parks and streets, and recreational areas. Its composition is very much local and cultural specific, but in general it consist of organic and inorganic components such as plant wastes, animal wastes, wood, paper, glass, plastics, rubber, tin-cans etc. The following table shows differences in its composition depending on location and the level of economic and social development of its society.

Table I : A comparison of the physical composition of urban waste in Brooklyn and Bandung (% by weight)

Type of material	Brooklyn, New York	Bandung *
Paper	35 **	9.7
Glass	9	0.3
Metals	13	1.3
Plastic and rubber	10	4.8
Textiles	4	2.5
Bones	4	0.7
Other materials	4	6.1
Total of non-food materials	78	25.4
Vegetables and materials that can decay	22	74.6
T o t a l	100	100.0

* Figures for Bandung refer only to domestic waste
** All figures in this column have been rounded.

Source : Cointreau 1982 and BUDP 1984

Not only the composition of waste is different between developed and developing countries. The production of waste per capita is also different. More affluent societies produce more waste with a larger proportion being inorganic waste.

In the case of the larger and metropolitan cities in developing countries there is a general trend of a change in life-styles, especially in those countries which are undergoing rapid economic development. There is a growing concentration of population and wealth in the larger cities, and especially in metropolitan cities. This trend is usually accompanied by a widenning gap between rich and poor, causing differential patterns of life-styles which are area bound. The morphology of these cities reflects this tendency, where one can find spatial differentiation in characteristics between the various settlements inhabited by different socio-economic strata. It makes the planning or urban waste management the more complex, since much of the low-income areas are too densely populated and therefore difficult to be served. This is compounded by low educational and income levels of the inhabitants and their indifference towards the quality of their environment, as it does not rank too high in their survival strategy.

A typical lay-out of a mixed high and low income area can be seen hereunder, where difficulties in waste collection service can be expected.

Map of a Mixed High and Low Income Area

The Table and morphology of cities as described above suggest that urban waste management has to be planned specifically for certain countries, and even certain cities in the urban hierarchy within those countries.

The Asian Development Bank and the World Bank has now a programme to assist developing countries to set up or modernize urban waste management systems. As is common practice with them, they have stringent requirements to get the loans approved. This include the planning of the waste management system on a long term basis. In Indonesia, a study on national waste management policy and strategy is now being conducted as part of the loan scheme, which will act as a kind of umbrella under which master plans for specific cities will be developed. However, it may well be that for certain countries loans may only be sought for the development of a waste management system for one or several cities, so that there is no need for a national plan.

Indonesia has opted for a waste management system based on collection - transportation - dumping, a practice common to other developing countries. Yet there is another system which is now being considered to be included as an alternative waste management strategy : Integrated Resource Recovery (IRR) or Integrated Waste Utilization including recycling.

To give a better insight into the application of EIA in Waste Management Planning both systems will be discussed hereunder.

3. Urban Waste Management System Based on Collection - Transportation - Dumping

As has been mentioned before, this system is common practice in cities in developing countries. It is the most simple and effective system available, which however has still many drawbacks. We will come back to this later.

A simplified model of the system can be represented in the following diagram :

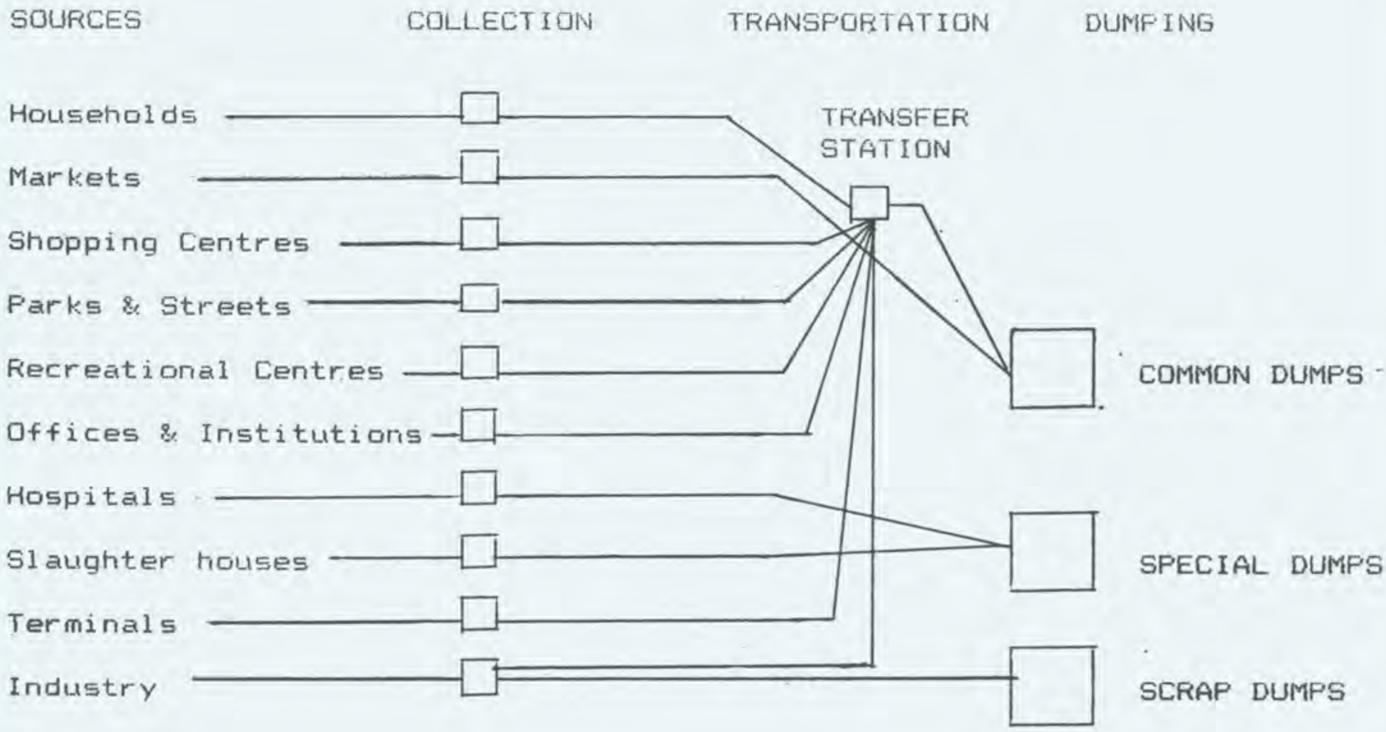


DIAGRAM I : FLOW OF URBAN WASTE FROM SOURCE TO DUMPING SITES

Some of the salient issues in waste management planning are :

(a) Affordability vs effectiveness

The objective of waste management is obviously in the first place to remove waste from the city to create a clean and healthy living environment. But concentration of population in a wide area necessitating long distance transportation, and increasing difficulties to find dumping sites makes waste management for large cities an expensive proposition. Centralization of management is a must, if health and sanitary considerations are seriously taken into account where the introduction of a more advanced closed container system, modern transportation and dumping methods become prerequisities. The question is how far a system like this is affordable to local governments which can ill afford to give subsidies, but on the other hand have to rely on contributions from a population which consists largely of low-income families. It is not suprising therefore that many city governments, especially metropolitan and large cities, can only cope with 60% - 80% of the waste generated in their cities. Where does the rest go ?

(b) Centralization vs Decentralization of Management

In wealthier countries where people can afford higher contributions, and where local governments can afford to give subsidies, centralization of management is a better option since it gives the possibility for a better control over the waste management system. But in less wealthier countries, local governments may well be forced to dicentralize its waste management, delegating part of their responsibility to local communities to organize their own waste collection services. This happens to Indonesia, where the neighborhood organizations are in many cases faced with the fact that the local government is not able to give them the necessary services. The problem is that there are great variations in the capacity of local communities to organize their own waste collection services. The result is obvious, that especially in Kampung areas waste is accumulating in small dumping sites on waste lands and in streams and rivers.

(c) High Technology vs Low Technology

The choice of technology for waste management is intricately related to the issues which have been discussed above. There are two extreme choices :

i. High technology :

Using containerization from household level to dumping site, motorization of transportation with specialized equipment, compacters and bailers to reduce the volume of waste, bulldosers for sanitary landfilling, and perhaps inceneration for energy generation and sophisticated waste recycling and mechanized composting in bulk at dumping sites.

ii. Low Technology :

Using ordinary garbage bins at household level, garbage carts, open trucks for tansportation and open dumping.

There is a spectrum of possible combinations in between these two extremes, based on the same principle of collection-transportation-dumping.

Garbage in very carrosive, and therefore the cost of maintenance and depreciation is very high. On top of that, special equipments need a special maintenance workshop with a specially trained crew. Something which a municipal government, at least in Indonesia, can ill afford. All these factors make the more simple and in expensive alternative a more attractive choice from the point of view of finance, althoughh it is not very efficient and clean compared to a system with modern and specialized equipment.

Inceneration for energy generation and sophisticated recycling and mechanized composting as "back end technologies" in the waste stream is very expensive, and practically out of question for developing countries like Indonesia. The experience with composting factories in Medan and Surabaya has been quite instructive : they have gone bankrupt, both because of marketing difficulties of their bulk products and also because of internal management problems. One composting factory in Jakarta was even not installed although the equipment is already delivered and on site.

Sanitary landfill is preferred above ordinary open dumping, because of its abvious advantages in terms of environmental pollution. Yet open dumping is still being practiced, simply because sanitary landfill is not affordable to most mucipalities. Not only that, it is becoming more and more difficult for big cities to find dumping sites anywhere. Cost becomes more and more prohibitive, but especially in metropolitan areas with an already densely populated fringe, nobody want a dumping site near their residence. The result is a tendency to have dumping sites further from the garbage source, increasing the cost of transportation. With constraints in increasing revenues to finance the waste management system, there will be more pressure to decentralize waste management to local communities, and tolerate small open dumps near their locations on waste lands, usually near railroads and on river banks.

The pessimistic view for cities in developing countries is that they just cannot afford to finance an effective waste management system. It is too expensive and needs too much subsidy. Therefore any solution should always be based on the acceptance of the reality that environmental degradation is unavoidable. The question is only the degree of it.

The optimistic view is based on the ussumption that the economy of the country will be growing, that cities will become more rich and that revenues will increase in the future. Therefore waste management should be planned on a long term basis, where solutions should evolve from simple, inexpensive but ineffecient and ineffective ones to become more and more efficient and effective as cities can afford more sophisticated and expensive solutions.

The two approaches will make a very interesting topic for an academic debate, but in the real world it is a difficult (and controversial) political decision.

4. Integrated Resource Recovery

Integrated Resource Recovery (IRR) is based on the concept of maximum utilization of waste through recycling and other methods. The objective is to reduce environmental pollution to the minimum, thereby minimizing social costs of pollution and gaining benefits from the utilization of waste.

IRR in advanced industrial countries is based on the introduction of "back end technologies", meaning technologies developed to recover waste at the end of the waste stream (at the dumping phase). It uses sophisticated plants for mechanical and chemical seperation of waste and recycling, it also uses inceneraters where possible to generate energy and produces compost from organic waste. Investment, operation and maintenance of plants for IRR are however very expensive, and is for developing countries still unaffordable.

There is however a hidden potential for the development of IRR in developing countries, which at this stage is still controversial. This is the scavengers who live from selling recovered plastic, paper, bones, glass, tim-cans etc. A study of the scavenging system in several Indonesian cities (Hans Versnel et. all, 1982) reveals the following characteristics :

- it is a pervasive system which can be found in big and small cities;
- it creates job opportunities in the urban informal sector with relatively high incomes (better even than textile workers and lower ranks in government);
- scavengers are in many cases "social drop outs" who go into scavenging as a last resort to survive in a hostile urban environment without going into criminal acts, such as theft, robberies, extortions etc. or prostitution.

Critics of developing the scavenging system as part of IRR argue, that :
- the contribution of scavengers in utilizing waste is not significant (less than 5%);
- scavenging is "below the dignity of men";
- scavengers are a nuissance, because they make the area around trash cans and transfer stations dirty;
- by giving legitimacy to scavenging, the city government will invite more people into this "dirty bussiness", and by doing that perhaps invite criminal elements to mix with them.

The conclusion is obvious : no IRR with scavengers.

A participatory action research (PAR) conducted by the ITB Center for Environmental Research (PPLH-ITB) from 1982 - 1986 with a group of scavengers in Bandung has given more insight into this controversial issue. Some of the most pertinent conclusions from the PAR are :

a. That the scavengers were able to organize themselves as a community within a relatively short period of time (± 4 months), complete with a school, a mosque and a savings and loan cooperative;

b. That they were able to increase their income and create new job-opportunities using loans from the cooperative;

c. That they were able to produce high quality compost and that there are spot markets for compost with relatively profitable prices.

The PAR has been useful in formulating a concept of IRR modules, which can be implemented step by step in middle size and large cities to take over the function of the existing waste management system based on collection - transportation - dumping. Every IRR module is designed to be economically a viable enterprise, with the following specification :

- one module serves ± 40.000 people (one Kelurahan);
- daily input 80 m^3 or appr. 60 tonnes;
- direct employment in the IRR module : 50 people;
- production outputs at initial stage (40% capacity) :

(a) compost = ± 10 tonnes @ Rp 40/kg	=	Rp 400.000/day
(b) plastic chips = ± 3 tonnes @ Rp 250/kg	=	Rp 750.000/day
(c) pulp + carton (estimated)	=	Rp 500.000/day
		Rp 1.650.000/day

- this gives a margin of profit in the order of Rp 300.000 per day, which can be used for improving the performance of the IRR module to a maximum of ± 80%, and for capital formation for replication of the module.

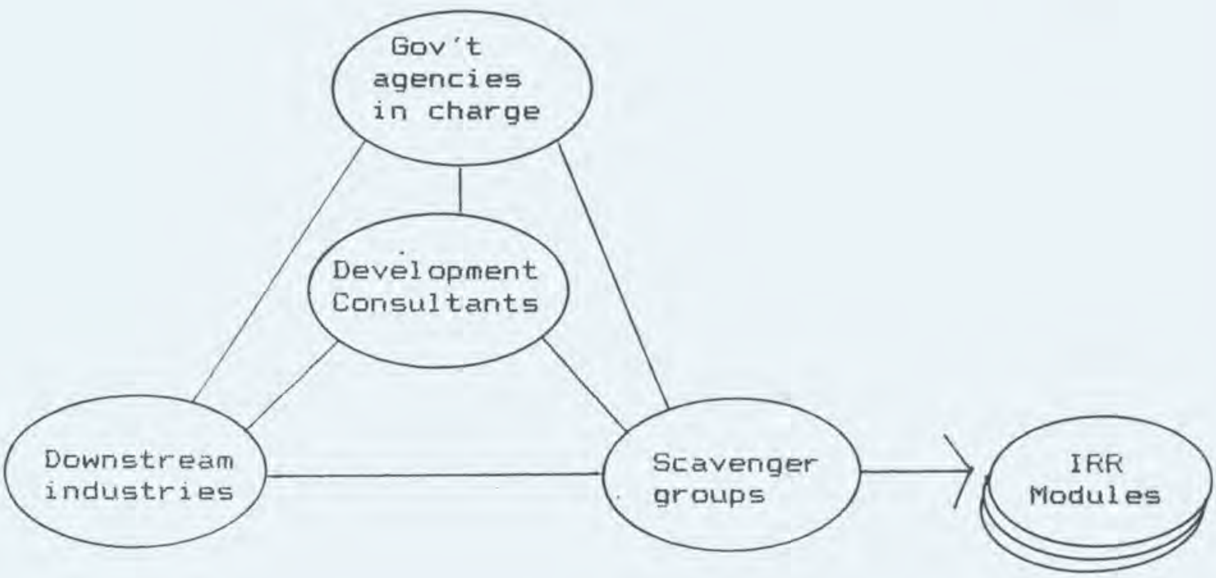
Pilot projects are being conducted in Bandung and Jakarta to test the viability of the concept on the scale of one module.

If the IRR experiment is successful, it can be replicated to replace incrementally the existing waste management system. The key in the implementation of IRR is the use of scavengers, organized into cooperatives, managing IRR modules. Management should be decentralized at the module level, with networking among them.

Planning of IRR involving scavengers is entirely different than ordinary waste management planning. In ordinary waste management planning, once decisions have been taken with regard to affordability vs effectiveness, centralization vs decentralization and high - tech vs low - tech, which by their nature are political decisions, the rest becomes a mechanistic - deterministic process resulting in a more of less "blue - print" plan. With IRR whole project development cycle is entirely different. It starts with a political decision to give legitimacy to the scavenging system. The second step would be a study of the scavenging system in the city, using social research techniques to get a picture of the structure and dynamics of the scavening system, through which two or three groups of scavengers may be identified who will be involved in PAR. Each group may consist of 25 - 40 people. PAR is an open-ended, stochastic process which may (or may not) end up in the establishment of an IRR module. After consolidation of the first experience, the process of replication may begin. Every step in the replication process is based on a unique opportunity to involve scavengers as subjects in the planning and implementation of an IRR module.

Thus the development of the scavenger-based IRR system must be conceptualized as an incremental, open-ended and stochastic process of replication of modules, responding to opportunities at each step in the process of replication. It is still to be seen whether government agencies can be given the responsibility to develop the IRR system on their own. There is some doubt in this regards, since government agencies may not be able to follow stochastic processes in the development of the IRR system.

A model for the development of the IRR system is suggested hereunder :



There is a need for professionally trained "development consultants", who can act as motivators, facilitators, catalysts and intermediaries in the process of establishing IRR modules, involving relevant government agencies, scavenger groups and parties in downstream industries and markets. The development consultants can be conceived as being part of a mechanism for conflict resolution in a creative process, where the actors involved have different interests which have to be resolved to come to an agreement for interdependent action.

Planning in this context should be conceived as being evolutionary, growing in its scope, depth and time frame as more experience is gained, networks become more consolidated and expanded, trained manpower becomes more available and more funds can be generated to finance the expansion of the system.

5. Application of EIA in Waste Management Planning

Any excercise in waste management planning will eventually result in a Waste Management Plan, which may take a more deterministic form as a Master Plan or a more flexible and adaptive from as a Structure Plan. In both (extreme) cases waste management planning can be conceptualized as a project, starting from initiation, going through its various phases to produce ultimately a Plan.

EIA is usually seen as being an external activity in project development. This is based on the premise that it should be an objective and independent activity, serving the interest of society at large. Project management (and the consultants involved in it) is by its very nature biased towards the interest of the "client"; in this case it may be the superior of the project management team within a local government organization, such as the head of the local planning board, or the chairman of a multi-sectoral commission responsible to the mayor for instance. In a case like this it is very likely that environmental impacts of certain decisions are ignored as project management (and its client) is very much dominated by (for instance) financial constraints, or other considerations in its planning. Within this context EIA is conceptualized as being an externally imposed corrective mechanism. A simplified diagram of the project organization may be illustrated as follows :

```
+-------------------------------------+
| CENTRAL GOV'T/LENDING AGENCY        +--------------+
|        LOCAL COUNCIL                |              |
+------------------+------------------+              |
                   |                                 |
                   |                                 |
+------------------+----------------+                |
|                  |                |                |
|       +---------+---------+       |        +-------+-------+
|       | THE "CLIENT" IN |         |        | EIA REVIEW    |
|       | LOCAL GOV'T       +-------+--------+ B O A R D     |
|       +---------+---------+       |        +-------+-------+
|                  |                |                |
|                  |                |                |
|    +-----------+-----------+      |                |
|    | WASTE MANAGEMENT      |      |                |
|    | PLANNING PROJECT      +----+-------------+    |
|    |    T E A M            |      |           |    |
|    +-----------+-----------+      |      +----+-+-------+
|                  |                |      |    E I A     |
|                  |                |      |  CONSULTANT  |
|    +-----------+------------+     |      +----+---------+
|    | WASTE MANAGEMENT       |     |           |
|    | PLANNING CONSULTANTS   +---+-------------+
|    +------------------------+     |
|                                   |
+-----------------------------------+
```

PROJECT MANAGEMENT SYSTEM

The situation may well be that a country does not have as yet an Environmental Act which makes it a legal obligation for local governments doing waste management planning to do EIA. In this case the Central Government (perhaps under pressure from the international lending agency) may require the local government as secondary borrower to assign an EIA consultant to make an assessment of the Plan, to be presented before an EIA Review Board, established by the Central Government and lending agency, supported perhaps by the Local Council representing the interest of the local community.

Looking back to the many alternatives which have to be explored in making the best choice to plan a waste management system for a particular city, it would seem that a set-up such as presented above may have inherent weaknesses, as external EIA consultants may have difficulties to follow the planning process at every step. Financial administrative requirements may not be supportive for this kind of purpose. Secondly, there may be no EIA consultant available who have got an insight into the complexities and intricacies of "internal politics" in local government administration to serve effectively.

EIA in waste management planning should be conceived as an integral part of a continuous project development process. This suggests that the project is best served by having EIA as an "in house" activity of the planning team (the project management and consultant), rather than being an external activity giving a feedback into the planning process after the plan has been formulated. It may be then already too late to resolve planning decisions which have been made before.

To clarify it further, two alternative structures of project management and management processes can be compared hereunder:

```
+--------------------+                            +--------------------+
| +--------------+   |     +----------+           |  +-------------+   | +---------+
| | THE "CLIENT" +--------+ E I A     |           |  | THE "CLIENT +----+ LOCAL   |
| +--------------+   |    |  REVIEW   |           |  +------+------+   | | COUNCIL |
|                    |    | BOARD     |           |         |          | +---------+
| +--------------+   |    +-----+-----+           |  +------+------+   |
| | THE PROJECT  |   |          |                 |  | THE  P M U  |   |
| | MANAGEMENT   +-----------+  |                 |  +------+------+   |
| |    UNIT      |   |       |  |                 |         |          |
| |  (P M U )    |   |    +--+--+------+          |         |          |
| +--------------+   |    |  E I A     |          |  +------+-------+  |
|                    |    | CONSULTANT |          |  | PROJECT CON- |  |
| +--------------+   |    +--+---------+          |  | SULTANT WITH |  |
| | THE PROJECT  |   |       |                    |  | IN HOUSE EIA |  |
| | CONSULTANT   +-----------+                    |  |     TASK     |  |
| +--------------+   |                            |  +--------------+  |
|                    |                            |                    |
+--------------------+                            +--------------------+
```

PROJECT MANAGEMENT SYSTEM (MODEL I)

PROJECT MANAGEMENT SYSTEM (MODEL II)

```
|   FEASIBILITY STUDY    |  PLAN DEVELOPMENT |    PROCESS OF ADOPTION     |
|<---------------------->|<----------------->|<-------------------------->|
|                        |                   |                            |
                                +-------------------+
                                V                   |
+-----------------------+   +------------+     +----+----+  +-----------+
| PRELIMINARY PLANNING  +-->| FINAL PLAN |     | REVIEW  +->| ADOPTION  |
| WITH BASIC OPTIONS    |   +-----+------+     +---------+  | OF PLAN   |
+-----------------------+         |            ^            +-----------+
                ^       |         |            |
                |       V         V            |
         +--+-------------+   +----------------+
         |  EXTERNAL EIA |   | EXTERNAL EIA |
         +----------------+   +----------------+
```

PLANNING PROCESS ACCORDING TO MODEL I

```
+----------------------+   +---------------+  +-------------+  +-----------+
| FEASIBILITY STUDIES  |   | REVIEW AND    |  | PLAN DEVE-  |  | ADOPTION  |
| OF OPTIONS WITH      +-->| ADOPTION OF   +->| LOPMENT     +->| OF PLAN   |
| INTERNAL EIA         |   | OPTION BY     |  +-------------+  | BY LOCAL  |
+----------------------+   | LOCAL GOV'T   |                   | GOV'T &   |
          ^                | AND COUNCIL   |                   | COUNCIL   |
          |                +-----+---------+                   +-----------+
          |                      |
          +----------------------+
```

PLANNING PROCESS ACCORDING TO MODEL II

Both models assume that the Terms of Reference (TOR) should be formulated with due recognition of possible environmental impacts to be assessed. The TOR itself may be formulated by the management team, and approved by the central Government and lending agency with/without involvement of the Local Council, or it may be formulated by an indenpendent mission from the lending agency.

The pro's and contra's of both models can be debated, but decisions may rest on practical or perhaps political grounds.

Removing waste from the city environment by any method has always a positive ballance from the point of view of its overall costs and benefits of such a project, even if only part of the waste can be removed (in Indonesia only 60% - 80% of urban waste can be handled). The difference between alternative systems is only in degree. It is at the component level of the waste management system, where there is a concentration of waste to be handled, that the environmental impacts can in ballance be negative. Therefore it is here that EIA must be focussed.

6. EIA on the Component Level of the Waste Management System

A waste management system has components in it which in the Master Plan or Structure Plan are left open for later decisions. Such components may be related to the waste management process as illustrated hereunder :

PROCESS / COMPONENT	SOURCE	COLLECTION	TRANSFER DEPOT	IRR MODULE	FINAL DUMP	DOWN-STREAM PRODUCTION
- SEPERATION	*	*	*	*	*	
- INCENERATION			*	*	*	*
- COMPOSTING				*	*	
- RECOVERY FOR RECYCLING	*	*	*	*	*	
- CONTAINER UTILIZATION	*	*	*	*	*	
- SANITARY LANDFILL					*	
- WASTE PROCESSING INTO NEW PRODUCTS				*	*	*
- OPEN DUMPING						

Separation of waste into organic and inorganic waste may be done intentionally or unintentionally by scavengers. Intentional separation is always related to utilization of waste such as composting and recycling. It can be done at various points in the waste management process. But ideally it should be done at source, so that inorganic waste is still unsoilled and can retain a high resale value. Separation of waste is always environmentally positive, and does not have to assessed as to its environmental impact.

Inceneration can be done at various points in the waste stream : at transfer depots or IRR modules, at dumping sites or as part of recycling. Inceneration without utilization of the energy generated by it is on ballance a loss. It creates air pollution compensated only by reducing solid waste to be dumped. Ash as a by-product may still be usefull. But the biggest positive contribution in the form of energy may be lost, so that EIA for inceneration may be negative. Yet, for Indonesia the problem of solid waste inceneration is not that its impact may be environmentally positive or negative. In a situation where the government cannot afford to give subsidies, the problem is simply that inceneration has to be economically viable. At present it is not.

Composting can be done in the IRR module or on the final dumping site. The environmental impact is definitely positive. Therefore no EIA may be needed. Rather, the problem is its economic feasibility. Manual composting can be done in small batches, very much adaptive to an uncertain market. A big composting plant may have difficulties in marketing its product in bulk. The experience in Indonesia is that composting plants are running at a loss. An EIA may be needed for these big plants, although a well designed and managed composting plant may only be a local nuissance.

Recovery of waste for recycling such as platics, paper, glass etc. can be done in a central plant. Centralized recovery at the end of the waste stream needs a large and sophisticated plant, too expensive for most developing countries to afford. However, if one is to be installed, EIA is needed to assess the impact of concentration of hazardous materials which may be a by-product of waste recovery. Decentralized recovery of waste in small plants such as an IRR module with manual methods is a dispersed operation. If there is an environmental impact it is most probably negligible.

Container utilization is adopted because of environmental health reasons, and therefore from this point of view definitely positive. Its social impact is therefore also positive, except for scavengers. They are isolated from waste and may have to look for other work opportunities. For metropolitan cities the number of people affected may run into the tens of thousands, which may create a significant problem of employment generation. In Indonesia, the decision has been made in favour of containerization.

Sanitary landfill as a technology has been adopted to mitigate the environmental impacts of open dumping. As a technology it is well known, so that EIA of open dumping is hardly needed. The solution is obvious, but the problem is how to finance the solution. Sanitary landfill is very expensive and has to be subsidized. In the Indonesian case, many cities still opt for open dumping.

Waste processing into new products in down stream industries, such as plastic, pulp and paper, steel and metal processing industries etc. may be done in entirelly different locations. Plastics from Bandung for instance is sold to factories in Jakarta. The pattern of location of these waste processing industries is highly unpredictable and therefore difficult to be assessed. EIA in this regard would be better done by having it as part of investment in processing and manufacturing industries, controlled through other channels. In the Indonesian case through planning and building permits.

Open dumping is the most polluting component in the waste management system. EIA may help in identifying more suitable locations, but any solution takes pollution for granted. The problem is only how to minimize any impacts it may have.

7. Concluding Notes

EIA in waste management planning can be seen as an attempt to increase rationality in decision making with regard to the choice of alternative technologies to be used. It may be excercised in planning of the total waste management system for a particular city as well as planning of its components.

However, in developing countries one may be confronted with difficult decisions, whether to tolerate negative environmental impacts to afford a solution at all for waste management, or to eliminate negative environmental impacts with high subsidies. Decisions are clearly political in most cases. It is here that EIA may contribute at least to give decision-makers a better understanding of the consequences of their decisions, and with it to be more responsible.

TOWARDS SUSTAINABLE DEVELOPMENT

by Emil Salim

There is something wrong in the way we are conducting development if:

- o the benefit of growth is accompanied by the reduction of the quality of life of the people;
- o if industrialization goes hand in hand with the increase process of pollution;
- o if the development process destroyes the resource base of its own growth;
- o if development raise the welfare of the current generation but reduces the options of future generations to raise their own standard of living.

The case of Bhopal in a developing country and the contamination of the river Rhijn in the developed countries are clear evidence of the mistakes made in the current pattern of development. A pattern of development that seperates development with the environment. A pattern of development that treats environment as an add on elements to be taken care of after the development has taken place.

For too long environment has been considered as an exogeneous variable in the developmental model. Development starts its process without environmental considerations. Only after the environmental issues emerge, than it is deemed necessary to take them into account.

Such an approach can be applied in the developed countries who can bear the costs of cleaning up the environment. The developing countries however cannot afford such a process. For the developing countries it is important to device a system that is least cost.

Sustainable Development

The developing countries can gain from the mistakes made in the development process by the developed countries. The lesson taught is that a different path needs to be chosen: the path of sustainable development.

But what is sustainable development. According to the World Commision on Environment and Development's definition in Our Common Future, "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Sustainable development maximizes the benefits of the existing resources while maintaining the capability of the same resources to produce benefits over time.

It refers to the use of the resources while maintaining its capacity to produce continuously. In the case of renewable natural resources it means that the capacity to renew itself naturally is maintained. While for non-renewable resources it means recycling of the resources through the production process, optimize output with minimum input, and to use the fruits of the use of these non-renewable resources to develop other sectors to allow sustained development.

It requires a development strategy that prevents the depletion of exhaustible resources, to use the resources while taking into account their rate of regeneration.

It chooses the technology and process of production that emphasizes efficient use of resources, minimum level of destruction and the avoidance of waste.

To make development sustainable, three major efforts are necessary. First, is the proper planning of resource use within a region. Through spatial planning it is necessary to take into account major characteristics of the resources. To maintain the sustainability of land resources for instances it is important to take into account factors that may influence the sustainability of land use, such as its slope, its height above the sea level, the composition of its soil, the density of rainfall, the accessibility of the land, etc. All these factors affect the continued sustainability of the land. Spatial planning will be useful to direct development into zones which takes into account the various use of natural resources, while keeping into account their major characteristics. Through the development in accordance with the proper zones, it will be possible to enable the process to proceeds along the sustainable path.

Zones are not only determined by the physical characteristics of land, but also by its mineral content, leading towards a trade off between agricultural development and mining,

Spatial planning is also aimed at the sustained use of water, either surface or ground water. Both its quantity and quality of water should be maintained at a level to support development. In this connection river basin development becomes of crucial importance.

Both soil and water are strongly affected by the conservation of forest, more specifically in catchment area and steep slopes. In spatial planning the forest is not only imprtant to maintain the water reservoir, it is also important to allow clean air and becomes the habitat for genetic resources.

In general, spatial planning is aimed at the sustained use of resources in support of development.

Second, is efforts to control pollution. Development produces not only useful output, but also negative output in terms of waste, solid, fluid and gas. Among all the waste, of the highest priority is hazardous and toxic waste. Efforts are directed to use the technology and process of production that minimizes waste. Recycling of waste is another effort to make waste useful. If this effort is exhausted, than efforts are concentrated to reduces the degree of hazardousness of the waste through various technology. If this is not sufficient, through incinerators the waste can be burned. As last resort, waste can be dumped as sanitary landfill.

In general, efforts to control pollution is amed at allowing production to be exercised below a given standard applied most commonly to water and air. The more stringent the application of the standard, the more cleaner is water and the air -- but also more expensive will become the company's cost of production. A trade off is here implied between the higher quality of the environment and the higher company's cost or production.

Finally the <u>third</u> effort is the implementation of the environmental impact analysis or EIA. This is considered part of the planning process. EIA is part of the feasibility study. A feasibility study usually starts with a technical feasibility study. It is now suggested that before one engage oneself into the economic feasibility study, it is necessary to conduct the environmental impact analysis.

It reveals the possible impact of the project development on the environment, either physical or social environment. It provides feedback to measure the positive as well as the negative impact of development on the environment. By setting standards that may not be exceeded by the impact of development, it makes possible a development without destruction. It allows for stressing and improving the positive impact and controlling or reducing the negative impacts of development on the environment.

<u>Shortcomings of Economics</u>

All these three major efforts, such as spatial planning, pollution control and environmental impact analysis assumes the intervention of the Government in the economy. Such an intervention is called for to overcome the shortcomings of economics.

The functioning of the environment is based on the principle of interdepence. Everything is related to everything in the environment. This is not true in economics. Interdependence are considered as producing externalities. While it is possible to take them into account, externalities are not treated as an indogenous variable in developmental models. Markets does not take interdepence explicitly into account. This is one of the reason why environmental issues have no response in the market. It also explains why market prices are imperfect as indicators for the proper conducts in the environment.

Under these circumstances the Government can intervene to correct price distortions in the market. Spatial planning, pollution control and the application of the environmental impact analysis are tools to improve the environment.

The weaknes under these circumstances is that corrections in of price distortions in the market by the government requires political considerations in addition to the economics one. It is therefore of primairy importance to enable active people's participation in the process of sustainable development. With "the people" are also included those that may be negatively affected by the process of development that ignores its impacts on the environment.

Through the inclusion of people's participation, it opens the possibility of channeling environmental consideration into the development process. Development hence requires a participatory approach that opens the window for environment to be merged into development.

People's participation in development however requires the growth of trust between the government in and the people. A trust that environment ~~does~~ is not only reveals the flag waiving at the top of the mast of the ship, but ~~environment~~ it also ~~enters into~~ the cargo carried ~~of~~ the ship. People's engagement in environment must not be interpreted as efforts of disguised politicing by the people. On the other hand, the government need not be treated as a priorie anti environment, and hence promoting development with destruction.

It is important to recognize that there is a built in conflict in the use of resource. The use of the land for agriculture will pre-empt the use of the same land resources for mining operation. By the same token, the use of resources for one purpose may have different environmental implications as compared with the use of resources for other purposes. These differences ~~results~~ may well create conflicts in the use of resources.

If the market does not function well to resolve these conflicts than the burden for ~~this~~ (resolving conflict) has to be ~~carried~~ borne by the government.

This implies that development with environmental considerations requires the active role of the government in the economy. Such an active role needs not mean that government should do everything. It does imply that the market needs correction, and the government will allow the economy functions better with environmental consideration if it takes the proper measures.

But governments in most developing countries are usually not ~~equi~~fully equiped in exercising the active role of correcting the market. In some cases it seems more desirable to ~~support a more~~ de-control and de-bureaucratize ~~role of~~ the [role of the] government in ~~the~~ its conduct of economic management.

Under these circumstances, the active involvement by the people can counterbalance these shortcomings. And people's partcipation may ~~may~~ be helpful to assist the government in correcting the market

These are then some of the considerations, why the environmental law in Indonesia puts much emphasis on the involvement of people's participation in development with environmental considerations. While this principle is recognized, much however needs still to be done to make people's partcipation more effective.

Among the important efforts that needs to be done is training and educating the people in the fields of environmental impact analysis. Training is required to read environmental standards, to make EIA reports and to analyse critically its results.

While traning is recognized of utmost importance, the Indonesian Government is however of the opinion that in cases of environmental destruction, the burden of the proof for not polluting the environment rest on the shoulders of the accused. The principle of "strict liability" has been introduced in the Indonesian law of the environment. This is based on the observation that the accused "polluter" is better trained and facilitated to deny pollution [and to proof its innocence as] compared to the accuser, which usually are the general public.

Because training and educating becomes important, this role is given to the Environmental Study Centres at more than 40 universities throughout Indonesia. These centres have the responsibility of training and assisting the regional government and the public in the field of environmental impact analysis.

The need for Cooperation

Sustainable development, while necessary is ~~recognized~~ not simple to be implemented. Especially when economic science has its shortcomings, and environment is treated as an exogeneous factor in the development.

Theoretically it is however possible to launch the pattern of sustainable development. To make it a succes however requires the development of a proper model that takes all the shortcomings of economics into account, and makes possible the implementation of spatial planning, pollution control and Environmental Impact Analysis.

Training and the built up of informations, techniques and methodologies are needed. It is with this awareness that I welcome the implementation of "the Regional Training Seminar on the Application of Environmental Impact Analysis in the Appraisal of Development Project Planning" in Bandung today.

There is a need to exchange information, to learn from each other, to conduct training seminar among countries in the region with similair problems.

It is expected of course that such a regional training seminar will plant the seeds for sustainable development. That it opens the way for a cotinued contact between partcipants and between countries.

That by so doing it provide a firm basis for strengthening the pattern of sustainable development, not only in Indonesia but in the ESCAP region as well.

Jakarta, Mei 30th, 1988

Application of EIA in Planning of Hydroelectric Projects: The Saguling Case

by

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The Saguling dam was constructed in the early 1980s and shed in 1985. In 1979/1980 an EIA was conducted by the itute of Ecology at the request of the State Electric Company Indonesia (PLN). At that time the Indonesian environmental law not enacted yet and consequently there was no legal basis yet conducting the EIA. But because the dam was partly financed loan from the World Bank, an EIA was required.

Identification of impacts

The impacts identified in this project are presented in res 1 to 4. Because of the shortage of time I will not uss all the important impacts, but will only select the most rtant ones for illustrative purposes. Details of the EIA were rted by the Institute of Ecology (IOE, 1979; IOE, 1980).

1. The impact of urban wastes.

This is an impact of the environment on the project. Since project is located downstream of Bandung and its satellite s, the urban liquid wastes of these population centres are harged through the tributaries into the main stream and ke into the lake. We expected that the lake would undergo phication which, among others, would stimulate excessive owth of aquatic weeds. Accordingly we monitored the main stream a station which was located a short distance from the lake and lculated the nutrient load from the data. From Table 1 and ble 2 we concluded that from the point of view of water quality was very likely that there would be excessive growth of uatic weeds. In surveys of the area to be inundated and the tchmwent area of the lake we found some troublesome weed ecies, among others, water hyacinth, Salvinia spp hydrilla and crocystis. Examination of the lake morphology further showed at the lake would be very indented, i.e with many bays, and the ores would on the average have gentle slopes. These conditions uld be very favourable for aquatic weeds growth. These findings rengthened our conclusion of the high probability that the lake uld be plagued by aquatic weeds.

Aquatic weeds would increase the loss of water from the servoir, because of the high rate of evapotranspiration; the gh rate of production of biomass would reduce the lifetime of e project; they would reduce the aesthetic value of the lake d hence reduce the potentials for tourism development; they uld interfere with water transportation; they would also be ed as habitats by certain disease vectors, e.g mosquitoes. wever, aquatic weeds also have their beneficial effects, i.e ey purify the water (Wolverton et al. 1976) and within certain mits they are useful for fish.

Monitoring after the lake was formed confirmed our ediction (Siregar, et al 1988).

The impact of soil erosion

From visual observations of the colour of the Citarum river suspected that the river basin was undergoing high erosion es. Accordingly we identified that the heavy sediment load ld have an adverse effect on the reservoir. Measurements were ducted to estimate the erosion rates of the river basins in catchment area of the lake and they were ranked according to levels of erosion.

Another type of erosion would be on the slopes of the drawdown as which would be cultivated by people who lost their land /or sources of living.

The impact of inundation

Major impacts of inundation were the loss of agricultural ds and the displacement of the people who resided in the area. loss of agricultural land would diminish the land/man ratio consequently would increase population pressure, since the ority of the people were farmers and hence depended on land their living. Furthermore, the land which would be inundated tained a large area of fertile irrigated agricultural fields.

Studies showed that most people who would be displaced by reservoir wanted to resettle in the surrounding areas and a low percentage were willing to be transmigrated. This ether with the loss of fertile agricultural land would create e problems for the people in finding new sources of living.

In addition to the above problems it was also found that a ge number of people who lived above the high water level (HWL) ended on the resources below the HWL and consequently that ese people would lose their sources of income. Therefore, though they would not be physically displaced, they would fer from the construction of the dam. And yet they would not ceive any compensation money, since their property above the would not be lost. On the basis of the result of interviews was revealed that the number of households who would be living ow the poverty line would increase (Table 3).

On the other hand although inundation would cause the loss agricultural lands, the reservoir would be a new resource ich could be used to create new sources of living.

Management of impacts

1. Aquatic weeds

Experience has shown that when aquatic weeds had already wn out of control, it was very difficult to eradicate them. It therefore recommended to control the weeds from the very inning, when they were still few in number. This would mean t from the very beginning of the existence of the lake, ular patrols would have to be carried out and measures taken manually take them out. However, if in spite of these measures y would still invade the lake, which presumably would occur ause of the high level of nutrient load and the favourable e morphology and morphometry, efforts should be made to elop methods which would make them beneficial for the people ing in the surrounding of the lake. If this could be done, the ple would utilize the weeds and by doing so they would control weeds. An upper limit of tolerance would have to be ablished for the occurrence of the weeds. Below this limit the e authority would allow the weeds to grow to be utilized by people and only when the weeds exceeded this limit, would trol actions be taken. It was also recommended to confine the ds to the upper parts of the lake to be used as a filter for purification of the water.

The upper tolerance limit was estimated to be about 1% to 2% the total lake area.

A method for the utilization of the weeds was subsequently eloped by processing them into compost to be used as a medium growing earthworms as fish feed in combination of rabbits. green matter required to feed the rabbits would be grown on upper slopes of the reservoir to control soil erosion. An tial economic analysis showed the feasibility of this scheme emarwoto, et al 1988).

er successfull laboratory experiments were conducted fields eriments are now being carried.

Displacement of people

The most difficult impact to be mitigated was the lacement of the large number of people. The most promising ibility was to develop fisheries, since our studies showed the people of the area had a deep rooted culture of eries, albeit pond and rice field fisheries. The types of eries which were thought to have good potentials were a) ure fisheries, b) aquaculture of common carps in floating , and c) agri-aquaculture in the drawdown areas.

The aquaculture development has proven to be very essful. Within about two years the number of floating nets risen to about 950. The dramatic growth of number of nets was to the high profitability of this system (Table 4). The table shows that potentially the revenue from fish culture would ed that of rice which was produced before the lake was ed. It has absorbed increasing numbers of labour.

The capture fisheries has not developed quite well, partly use of overfishing by the people because they their sources income by inundation. However, experiments for growing erlings of the nile tilapia, which can be used to restock the has been successfull. We are also optimistic that we will able to develop hatcheries of this species in floating nets. selection of the tilapia was based on the information that species could feed on Microcystis, a troublesome microphytic tic weed (Moriarty, 1973).

Another effort to develop capture fisheries is to stock the gic zone of the lake which is presently not utilized by any species. The plan is to introduce a fresh water sardine eichthys aesarnensis) from the Ubolratana reservoir in land which has shown to be very productive and can be caught ishermen using very simple gear.

The agri-aquaculture system has also not developed yet, use the water level of the lake has dropped to very low ls due to the filling of Cirata and an unusual long dry son in 1987 as an effect of the El Nino. Initial experiments already been conducted to grow plants on the slopes of the down areas for feeding the rabbits. With more people who keep its and earthworms the need for growing plants for the rabbit has already been created and it is expected that when they seen our demonstration plots they can be induced to grow the nts with proper soil conservation methods.

Beside fisheries development other recommendations were the elopment of tourism and secondary development. However, these ommendations have not been carried out.

Figure 5 presents the options of resettlement. For each ion the responsible governmental agency, which would carry out respective activities, were identified.

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Table 1. Critical nutrient load for total-N and Total-P with respect to aquatic weeds blooms

Av. depth	Threshold (g/m3/yr) Total-N	Total-P	Dangerous level (g/m3/yr) N	P
5	1.0	0.07	2.0	0.13
10	1.5	0.10	3.0	0.20
50	4.0	0.25	8.0	0.50
100	6.0	0.40	12.0	0.80
150	7.5	0.50	15.0	1.00
200	9.0	0.60	18.0	1.20

Table 2. Prediction of total-N and total-P loads in the proposed Saguling reservoir

Parameter	N	Equation	Load	
			Ton-yr	g/m3/yr
Total-N	84	$L = 0.00034\ Q^{2.64}$	976.3	17.4
Total-P	84	$L = 1.98\ Q^{0.39}$	570.8	9.1

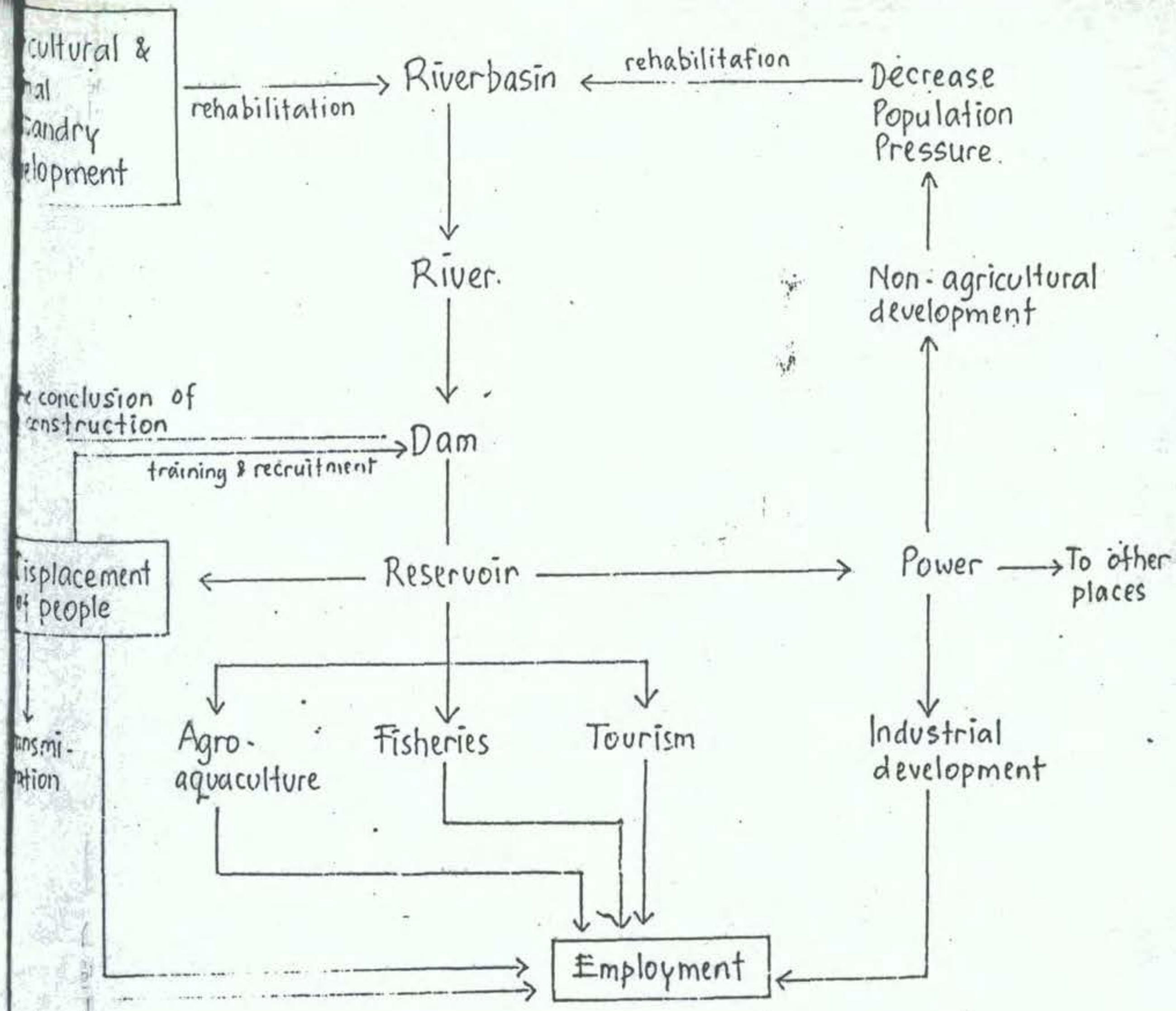
Table 3. Standard of living of people residing above the HWL base on total income and income from resources above the HWL only

Level of dependency on resources below HWL (%)	Based on total income > PL		< PL		Baed on income above HWL only > PL		< PL	
	HH	%	HH	%	HH	%	HH	%
< 25	1,678	22	610	8	1,526	20	762	10
25 - 49	2,288	30	762	10	1,601	21	1,449	19
50 - 74	1,220	16	458	6	306	4	1,372	18
> 75	305	4	306	4	-	-	611	8
T o t a l	5,491	72	2,136	28	3,433	45	4,194	55

e: PL = poverty line

le 4. Mitigation of inundation by fisheries development

Production Ton/yr (2)	Production Rp/yr (3)	No. of people (HH) (4)	Floating net (5)	Net income Rp/unit/3 md (6)	5400 units (at 632.5 m water level) Net income (7)	Impact 8 : 3	Employment (people) (9)
5,394	1.0×10^9	3,038	Fish farmer				
			Av.	130,000	2.2×10^9	1.2	17,280
			Max.	543,000	8.8×10^9	4.6	
			Demonstration plots				
			Low	288,000	4.7×10^9	2.5	
			High	474,000	7.7×10^9	4.1	



5. SUMMARY OF THE RESETTLEMENT SCHEME

Application of EIA in Agricultural Development

by

Otto Soemarwoto

Agricultural development can have many objectives, among others, to increase food production for overcoming food shortages or for achieving selfsufficiency in food, to increase the export of certain commodities, to resettle displaced people, to create new employment, and to combat soil erosion. Often it has a multipurpose nature, i.e a combination of several objectives, although in many cases one has been identified as the main objective. The impacts of agricultural development will obviously depend on the objective(s), since the technology used will be selected in accordance with the objective(s). For example, the impacts of agricultural development for increasing food production will be different from the ones caused by agricultural development for combatting soil erosion, although some impacts may be similar. It is therefore important to identify the impacts of specific agricultural development projects beforehand using techniques as discussed earlier in this seminar (Soemarwoto, 1988).

Because of the multitude of types of agricultural development and the time constraint in this seminar, we will discuss only one specific example, i.e agricultural development for increasing food production which is being done in many countries of the Asia-Pacific region. In general increasing food production can be achieved by extending the hectarage of land under cultivation without substantial improvements of the methods of production and/or by intensifying the inputs, e.g introduction of high yielding varieties, improvement of irrigation, better crop protection, and increasing the cropping intensity. Again because of time constraint let us limit our discussion to agricultural intensification. Figure 1 presents a flowchart of the potential impacts.

The toxicological aspects of agricultural development will be discussed by Dr. Nani Djuangsih.

We will discuss the following impacts.

Genetic erosion

A very common method of agricultural development is the introduction of high yielding varieties (HYV). When this introduction of HYVs is successful it will spread throughout the area of development and even beyond it. As a result a large area is planted with only a few varieties and often even with only one. The local varieties disappear. This has been observed with rice, wheat and other crops in the green revolution. This means that a high rate of genetic erosion often accompanies agricultural development.

Strengthening of the social value of the main staple food

The main staple food generally also has a high social value. For example, in Indonesia rice has a high social status. On the other hand non-rice food is considered of low status, i.e only good for the poor. The rice campaign in Indonesia has strengthened the social status of rice. Consequently, with the success of our rice campaign together with the rise in the average income of the people food consumption has increasingly shifted to rice (Figure 2). Hence, Indonesia is depending more and more on one staple food, i.e rice. Ecologically this is a dangerous trend. Should rice production suffer a dramatic decrease because of natural disasters, e.g outbreaks of a disease or unusual draughts, or wars, either at the national or international level, we would find ourselves in a very difficult position. In other words the success in the rice campaign has ironically made us more vulnerable.

Loss of crop rotation

In many places the traditional way of crop production is by rotating the crops sequentially and/or by mixing many crops. By doing so the people can fulfill their multiple needs. However, by emphasizing the main staple food, often by giving incentives for growing this crop, e.g by giving credits and the construction of infra-structures, and disincentives for the other crops, the people are pushed to increasingly grow this particular crop. The result is that crops other than the main staple food are disappearing and the main staple crop is grown continuously without rotation. A further consequence of the loss of rotation is a build up of pests and diseases (Figure 3). This problem is often exacerbated by the appearance of resistance of pests to pesticides, the killing of predators of pests, the appearance of secondary pest and pest resurgence (Dasmann, *et al*, 1973; WHO, 1987). In Indonesia the total losses in irrigated rice due to the 1986/87 outbreak of the brown planthopper pest was estimated to be $300 million (Barbier, 1987).

Loss of employment

Increasing inputs also means modernization. New methods are introduced which are more efficient in terms of costs. This cost reduction also includes labour. Consequently, people loose their jobs. This has been reported, among others, in the Philippines, Indonesia and Thailand (Gooneratne, 1982). For example, in Indonesia rice was traditionally harvested by women with a small hand knife and the rice pounded by hand, also by women, to remove the husks. Now, however, these methods have been replaced by, respectively, harvesting by men with sickles and mechanical rice hullers. A large number of women lost their jobs (Collier, *et al*, 1974; Collier *et al*, 1982; Timmer, 1974).

Health impacts

Development of irrigation also means the creation of new habitats for mosquitoes. Furthermore it often facilitates the growing of rice the whole year round which in turn enables the mosquitoes to breed continuously. Therefore, it has been suspected that irrigation has increased the incidence of malaria. However, the relationships seem to be complex (WHO, 1987). In Saguling there is the risk that malaria will be introduced in the area, because some transmigrants who returned from malaria endemic areas brought with them the parasites, while the vectors are present in the Saguling area.

Bilharziasis is another disease which may be increased because of irrigation development.

It was also reported that the use of agricultural pesticides have induced resistance to pesticides in disease vectors (WHO, 1987).

Management of impacts

A major tool for the management of the impacts of agricultural development is to endeavour to maintain crop diversity as much as possible. Although crop diversity **per se** does not necessarily mean less pests, it does often mean that the risk of crop losses due to pests can be reduced. The reasons for this are many, among which the following.

First, by having crop diversity in space as well as in time "the eggs are not being put in one bag".

Second, temporal crop diversity, i.e crop rotation, prevents the accumulation of pests, particularly mono- or oligophagous pests, such as the brown planthopper. The effects can be increased, if accompanied by sanitary measures.

Third, sometime certain crops have an inhibitory effect on pests.

Because of the reduction of the risk of crop losses the need for pesticides will also be reduced which in turn will reduce many problems, such as pollution, pest and vector resistence, secondary pests and pest resurgence. In the case of rice the rotation of rice with non-rice will reduce the requirements for water and, hence, also the need for more irrigation development, thus eliminating many of the adverse effects associated with water resources development.

A major requirement for preserving crop diversity is that not a single crop will be excessively enhanced above the other ones, including its social status. In fact in cases where a crop has occupied a too high social status, such as rice in Indonesia, its importance should be deemphasized.

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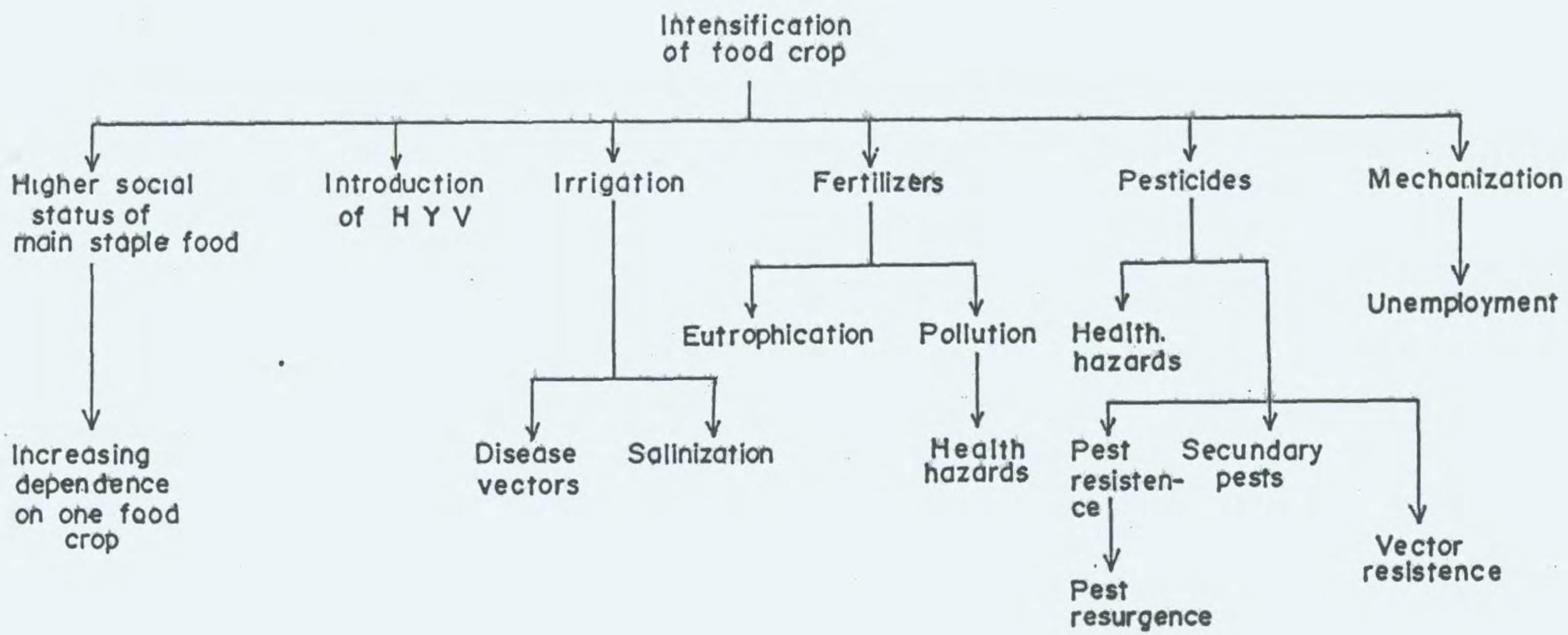

Figure I. Flowchart for the Identification of the potential impacts of intensification of food crop

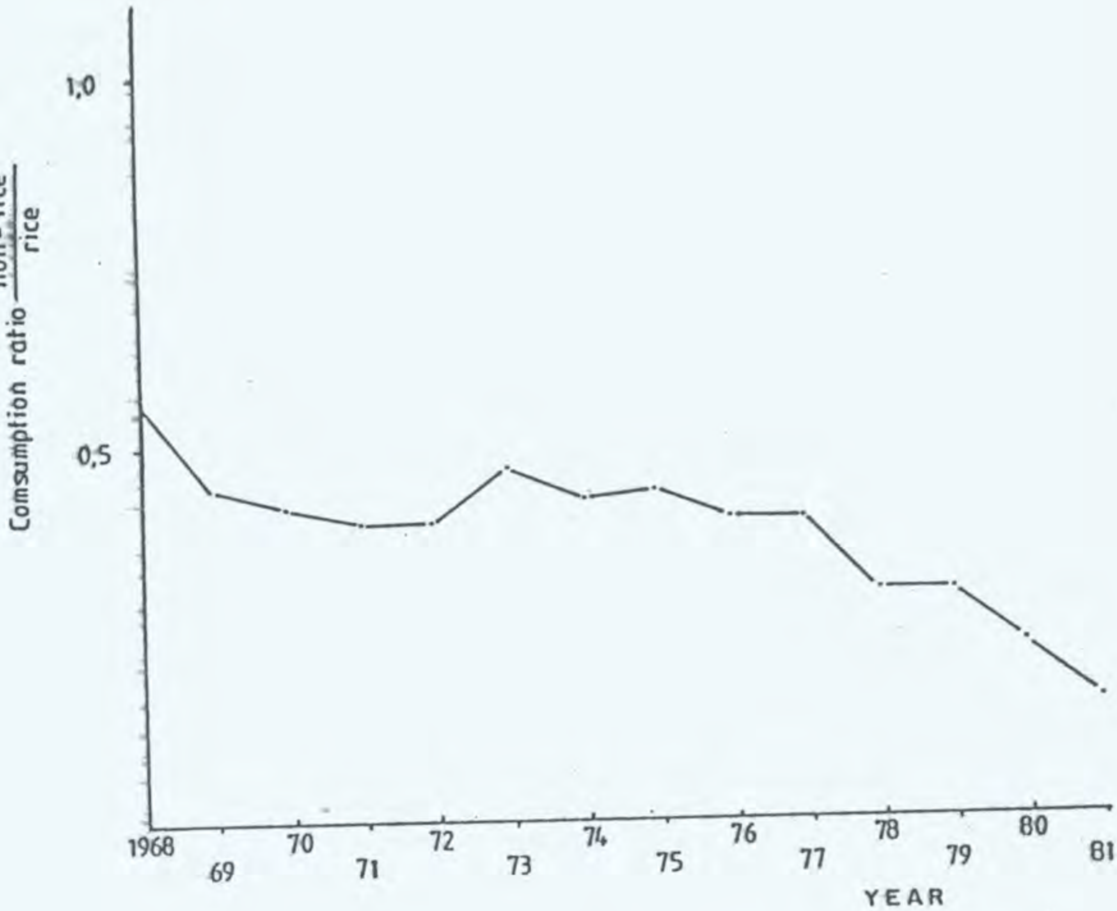

Figure 2. Shift of food consumption from rice to non- rice.

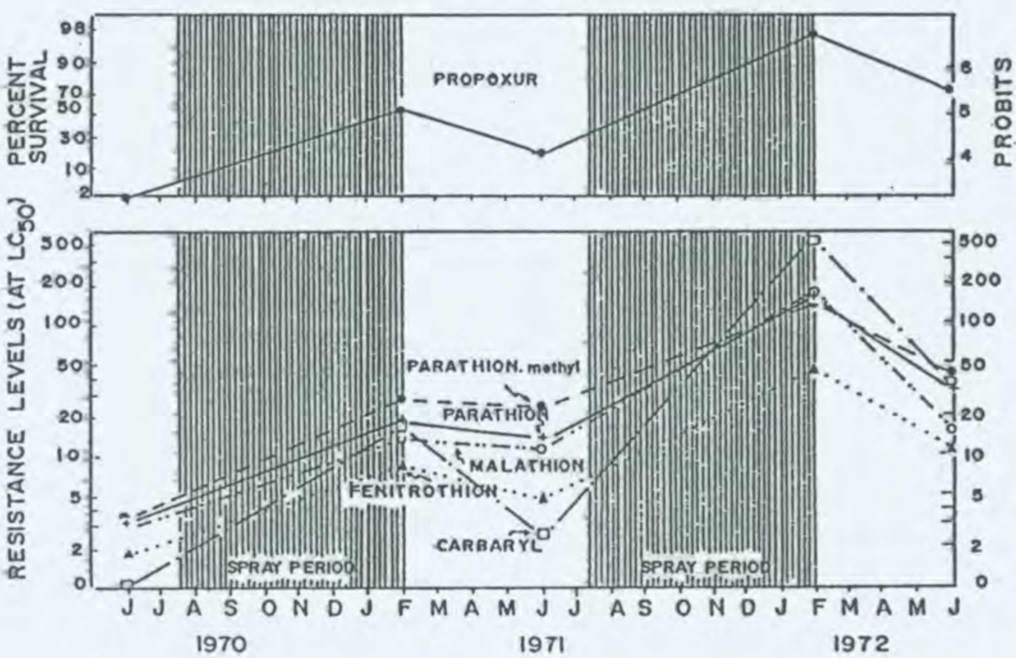

Figure 4. Fluctuation in resistence levels toward organophosphates and carbamates in Anopheles albimanus with reference to alternating agricultural spray and non-spray periods (after Georghiou et al., 1973)

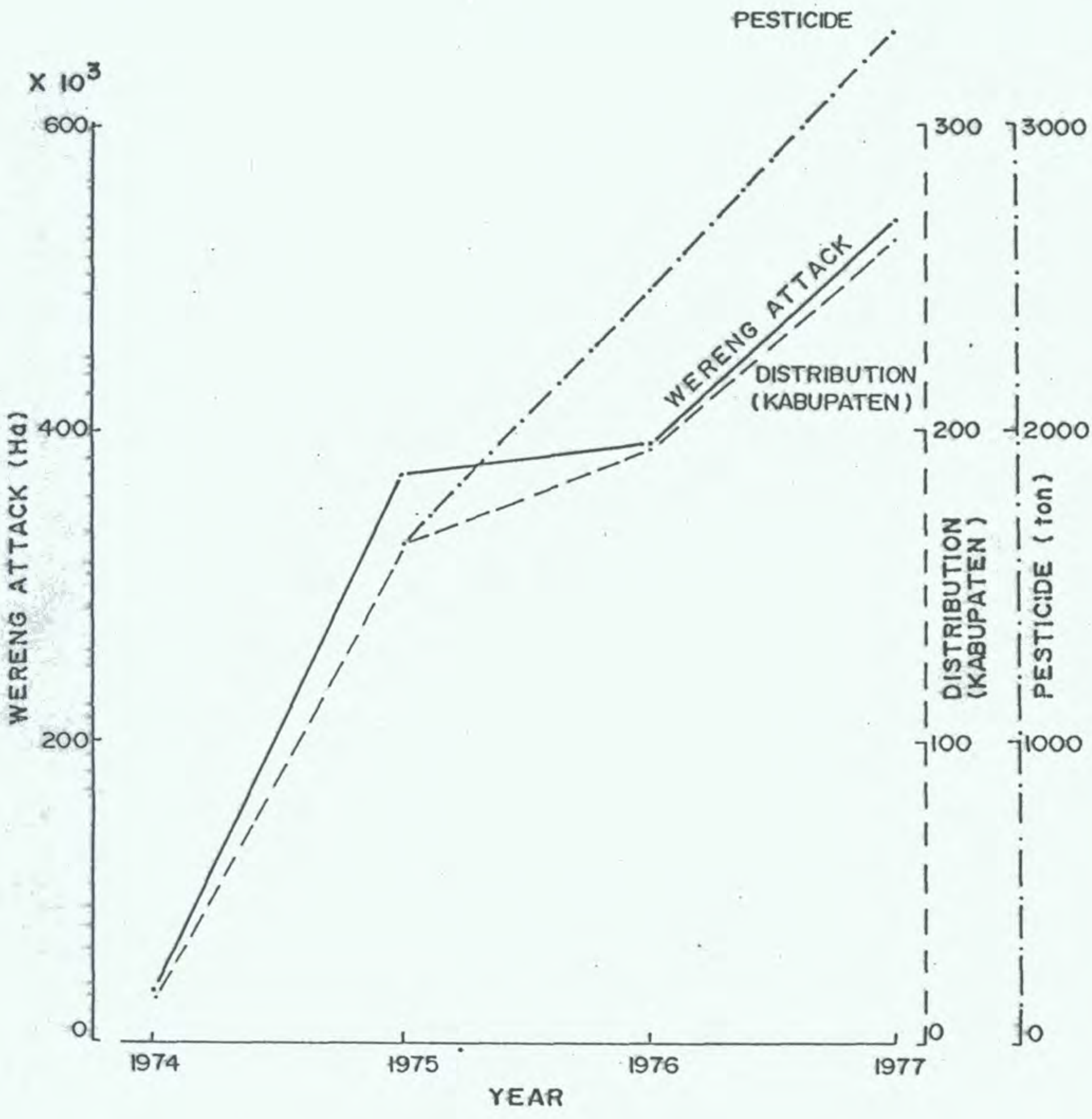

Figure 3. Wereng attack. Its geographical distribution and pesticide use. In spite of a sharp increase in the use of pesticide, the wereng attack did not decrease, but continued to increase (Birowo, et al., op. cit)

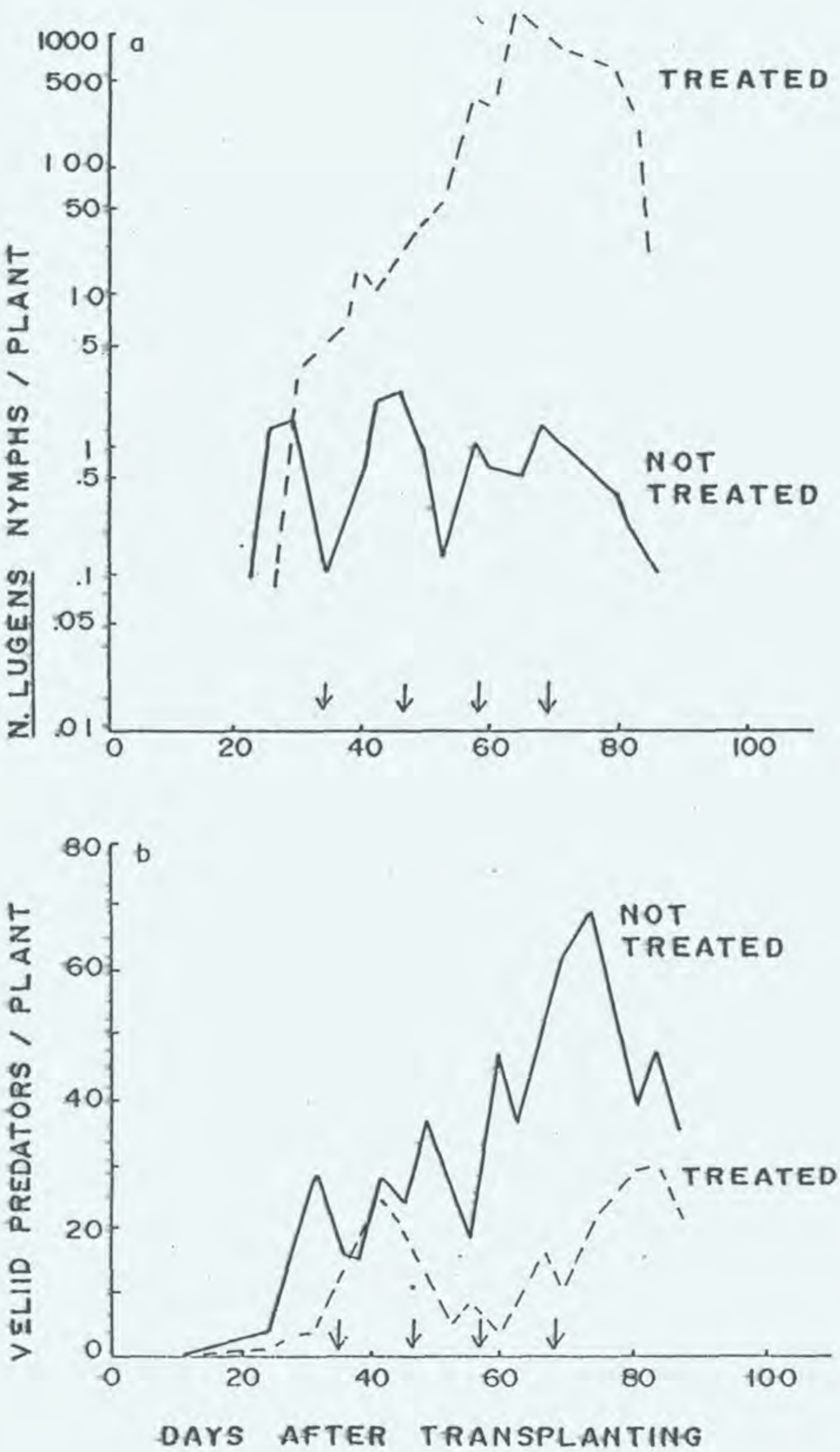

Figure 5. Population changes of the brown planthopper N. lugens and of its veliid predators in an untreated rice field and a field treated (arrows) once with the insecticide diazinon (OP) and the three times with deltamethirn (pyrethroid) (Kenmore et al., 1985)

Prediction of Impacts

by

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The purpose of prediction of impacts is to obtain measures of the likely magnitudes an importance level of significant impacts which have been identified in the scoping process.

Definition of impact

Since the results of the prediction of impacts depend on the definition of impact, it is useful to define it at the outset. Two definitions are being used in EIAs, but in many cases they are not explicitly stated. To avoid confusion it is recommended that when one carries out an EIA one should define his meaning of EIA. The two definitions of impact are respectively as follows (Munn, 1979):

a) the difference between the environment as it exists before the project is initiated and as it would exist when the project has been implemented, and

b) the difference between the environment as it would exist without the project and with the project.

We would obtain the same results using the two definitions, if the environment were static, i.e did not change between the time before the project was started and when the project was implemented. In general however, the environment is not static, but undergoes changes irrespective of the project. These changes may be cyclical or seasonal, or have a certain trend, either linearly or non-linearly, or stochastically. Cyclical changes may be of short duration, e.g diurnal, or have a long period of occurrence, e.g the El Nino. The nature and magnitude of the changes can have important effects on the results of the prediction of impacts. An example will clarify this.

In all countries of the Asia Pacific region the population is growing at a certain rate. Suppose in 1988 we are planning a project, say a dam, which will inundate y hectares of land in which x people are living and the annual population growth rate in that area is z %. Suppose further that if the project proves to be feasible, it will be implemented in 1998 at which time the people who reside in the project area will be displaced and have to be resettled. The displacement of the people is an impact of the project. According to the first definition the magnitude of the impact will be (x - 0) people, 0 being the number of residents of the area after the project has been implemented. According to the second definition, however, the number of people displaced will be

$$P_t = P_o (1 + r)^t$$

P_t = number of people at time t;

P_o = number of people at t_o : r = annual population growth rate;

t = time interval (years).

This number of people, i.e the magnitude of the impact, will be larger than x because of the population growth between 1988 and 1998. Since the magnitude of the impacts has financial and other consequences, the use of the first definition of impact would cause grave difficulties. It is therefore more appropriate to use the second definition of impact rather than the first one.

The *environmental conditions without the project* is called the baseline.

The second definiton can be shortly written as

$$\text{Impact} = Q2 - Q1$$

in which Q2 is the environmental condition as it would exist with the project and Q1 the environmental condition as it would exist without he project, i.e the baseline. Therefore, prediction of impacts involves two activities, i.e

1. The prediction of the environmental condition as it would exist without the project, i.e the baseline, and

2. The prediction of the environmental condition as it would exist with the project.

Methods of prediction

Methods of prediction can be divided into two groups, i.e informal and formal methods, respectively (Environmental Resources Limited, 1985).

Informal methods

Although EIA has been practiced for more than 15 years, its scientific basis is still weak, even in developed countries like the USA and Canada. Most predictions have been done informally using experience and expert judgement, not only in the soft sciences, in which many impacts are of qualitative nature, but surprisingly also in the hard sciences where exact quantification has been a longstanding tradition. An example is the Leopold method in its original form in which the magnitude (and also the importance) of the identified impacts are scored from 1 to 10 and the values are entered into the interaction cells, e.g (Leopold et al 1971). The authors did not give any guidance for the derivation of the values of the scores. Consequently, these values are filled in based on the experience, judgement or even mere intuition of the investigator(s). Therefore, they are very subjective and are not free from bias. For example, conservationists will tend to give high scores to negative impacts on habitats of wildlife, particularly endangered animal and plant species. Understandably the scores for a paricular impact can vary largely from person to person who carries out the EIA.

Informal predictions often cannot be avoided, because of lack of data, and lack of time, funds and manpower to collect additional data. The quality of the predictions can be improved by more or less formalizing the method, e.g by seeking advice from experienced professionals or scientists in the particular field of study. Another method is to use published information on impacts of similar projects in similar environmental settings.

Formal methods

Formal methods consist of:

a) mathematical models;

b) physical models;

c) experimental models.

Mathematical models

Predictions with mathematical models may use pre-existing models or models which are expressedly developed for an EIA study. In the first instance we have an _a priori_ knowledge of the environment or a parameter of the environment we are studying. We assume that the model we use represents said environment. In general a mathematical equation presents an output variable (X) as a function of one or more input variable(s) (A, B, C, ...), i.e X = f (A, B, C, ...).

Nowadays mathematical models are increasingly being used in EIA studies using computer modelling techniques (Munn, 1979).

Physical models

Physical models are used to simulate conditions in the field. The models are built at a certain scale, e.g 1:10 which means that the model is 1/10 of the actual size. A well known physical model is the wind tunnel which has been used for pollution studies, e.g the distribution of pollutants as affected by buildings. A tank of water can be used to simulate the effects of wave actions on the shoreline as a result of the removal of mangrove forests. Models can be simple or sophisticated depending on the purpose and requirements of the study and the available budget and manpower.

Physical models usually produce mathematical models which may be used for a limited purpose of the study or may have a more general usefulness.

Experimental models

Experiments are conducted in laboratories, greenhouses and in the field, many times involving living organisms. For example, the effects of pollutants have been extensively studied in laboratories under controlled conditions. However, the extrapolation of laboratory results to field conditions often presents problems. Consequently, it is common practice that these results are successively validated under greenhouse and field conditions. Care should also be taken when one wishes to generalize the results of limited field studies for larger areas.

Baseline studies

Baseline studies are very crucial for the prediction of impacts, since the baseline serves as the reference point for measuring impacts. Afterall an impact is a change and whether a change has occurred can only be known, if we know the condition before the change has occurred.

Experience has shown that baseline studies has often produced more data than actually needed, so that much of the data collected is not used, but merely tabulated and described in the report. As a result many EIA reports are unnecessarily bulky. Of course, this mode of operation is not efficient and is a waste of energy, money and time. In addition it makes the use of the report cumbersome and difficult, since much of the information is buried in a mass of tables and figures. It is therefore essential to plan the baseline study well. The following points can be used as a guide (Soemarwoto, 1988).

First, baseline studies are only made of the important impacts which have been identified in the scoping process.

Second, examine which model(s) will be used for predicting the respective impacts. Suppose that the following important impacts have been identified: surface run-off, cultural values, and population growth rate. Examination of the literature reveals that the following models are deemed suitable:

Surface run-off: Q = CIA (Chow, 1964)

in which Q = is run-off flow (m3/sec),

C = run-off coefficient,

I = rain intensity (mm/hour),

A = area of study (km2).

Cultural value is expressed as an index of modernization (IM) which is a function of the value people place on education (E), age of marriage of females (Mf), age of marriage of male (Mm), number of children (C), type of job (J) and work productivity (P), so that IM = f (E, MF, Mm, C, J, P)

Population growth: Pt = Po (1 + r)

in which Pt = population at time t,

Po = population at time to,

r = annual population growth rate,

t = time period of calculation.

The three models show clearly the specific data needed in the study (Table 1).

To obtain the baseline condition additional information needs to be collected about the trend of change of the environment without the project, e.g by calculating rates of growth of, respectively, population, food crops production, and industrial development, and temporal changes of forest cover, sediment loads in rivers and agricultural landuse.

Third, after the data need has been determined, the actual collection of the data can best be done by assigning each individual team member to do specific jobs. These specific assignments prevent duplication of efforts or the overlook of certain data.

Prediction of impacts

After the baseline studies have been gathered, the next step is to predict the environmental condition as it would exist with the project by using one of the methods mentioned above. This is a tricky job, since our predictive capability is generally still limited. Uncertainty is often high and in many cases we can only make educated guesses, since impacts are not only determined by the type and magnitude of the impact generating activities, but also by the conditions of the impacted environment. In many cases the mechanisms involved are not fully understood yet. Even so in many cases the available information has often not been fully used. It is therefore essential to study thoroughly the relevant literature.

Another common method is to use experience from other similar projects in similar environments.

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Table 1. Model and data need

Model	Data need	Team member
Run off		
$Q = C\ I\ A$	- Run off coefficient	Agric.
	- rainfall intensity	Agric.
	- acreage od project	Agric.
	- type of landuse	Agric.
Population growth		
$P_t = P_o\ (1 + r)^t$	- number of population	Demography/
	- population growth	
Modernization		
IM = f (E, M, f, Mm, C, J, P)	values of resp.	Anthropology
	- education	
	- age of marriage	
	- number of children	
	- type of jobs	
	- work productivity	

Human Ecology As a Basis for EIA: Imbedding EIA in The Social-Cultural Fabric

by

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Modern man has evolved from his predecessors over a period of several million years. During this long process of evolution man has been in canstant interaction with his environment: he has been influenced by his environment and conversely he is also influencing his environment. Both he himself and his environment are the result of these interactions. Any individual as we know and see him is a phaenotype, i.e the result of the interplay of his genetic constitution and the forces of the environment. Likewise his culture and way of life are strongly influenced by this interplay. This is not to say that the environment is the determining factor of man's life, but that environmental factors do play an important role in man's life, both biologically as well as social-culturally. Consequently, human ecology, i.e the study of the interaction of man and his environment, should be one of the bases of EIA.

Man's view of his environment

Since the dawn of man he has been observing his environment: the stars and other heavenly bodies, and the climate and seasons which influence the abundance and distribution of the plants and animals on which he depends for his living. He knows that his life depends on his environment. In the early process of his evolution, i.e when science and technology are still primitive and his ability to modify the environment is still limited, his survival is only possible within the range of his ability to adapt himself to his environment.

From his observations and experiences he builds a model of his environment and his relationships with it, i.e the way he believes the environment functions and influences his life, and the way it responds to his actions. This model is used as a guide for his actions and environmental management, e.g in agriculture and sea voyages. In general in the oriental world man and the community in which he lives consider themselves as part of the environment, although there is a distinct differentiation between the biophysical system and the social system. Even so they feel the existence of a functional relationship between the social system and the biophysical one which binds them together into one whole which ecologically may be called the socio-biophysical ecosystem. This socio-biophysical ecosystem in turn forms a part of a larger whole, the cosmos. This is schematically presented in Figure 1. The Sundanese view of his place in the cosmos can be used as an example, i.e "man is within and part of a large whole and as a part of this large whole he also possesses the power of this large whole ...." (Hidding, 1935). The power or energy of the large whole is called chi in Chinese, ki in Japanese, qi in Korean, and prana in Indian. The Sundanese and the Javanese consider man as the small world and the cosmos as the large world. If someone can control the small world, he will also be able to control the large world. It is also interesting to note the holistic view of the Sundanese, i.e "to understand about something is to be able to indicate the place of that particular thing within the whole and its relationships with the other parts. Everything has its place in the whole and nothing stands on its own." (Hidding, 1935).

As part of the large world man will also suffer when this large world is damaged. Therefore, every effort is made to maintain harmony between himself and God, and between him and his environment, both the social-cultural as well as the biophysical environment. To work against harmony, i.e to cause disharmony, is a sin which will bring disaster to himself and his community (e.g de Jong, 1976; Mulder, 1984). Therefore, in Figure 1 the flow of information, energy and matter from the social system to the biophysical one is not so much a tool for exploitation, i.e to maximize the flow of information, energy and matter in the reverse direction, but more a flow to maintain harmony in the functional relationships between the two systems. Consequently, although the biophysical system is a resource for man its exploitation is carefully regulated. Hunting, fishing and agriculture are governed by social laws, traditions, institutions and rituals (Schefold, 1979/80). Acting against these laws will be sanctioned by the community as well as by God. By such regulations overexploitation of the fauna and flora can be prevented and ecological wisdom also flourishes, such as the contour plantings found in many parts of Asia and the Pacific. Even so environmental damage still occurs. The reasons for this damage are several.

First, the perceived model is not perfect in the sense that it does not represent the true world. There are always discrepancies between the perceived model of the world and the way the world actually works. Even though from time to time the perceived model is corrected on the basis of observations or experiences, often environmental changes are not noted. Consequently, the traditional environmental management does not change which makes it unsuitable in a changing environmental. An example is the shifting cultivation which has become disastrous because of a growing population while the practice continues in the same way.

Second, often the people do not correct the environmental damage, but instead they adapt to this lower environmental quality. This happens, for example, when soil erosion lowers agricultural yield and the people adapt themselves with lower intake of food.

Third, people do not always act rationally in accordance with the perceived model, particularly when people have to fulfil their short term daily needs, such as food and fuel. This can lead to extreme problems, such as deforestation and desertification.

Fourth, while the above damages are caused unintentionally because of lack of knowledge or the pressure for survival, presently we are faced with environmental damage caused by greed. The problem has become more acute, since it is accompanied by the capability to exploit the environment on a large scale basis by the development of technology, to wit. for example, the large scale loggings in some parts of the Asia Pacific region.

Sustainable development

In his keynote address Prof. Emil Salim has extensively dealt with this topic. I do not wish to repeat him, but only want to point some salient features.

Development by its nature is bound to change the environment and hence also environmental equilibrium. With development we wish to change the environmental equilibrium from one with a low quality to one with a higher quality. Sustainable development requires that this change must not be at the expense of the loss of the capabilitiy of the environment to sustain our life at the higher standard of living. Otherwise sooner or later there will be collapse (Figure 2).

Since our planet earth is finite, we must assume that there is a certain limit of the capability of our planet to supply resources, such as minerals, and to assimilate wastes to render them non-toxic to man and to plants and animals (Meadows et al. 1972). It is true that technology can and have alleviated this limit, but there must be an ultimate limit which we may call the carrying capacity. Consequently, if we continue to increase our consumption and the production of pollutants, albeit at a lower rate, the carrying capacity will eventually be exceeded. Therefore, we must endeavour to remain below the carrying capacity with our consumption and production of pollutants. The safest way to do so is to increasingly satisfy our needs for higher quality of life with non-material things, such as arts, philosophy and science (Figure 3).

The difficulty with dealing with environmental quality and quality of life is that it cannot be entirely judged on an objective quantitative way. Good or bad depends very much on the angle of our view. This can be illustrated from the Ramayana story. Rahwana, who is a symbol of evil, had two brothers. Wibisana sided with Rama, the symbol of goodness, while Kombakarna remained loyal to Rahwana. If we look it from the point of view that Wibisana wanted to defend goodness, he can be considered to be on the right side. However, from the point of view of nationality, Wibisana was a traitor. Conversely, Kombakarna who defended Rahwana was on the side of evil. But nationally, he was a hero. His standpoint was "right or wrong my country". The relative nature of good and bad is schematically presented in Figure 4. On the left hand side the good dominates the bad and the particular thing under consideration is considered good. The reverse is the case on the right hand side of the graph.

EIA from the point of view of human ecology

Since EIA is an activity to assess the impacts of our activities on the environment, we must consider it within the social-cultural framework of the country or region in which the study is being carried out. Efforts must be taken to take benefit of traditional ecological wisdoms. However, this should not be construed that we should not change traditions which have become anachronistic, because the environment is not static, but is continuously in a constant flux of change. For example, because of population growth we have to increase food and other agricultural production, either by more and better inputs and/or by extending the area of agriculture. Sometimes the changes are slow and subtle, sometimes they are large and rapid, and hence dramatic. But the changes of traditions have to be done with care. Even so there is no guarantee that these changes will lead to sustainability. On the other hand constancy in a changing environment will surely lead to collapse.

Making changes is also often difficult, because good or bad is not absolute. There will always be disagreements and even conflicts. But these are the risks of development, as well as the risk of collapse as mentioned above. But in this world there is always risk. We cannot live without risk. EIA is intended as a tool to minimize these risks. Consequently EIA should also include the management of conflicts. Existing laws and traditions have to be taken into account in the decision making process. But since there will never be complete information, judgement have to be made on the best available information. It should be noted that in many cases development cannot wait and, hence, decisions have to be made quickly, no matter how meagre the body of information is. In such cases to my opinion it is better to make an educated guess, rather than to let the process goes uncontrolled.

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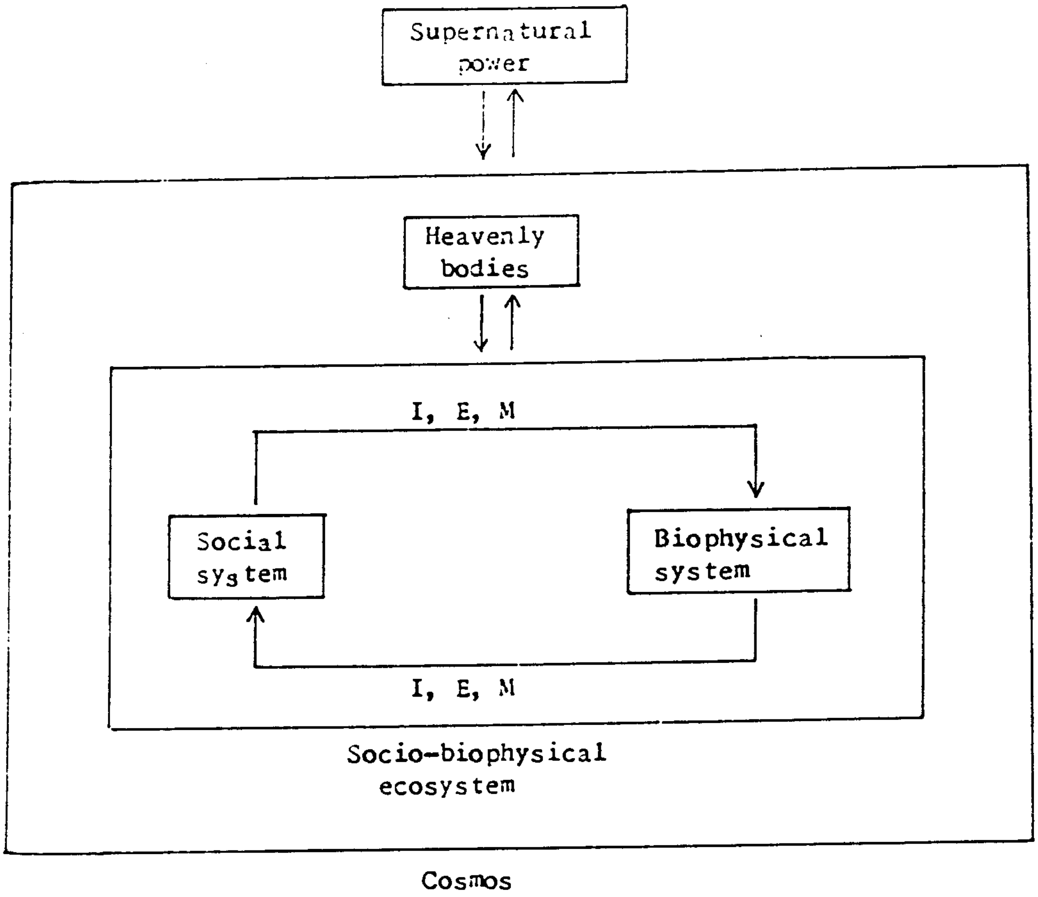

Figure 1. A traditional view of the cosmos and the place man in it.
I = information, E = energy, M = matter.

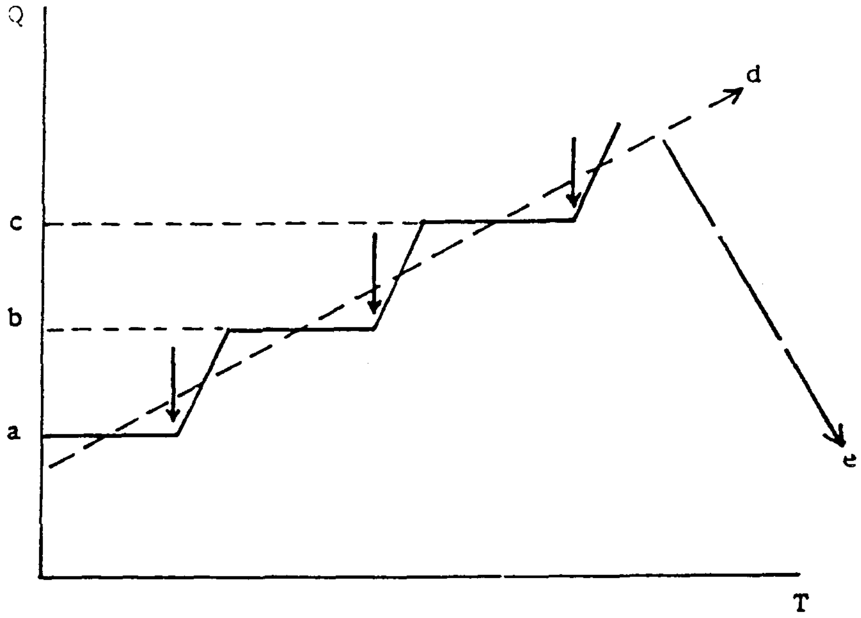

Figure 2. Development is an effort to bring a certain environmental equilibrium of low quality to successively higher qualities, but collapse should be prevented.

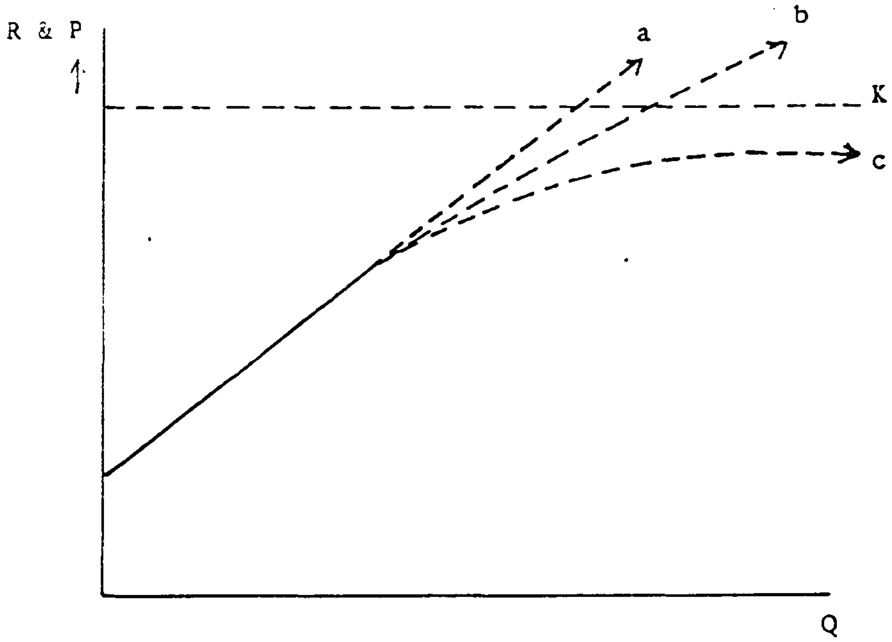

Figure 3. Posible relationships of quality of life and the consumption of resources and production of pollution, resp.
K = carrying capacity; a = overshoot;
b = delayed overshoot; c = sustainable.

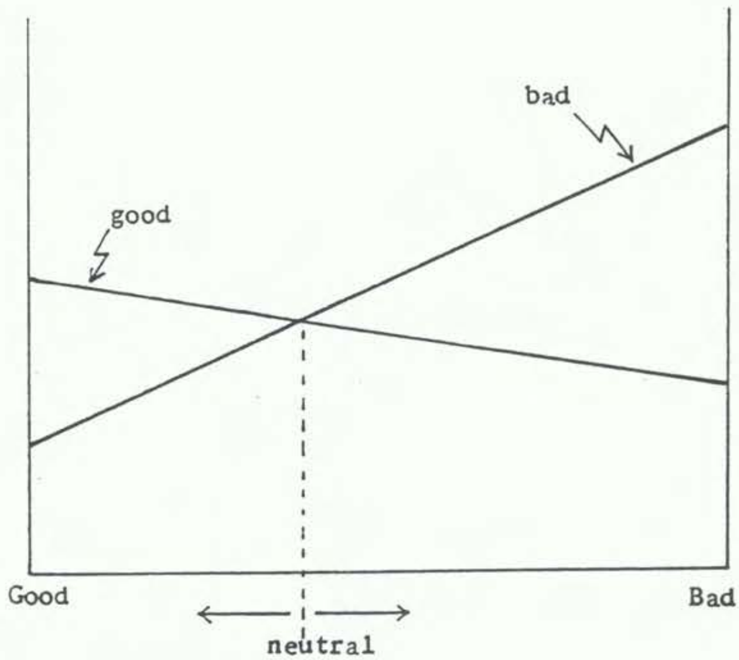

Figure 4. A Schematic presentation of perceived good or bad as influenced by point of view.

Identification of Impacts

by

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The meaning of impact in EIA

Development has the aim of changing our environment with the intention, of course, to improve our quality of life. However, the changes which occur are often more extensive than we intend to bring about. For example, we may want to increase our rice production by extending the irrigation system. But, the extention of the irrigation system does not only benefit the rice plants. It also creates new habitats for mosquitoes which increase the risk of malaria outbreaks. In EIA such side effects of development activities, which often arise unintentionally and often also unexpectedly, are called **impact**. This is a more restricted meaning than in daily use in which impact is generally understood as the consequence or effect of an activity. For example, when we build a hydroelectric dam to provide electricity for rural electrification the generated electricity and the resulting rural electrification are not considered as an impact. However, if because of the electricity the rural people change their lifestyle, e.g they spend more of their scarce money on cosmetics with the result that their nutritional status declines, this latter, i.e the decline of the nutritional status, would be called an impact. Primary impacts can give rise to secondary ones, etc. This is shown schematically in Figure 1. It also shows that biogeophysical and social-cultural impacts are interconnected. Hence, we cannot separate the two groups. This is more clearly demonstrated in the flowchart in Figure 2.

Generally, but not always, the more intense and/or extensive the activity is, the larger its impacts. Hence, with the development of technology which enables us to manipulate our environment more intensely and more extensively, the larger have become the impacts of our actions to the extent that many impacts have become transnational in nature and even global. Examples are the green house effect and the acid rain arising from the excessive burning of fossil fuels which may cause global climatic changes, respectively, the decay of forests and lakes in far away places. Such large scale impacts and also smaller but significant ones, e.g toxic effects on animals and people at the local level, have caused considerable concern.

Positive and negative impacts

EIA was born as a response of people to the degradation of the human environment. As such it is understandable that it focuses on negative impacts, even though impacts can be both negative or positive. Consequently, in textbooks of EIA generally we find a chapter on the mitigation of impacts, which implies that the impacts are negative, but none is written on the enhancement of positve impacts. This narrow view has often caused environmentalists to acquire "tunnel vision", the very weakness they accuse their adversaries are suffering from. It strengthens the suspicion that environmentalists are against development and that EIA is their tool to stop or at least to inhibit development. It also creates conflicts which often have unnecessarily delayed highly needed development projects.

In developing countries we must admit that without development there can be no improvement in our quality of life. Furthermore, without development environmental quality will also decline. For example, because of population growth population pressure will continue to increase which will bring about increasing rates of deforestation and soil erosion, and higher frequencies of floods. If this trend is allowed to continue unabated, sure collapse will be the ultimate result.

Therefore it is essential not only to look at the negative impacts, but also to try to identify the positive ones and to endeavour to enhance such impacts. For instance, when we plan to drain a marsh, we may destroy valuable habitats of aquatic birds. However, habitats of mosquitoes will also be eliminated. Likewise when we build a dam, agricultural lands will be inundated and lost. But it is replaced by a new resource, i.e a water body which can be used for fisheries and tourism development.

In the above examples the positive and negative impacts are fairly easy to identify. This is not always the case as was discussed in my previous lecture.

Impact of the environment on the project

In developed countries people are more concerned about their environment. They are worried that their affluent and secured life is being threatened by environmental degradation. We in the developing countries are also eager that development should proceed rapidly and safely. Many environmental factors can have adverse effects on development. Consequently, in EIA we should also be concerned on the impact of the environment on development. A good example is the construction of a dam. Excessive erosion in the upper watershed will lower the effective lifetime of the reservoir. Therefore such impacts should be identified.

Methods of identification of impacts

Identification of impacts is a preliminary step preceding the prediction and evaluation of impacts. It is part of the scoping procedure in which the significant impacts are identified. The significant impacts so identified serve as a boundary and basis for the collection of data in the EIA study.

In many types of projects development phases can be clearly distinguished, i.e respectively the pre-construction, construction and operational phase. The activities in one phase differ from those in the other ones and hence also the impacts. Therefore, it is useful to identify the impacts according to each phase, although the transition from one phase to the other is usually gradual.

Several methods have been developed for the identification of impacts. Comprehensive reviews of these methods can be found among others in Bisset (1984) and Canter (1986). They can be distinguished into four groups each one having its own variations. These are:

i) checklist,

ii) matrix,

iii) flowchart, and

iv) combination of the three methods.

In many cases the overlay method, e.g the one developed by McHarg (1969), is also considered as a method for the identification of impacts. However, to my opinion it should be more properly considered as a method for evaluation and aggregation of impacts.

Checklist

Checklists essentially list the possible environmental parameters with may be impacted by the projects. Such lists can be very simple, but extensive to cover all possible impacts of a wide variety of projects. An example is shown in Table 1. In using such list for the identification of impacts, one simply goes down the list and ticks the impacts which he thinks are likely to occur in the project under study.

Other checklists are specific as for example the ones developed by the World Bank (1974). In this case the lists take the form of questionnaires, an example of which is shown in Table 2. Yet another variation is the socalled descriptive checklists, e.g the one according to Schaenman (1976) for land development (Table 3).

Many people do not distinguish the three subsequent steps of, respectively, identification, prediction and evaluation of impacts, and combine the three. The weakness of such combined operation is that the prediction and evaluation of impacts are done very qualitatively, often intuitively without any data or only on the basis of very limited data. A temptation to do so is often when one uses a questionnaire checklist. Indeed some questionnaire checklists are structured in such way, e.g the USAID checklist for rural development as can be seen in Table 4 (USAID, 1980). To overcome this weakness one should use the checklist properly for just the identification of impacts and wait with the prediction until adequate data has become available.

Unlike the questionnaire checklist the descriptive checklist of Schaenman (1976) indicates to the investigator the kinds of data and their sources which are needed for the EIA study.

All checklists have the shortcoming that the impact causing activities are not explicitly mentioned in the lists. The investigator, therefore, has to search in his mind these activities and to relate them with the environmental parameters in the list.

Matrix

The matrix overcome the difficulty of relating the project activities with the environmental parameters which may be impacted by the project, since both are explicitly listed. Usually the project activities are listed on the horizontal axis at the top of the matrix, and the environmental parameters on the left hand vertical axis. An example is given in Table 5 which is part of the Leopold matrix (Leopold et al, 1971). Leopold et al attempted to make the matrix as comprehensive as possible for many kinds of projects, hence, the very long list of both the project activities, i.e 100, and the environmental parameters, i.e 88. Therefore in total there are 8800 cells of interactions. In using the matrix the investigator checks the project activities and for each activity checked he goes down the list of environmental parameters. Whenever he finds an interaction between the project activity and an environmental parameter, he crosses the cell where the column of the activity intersects the row of the parameter concerned with a diagonal line from the top right to the bottom left of the cell, as shown in the example. It was estimated that only about 25 to 50 cells would be crossed for a given project under study.

There are many variations of matrices some of which are more specific and, therefore, simpler.

Leopold _et al_ suggested to use the matrix simultaneously for the identification, prediction and evaluation of impacts, i.e after the cells of interaction have been crossed numbers from 1 to 10 are filled for, respectively, the magnitude of impacts in the upper left hand corner of the crossed cell and the importance of the impact in the lower rigth hand corner of the cell. However, they did not give guidelines for the assignment of the values. Consequently, the values are intuitive and subjective. As in the case of the checklist it is better to assign the values on the basis of data and calculations made in the prediction and evaluation.

Flowchart

Flowchart or network was originally designed by Sorenson (1971) in his study on the identification and control of resource degradation and conflict in the multiple use of the coastal zone. An example is shown in Fig. 3.

A variation of this method was used by the Institute of

Ecology for the EIA study of the Saguling dam in West Java, Indonesia (Institute of Ecology, 1979). Figures 4, 5, 6 and 7 present flowcharts of, respectively, the potential impacts of the environment on the project, the potential impacts during the pre-construction period, the potential impacts during the construction period and the potential impacts during the operational period. The plus and minus signs are used to indicate, respectively, beneficial and adverse impacts.

While checklists and matrices exist for general use or for specific projects, flowcharts have to be constructed for each individual project and each particular environmental setting. This is a disadvantage for beginners of EIA practitioners, although guidance can be obtained from existing flowcharts for similar projects and environmental conditions. But they have the advantage that one cannot use flowcharts mechanically, as is often the case with pre-constructed checklists and matrices. Another advantage is that flowcharts can trace the different orders of impacts which can then be used to guide the calculations in the prediction of the impacts.

Combination of the three methods

The matrix shown in Table 5 and the flowcharts in Figure 4 to 7 are finished products which actually were built stepwise but not shown explicitly. The first step to be done is to identify the project activities for all alternatives from the project description and to make a cumulative list of these identified activities in a systematic way. Secondly, one identifties the environmental parameters which have possible relationships with the project activities and list them also in a systematic way. For the construction of a matrix the first checklist of project activities are put on the horizontal axis at the top of the matrix and the second one on the vertical axis at the left hand side of the matrix. This matrix is then used to identify the first order impacts as explained earlier.

The first order impacts so identified are now considered as activities. A checklist is prepared of possible parameters which will possibly be affected by these activities. A new matrix is constructed which is used for the identification of second order impacts. This activity is continued to identify higher orders impacts (Figure 8)

By examining the matrices the successive orders of impacts can be used to construct a flowchart. Essentially the flowchart forms a summary of the matrices (Figure 9)

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Table 1: Checklist of Environmental Health Factors that may be Affected by Development Projects (World Bank, 1982)

<u>Effects on inhabitants of project area</u>
Communicable disease
Housing and sanitary facilities
Dietary change
Effects on groundwater
Changes in ecological balance
Changes in agriculture
Increased risk of road accidents
Risks to community health from certain industrial processes
<u>Effects on workers</u>
Work accidents
Exposure to chemical and physical hazards
Exposure to local diseases
Nutritional status of workers
<u>Indirect effects</u>
Introduction of new disease vectors
New infection or reinfection of existing vectors
Increased propagation and spread of existing vectors
<u>Effects on existing health services</u>

Tabel 2.

III. TRANSPORTATION

ENVIRONMENTAL CONSIDERATIONS

1. AIRPORTS

A. Environmental/Resource Linkages

☐ How will airport construction or expansion and attendant operations affect local residents, and plant and animal life of the area?

☐ To what extent will the natural habitat of valuable species of fish and wildlife be affected?

☐ How can any such losses be mitigated?

☐ What effects will the airport and related uses of adjacent land have on the water table in the area?

☐ How will regional water drainage patterns be affected?

☐ Will increased water runoff resulting from heavy rain or snow clog sewerage systems or drainage ditches?

☐ Will the disruption of natural water and drainage patterns complicate the operation of public water or sewer systems?

B. Project Design and Construction

☐ Are road patterns, land excavations, fill sites, refuse disposal activities, etc., planned to minimize damage to the natural environment?

☐ Will topsoil be stored for respreading?

☐ What provisions have been made for restoring scarred sections of the construction area by filling, grading and reseeding to prevent erosion?

☐ Can health levels of construction personnel be protected?

☐ Is there a danger of introducing new health hazards along with the work force into the project area?

C. Operations

☐ What disposition will be made of airport wastes, including sewage, petroleum and solid wastes?

☐ If dumped into ground "sinks," will wastes percolate into wells or aquifers?

☐ Will surface disposal degrade streams, marshes, etc., due to leaching and runoff?

☐ Have monitoring criteria been established for key variables?

☐ How will waste disposal be monitored?

☐ What levels of noise can be expected from aircraft operations?

☐ How will this impact increase, if the airport eventually expands?

☐ How can the disruptive effects of aircraft noise on local residents, schools, hospitals, offices, etc., be held to acceptable levels?

D. Sociocultural Factors

☐ Will the management of historical, religious, geological, or archaeological sites and artifacts be provided for protection or preservation?

☐ What provisions have been made for resettlement in adequate housing of residents displaced by the development?

E. Health Impacts

☐ Will monitoring and controls of possible foreign disease vectors be implemented?

☐ Has a plan for controlling the introduction of animal and plant diseases been prepared?

☐ Have plans been made for the management and control of airport sanitation?

F. Long-Term Considerations

☐ Even though not directly preemptive, is the airport likely to attract industry and housing to adjacent areas which possess unique and valuable ecological features?

☐ What impact would such developments have on the natural environment?

☐ What future projects have been planned for the area, and how will they interact with environmental factors?

2. PORTS AND HARBORS

A. Environmental/Resource Linkages

☐ What modifications of the landscape, waterways and offshore geology will result from the development?

☐ Will these changes adversely affect fish and wildlife resources? If so, what measures are planned to mitigate the impact?

☐ What impact will the changes have on existing or projected sewerage or waste-disposal systems?

☐ Will stagnant pools develop to trap pollutants?

☐ Will stream discharge patterns be adversely affected?

☐ Is the project part of a coherent plan for the development of the region?

B. Project Design and Construction

☐ What are the predevelopment coastal or waterway sedimentation patterns?

☐ How will wave and current action be modified?

☐ Will the development interrupt sediment transport needed to replenish adjacent beach areas?

☐ Might induced tidal wash and currents cause beach and coastal erosion?

☐ If the development is on a river, what may the impact be on the upstream and downstream environment?

☐ What will be the source of landfill and rock materials, and what are the likely effects on the environment, both at the source and at the point of deposition?

☐ What provisions will be made for reclamation of quarry and barrow areas?

C. Operations

☐ What cargoes are likely to be handled, and what are the potential dangers to the environment from deliberate or accidental spills or dumping?

☐ Have accident contingency plans been formulated?

☐ Are measures available to handle emergencies or accidents (spills, collisions, etc.)?

☐ What safeguards and contingency plans will be available to contain and clean up hazardous chemicals and oils, slops or wastes of normal operations?

☐ To what extent will land-filling and dredging operations be necessary?

☐ How will dredged spoils be disposed of and with what ecological impacts?

☐ Will ships and industrial development create significant air pollution from stacks in view of prevailing winds?

☐ How will ship and harbor sewage and other effluents be handled?

D. Sociocultural Factors

☐ In preparation for the increased population that is expected to result from port and anticipated industrial development, what consideration has been given to land-use planning, zoning, etc., to providing adequate housing, and to essential community services, such as sewage and transportation facilities?

☐ Will port construction or operations adversely affect local cultural or economic values, such as scenic beauty, local fishing and other economic enterprises?

☐ Have steps been taken to provide for possible population influxes?

☐ Will historical, religious, archaeological, and geological artifacts be preserved?

E. Health Impacts

☐ Will air or water pollution associated with the port adversely affect local workers or adjacent populations?

☐ Will water supplies and sewage treatment facilities be adequate to meet increasing demands?

☐ Will health care services be adjusted to fit new requirements?

☐ Have plans been formulated for protecting humans, animals and plants from the introduction of diseases, and for controlling these diseases?

F. *Long-Term Considerations*

☐ Have the environmental consequences of future area projects been considered in the design and operation of port facilities?

3. ROADS AND HIGHWAYS

A. *Environmental/Resource Linkages*

☐ Will environmental criteria be incorporated into the selection of the road or highway route?

☐ Are the character, quality and major components of the affected ecosystems known?

☐ Will access provided by the road open unsettled or previously inaccessible areas to human, animal or plant communities?

☐ Will the road's impact on agricultural, industrial, commercial, or other urban land-use patterns be considered?

☐ Does the project complement land-use patterns developed for urban or regional programs?

☐ Will the road have adverse effects on important domestic livestock, wildlife or vegetation?

☐ Will wildlife migration routes be disturbed?

☐ Will squatter settlements along the highway route be controlled?

B. Design and Construction

☐ Is there a consolidated construction plan for the project that takes into account ecological factors?

E. Health Impacts

☐ Will the roadway and related construction activity open up new pathways for disease vectors affecting humans, plants or animals (e.g., hoof and mouth disease)?

F. Long-Term Considerations

☐ Has the project been examined for ecological and environmental effects in the context of local and regional plans for development?

☐ Have the effects of future highway or transport development on the ecology of the area been considered?

- ☐ Are forest conservation principles being incorporated into design and construction activities in forested areas?
- ☐ Will natural drainage patterns be unnecessarily disturbed?
- ☐ Do plans include provisions for preventing despoilment of the landscape and vegetation during construction?
- ☐ Will clearing, grubbing and burning be limited to the extent practicable?
- ☐ Will the size and number of quarry, barrow and disposal sites be controlled?
- ☐ Will topsoil be stored for respreading?
- ☐ Will soil stabilization measures be taken during construction to minimize damage, e.g., slope reseeding to prevent erosion by wind or water?
- ☐ Do plans include provisions for preventing water pollution by spillage and runoff during construction or during use of roadway?
- ☐ Will water impoundments create health hazards?
- ☐ Will wastes from machinery, asphalt and concrete plants, construction camps and shops be controlled to prevent water pollution?
- ☐ Will air pollution by smoke, fumes and sprays originating from construction operations be a problem?
- ☐ Will air pollution by dust from unsurfaced roads or construction operations have a deleterious effect on the environment or on human welfare?
- ☐ Does the roadway traverse a scenic area? If so, are steps being taken to protect and/or enhance areas of aesthetic and tourist value?
- ☐ If a large work force is to be assembled from various locations, is provision being made for a preemployment medical screening and periodic examination of employees to prevent introduction of new diseases and/or further spreading of endemic diseases?

C. Operations

- ☐ Will the road serve purposes other than transportation?
- ☐ Will road shoulders and aprons provide space for strip urbanization or vendors?
- ☐ Will heavy traffic produce congestion, pollution or noise with adverse consequences to surrounding human, animal or plant communities?
- ☐ Will traffic preempt or disrupt use of agricultural land?
- ☐ Will there be an adverse effect on habitat and migration of wildlife?
- ☐ Will facilities be available to monitor circulation and impact of traffic and new access upon important elements of ecosystems — population settlements, migration patterns, diseases, surface water, and erosion?
- ☐ What will be the environmental effects of herbicides and pesticides if they are used?

D. Sociocultural Factors

- ☐ Will the roadway disrupt the existing cultures, or impact on archaeological sites or other unique resources?
- ☐ Has provision been made for adequate living conditions for populations that are displaced by construction activity, and those that are attracted to newly opened areas?

Table 3: Descriptive Checklist for Land Development Projects (Schaenman, 1976)

Factor	Bases for Estimates
I. Local Economy	
Public Fiscal Balance	
1. Net change in government fiscal flow (revenues less expenditures).	Public revenues: expected household incomes by residential housing type; added property values. Public expenditures: analysis of new service demand, current costs; available capacities by service.
Employment	
2. Change in numbers and percent employed, unemployed, underemployed, by skill level.	Direct from new business; or estimated from floor space, local residential patterns, expected immigration, current unemployment profiles.
Wealth	
3. Change in land values.	Supply and demand of similarly zoned land, environmental changes near property.
II. Natural Environment	
Air Quality	
Health	
4. Change in air pollution concentrations by frequency of occurrence and number of people at risk.	Current ambient concentrations, current and expected emissions, dispersion models, population maps.
Nuisance	
5. Change in occurrence of visual (smoke, haze) or olfactory (odor) air quality nuisances, and number of people affected.	Baseline citizen survey, expected industrial processes, traffic volumes.
Water Quality	
6. Changes in permissable or tolerable water uses and number of people affected - for each relevant body of water.	Current and expected effluents, current ambient concentrations, water quality model.
Noise	
7. Change in noise levels and frequency of occurrence, and number of people bothered.	Changes in nearby traffic or other noise sources, and in noise barriers; noise propagation model or nomographs relating noise levels to traffic, barriers, etc.; baseline citizen survey of current satisfaction with noise levels.
Wildlife and Vegetation	
8. Change in diversity and population size (abundance) of wildlife and vegetation (including trees) of common species.	Wildlife and vegetation inventory; expected removal of cover or changes to habitats.
9. Change in numbers of rare or endangered species.	Changes in amount and quality of (a) habitat by animal type; (b) green space, or (c) number of mature trees.

Table 3 : (Continued)

Factor	Bases for Estimates
Natural Disasters	
10. Change in number of people and value of property endangered by: flooding, earthquakes, landslides, mudslides, and other natural disasters, by frequency of occurrence.	Flood plain and other hazard maps; changes in local topography and severing; change in percent permeable cover; stream flow and hydraulic models.
III. Aesthetics and Cultural Values	
Attractiveness	
11. Change in number and percent of citizens who are satisfied with neighborhood appearance.	Baseline citizen survey of ratings of current attractiveness and identification of problems and assets; visual simulation of proposed development using retouched photos, drawings or 3-D models for assessing future preferences using a sample of citizens.
View Opportunities	
12. Change in number or percent of citizens satisfied with views from their homes (or businesses).	Baseline citizen survey; geometric analysis of structures to identify view opportunities before and after development.
Landmarks	
13. Number and perceived importance of cultural, historic, or scientific landmarks to be lost, made less accessible, or made more accessible.	Inventory and importance ranking of landmarks; survey of citizens and scholars regarding importance.
IV. Public and Private Services	
Drinking Water	
Availability	
14. Change in frequency duration and severity of water shortage incidents, and number of people affected.	Current usage, expected new demand; projected supplies.
Quality	
15. Changes in salinity and other indices of drinking water quality and safety, and number of people affected.	Expected effluents from new development; purification process used; current and expected usage; profile of underground water systems.
Hospital Care	
Emergency Care Availability	
16. Change in number of citizens	Maps of population distribution and emergency facilities; number of emergency vehicles (if any), expected calls, and dispatch policy.
Availability/Crowdedness	
17. Change in potential bed need versus bed supply of area hospitals, by type of clinical service (medical, surgical, pediatric, obstetrical).	Current patient hospital bed days per 1000 population by sex-age group and medical service; available bed capacities; expected population by sex-age group.

Table 3 : (Continued)

Factor	Bases for Estimates
Crime Control	
Crime Rate	
18. Change in rate of crimes in existing community.	Current crime rates and case histories of similar neighborhood changes; changes in community lighting, sightlines, hiding places, people mix.
Feeling of Security	
19. Change in percent of people feeling a lack of security from crime.	Baseline citizen survey plus the data above.
Fire Protection	
20. Change in fire incidence, property loss, and casualty rates.	Incident rates by occupancy types; people mix; available water supply; available fire suppression equipment and manning; likely building materials; site plan if available.
Recreation-Public Facilities	
Overall Satisfaction	
21. Change in number and percent of households satisfied with public recreation opportunities.	Baseline citizen surveys, and expected changes in facilities and environment (noise, air quality, dangers).
22. Change in number or percent of households using facilities (viewed relative to nominal capacity), by facility.	Citizen survey.
Accessibility	
23. Change in number and percent of households with access to various types of recreation facilities within x minutes travel, by type of facility and mode of travel.	Maps of facilities and distribution of population; citizen survey of travel mode.
Recreation-Informal Settings	
Overall Satisfaction	
24. Change in number or percent of households satisfied with recreation in informal outdoor spaces in neighborhood.	Baseline citizen survey and observation of current usage patterns; physical environment changes expected.
Availability	
25. Change in availability of informal physical settings for recreation and number of people affected.	Changes in open space and physical environment expected.
Education	
Accessibility/Convenience	
26. Change in number and percent of households satisfied with accessibility of schools.	Citizen survey; changes in available path, nearby traffic conditions en route to schools.
27. Change in number and percent of students within x minutes, by type of school and travel mode.	Map of school and population distribution; busing records.

Table 3 : (Continued)

Factor	Bases for Estimates
28. Number and percent of students having to switch schools or busing status.	Relation of capacity to expected demands, and school board policy.
Crowdedness	
29. Change in school crowdedness indicators; e.g., student-teacher ratios, number of shifts.	Citizen survey; expected change in noise, traffic hazards, air quality, other hazards.
Transportation-Mass Transit	
Satisfaction	
30. Change in number and percent of households satisfied with mass transit service.	Citizen survey, expected service changes, expected change in factors affecting satisfaction. Usage levels, from fares and surveys.
Accessibility	
31. Change in number and percent of citizens residing (or working) within x feet of public transit stop.	
Transportation-Pedestrians	
Satisfaction/Accessibility	
32. Change in number and percent of households satisfied with walking conditions and walking opportunities in their neighborhood.	Baseline citizen survey, estimated changes in physical walking conditions; additions or removals of desired destinations.
Safety	
See measures 33 and 34 below.	N/A
Transportation-Private Vehicles	
Safety	
33. Change in number and percent of households satisfied with traffic safety (vehicle and pedestrian).	Baseline citizen survey, changes in traffic and traffic controls; circulation patterns.
34. Change in number and severity of accidents per 1,000 persons by pedestrians and riders.	Accident frequency and causation data; changes in traffic and traffic controls, circulation patterns, expected traffic volumes.
Travel Time	
35. Change in vehicular travel times between selected origins and destinations, by time of day and day of week.	Current traffic volumes; changes in street layout, width and traffic controls; estimated net new vehicular trips.

Table 3 : (Continued)

Factor	Bases for Estimates
Parking Availability	
36. Change in average time needed to find acceptable parking space within x feet of residence (or desired destinations) in neighborhood of development, by time of day and day of week.	Current spaces available; new demand and supply; math model for estimating parking times.
37. Percent of drivers finding neighborhood parking satisfactory.	Baseline citizen survey; expected changes in supply and demand for spaces.
Shopping	
38. Change in number and percent of households satisfied with shopping opportunities.	Baseline citizen survey; change in physical conditions around shopping areas.
39. Change in number and percent of households within x minutes travel time to shopping, by type store and mode of travel.	Map showing location of stores and population, before and after development.
Energy Services	
40. Change in the frequency and duration of energy shortages, and the number of people affected, by fuel type.	Current and expected usage and supply in community; design and construction of buildings, type of manufacturing activity expected.
Housing	
41. Change in number and percent of housing units that are substandard and the number of people living in them.	Current housing stock conditions number to be removed or improved.
42. Change in number and percent of housing units relative to need, by type of housing (price, owner/rental, number of bedrooms, style, etc.)	Current profile of housing units added or destroyed; past housing chain effects in distribution of population by income level, indicators of latent demand for housing.
V. Other Social Impacts (in addition to those included above)	
People Displacement	
43. Number of residents (or workers) displaced by development, and whether satisfied with move.	Number of persons living in building to be destroyed; special survey of them.
Special Hazards	
44. Number of children physically at risk from "special" hazards created by development (e.g., machinery, junk, unguarded deep water).	Physical outdoor changes expected.

Table 3 : (Continued)

Factor	Bases for Estimates
Sociability/Friendliness	
45. Change in social interaction patterns (e.g., frequency of neighboring, community activities).	Baseline survey of current neighboring and community activity patterns; changes in availability of community and small group meeting places; changes in physical barriers (e.g., highways, fences, heavy traffic, buildings which hinder access from one area of a neighborhood to another or footbridges or removal of barriers linking the areas); changes in people mix.
Privacy	
46. Change in number and percent of households satisfied with privacy in outdoor areas around home.	Citizen survey; geometric analysis of sightlines; changes in sight and sound barriers.
Overall Con..entment with Neighborhood	
47. Change in number and percent of citizens satisfied with their residential (or work) neighborhood.	Citizen survey using data from other measures.

Table 4 : Extract from the U.S. AID Questionnaire Checklist (U.S. AID, 1980)

<u>Disease Vectors</u>

a) Are there known disease problems in the project area transmitted through vector species such as mosquitos, flies, snails, etc.?	Yes___	No___	Unk___
b) Are these vector species associated with:			
Aquatic habitats?	Yes___	No___	Unk___
Forest habitats?	Yes___	No___	Unk___
Agricultural Lands?	Yes___	No___	Unk___
Degraded habitats?	Yes___	No___	Unk___
Human settlements?	Yes___	No___	Unk___
c) Will the project:			
Increase vector habitat?	Yes___	No___	Unk___
Decrease vector habitat?	Yes___	No___	Unk___
Provide opportunity for vector control?	Yes___	No___	Unk___
d) Will the project work force be a possible source of introduction of disease vectors not currently found in the project area?	Yes___	No___	Unk___
e) Will increased access to and commerce with the project area be a possible source of disease vectors not presently occurring in the project area?	Yes___	No___	Unk___
f) Will the project provide opportunities for vector control through improved standards of living?	Yes___	No___	Unk___

ESTIMATED IMPACT ON DISEASE VECTORS.......NO..HA..MA..LA..O..LB..MB..HB

<u>Public Health</u>

a) Are vector-borne diseases an important part of the local public health situation?	Yes___	No___	Unk___
b) Are there clinics or other disease control programs in operation or planned for the area?	Yes___	No___	Unk___
c) Will the project decision result in an increase in disease vector density or distribution?	Yes___	No___	Unk___
d) Will the project decision result in workers or other persons entering the area with contagious or vector-borne diseases?	Yes___	No___	Unk___
e) Will the project decision result in clearing operations that could expose workers to disease vectors?	Yes___	No___	Unk___

Table 5a. Part of Leopold matrix.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

INSTRUCTIONS

1- Identify all actions (located across the top of the matrix) that are part of the proposed project.
2- Under each of the proposed actions, place a slash at the intersection with each item on the side of the matrix if an impact is possible.
3- Having completed the matrix, in the upper left-hand corner of each box with a slash, place a number from 1 to 10 which indicates the MAGNITUDE of the possible impact; 10 represents the greatest magnitude of impact and 1, the least, (no zeroes). Before each number place + if the impact would be beneficial. In the lower right-hand corner of the box place a number from 1 to 10 which indicates the IMPORTANCE of the possible impact (e. g. regional vs. local); 10 represents the greatest importance and 1, the least (no zeroes).
4- The text which accompanies the matrix should be a discussion of the significant impacts, those columns and rows with large numbers of boxes marked and individual boxes with the larger numbers.

SAMPLE MATRIX

	a	b	c	d	e
a		/1			8/5
b		3/5	8/8	3/1	9/7

I. PROPOSED ACTIONS WHICH MAY CAUSE ENVIRONMENTAL IMPACT

A. MODIFICATION OF REGIME
a. Exotic flora or fauna introduction
b. Biological controls
c. Modification of habitat
d. Alteration of ground cover
e. Alteration of ground water hydrology
f. Alteration of drainage
g. River control and flow modification
h. Canalization
i. Irrigation
j. Weather modification
k. Burning
l. Surface or paving
m. Noise and vibration

B. LAND TRANSFORMATION AND CONSTRUCTION
a. Urbanization
b. Industrial sites and buildings
c. Airports
d. Highways and bridges
e. Roads and trails
f. Railroads
g. Cables and lifts
h. Transmission lines, pipelines and corridors
i. Barriers including fencing
j. Channel dredging and straightening
k. Channel revetments
l. Canals
m. Dams and impoundments
n. Piers, seawalls, marinas, and sea terminals
o. Offshore structures
p. Recreational structures
q. Blasting and drilling
r. Cut and fill
s. Tunnels and underground structures

C. RESOURCE EXTRACTION
a. Blasting and drilling
b. Surface excavation
c. Subsurface excavation and retorting
d. Well drilling and fluid removal
e. Dredging
f. Clear cutting and other lumbering
g. Commercial fishing and hunting

D. PROCESSING
a. Farming
b. Ranching and grazing
c. Feed lots
d. Dairying
e. Energy generation
f. Mineral processing
g. Metallurgical industry
h. Chemical industry
i. Textile industry
j. Automobile and aircraft
k. Oil refining
l. Food
m. Lumbering
n. Pulp and paper
o. Product storage

E. LAND ALTERATION
a. Erosion control and terracing
b. Mine sealing and waste control
c. Strip mining rehabilitation
d. Landscaping
e. Harbor dredging
f. Marsh fill and drainage

F. RESOURCE RENEWAL
a. Reforestation
b. Wildlife [illegible]ing and management
c. [illegible]ter recharge

PROPOSED ACTIONS

II. EXISTING CHARACTERISTICS AND CONDITIONS OF THE ENVIRONMENT

A. PHYSICAL AND CHEMICAL CHARACTERISTICS

1. EARTH
a. Mineral resources
b. Construction material
c. Soils
d. Land form
e. Force fields and background radiation
f. Unique physical features

2. WATER
a. Surface
b. Ocean
c. Underground
d. Quality
e. Temperature
f. Recharge
g. Snow, ice, and permafrost

3. ATMOSPHERE
a. Quality (gases, particulates)
b. Climate (micro, macro)
c. Temperature

4. PROCESSES
a. Floods
b. Erosion
c. Deposition (sedimentation, precipitation)
d. Solution
e. Sorption (ion exchange, complexing)
f. Compaction and settling
g. Stability (slides, slumps)
h. Stress-strain (earthquake)
i. Air movements

B. BIOLOGICAL CONDITIONS

1. FLORA
a. Trees
b. Shrubs
c. Grass
d. Crops
e. Microflora
f. Aquatic plants
g. Endangered species
h. Barriers
i. Corridors

2. FAUNA
a. Birds
b. Land animals including reptiles
c. Fish and shellfish

Figure 8. Series of matrices for identifying impacts

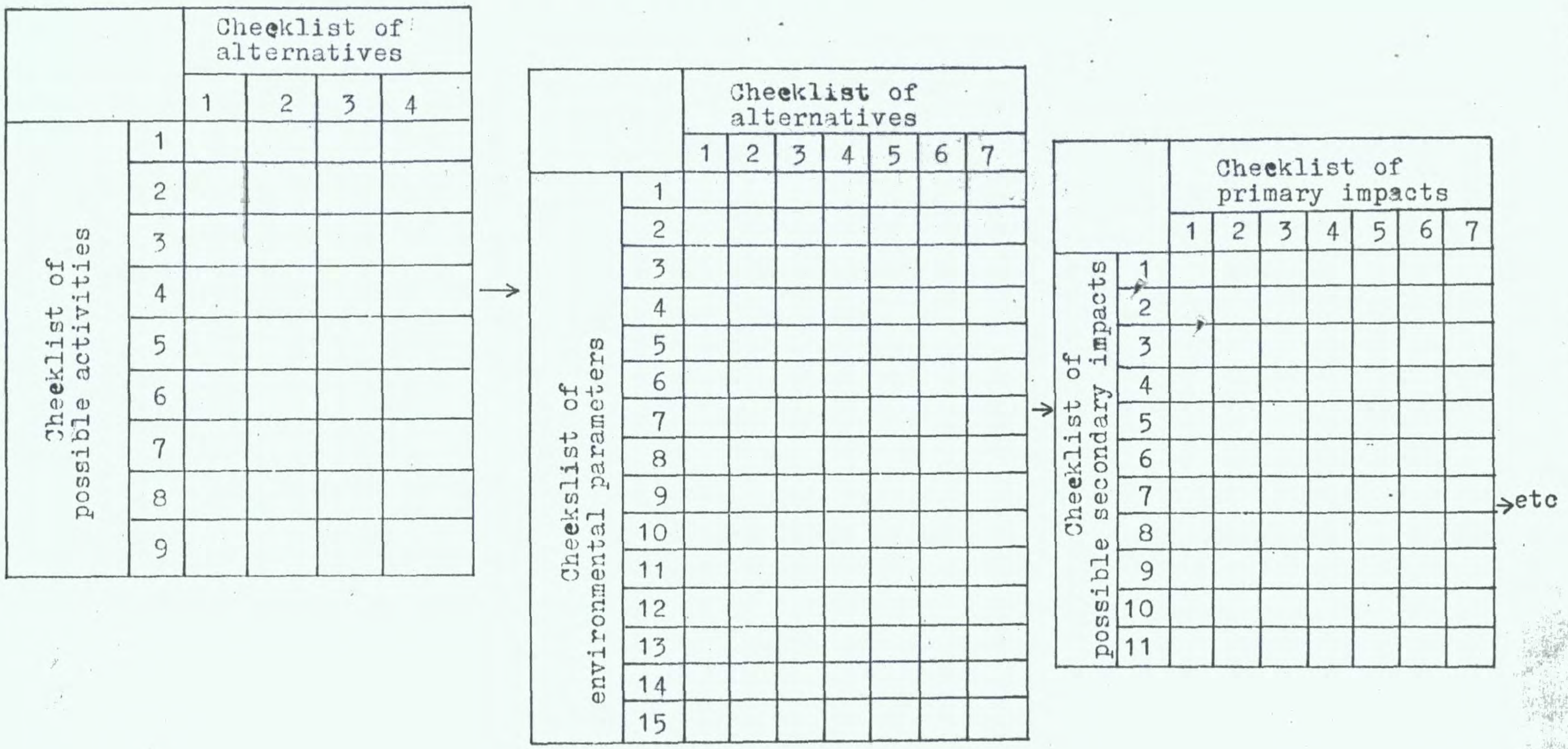


Figure 9. Flowchart derived from the matrics of Figure 8.

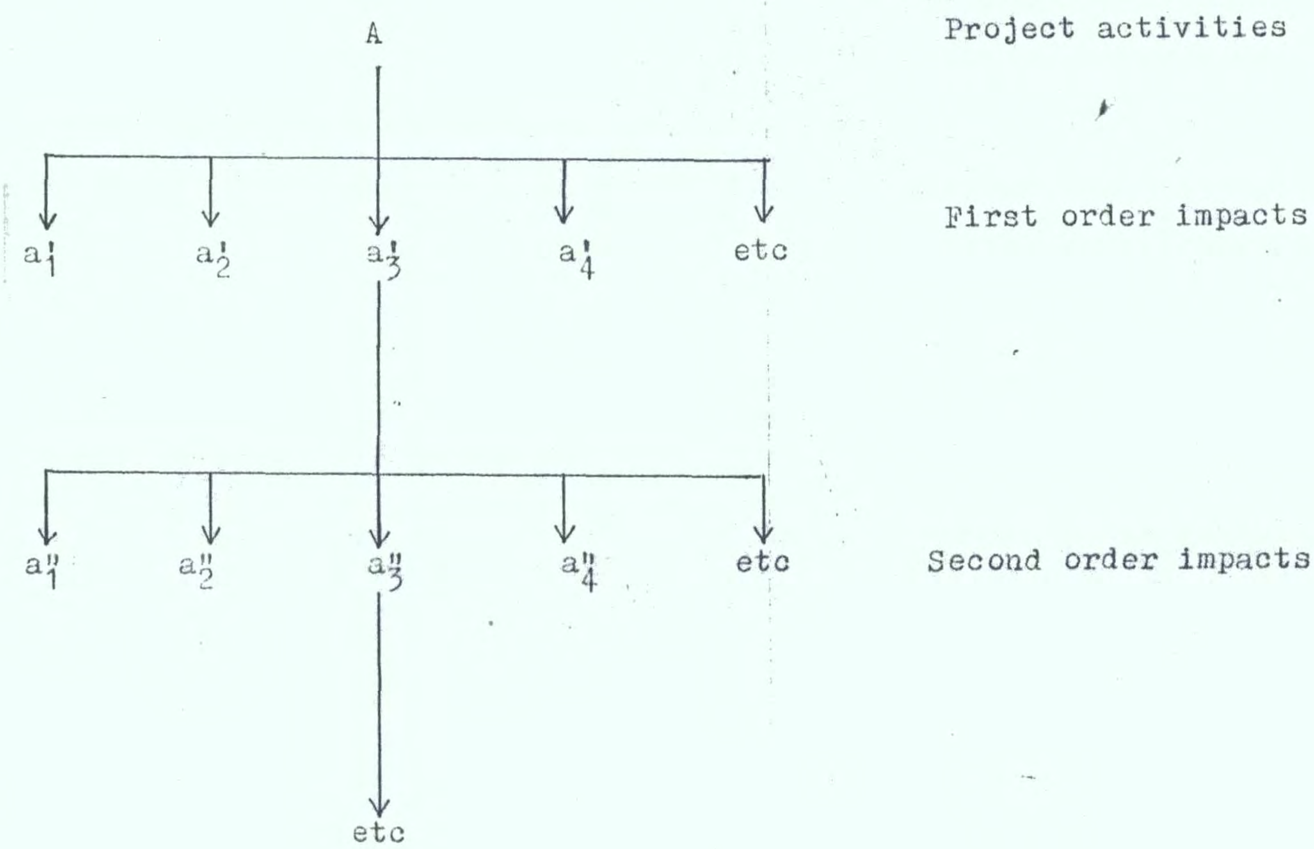


Table 5b. Actions and Environmental Items in Leopold Interaction Matrix

Actions		Environmental items	
Category	Description	Category	Description
A Modification of regime	a Exotic fauna introduction	A Physical and chemical characteristics	
	b Biological controls	1 Earth	a Mineral resources
	c Modification of habitat		b Construction material
	d Alteration of ground cover		c Soils
			d Land form
	e Alteration of groundwater hydrology		e Force fields and background radiation
	f Alteration of drainage		
	g River control and flow modification		f Unique physical features
		2 Water	a Surface
	h Canalization		b Ocean
	i Irrigation		c Underground
	j Weather modification		d Quality
	k Burning		e Temperature
	l Surface or paving		f Recharge
	m Noise and vibration		g Snow, ice, and permafrost
B Land transformation and construction	a Urbanization		
	b Industrial sites and buildings	3 Atmosphere	a Quality (gases, particulates)
	c Airports		b Climate (micro, macro)
	d Highways and bridges		
	e Roads and trails		c Temperature
	f Railroads	4 Processes	a Floods
	g Cables and lifts		b Erosion
	h Transmission lines, pipelines, and corridors		c Deposition (sedimentation, precipitation)
			d Solution
	i Barriers including fencing		e Sorption (ion exchange, complexing)
	j Channel dredging and straightening		f Compaction and settling
	k Channel revertments		g Stability (slides, slumps)
	l Canals		
	m Dams and impoundments		h Stress-strain (earthquakes)
	n Piers, seawalls, marinas, and sea terminals		i Air movements
		B Biological conditions	
	o Offshore structures	1 Flora	a Trees
	p Recreational structures		b Shrubs
	q Blasting and drilling		c Grass
	r Cut and fill		d Crops
	s Tunnels and underground structures		e Microflora
			f Aquatic plants
C Resource extraction	a Blasting and drilling		g Endangered species
	b Surface excavation		h Barriers

Table 5b. (Continued)

Actions		Environmental items	
Category	Description	Category	Description
	c Subsurface excavation and retorting		i Corridors
		2 Fauna	a Birds
	d Well dredging and fluid removal		b Land animals including reptiles
	e Dredging		c Fish and shellfish
	f Clear cutting and other lumbering		d Benthic organisms
			e Insects
	g Commercial fishing and hunting		f Microfauna
			g Endangered species
D Processing	a Farming		h Barriers
	b Ranching and grazing		i Corridors
	c Feed lots	C Cultural factors	
	d Dairying	1 Land use	a Wilderness and open spaces
	e Energy generation		
	f Mineral processing		b Wetlands
	g Metallurgical industry		c Forestry
			d Grazing
	h Chemical industry		e Agriculture
	i Textile industry		f Residential
	j Automobile and aircraft		g Commercial
			h Industry
	k Oil refining		i Mining and quarrying
	l Food	2 Recreation	a Hunting
	m Lumbering		b Fishing
	n Pulp and paper		c Boating
	o Product storage		d Swimming
E Land alteration	a Erosion control and terracing		e Camping and hiking
			f Picnicking
	b Mine sealing and waste control		g Resorts
		3 Aesthetic and human interest	a Scenic views and vistas
	c Strip mining rehabilitation		b Wilderness qualities
	d Landscaping		c Open-space qualities
	e Harbor dredging		d Landscape design
	f Marsh fill and drainage		e Unique physical features
F Resource renewal	a Reforestation		f Parks and reserves
	b Wildlife stocking and management		g Monuments
			h Rare and unique species or ecosystems
	c Groundwater recharge		
	d Fertilization application		i Historical or archeological sites and objects
	e Waste recycli		
G Changes in traffic	a Railway		
	b Automobile		j Presence of misfits
	c Trucking	4 Cultural status	a Cultural patterns (life-style)
	d Shipping		

Table 5b. (Continued)

Actions		Environmental items	
Category	Description	Category	Description
	e Aircraft		b Health and safety
	f River and canal traffic		c Employment
			d Population density
	g Pleasure boating	5 Manufactured facilities and activities	a Structures
	h Trails		b Transportation network (movement, access)
	i Cables and lifts		
	j Communication		
	k Pipeline		c Utility networks
H Waste replacement and treatment	a Ocean dumping		d Waste disposal
	b Landfill		e Barriers
	c Emplacement of tailings, spoils, and overburden		f Corridors
		D Ecological relationships	a Salinization of water resources
	d Underground storage		b Eutrophication
	e Junk disposal		c Disease–insect vectors
	f Oil well flooding		d Food chains
	g Deep well emplacement		e Salinization of surficial material
	h Cooling water discharge		f Brush encroachment
			g Other
	i Municipal waste discharge including spray irrigation	E Others	
	j Liquid effluent discharge		
	k Stabilization and oxidation ponds		
	l Septic tanks, commercial and domestic		
	m Stack and exhaust emission		
	n Spent lubricants		
I Chemical treatment	a Fertilization		
	b Chemical deicing of highways, etc.		
	c Chemical stabilization of soil		
	d Weed control		
	e Insect control (pesticides)		
J Accidents	a Explosions		
	b Spills and leaks		
	c Operational failure		
K Others			

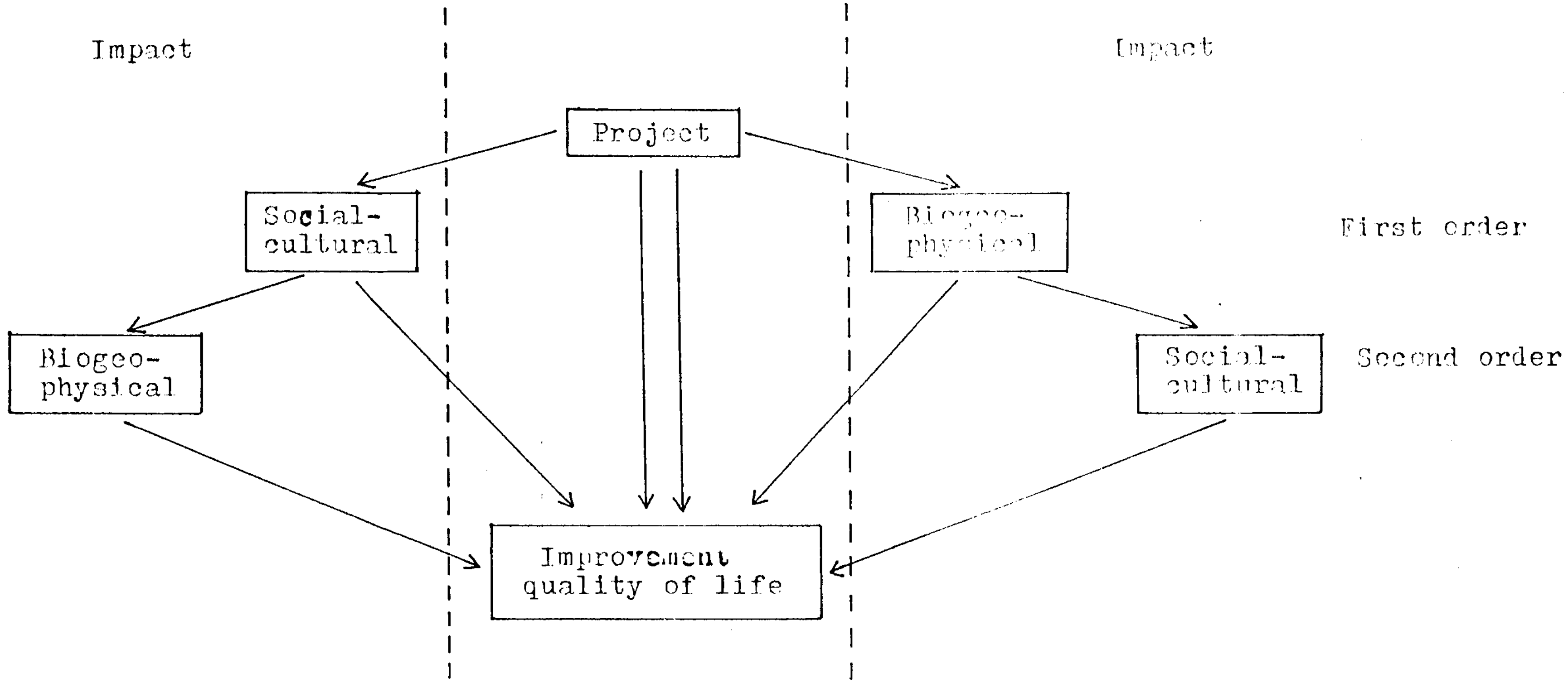


Figure 1. Environmental impacts of development.

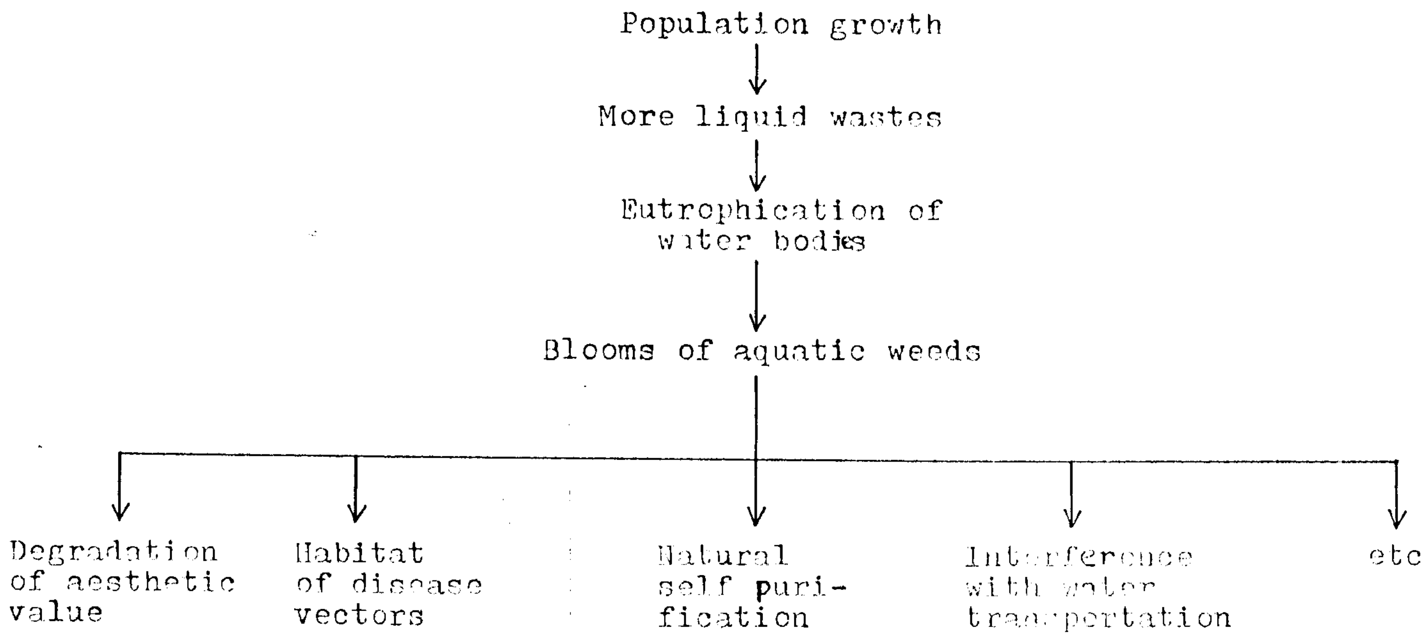


Figure 2. Flowchart showing close interrelationships between biogeophysical impacts and social-cultural ones

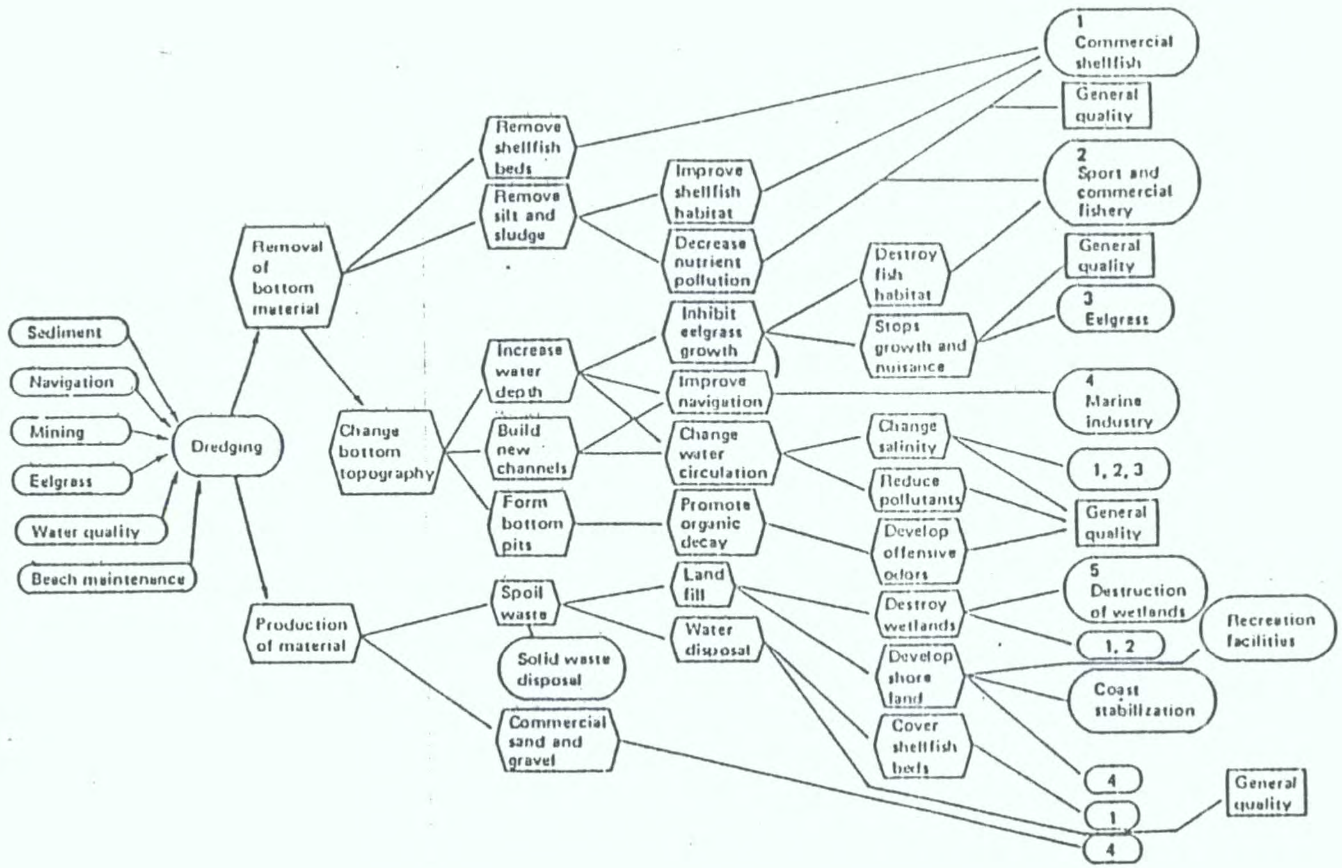


Figure 3: Network Diagram for Dredging Project (Sorensen, 1971)

EIA APPLICATION ON RESETTLEMENT (TRANSMIGRATION) PROGRAM

1. BASIC PROBLEMS

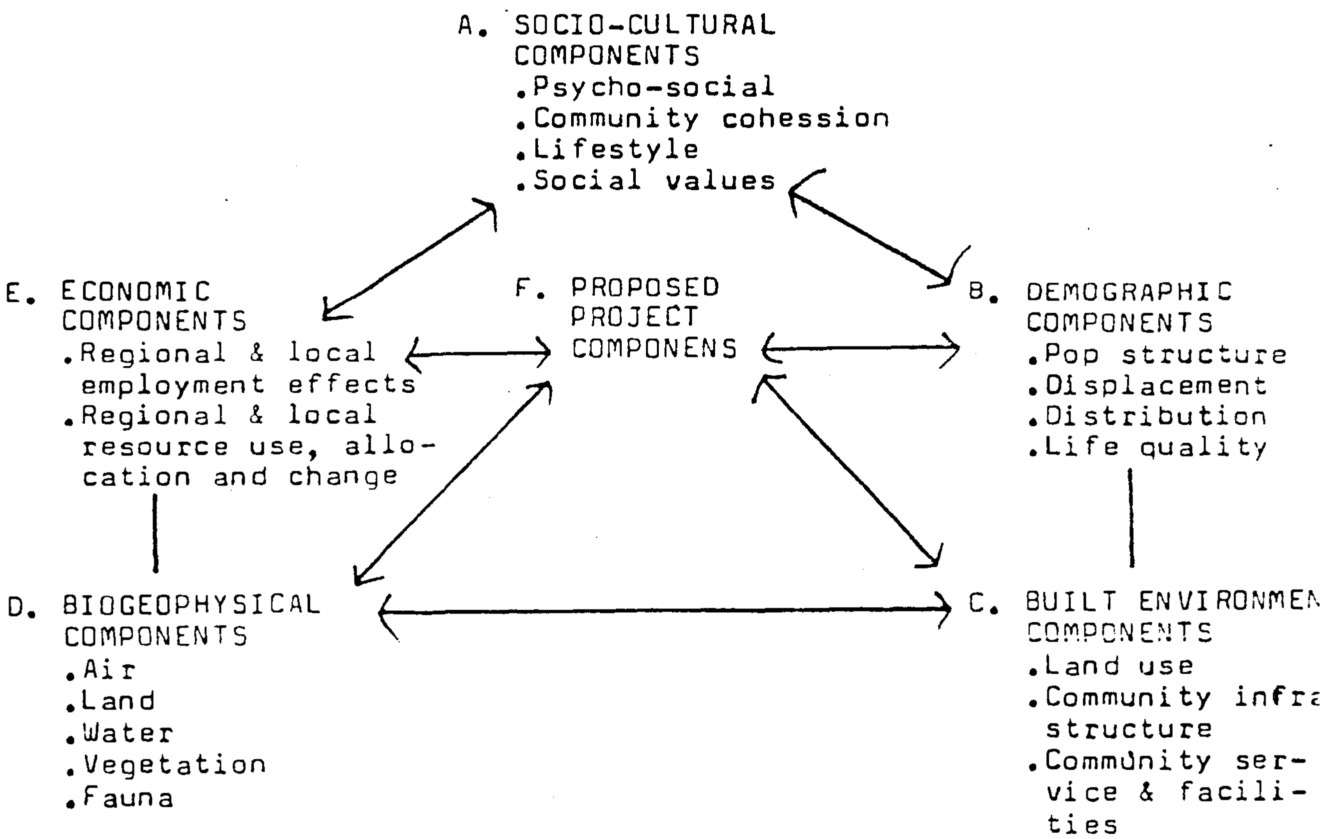
a. BEING AN ARCHIPELAGIC COUNTRY, INDONESIA IS FACING THE PROBLEM OF UNEVEN DISTRIBUTION OF POPULATION AMONG ISLANDS.

b. THIS PROBLEM HAS LED TO GAPS ON THE DEVELOPMENTS IN THE DENSELY POPULATED AREAS AND THE SO-CALLED OUTER ISLANDS.

c. RESETTLEMENT OR TRANSMIGRATION PROGRAM CARRIED OUT WITH AND/OR WITHOUT BEING SPONSORED BY THE GOVERNMENT IS CONSIDERED TO BE THE SOLUTION TO SOLVE THE PROBLEM.
THE PROGRAM HAS BEEN INITIATED SINCE THE DUTCH COLONIAL PERIOD, AND CONTINUES UP TO THE PRESENT TIME.

d. ANYHOW, RESETTLEMENT OR TRANSMIGRATION PROGRAM WITH THE LEAST ENVIRONMENTAL CONSIDERATION HAS PROVED TO CREATE DETRIMENTAL CONSEQUENCES. THEREFORE, EIA APPLICATION DURING THE PRE-PLANNING STAGE IS RECOMMED.

2. FRAMEWORK OF EIA



3. GENERAL AIMS

THE GENERAL AIMS OF TRANSMIGRATION PROGRAM IN INDONESIA ARE AS FOLLOWS:

a. INCREASE LIVING STANDARDS
b. PROMOTE REGIONAL DEVELOPMENT
c. BALANCE POPULATION DISTRIBUTION
d. PROMOTE DEVELOPMENT THROUGHOUT THE COUNTRY
e. DEVELOPMENT OF NATURAL AND HUMAN RESOURCES
f. STRENGTHEN THE INTEGRITY AND UNITY OF THE NATION
g. STRENTHEN NATIONAL SECURITY AND DEFENSE

4. GENERAL EIA COMPONENTS

a. CLIMATE
   1) Changes to micro-climatic components

b. GEOLOGY, SOILS AND GEOMORPHOLOGY
   1) Erosion potential of soils
   2) Siltation effects to treams and rivers

c. HYDROLOGY
   1) Changes in the seasonal regimes of groundwater and surface water due to changes in vegetation covers & watershen characteristics
   2) Changes of groundwater due to withdrawl & pollution
   3) Idem for surface water

d. VEGETATION
   1) Changes inquantity and quality of the vegetative covers
   2) Habitat changes due to vegetation removal

e. FISH AND WILDLIFE RESOURCES
   1) Habitat loss
   2) Population dynamic impacts
   3) Fish habitat and production/reproduction

f. SOCIO-ECONOMIC, CULTURAL,DEMOGRAPHIC COMPONENTS

INSTITUTIONAL ARRANGEMENT FOR CARRYING OUT EIA

1. IMPORTANCE OF EIA'S INSTITUTIONAL ARRANGEMENT

a. TO GAIN ACCEPTANCE FOR INCORPORATING EIA INTO THE DECISION MAKING AND PLANNING PROCESSES

b. TO ORGANIZE TECHNIQUES AND PROCEDURE FOR IMPLEMENTING EIA AS A PART OF ON-GOING I & P OF DEVELOPMENT PLANNING

c. TO SECURE THE NEEDS FOR EIA EXPERTISE RECRUITMENT

2. BASIS FOR EIA'S INSTITUTIONAL ARRANGEMENT

a. LEGAL BASIS

IN CASE OF INDONESIA

1) ACT NO. 4/1982: BASIC PROVISIONS FOR THE MANAGEMENT OF THE LIVING ENVIRONMENT

a) ARTICLE 16 :
EVERY PLAN WHICH IS CONSIDERED LIKELY TO HAVE A SIGNIFICANT IMPACT ON THE ENVIRONMENT MUST BE ACCOMPANIED WITH AN ANALYSIS OF ENVIRONMENTAL IMPACT, CARRIED OUT ACCORDING TO GOVERNMENT REGULATIONS.

b) ARTICLE 18 :

(1) THE MANAGEMENT OF THE LIVING ENVIRONMENT ON THE NATIONAL LEVEL SHALL BE CARRIED OUT IN THE INTEGRATED MANNER BY MEANS OF INSTITUTIONAL MECHANISM HEADED BY A MINISTER ESTABLISHED BY LEGISLATION.

(2) THE MANAGEMENT OF THE LIVING ENVIRONMENT, IN RELATION TO THE INTEGRATED IMPLEMENTATION OF THE NATIONAL POLICY PERTAINING TO THE MANAGEMENT OF THE LIVING ENVIRONMENT, SHALL BE CARRIED OUT SECTOR-WISE BY DEPARTMENTS AND NON-DEPARTMENTAL INSTITUTIONS IN ACCORDANCE WITH RESPECTIVE FUNCTIONS AND RESPONSIBILITIES.

(3) THE MANAGEMENT OF THE LIVING ENVIRONMENT, IN RELATION TO THE INTEGRATED IMPLEMENTATION OF THE NATIONAL POLICY PERTAINING TO THE MANAGEMENT OF THE LIVING ENVIRONMENT, SHALL BE CARRIED OUT ON

THE REGIONAL LEVEL BY REGIONAL GOVERNMENTS IN ACCORDANCE WITH THE EXISTING REGULATIONS

c) ARTICLE 19 :

SELF-RELIANT COMMUNITY INSTITUTIONS SHALL PERFORM A SUPPORTING ROLE IN THE MANAGEMENT OF LIVING ENVIRONMENT

2) GOVERNMENT REGULATION No. 29/1986: ANALYSIS OF IMPACTS UPON THE ENVIRONMENT

a) ARTICLE 23 :

(1) THE MINISTER OR HEAD OF THE NON-DEPARTEMENTAL GOVERNMENT INSTITUTION IN CHARGE OF THE FIELD OF ACTIVITY CONCERNED WILL ESTABLISH A COMMISSION AT THE CAPITAL COMPOSED OF PERMANENT MEMBERS AND TEMPORARY MEMBERS

(2) THE PERMANENT MEMBERS REPRESENT THE STRUCTURAL ELEMENTS OF THE DEPARTMENT OR THE NON-DEPARTMENTAL GOVERNMENT INSTITUTION CONCERNED, A REPRESENTATIVE APPOINTED BY THE MINISTER OF INTERIOR, A REPRESENTIVE APPOINTED BY THE MINISTER IN CHARGE OF ENVIRONMENTAL MANAGEMENT AND EXPERTS IN RESPECTIVE FIELDS, WHILE THE TEMPORARY MEMBERS REPRESENT THE DEPARTMENT AND/OR NON-D GOVERNMENT INSTITUTION CONCERNED AND OTHER MEMBERS IF IT IS DEEMED NECESSARY

(3) THE COMMISSION AT THE CAPITAL REFERRED TO IN PARAGRAPH (1) SHALL HAVE THESE TASKS:

(a) TO DEVISE THE TECHNICAL GUIDELINE FOR ESTABLISHING THE EIA

(b) TO EVALUATE PEIR

(c) TO ESTABLISH THE TERMS OF REFERENCE FOR EIA

(d) TO EVALUATE EIA

(e) TO EVALUATE THE PROPOSED EMaP FOR THE ACTIVITY CONCERNED

(f) TO EVALUATE THE PROPOSED EMoP FOR THE ACTI-

VITY CONCERNED

(g) TO EXPEDITE THE ISSUE OF THE DECISION CONCERNING PEIR, EIA, PROPOSED EMaP & EMoP

(h) TO CARRY OUT ANY OTHER TASKS GIVEN BY THE MINISTER OR HEAD OF NON-D GOVERNMENT INSTITUTION IN CHARGE OF THE FIELD OF THE ACTIVITY CONCERNED

b) ARTICLE 24 :

IDEM FOR ON-GOING DEVELOPMENT ACTIVITIES

c) ARTICLE 25 :

IDEM FOR PROVINCIAL GOVERNMENT AT REGIONAL LEVEL

3) MINISTRY OF STATE FOR POPULATION AND ENVIRONMENT MSPE DECREES

a) MSPE DECREE No. 49/1987: GUIDELINES IN DETERMINING THE SIGNIFICANT IMPACTS

b) MSPE DECREE No. 50/1987: GUIDELINES IN COMPOSING EIA REPORT

c) MSPE DECREE No. 51/1987: GUIDELINES IN COMPOSING EES REPORT OF ON-GOING DEVELOPMENT ACTIVITY

d) MSPE DECREE No. 52/1987: DEADLINE FOR COMPOSING EES REPORT OF ON-GOING DEVELOPMENT ACTIVITY DEALING WITH HAZARDOUS SUBSTANCE

e) MSPE DECREE No. 53/1987: GUIDELINES OF THE MEMBERSHIP AND WORKING PROCEDURES OF THE COMMISSION

b. POLICY AND STRATEGIC BASIS

1) AS STATED IN THE GENERAL STATE POLICY GUIDELINES

a) IN THE DIRECTIVES FOR LONGTERM NATIONAL DEVELOPMENT :

IN THE IMPLEMENTATION OF DEVELOPMENT, UTILIZATION OF INDONESIAN NATURAL∠WILL BE CARRIED OUT ON RATIONAL BASIS. IT WOULD BE CONDUCTED AS SUCH SO THAT IT WILL NOT DESTRUCT THE ENVIRONMENT, IMPLE-

∠ RESOURCES

MENTED INTEGRATEDLY CONSIDERING THE NEEDS FOR FUTURE GENERATION

b) IN THE GENERAL PATTERN OF FIVE-YEAR DEVELOPMENT PLAN :

COMMITMENTS OF SECTORAL DEPARTMENTS TO INCORPORATES ENVIRONMENTAL CONSIDERATION (THORUGH EIA TECHNIQUES & PROCEDURES) IN THEIR RESPECTIVE DECISION MAKING AND PLANNING PROCESSES

3. PATTERN OF EIA'S INSTITUTIONAL ARRANGEMENT

a. SHOULD REPRESENT LINKAGES AMONG VARIOUS PARTIES CONCERNED

b. SHOULD MINIMIZE APPOINMENTS OF NEW STAFFS AND BUREAUCRATIC STRUCTURAL ORGANIZATION

c. SHOULD SPREAD THE RESPONSIBILITIES FOR IMPLEMENTING EIA OUT TO THE RIGHT MAN IN THE RIGHT PLACE APPROPRITELY

d. SHOULD BE SISTEMATICALLY CHECK AND RECHECK ALONG THE STAGES OF DEVELOPMENT CYCLE ON THE EFFECTIVITY AND EFFICIENCY OF EIA IMPLEMENTATION

JUNE 1, 1988 R. E. SOERIAATMADJA PH.D.

ENVIRONMENTAL IMPACT OF A COALFIRED ELECTRICITY PLANT (FIRST PHASE) IN WEST JAVA, PARTICULARLY ON AIR QUALITY

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Abstract

One of the most important immediate solutions to overcome the present energy crisis is to enchance the utilization of coal. Coal utilization was reduced in the past because of its "dirty" character, mainly as a source of SO_2 and dust particles in the air, as well as NO and other pollutants. Coal, with an economicall recoverable 3,000 billion barrels of oil equivalent, has a potential to produce 5 to 6 times the amount of energy that can be produced from oil. Coal production in Indonesia declined from 1918 to 1980, and it will rise again in the near future to reach ca. 15 million thousand tons, of which 11 million tons will be consumed, mainly for electrical usage (coalfired electricity).

For coalfired electricity, the technology chosen is to produce steam with coal burning. In the first phase there will be two generators to produce 2 X 200 MW. The generators constructed in the second and third phases will produce 2 X 400 MW and 3 X 500 MW, so that the total electricity produced will be 3,100 MW which will be part of a wide-grid network of 380 KV throughout Java.

In the first construction phase, 1,500 workers were employed while 500 employees will be employed during the first operational phase. The project covers an area of 225 ha situated in Suralaya village in West Java, including 24 ha to be used for bottom ash storage representing 99,5 % of ash particles produced by the coal burning. The total bottom ash deposited will be ± 2 m3/hour, and a total amount of fly ash of 0.125 m3/hour will be produced. The coal burning in the first phase will affect the air quality as follows: emissions of CO_2 will be 10.5 ppm (quality scale 5), CO: 0.0022 ppm (quality scale 5), SO_2: 0.029 ppm (quality scale 5), NO_2: 0.053 ppm (quality scale 4) and fly ash to become 1.74 mg/m3 (quality scale 5)*. This means that the air quality will be affected mainly by NO_2 pollution in the first phase. This will become worse when the following phases of the project (second and third) are constructed and operational.

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* Quality scale : very good 5; good 4; fair 3; inadequate 2; bad 1.

The recommended treatments to be considered are among others :

1) To minimize the air pollution by applying alternate technologies for future phases, e.g. fluidized bed combustion or "magnetohydrodynamics system" (MHD), or coal gasifying or coal liquefaction.

2) Regreening the area with locally growing tress with fire resistant characteristics such as most legume species, macadamia, etc.

3) The recycling of waste to be utilized as building materials, bricks, filler for mining chambers, grouting, cooling for steel factories, etc.

4) Incidence analysis should be employed to monitor social groups who benefit and/or are affected by the risks of the project, and social corrections in the equitability efforts of the project be initiated and maintained. This includes ease in using the electricity produced by local people.

5) Some social engineering to enhance the benefits obtained by the local people, e.g. construction of health centres, schools, recreation facilities, religious centres, commercial centres, etc. Besides, there should be scholarships made available for bright local students, local people should be considered for employment within the project, etc.

6) It seems that the construction of phases II and III will have to be carefully replanned and perhaps also to be rescheduled.

1. Introduction

Any activity of man will always create the expected results of benefits and at the same time will create unexpected results, pollutant, waste, and certain risks. Fig.1. clearly explains this situation.

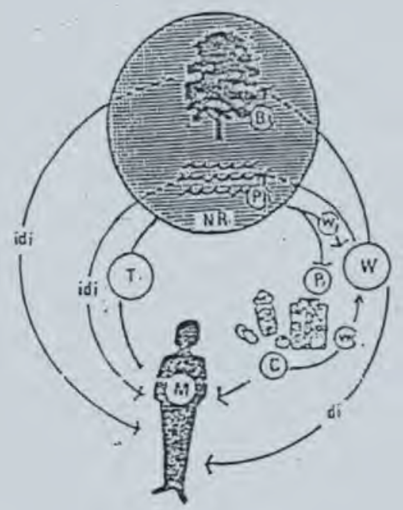

Fig.1. Man with his activities to produce products (P)from natural resources (NR) through technology (T) which create waste (W) from industries (W), and from consumption processes (W). The wastes create direct (di) and indirect impact (idi) to man himself.

The more the activities we perform, the more risks we have to face since the quality of the environment is continuously decreasing. As a developing nation, Indonesia tends to have increasing activities in all sectors. Most of these activities create various wastes and problems that deterioriate the environmental quality of our soil and space, water, air and finally the quality of life in general.

Air pollution in particular can be created by natural disasters e.g. volcanie eruptions (CO, NOx, and ash or dust), and by most activities of man for development , e.g. transportation (Pb, CO, SO_2, and dust), and industries such as fertilizer, steel, cement, and electric generators.

As a legal instrument for an appropriate environmental management, the Environmental Law No.4/1982 has been enacted. This forms a basic provision for environmental management. As a logical follow up, various national and provincial regulations are being made and prepared, among others, the procedures in implementing the environmental impact analysis (EIA) known as analisis dampak lingkungan (ANDAL).

This paper is one of the important case studies, in which an EIA was prepared for a coalfired electric generator established in the village Suralaya in West Java. The case is presented to seek comments and suggestions for future better environmental management of similar cases as well as for future better air quality protection and management.

2. Energy Crisis

Energy is the source of life in the ecosphere, for all lives, including men. Energy, no doubt is an absolute need, and functions as an indicator of living conditions. It corresponds highly to the level of development achieved by any individual or a particular social community.

A general description of energy consumption phases by groups of people can be illustrated as follows (Fig.2).

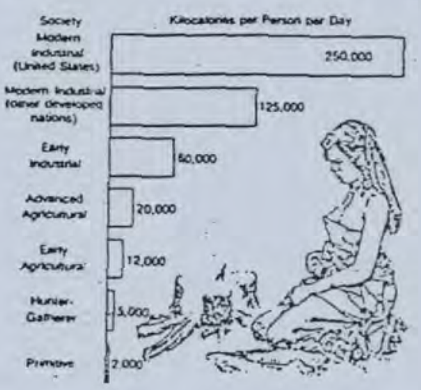

Fig. 2. Energy consumption per capita per day by various levels of cultural development (from Cook in Miller 1979).

Other data shows that among the ASEAN countries, Indonesia consumes the lowest energy per capita (Table 1).

Table 1. Energy consumption per capita in ASEAN* countries

No.	Countries	Energy consumption per capita	
		Equivalent kg of coal/year	Kilocalorie/day
1.	Singapore	2,289	50,800
2.	Malaysia	639	14,200
3.	Philippines	336	7,500
4.	Thailand	320	7,100
5.	Indonesia	225	5,000

* Except Brunei. Source: Anon in Scientiae 1984.

Until the end of 1980, industrial nations mainly derived their energy supply from oil, whereas in other parts of the world, oil takes roughly one third of each country's energy supply on the average.

The energy crisis began in 1973, when Arab countries imposed an oil embargo on the United States of America and other industrialized countries which was also followed by a considerable increase in oil prices by the OPEC countries. The blessing drawn from the crisis is, that it evoked the will to search for alternative energy sources which could replace the role of oil, considering the fact that dependence on the conventional sources of energy (including oil and uranium) will last less than the coming 40-80 years. One of the solutions found was to refer back to coal, besides diversification efforts involving other energy sources. It should also be noted that there are trends of re-orientation towards more conventional solutions of using kerosene instead of firewood, in several villages in the developing world, including in Indonesia.

3. Coal Energy

The construction of PLTU (Pusat Listrik Tenaga Uap = steam powered electric generator) Suralaya in West Java draws the interest of many, as it takes mainly coal as the source of energy. The decline of coal use in the past was due to the fact that it was considered as a "dirty" energy source. Therefore, the present trend of the increase of coal usage following the declining role of oil, has created certain concerns since it may cause serious impacts on the environment, cumulatively with the other present sources of pollution in our environment. Calculation of potential resources shows that coal represents 5 to 6 times the amount of energy available from oil (Fig.3).

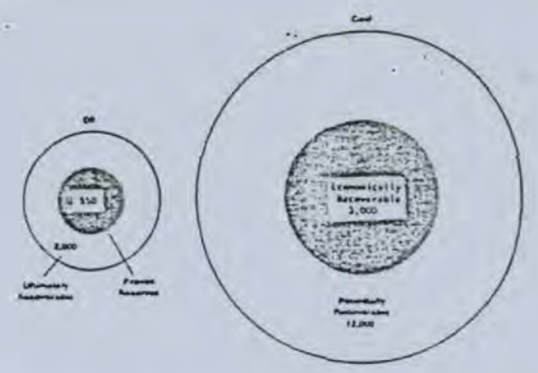

Fig. 3. A comparison of oil and coal reserves (Units: billion barrels oil equivalent. From Wilson 1977)

Coal has been the main source of SO and dust particles in the air, and second for NO pollution, besides several other polluting agents. The USA is known for her intensive debate on environmental matters going on between industrial society and the environmentalists. It is interesting to note that in the case of coal usage, industrialists have agreed that the means of coal usage should be approved by the community.

Alexander (1978) cited that from 1920 until 1972, coal consumption as energy declined from 78 % to 17 % in the USA. However, it was agreed that coal consumption should be doubled in 1985, provided that efforts to find better techniques for its pollution control are consistently strengthened.

The major coal deposits in the Asia Pacific region are illustrated in Fig.4, while Fig.5 shows the description of the total important impacts of coal exploitation on the environment.

4. Coal in Indonesia

In Indonesia coal is produced mainly in Ombilin, Bukit Asam, and Mahakam (Table 2). Total production reached its peak in the 1930-1940's, and then declined in the 1950's, to the lowest point in the 1970's but increased again in the 1980's. Coal production experienced a decline to 24% in the 1960-1970 period, but increased to 176% in the period 1971-1981.

The increase of coal consumption in Indonesia is due to increase of a variety of usages such as for electricity, cement production, railway services, alumina processing, etc. Future coal production and consumption is estimated in Table 3. Until 1985 there was a shortage of coal to be overcome by imports from India and Australia, while from 1986 and on there will be overproduction so that the surplus can be exported.

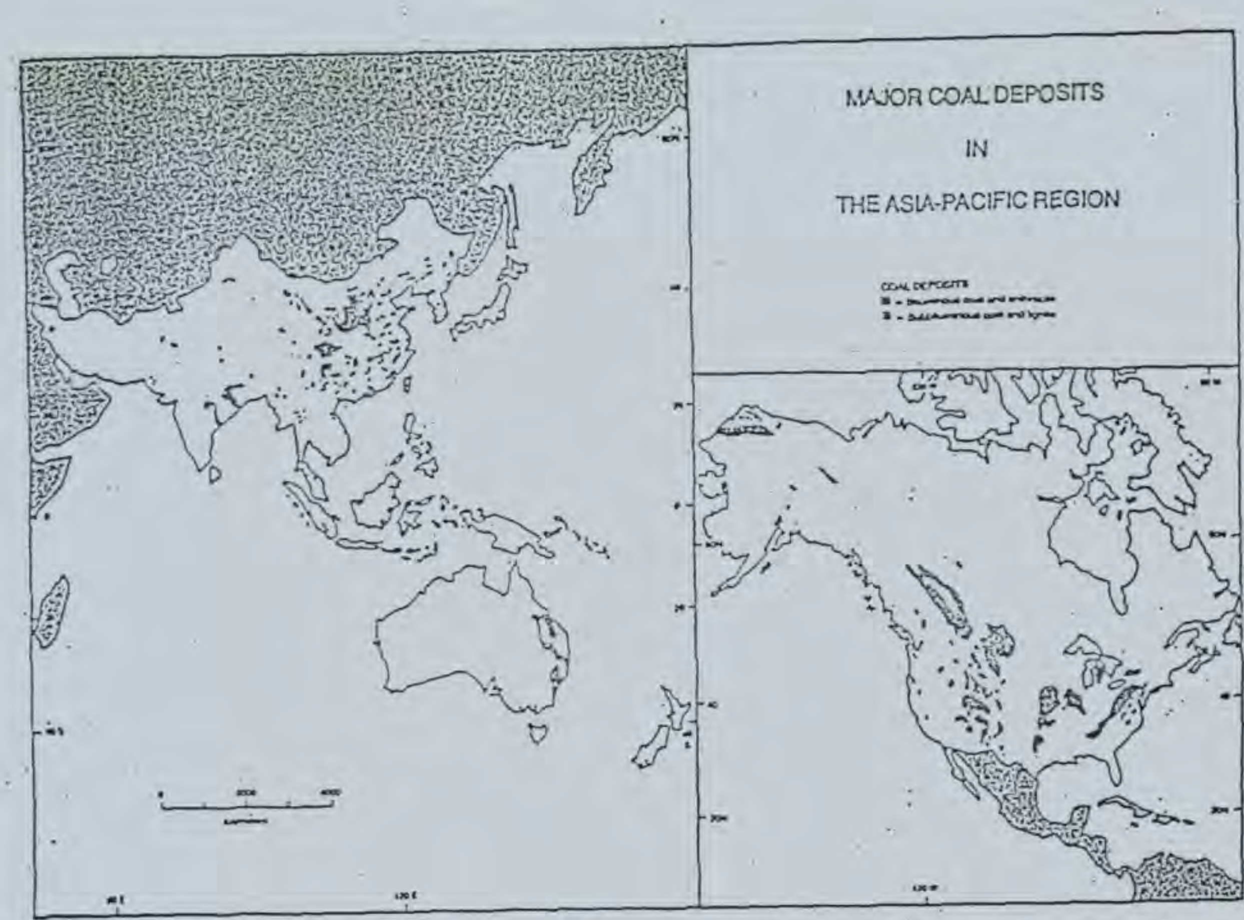

Fig 4. Major coal deposits in the Asia Pacific region (Sidiqqi and Jones 1983).

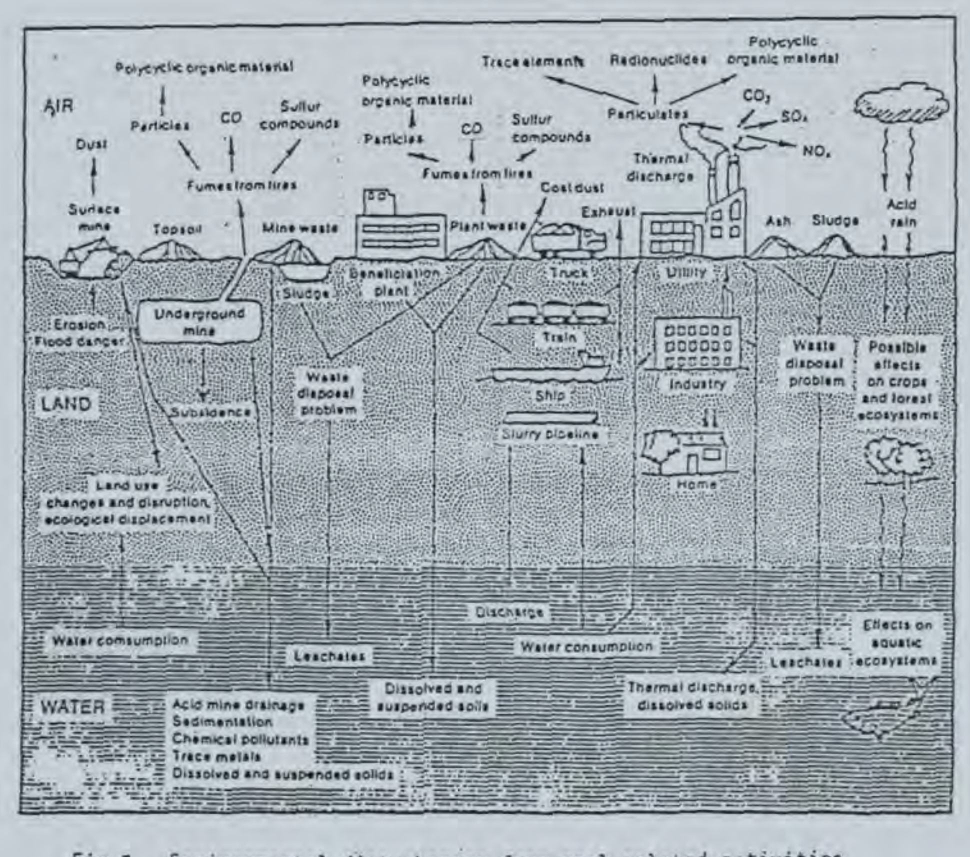

Fig 5. Environmental disturbances from coal related activities.

Table 2. Coal production in Indonesia
1918-1990 (in ton)*.

Years	Coal Production			Others	Total
	Bukit Asam	Ombilin	East & South Kalimantan		
1918	50.312	504.201	36.366	-	590.878
1920	191.618	567.142	33.863	-	742.623
1940	847.835	577.616	161.712	-	1.587.160
1960	599.718	77.606	32.092**	-	709.479
1980	161.160	142.329	-	10.000	795.000
1984	350.000	435.000	-	20.000	1.535.000
1986	2.185.000	1.310.000	-	25.000	3.535.000
1987	2.960.000	1.510.000	1.000.000	50.000	5.520.000
1988	3.035.000	1.510.000	4.000.000	50.000	8.595.000
1989	3.035.000	1.650.000	7.000.000	75.000	11.770.000
1990	3.035.000	1.810.000	10.000.000	100.000	14.945.000

*source: PT Batubara Bukit Asam 1983.
**not in production since 1971.

Table 3. Estimated production and consumption
of coal in Indonesia (in ton)*.

Year	Production		Consumption		(m ton)**
	m ton	+ %	m ton	+ %	
1984	795.000	-	1.095.000	-	- 300.000
1985	1.535.000	93	2.260.000	106	- 725.000
1986	3.520.000	129	2.895.000	28	+ 625.000
1987	5.520.000	57	4.375.000	51	+ 1.145.000
1988	8.595.000	56	6.488.000	48	+ 2.107.000
1989	11.770.000	37	8.370.000	29	+ 3.400.000
1990	14.945.000	27	11.161.000	33	+ 3.784.000

*source: PT Batubara Bukit Asam 1983.
**coal is imported from Australia and India in case of
shortage, or else exported in case of over production

5. Electrical Energy

To meet the increasing demand for electricity in Indonesia, many electric generators have been set up in several places, powered by different sources of energy. In this effort the State Electricity Corporation (SEC or PLN = Perusahaan Listrik

Negara) has launched the idea of using coal from Bukit Asam. An agreement for a combined research effort was made with Montreal Engineering Company (Monenco) in 1976. Later, in September 1977, a project report for West Java Steam Power Station (known as PLTU Suralaya) was delivered. It was based on this report that preliminary construction efforts were executed.

In 1981 SEC requested the Centre for Studies of Human Resources and the Environment (CSHRE), University of Indonesia, to conduct a study on the environmental impact analysis (EIA or known as ANDAL in Indonesian = Analisis Dampak Lingkungan) for the project. This paper presents a brief summary of data and information of the study, the predicted impacts, recommendations for environmental management, e.g. to mitigate negative impacts and enhance positive opportunities, and the project evaluation.

6. Procedure of the Environmental Impact Analysis

In the preliminary study of the PLTU Suralaya project in 1977, basic information on the environment was provided by the Monenco Consultant. The report recommended further environmental study and concluded that an EIA should be carried out.

EIA for PLTU Suralaya was basically conducted on the following systematic :

(A) Project description
- (1) Objectives of the project
- (2) Technological aspects of the project
- (3) Phases of the project development

(B) Evaluation of the project importance
(C) Environmental profile
- (1) Physical environment
- (2) Biotic environment
- (3) Social Environment

(D) Predictions
- (1) Impact areas
- (2) Prediction of potential impacts

(E) Recommendations
- (1) Recommendation for the project execution; which refers to alternatives conducive to a better implementation, eliminating or minimising the risk, and minimising the unavoidable negative impacts.

(2) Recommendation on the effective monitoring system of impacts, compared to or in conjunction with the predicted impacts, and

(3) Recommendation for the long-term management procedures.

7. Project Decription

7.1 Objectives

PLTU Suralaya was establesned to give an additional supply of electricity in Java. Its electricity production is derived from coal energy supplied from Bukit Asam. The construction will be in units following phases shown in Table 4.

Table 4. Development phases of PLTU Suralaya

Phases	Unit No.	Electricity Production (MW)	Operating	Fuel
1	1	400	1984	coal/residue
	2	400	1985	coal/residue
2	3	400	1988	coal
	4	400	1989	coal
3	5	500	1991	coal
	6	500	1992	coal
	7	500	1993	coal
Total		3.100		

Electricity produced by PLTU Suralaya will be distributed through a network throughout Java, with a transmission centre built near Suralaya. The project costs US$673,474,000 which constitutes US$408,171,000 foreign currency and US$265,303,000 in Indonesian Rupiahs.

The capital came from the World Bank (IBRD) US$345,186,000, commercial bank credit US$43,372,970, APBN (Anggaran Pendapatan Belanja Negara = annual national budgetary fund) Rp. 142,811,177,266 and the SEC budgetary fund of Rp. 23,603,197,734.

7.2 Choice of Technology

Coal will be utilized to produce steam. The coal, with 25% water content, will produce 5,300 kal/kg. A reheat type kettle is used to produce 1,2 million kg of steam channelled through a super heater pipe in order to reach 170 bar. pressure, with a temperature of 538 ^{O} C.

The steam powered generator will have a 3,500 RPM rotation, and will produce 400 MW electricity. The generator has a 30 ^{O} C cooler and a condensor with a pressure of 0.034 bar.

PLTU Suralaya has also a substation connected with a wide-grid network of 380 KV throughout Java and a grid distribution control system located in Cinere, south of Jakarta. There are two more substations with a voltage of 150 KV connected with a steel industry (PT Krakatau Steel) in Cilegon, west of Jakarta, and PLTU Muara Karang, Jakarta.

7.3 Summary of Development Activities

In the course of development, 1,500 workers were employed. At the highest peak of activities, up to 4,600 workers were needed, beside the 500 persons constituting SEC managerial employees. Approximately 500 workers are needed to operate the project after completion, including several foreign technicians. The brief development activities are as follows.

7.3.1 Landscape alteration

PLTU Suralaya project covers an area of 225 ha, situated in the village of Suralaya. The land to be cleared and flattened forms a horse-shoe shaped area which will accomodate a heater installation, a turbine, office buildings and a complex for employee settlements. There will be a reclaimed area of 20 ha for coal-stock piling. The 24 ha area to the east will be used for bottom-ash storage.

7.3.2 Construction

A road rehabilitation work will take place along the 7 km route which connects Suralaya and Merak. The original road which runs along the coast will be rebuilt by the project.

The main building is constructed to accomodate the turbine and generator, while the water kettle will be installed outside the building. A modern control room is to be built nearby consisting of fully automatic electronic devices and a high precision and sensitive receptor.

There are other office buildings and complementary facilities including an auditorium and a cafeteria. A housing complex for employees is to be built on an area of 35 ha, along the route to Merak.

A number of barges will be constructed to transport coal from Sumatra, one able to carry 7,500 tons. Embarkation facilities will also be constructed for coal to produce electricity up to 1,500 MW. Coal storage will also be prepared for everyday usage and will serve as a buffer in the case of possible supply discontinuity.

An estimated ± 750,000 tons, dead storage' space will be needed for 30 day usage, covering an area of 13 ha. Facilities for residue disembarkation and storage are also needed for tankers of 35,000 tons capacity.

7.3.3 Operation phase

The main activities of the project consist of coal or oil residue burning, including the cooling process and supply of pure water from the sea.

Coal to be used amounts to more or less 2.45 million tons in the form of coal powder. Oil residue can also be an alternative source of energy. Sea water is being used in the cooling process.

Pure water, taken from ground water, is needed for everyday usage by the employees and kettle units. Distillation methods would be a better solution, considering the possible danger of sea water instrusion. For this purpose, two distillation units (multiple flash type) of 2,800 tons/day capacity will be constructed. For fresh water storage, two storage tanks of 5,600 tons are needed. It will be channelled by 3.5 kg/cm2 pressure. When the project reaches the electricity production of 3,100 MW, there will be a water need of 300,000 l/hour; 250,000 l/hour for steamer tank; 10.000 l/hour for employees; and 40.000 l/hour for household consumption.

7.3.4 Waste treatment

Sea water used by the steam cooling kettle creates a large amount of energy waste. However, sea currents will contribute to the cooling process, so that the impacts on the environment can be reduced. There are other forms of solid waste, namely from households and other social activities.

Ninety-five percent of the total ash and dust produced is captured by the electrostatic precipitator. The captured coal dust or bottom ash will be transported after being transformed into slurry by sea water. It is calculated, with the 800 MW capacity, an ash of approximately 25 m3/hour will be produced. This means a total of 4.10^6 m3 of ash, or 9.10^6 m3 if compacted and up to 1,280 kg/m will be produced in approximately 20 years.

Coal dust or bottom ash can be treated as follows:

(1) Discharging it in the Sunda strait, + 100 km from the shore at a depth of 200 m or further 180 km at a depth of 1,700 m.

(2) Storing in an area of 24 ha, which will form a 100 m pile of coal dust in 30 years.

This stored bottom ash can be utilized, e.g. for bricks, for road construction, as a substitute for cement, etc. However, it is estimated that only a limited amount of the whole can be processed, as it reaches a total of 1,300 ton/day.

8. Environmental Profile

Baseline information on the environmental profile includes physical environment(land, air, water), biotic environment (flora and fauna) and social environment (men). Research location was chosen based on the three patterns of annual wind direction. The wind directions give the transections by which 20 locations were taken, each with 1 or 2 sampling plots.

8.1 Physical environment

In general, soil in Suralaya and the surrounding area has a low fertility. Only one village has a moderate level of fertility and a moderate pH of 6.25.

8.1.1 Water

Field and laboratory studies of 16 water samples from wells, ground water, rivers, and rice fields show that they have qualities below the safe quality standard for drinking. Several samples of ground water indicate metals content (Cd, Se, Fe) beyond the safe quality standard.

Several samples from steam kettle units show low water quality, namely high dissolved solids value. As a whole, water quality is slightly below the ideal standard.

8.1.2 Air

SO_2 content in the air ranges from 0.004-0.04 ppm, with 0.007-0.013 ppm content of NO_2, dust content of 0-45 mg/m3. The index of air quality was 5* (100%) for SO_2 and NO_2 (Soerjani 1984) and 15%, or low quality, for its high concentration of fly ash. There is a good climate condition.

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* 5 is an index for good quality and 1 for a poor quality

8.2 Biotic components

Floral diversity around the project and the surrounding area is valued low. Weru (Albizia procera), Mangga (Mangifera indica), Nangka (Artocarpus heterophylla), Kelapa (Cocos nucifera) and Randu (Ceiba pentandra) show the highest frequency. Forty three species of birds were observed, nine of which are often seen. Species of insects, mammals, reptiles, amphibians, fish, and mollusc were also identified. The quality of biota has a general value of 3, which ranges from low to moderate quality.

8.3 Social condition

The population of Pulomerak sub-district is 89,620 with a population density of 2,334 people/km2, with main occupation of farming (51,9%) and fishing (0,9%).

The population of Bojonegara sub-district is 40,477 with working population percentage of 45%, and a population density of 645 people/km2. They are mainly farmers, farm labourers, fishermen, fish pond farmers, and labourers.

Based on the number of population, the impact area is considered satisfactory (5). Population density of Pulomerak is considered bad, as it is acquiring much of a town's characteristics (value 1).

From the view point of income criteria, population of Banten subdistrict is poor and very poor. Three villages in Pulomerak are exceptions, and categorized as villages of high income groups. Almost all villages in Bojonegara are considered poor, only one can be classfied as almost poor.

Economic conditions in Pulomerak are rated as moderate (3), whereas residents of Bojonegara have a bad economy (1). Health conditions range from unsatisfactory to moderately satisfactory (3), housing is unsatisfactory (2).

Bojonegara sub-district has a typical village land pattern: mixed croppings, rice fields, and upland farming. Surrounding Suralaya there is a forest area of 205 ha, 94.8 ha of which are occupied by part of the project area.

9. Prediction of the Project Impact on the Environment

In predicting the project's impact on the environment, a matrix was prepared. The columns are the project activities, while the rows are the environmental profiles. The enviromental baseline conditions are expressed in percentage of the ideal conditions, then converted into scale indices (1 to 5). The environmental conditions as affected by the project are expressed in scale indices. The ratio between the actual total scale indices of the environmental conditions and the maximum potential scale indices (5) is expressed as percentage of the whole conditions of the environmental component (e.g. of land, flora, etc.), and in the matrix it is coverted again into a scale index (Table 4). The indices of the base-line conditions and the indices of the affected conditions are compared to show the differences, namely whether the environmental conditions are declining or improving in their quality. From the matrix it can be interpreted which environmental conditions must be given priority in the environmental management of the project, and which activities of the project have to be given higher priority in the project environmental management, so that the decline of the environmental quality can be mitigated (if not eliminated) while the increase in environmental quality can be enhanced.

Tabel 4. Matrix of the project's environmental impacts (Soerjani 1984).

Environmental project \ Project activities		Prior to project		Construction				Process		Waste management		Total scale value	Max. value scale	%	% Diffrence (%)	Diffrence (scale)
		%	Scale	1.1 Roads	1.2 Buildings	1.3 Wharf	1.4 Others	2.1 Burning	2.2 Sea water usage	3.1 Waste water	3.2 Dust & ash					
1. Land		35	2	1	1	3	4	-	-	-	1	10	25	40	+5	+1
2. Water	2.1 Fresh	40	2	2	2	-	4	-	-	-	-	8	15	53	+13	+1
	2.2 Sea	80	4	-	-	2	-	2	3	2	3	12	25	48	-32	-2
3. Air	3.1 Chemical	100	5	4	-	-	5	3	-	-	4	16	20	80	-20	-1
	3.2 Physical	15	1	1	2	-	4	1	-	-	2	10	25	40	+25	+2
	3.3 Climate	90	5	4	3	-	5	3	-	-	3	18	25	72	-18	-1
4. Biota	4.1 Flora	60	3	2	2	-	4	2	2	2	2	16	35	40	-20	-1
	4.2 Fauna	55	3	2	1	-	4	1	2	2	2	14	35	40	-15	-1
5. Social	5.1 Population	80	4	3	3	-	-	3	-	-	3	12	20	60	-20	-1
	5.2 Labour force	65	3	4	4	4	4	2	-	-	2	20	30	67	+2	+1
	5.3 Economy	40	2	3	3	3	4	-	-	-	4	17	25	68	+28	+2
	5.4 Health	50	3	3	3	-	4	1	-	-	1	12	25	48	-2	-1
	5.5 Settlement/ Housing	40	2	-	-	-	3	-	-	-	-	3	5	60	+20	+1
Total scale values		-	39	29	24	12	45	18	7	6	27	168				
Maximum scale values		-	65	55	50	20	55	45	15	15	45		310			
average %		69	60	53	48	60	82	40	47	40	43			54		
Difference (%)		-	-												-15	
Difference (scale)																-1

9.1 Negative impacts

Negative impacts include sea water, air quality (gas emissions), climate, flora, fauna, human population, and health impact.

Negative impacts on sea water are due to construction of sea wharves, especially for coal embarkation, cooling process of kettle units, and dust clearing and transportation. Physical impacts are due to dust present and the amount of heat extracted.

Air pollution became apparent from coal dust during transportation, while the coal burning will produce gas emissions (SO_2, CO and NOx), fly ash, and micro particles contained in fly ash such as Al, Ba, Ca, Cl, Cs, Fe, K, Mg, Mn, th, As, Cd, Cu, Pb, Sb, Se, Zn, br, Hg, and J. Possibly Cr, Ni, U and V are also present. Micro climate will become slightly worse, due to office and road construction, emissions of SO_2, CO (or CO_2) and NOx. SO_2, and NOx will gradually be converted into sulphates and nitrates (1-5% per hour) producing acid rain.

Diversity indices of flora and fauna will decline due to various activities of road and building construction, water usage, waste management, and coal burning. Garden construction, recreation facilities, and other greening efforts are expected to increase the diversity of flora and fauna.

The overall quality of life will decrease as a result of project activites especially due to road contruction, coal burning, and dust emission. The risk of the decline of health conditions will also follow. In general the impact of the gas emission from coal burning on man is shown in Table 5. Further reference to the impact of coal on natural environmental systems can be obtained from various publications (Chadwick & Lindman 1982, Singh & Deepak 1980, Sell 1981, etc).

Table 5. Some health effects associated with emissions from coal combustion (from Sidiqqi & Jones 1982).

Substance Emitted	Chronic Health Effects	Primary US Ambient Air Quality Standard	Comments
Sulfure Dioxide (SO_2)	Increased respiratory disease, in combination with particulates. Sulfates may be more harmful	365 $\mu g/m^3$-24 hr	About 2/3 of total SO_2 emissions in US are from coal combustion
Nitrogen Dioxide (NO_2)	Changes suspected in lung function; emphysema; Nitrates area a direct animal carcinogen	100 $\mu g/m^3$-annual mean	Ambient standard for NO_2 recently relaxed in Japan
Carbon Monoxide (CO)	Increased risk of coronary heart disease, possibility of arterial sclerosis	40 mg/m^3-1 hr max 10 mg/m^3-8 hr max	
Ozone (O_3)	Nose, throat, and eye irritation. Breathing difficulties	235 $\mu g/m^3$-1 hr max	Ambient standard recently relaxed in U.S.A.
Suspended Particulates	Pulmonery irritation during disease	260 $\mu g/m^3$-24 hr. max 75 $\mu g/m^3$-annual average	Small particulates may be proportionally more harmful than larger ones

Source: Adapted from U.S. Congress. O.T.A. (1979).

The most important aspect to be considered is the following calculation of emissions produced by the subsequent phases of the project (Table 6) which shows an increase of various emissions that may exceed the tolerable threshhold levels. From the calculations of emissions at various distances (0.3 to 10.0 km from the 200 m stack), it is clearly shown that the highest ground levels of emissions occured at 6 km away from the stack. therefore Table 6 only lists emissions of CO_2, CO, SO_2, NO_2 and fly ash at 6 km.

Table 6. Distribution of emissions from PLTU Suralaya at areas 6 km way from the stack.

Coal type	Electricity produced	Gas emissions								Fly ash		Remarks
		CO_2		CO		SO_2		NO_2		mg/m^3	scale	
		ppm	scale	ppm	scale	ppm	scale	ppm	scale			
Average	800 MW	-10.47	5	0.0022	5	0.029	5	0.053	4	1.74	5	temperature 28°C, 1 atm. pressure.
	1,600 MW	17.80	5	0.0038	5	0.049	5	0.090	2	2.99	5	
	3,100 MW	34,49	5	0.0072	5	0.096	4	0.175	1	5.72	5	
Worst	800 MW	11.67	5	0.0024	5	0.069	4	0.050	4	2.74	5	
	1,600 MW	19.83	5	0.0041	5	0.117	3	0.095	2	4.65	5	
	3,100 MW	38.43	5	0.0079	5	0.227	1	0.184	1	9.02	5	

*5 = good; 4 = sufficient; 3 = moderate; 2 = inadequate; 1 = bad.

From the calculated emissions in Table 6 it can be concluded that

(a) NO_2 pollution is the worst; the second phase (to produce 1,600 MW) of the project will have to deal with a high risk of NO_2 pollution, which has to be overcome.

(b) From the view point of SO the third phase (to produce 3,100 MW) is still within the tolerable limit, only if average coal type is used.

(c) The other pollutants, e.g. CO_2, CO, and fly ash are still within the tolerable limit.

9.2 Positive impacts

Continuous supply of clean fresh water is one of the positive aspects due to effective management of fresh water by the project. It is expected that the community will also gain from the availability of fresh water supply.

Physical condition of the air is bad at present, with its high concentration of dust particles. In the improvement of recreation facilities, parks, green belts, and road vegetation, dust particles will also be under control.

Economic condition of the community is expected to rise following increased work opportunities in and around various sectors, recreation areas, waste management, recycling efforts (brickmaking, etc), and other economic, industrial, educational, health, and service activities.

Vertically, the construction of parks, recreational facilities, greening efforts, etc. will contribute much positive pay-off for a better ecosystem in general.

10 Recommendation for Environmental Policy and Management of the Project

It is recommended that the project be continued considering the increasing demand for electricity. It is an effort to further improve the welfare of people whose present energy (electricity) consumption is generally very low.

10.1 Recommendations for project execution
Based on the network analysis shown in Fig.7, a number of recommendations and suggestions are derived, namely to mitigate the negative impacts and enhance the positive ones.

10.1.1 Development of technological access

The development of technological applications should be considered to achieve higher levels of efficiency in energy production, and in a better effort of pollution control. These should become points of attention, particularly if the second and the third phases are to be constructed. Another efficient method to be considered in the improvement of the coal burning is to use less water in the process, along with efforts to minimize SO_2 emission by applying "fluidized bed combustion (FBC) or magnetohydrodynamic system (MHD)." Fluidized bed combustion works by channelling hot air through a steam kettle to form a suspension of coal powder and limestone. This will add 40-50% efficiency, compared to conventional level of 35%. Besides, limestone will capture 90-95% of S in coal. Tight safe-keeping should be imposed on its waste product, namely the calcium sulphate (Miller 1979). With MHD generator coal is cured and treated with potassium (K), then channelled to the incinerator with a temperature of 2,760^{o} C. The chemical components will expand in gaseous forms, and turn into ions by K in the process. Gas ions (plasma) will be forced to flow at a high speed through a magnetic field and so produce electricity. This has 55% efficiency while K binds S. The volume of the fly ash produced will be the same as with conventional burning; whereas

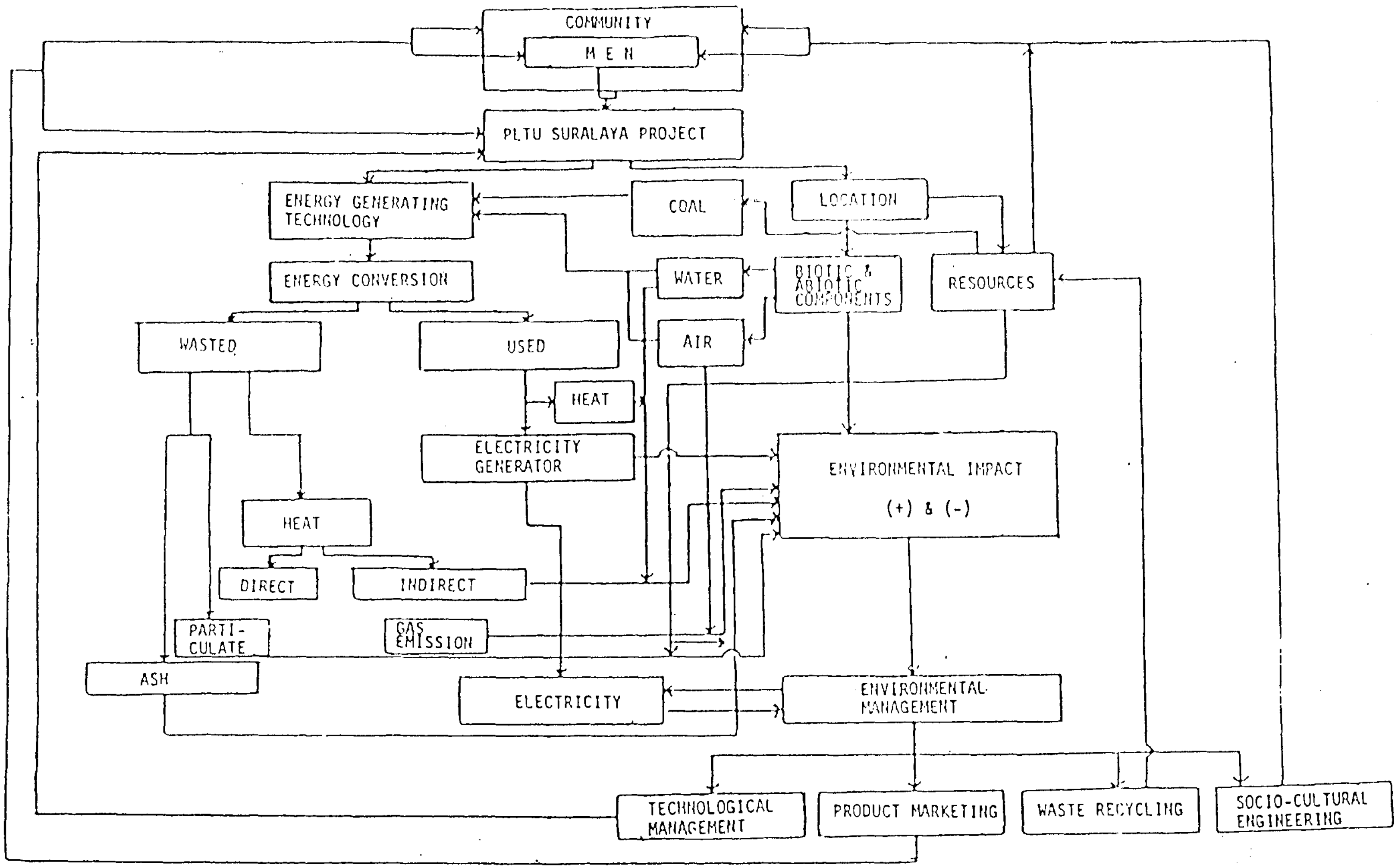

Fig. 7. Network analysis of operational impacts of PLTU Suralaya.

NO will increase due to hgher temperature burning. But this technology will only be available by 1985 in Soviet Union, and in 1987 in the United States (Miller 1979).

Another method is coal liquifaction to produce liquid hydrocarbon, or gasifying coal, adapted in Cool Water California Steam Power Plant (Abelson 1983). In the process S is captured and the remaining CO_2 can be utilized to form solid carbons for injection purposes of the "tertiary recovery" of oil.

10.1.2 Regreening the area

Complementary efforts are needed to identify trees which have a low compensation rate of CO_2, giving a higher assimilate return at higher CO_2 (five times the normal amount), to be planted for reforestation in the area. It is recommended that the area be regreened with fire resistant plants, e.g. Macadamia integrifolia, most broadleaved legumes, etc. The regreening efforts will increase the diversity index of biota in the area. Trees that may attract more species of birds and other wild animals should be encouraged. Also trees that can absorb other pollutants, e.g. NO, Cd, Pb etc. should be studied and used as plant materials in the regreening efforts in the area.

10.2 Recommendation on monitoring system

During the operational phase of the project a monitoring system is to be established. The most important aspects to be monitored are the natural conditions and the socio-cultural status of the community.

10.2.1 Natural conditions

The natural conditions to be monitored are the air quality (mainly NO_2, CO_2, fly ash, and temperature), water quality (mainly temperature, and other water pollutants), biotic diversity indices. and identification of the appropriate bio-indicators for certain quality of the environment.

10.2.2 Socio-cultural status

The socio-cultural changes of the community should be monitored by the socio-cultural indicators (e.g. the quality of life indices and psychological indices; by incidence analysis, and by studying aspects of the ecology of poverty.

10.3 Long term management of the project

10.3.1 Distribution of electricity

Widespread distribution of electricity should be planned to overcome social inequality. Land owners who shared part of their land for the project, residents, fishermen, farmers, who live near the site should be given higher priority. They should be guided to utilize electricity to increase their productivity, e.g. for home or small industries.

10.3.2 Recycling of waste

The largest amounts of waste are those of ash. Ash is to be piled on an area of 24 ha. With its chemical characteristics (Si, Al, Fe, Ca, Mg, Ti, Na, K and S) and its physical characteristics (50 um in diameter), the ash can be utilized for 21 purposes (Hui 1983). Coal has characteristics of sand, thus can be a substitute for sand for roads and building, bricks, etc. It can also be used as a filler of mining chambers, grouting, cooling medium for steel industry, etc.

10.3.3 Social engineering

The social engineering should also be a consideration as PLTU Suralaya uses high technology, and there should be efforts to create a situation conducive to integration and assimilation processes between the outsiders and the local residents. There should be a maximum utilization of the growing opportunities by local residents provided by available institutions and those developing in response to social changes such as schools (teachers, buildings, public library, etc), health centers (nurses), religious facilities, commercial centers, recreation facilities, etc. Scholarships for potential students should be made available, and local residents should be recruited as employees of the project.

11 Conclusion

Continuous evaluation and research on the four aspects of management (Fig.7) should be carried out including : development of technological access, distribution of products, recycling of waste and social engineering. It should be integrated in the whole plan and process to achieve the sectoral objectives of the project as well as the overall objectives of development, namely to improve the social welfare, living conditions, and quality of life of the people in a healthier environment.

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PROJECTING SOCIO-CULTURAL CHANGE IN IMPACT ASSESSMENT

by

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INTRODUCTION:

In the attempt to better the life of the people, many developing countries, including Indonesia, have opted to industrialize the nation through various stages of development. As we reach the 1990's the conceptual framework by which development policies, planning and strategies have gone considerate changes, from purely short-term economic planning oriented toward economic growth to planning which account for the carrying-capacity of the living environment. Admittedly, the 1980's have been favorable to the escalation of environmental awareness, with emphasis on the natural environment. This is clearly shown by the relentless efforts of so many agencies to promote the inclusion of environmental impact assessment as part of feasibility study on project level. Many developing nations, particularly in the Pacific regions have shown great support for this effort, and certainly should be highly commended. Evenmore so the present efforts to include calculation of natural environmental depletions in the national accounting system are praiseworthy. This indicates that we are veturing towards more realistic planning in that we attempt to cover more variables in predicting the outcome of development actions. Underlying such attempts is the realization that more care should be taken to

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ensure the continuation of mankind and of our earth in development activities, under the coined term "sustainable development". Hence, many development project feasibility studies consist now of three main components; namely, financial analysis, technological study, and environmental considerations; better known as environmental impact assessment. However, as development of methods and techniques for predicting and assessing changes of the biophysical environment in the last decade has progressed to a level of better percision, there is a growing realization that development planning without further consideration on how it will affect the social environment will not be adequate since the ultimate objective of development for many developing countries is the betterment of the quality of life. Eloquently, in many of our political discourses, we often refer to our committment towards this objective, yet, in our planning activities we often fail to seriously measure and estimate the social consequences of our development endeavours. This shortcoming is not without reasons. First, there is a problem in defining what consitute social environment as it relates to the traditional definition of environment *). Second, we face difficulties in delineating or defining the scope of social impact assessment. In other words, determining "the cut-off points" of the multiplying effects. Third, questions are often raised about the reliability and validity of the predictions of social changes; hence, what is the acceptable margin of error in our predictions. Fourth, whose

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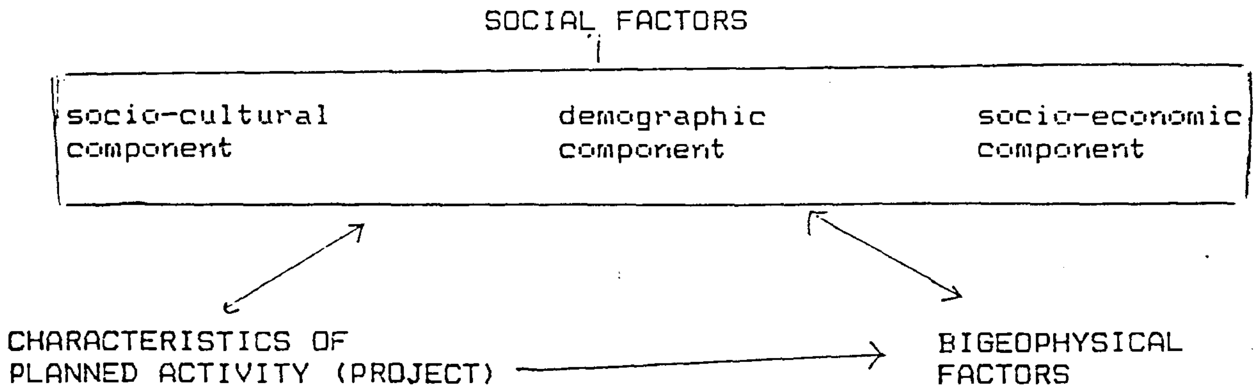
* Human ecology concept main works have been on individual level and less so on societal and community level in its discussion of impacts although this concept is one of the few which takes into serious consideration human resources as opposed to natural resources.

value judgements should be used in defining positive or negative social impacts. Lastly, admittedly, there exist within the social science field two quite distinct yet related paradigm or schools which have different views about social changes. As a consequence, the social sciences are often perceived as less applied in nature than exact sciences. Notwithstanding these, there are continuous efforts to improve the methodology, and endless attempts to intergrate various impacts in the planning process. This paper discusses thus the crucial factor in assessment; that is prediction of social impacts. To do this, first, it will briefly give an overview the social components in the baseline study, using the case of Indonesia, as example.

RELATIONSHIP AMONG PLANNED ACTIVITY, BIOPHYSICAL AND SOCIAL FACTORS:

Based on the premise that impact assessment study is part and parcel of feasibility study of a given development or planned activity, the following diagram inicates the relationship among the various factors in the planning stage, as coneptualized in Indonesia.

Diagram I:



As showm in the diagram, there are interrelatedness among the various aspects to be considered in planning stage. While philosophically there is a need for holistic approach, in the implementation of impact assessments there is a need to operationally define what should be included and excluded fromthe study.

The diagram indicates further that there are three main grouping of factors, termed components, which constitute the entire social factors, namely the socio-cultural, demographic, and socio-economic component. Each component consists of a set of factors as defined in the regulation. In Indonesia, the socio-cultural component consists thus, of the following factors:

1) the community view point with regard to development and the ability to adapt to changes,

2) extra-local linkages with other community with different ethnic/cultural backgrounds.

3) built-in cultural heritage,

4) traditions and ceremonies of the community,

5) traditions related to birth, marriage, death and inheritance in the community,

6) community integration and its capacity for "gotong-royong" (self-help),

7) social stratification system of the local community,

8) dominant political activities,

9) level of criminal acts,

10) mobility of people,

11) level community dependency on other communities,

12) main social institutions in the community,

13) local community self-concept of its community boundary,

14) existing social problems in the community.

The rationale underlying the decision for inclusion of these factors as part of the socio-cultural components are:

a) government regulation 29/86 in Indonesia approaches impacts globally, covering any kind of impacts (see further diagram 2), hence there is a need for an exhaustive list of factors to be covered in the baseline study,

b) an exhaustive list will ensure that whoever conducts the study will have a better base for what is required. Should a certain factor not be applicable for a certain community, s/he can provide arguments for excluding a certain factor in the study. As such, the decision-maker is informed about the exclusion rather than having to guess as to whether the baseline study is complete.

SOCIAL IMPACTS TO CONSIDER IN FEASIBILITY STUDY:

While diagram 1 shows the relationship between development project and EIA study, of which social impact study is part, diagram 2 indicates how the Indonesian environmental regulation no. 29/86 regards environmental impacts, particularly the social impacts.

Diagram 2:

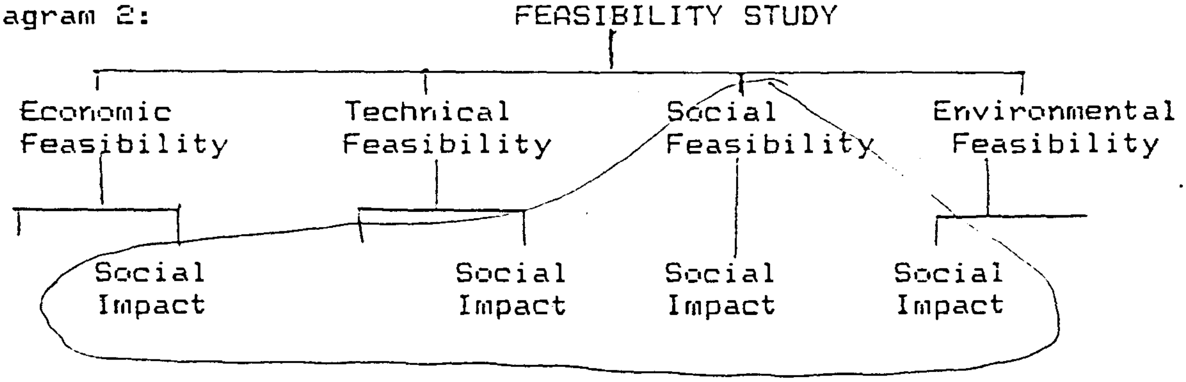


Diagram 2 indicates that there are various social impacts presently known . Finsterbush (1984) is of the opinion that in deliniating what should be covered by a certain study, there is a need to have a clear unerstanding of levels of impacts. Thus, under economic feasibility study it is possible that the study covers also the multiplying effects of a certain economic action. This differ from social impact covered in technological feasibility study, which often is part of technological risk analysis. The same holds true for environmental impact study which can cover social impacts resulting from biophiscial environmental changes. Thus, Finsterbush coined the terms, "social impact study of environmental impact analysis" to cover the latter, and "social impact study of technological risk analysis". The social impact study which is the same as the social feasibility study stands apart as it is not secondary impact study, but rather the direct social impacts of a certain planned activity. Under the Indonesian regulation no. 29/86 the approach taken is to consider all of the above social impacts as being part and parcel of EIA. This clarifies thus, why the social factor of EIA study in Indonesia consists further of demographic and socio-economic components.

In essence thus, theoretically EIA in Indonesia may be applicable for such planned activity as introduction of parabolic anthena, introduction of telecommunication to rural areas. Hence, in the attempt to avoid this, the operational definition of

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Finsterbush, Kurt, 1984. "Social Impact Assessment as a Policy Science Methodology", Impact Assessment Bulletin, vol 3/2, 37-43.

'planned development activity' covers three main categories, namely, activities related to industrialization, population relocations including transmigration, and agricultural extensification as well as intensification. Also, project activity is defined as porject with clear location, so that the study can be project- and site-specific. Consequently, at the same time thus, delineations of social impacts as part of EIA are done as follows:

1) social impacts due to biogeophysical environmental changes

2) social impacts due to relocations resulted from project activity,

3) social impacts due to changes in economic activities as a result of project activity,

4) social impacts due to technology introduced by a project activity,

5) social impacts as a direct consequence of the presence of the project activity.

FRAMEWORK FOR SOCIO-CULTURAL IMPACT PROJECTION:

In projecting the possible changes there is a need to make projections of the following scenarios:

1) possible changes to the socio-cutural factors covered in the baseline study without interference/introduction of the project activity,

2) possible changes to the socio-cutural factors covered in the baseline study with interference/introduction of the project activity,

3) the future condition as expected by the member of the community.

While point 1) and 2) are usually covered in the biophysicial environmental impact studies, point 3) is pertinent for social impact evaluation and assessment, and therefore, needs to be included in the projection framework. The rationale is that any social impacts which do not meet the future expectation of the community will thus be seen as negative. While this might be ideal, particularly in a complete democratic states; where no social change on local level is an option, questions may be raised as to whether this can be applicable for developing countries where there are on the national level political ideologies to be taken into account which may stress planned social changes. In such condition, the national level consideration may well overrule local expectations. It becomes thus imperative for the assessor to have clear understanding of the higher level social change desired directions.

PROJECTION AND PREDICTION METHODS:

While it is possible to list the research methods invented for projecting/predicting social changes (see appendix), they can be classified into four main groups as follow :

1) trend-forcasting which are best for demographic changes.

2) scenarios which are best for qualitative socio-cultural changes,

3) professional judgements, also good for qualitative and quantitative data,

4) argument by analogy which are more applicable for qualitative, intangible data.

Based on the methods classified above, it becomes obvious that no single method can predict socio-cultural changes accurately. The reasons are:

1) socio-cultural changes span over a longer period of time, and often realized 'after-the- fact'. Consquently, there is a problem in defining the time-frame in projecting changes.

2) the longer the period of projection, the larger is the margin of error. To minimize this, triangulations are needed. This will in addition be important to ensure completeness of coverage.

Identified are four types of triangulation:

1) data triangulation whereby various data resources are used.

2) researchers triangulation whereby more than one researcher are used,

3) methods triangulation whereby more than one method are employed in data analysis,

4) theory triangulation whereby combination of theories are used to predict possible and define the most probable changes.

TREND FORCASTING METHODS:

This group of methods are based on a set of assumptions about the social reality:

1) that past pattern of changes will remain constant; thus estimate about the degree of changes found in the past can be used to predict the future,
2) that only certain variables under study will undergo changes whilst the other variables remain constant.
3) that there are minimal or no interdependency among the variables,
4) that changes are linear in nature.
5) Minimal data requirement are set of time serial data from two points in time.

Obviously the data are quantitative, and the methods are more applicable for demographic and socio-economic predictions.

SCENARIOS:

In contrast to trend-forcasting which requires that some variables be assumed to remain constant, scenarios assume that no variables will remain constant; that is, changes in one variable will result in changes to other variables. These methods in a sense 'manipulate' certain variables to see how they will affect other variables. As such the basic requirements are :

1) a model which is used for baselining and projecting

2) a theoretical knowledge of what constitute endogenous social changes,

3) some sense of creative ability to imagine the future.

To do scenario projections at present there are various computer models based on statistical analysis to assist us. In using often qualitative data need to be converted into quantitative ones.

PROFESSIONAL JUDGEMENTS:

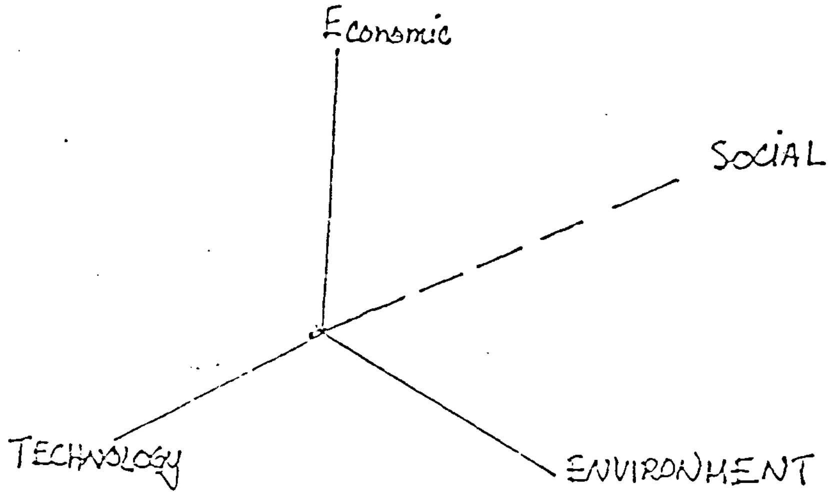
Predictions of social changes using professional judgements rely on the ability of professionals in forcasting. It is based on the premise that these professionals have accumulated rich experience in analyzing changes that they have the ability to define probable changes; what is often termed as the use of Baysian logic. Such logic is best described as being similar to what school teachers use to decide on the grades given to students. At the same time, prediction is made about the degree of success a certain student may have in the future. To minimize possible biases, judgements are collected from more than one expert, and comparison is then done to reduce error.

ARGUMENT BY ANALOGY

Similar to professional judgements, argument by analogy uses also past experiences with social change to predict future conditions. Yet, unlike professional judgements the methods rely on documented evidence of social changes that have taken place due to a certain project activity similar in nature to the planned one. An extensive review of exisiting literature is needed to ensure that the predictions made are reliable; that is. the variables under consideration are comparable. The underlying rationale is that causal social relationship is to some degree predictable, since human behavior is in many ways predictive. Second, that for analytical reasons changes through time can be omitted since the objective is to find the general pattern of change to be used as basis for predicting possible changes.

CLOSSNG REMARK:

This paper has discussed the various ramifications of conceptualizzng social impact and the presently methods predicting social changes. It has not given description of the stages for application of various techniques. The main objective is to aquaint decision-makers of the problems that the various methods have and the underlying assumptions. Crucial for prediciting .social changes is the way we perceive what should be included in the analysis. In the case of Indonesia the Ministry of Population and Environment has attempted to give guidelines so as to assist researchers in the study.



- Levels of Analisis for Social Impacts:

SIA: policy level — • societal level } • community resources
SIA: project level { • community level
• group level
• individual level. } • human resources

- Objectives for doing SIA:
  - Provide Social Information
    1) • to predict the ability of a community / group to adapt to changing conditions
    2) • to define the problems / clarify the issues involved in a proposed change
    3) • to anticipate and assess impacts on the quality of life
    4). to identify mitigation opportunities or requirements

Development Objective ⟹ Betterment of the quality of life
↓
What are the social consequences of our development activity?

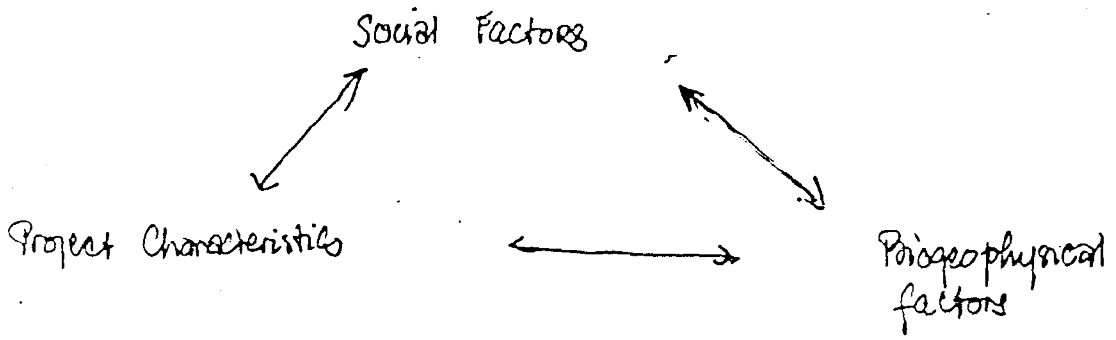
Problems:

1. what constitute social environment and how does it relate to biophysical environment.
2. how to delineate the social assessment study.
3. how valid & reliable are our predictions about possible social changes ⟹ what is the acceptable margin of error
4. whose value judgements should be used in assessing negative / adverse & positive social impacts

For Indonesia:

SIA is important:

Population ⇄ Living Environment



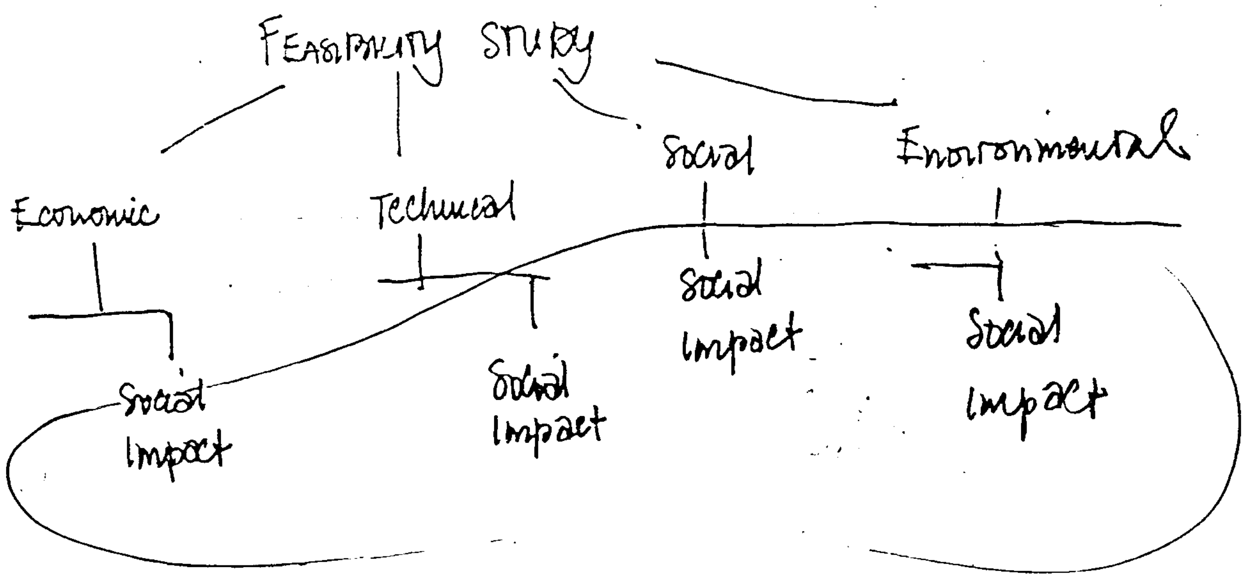
Social Factors:

- Socio-cultural components
- Demographic components
- Socio-economic component

Socio-Cultural Component:

1. the community view point with regard to development and the ability to adapt to changes
2. extra-local linkages with other community
3. built-in cultural heritage
4. traditions & ceremonies in the community
5. traditions related to birth, marriage, death & inheritance
6. community integration & degree of self-help
7. social stratification system
8. dominant political activities
9. level of criminal acts

10. mobility
11. level of dependency on other community
12. omani social institutions
13. self-concept of community boundary
14. social problems



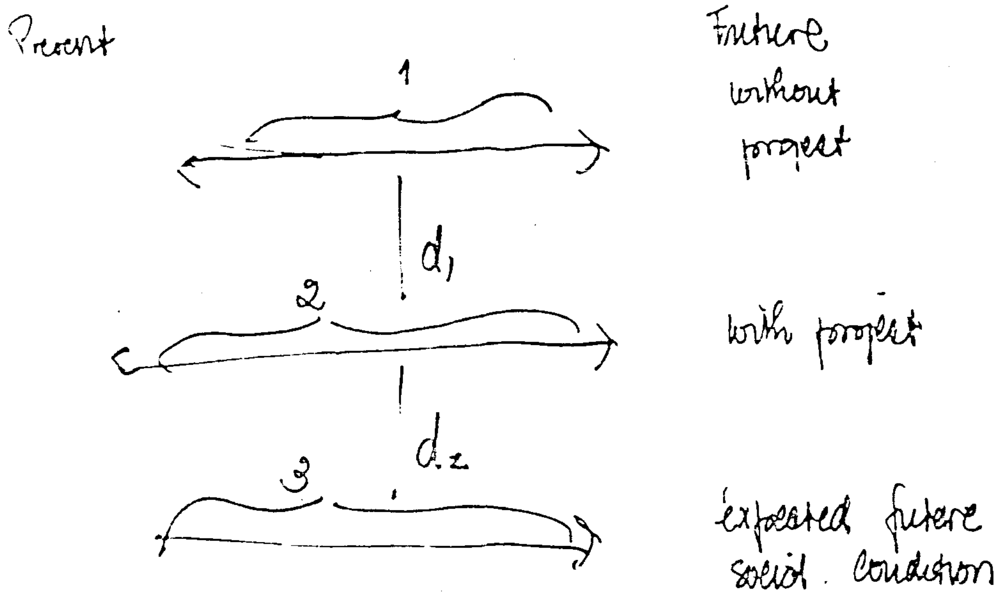
1) Existing Condition → (Project ↓) Natural Environmental Changes → Social Environ. Changes

2) Existing Condition → Project ↓ Social Changes → & Envir. Changes.

3) Exist. Condition → Project ↓ Economic Changes → Social Changes

4) Existing Condition — Project — New Technology Introduction — Social Changes

5) Existing Condition — Project → Relocations — Social Changes



4 Groups of Projection Methods:

- Trend forecasting
- Scenarios
- Professional Judgements
- Argument by Analogy

Baysian logic

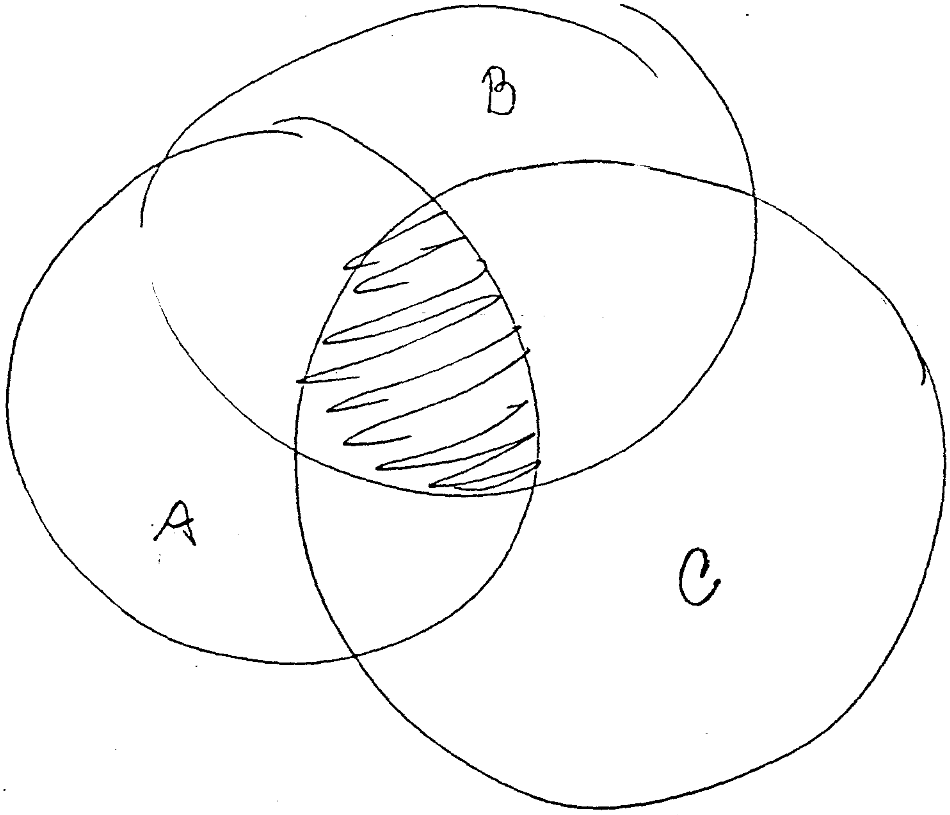
Triangulations:

1) data triangulation

2) researchers triangulation

3) methods triangulation

4) theories triangulation



Delphi methods

DR. RIGA

Techniques for Estimating Future Social Conditions

1. Cost-benefit analysis
2. Statistical models (Bayesian)
3. Marginal analysis
4. KSIM
5. Mission flow diagrams
6. Parameter analysis
7. Cross-impact analysis
8. Input-output analysis
9. World oil price simulation
10. Breakthroughs
11. Precursor events
12. Econometric forecasting
13. Dynamic models
14. Structural models
15. Decision analysis
16. Morphological modeling
17. Decision matrices
18. Relevance trees
19. Theoretical limits and barriers
20. Analysis of industrial behaviour
21. Technological audit
22. Social trend analysis
23. Canonical trend variation
25. Surprise-free projections
26. Social indicators
27. Leading indicators (economic)
28. Change signals monitoring
29. Critical factors analysis
30. Estimates of preferences
31. Subjective estimates of probability
32. Prediction of changeover points
33. Amplitude-adjusted index
34. Diffusion index
35. Authority or "genius" forecasting
36. Surveys of intention or attitudes
37. Surveys of activities or units
38. Panels
39. Delphi
40. Psychographics or life style
41. Activities, interests, opinions
42. Life ways
43. Historical analogy
44. Alternative futures
45. Divergence mapping
46. Introspective forecasting
47. Utopias/dystopias
48. Modes and mechanisms of change
49. Study of forces of change
50. Macrohistorical cycle
51. Cross-cultural comparisons
52. Synectics
53. Brainstorming
54. Bionics
55. Science fiction as forecasts
56. Exponential smoothing
57. Simple regression
58. Moving averages
59. Multiple regression
60. Growth curves
61. Envelope curves
62. Link-relative prediction
63. Box-Jenkins
64. Cycle analysis
65. Systems analysis
66. Risk analysis simulation
67. Contextual mapping
68. SRI Gulf energy models
69. Games
70. Policy capture
71. Probabilistic forecasting
72. Normex forecasting
73. Substitution forecasting

Source: Arnold Mitchell, et al. Handbook of Forecasting Techniques (Fort Belvoir, V.A: U.S. Army Engineer Institute for Water Resources, 1975), pp.289-291.

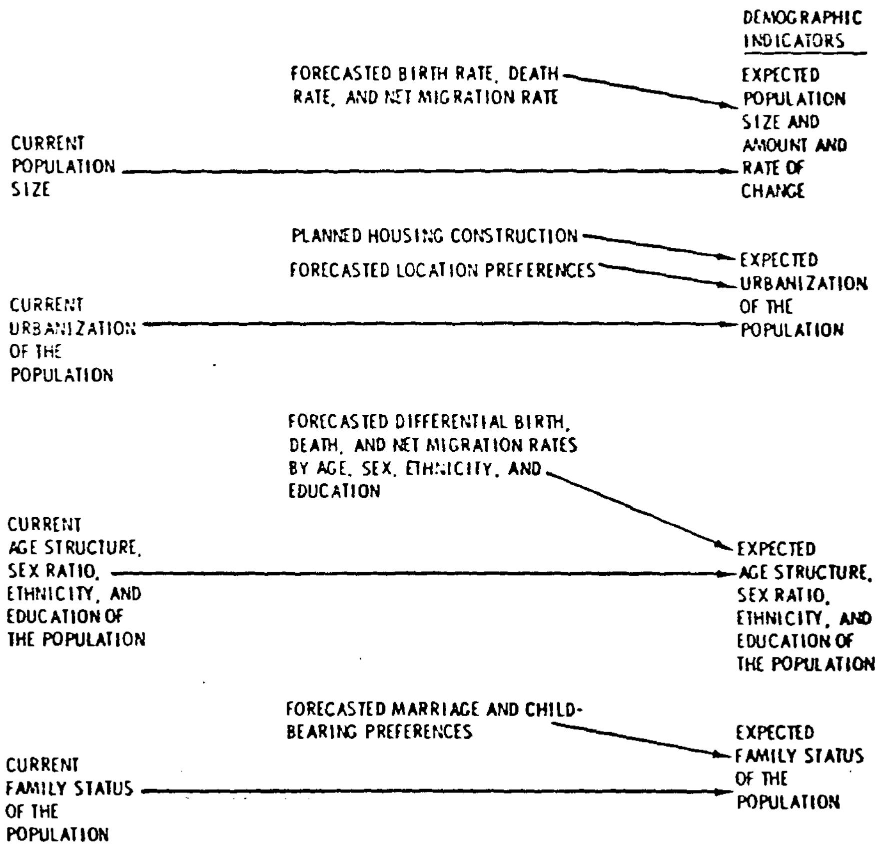


Figure 26: Demographic Flow Chart without the Proposed Project (Olsen, Melber and Merwin, 1981)

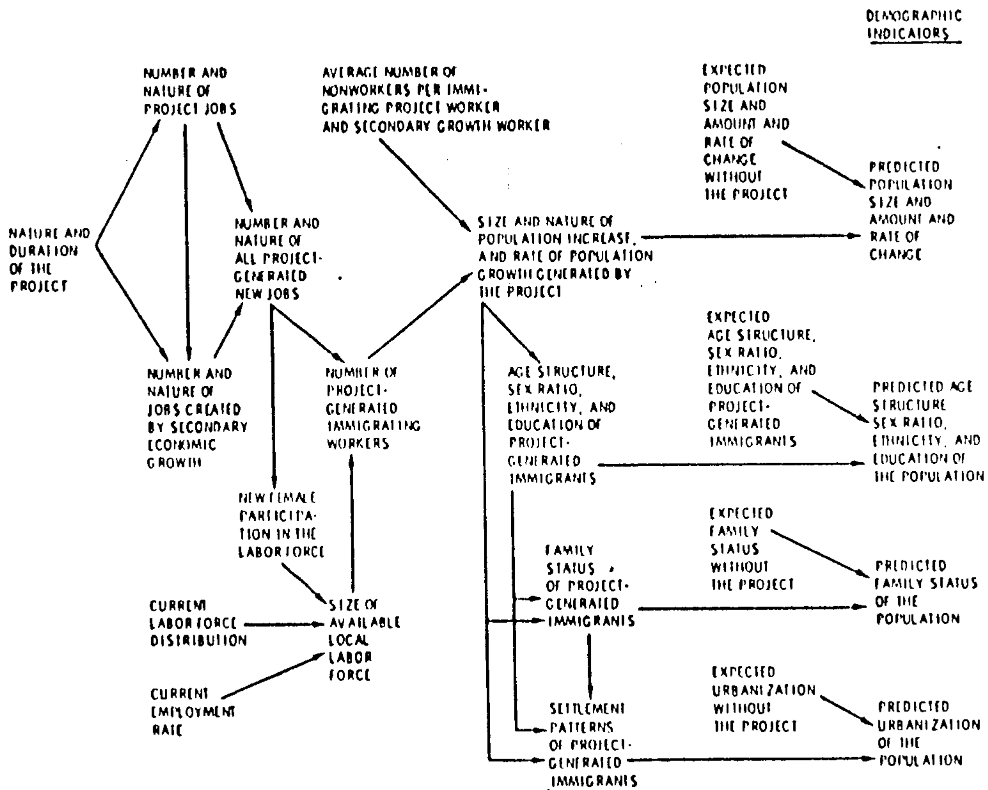


Figure 27: Demographic Flow Chart with the Proposed Project (Olsen, Melber and Merwin, 1981)

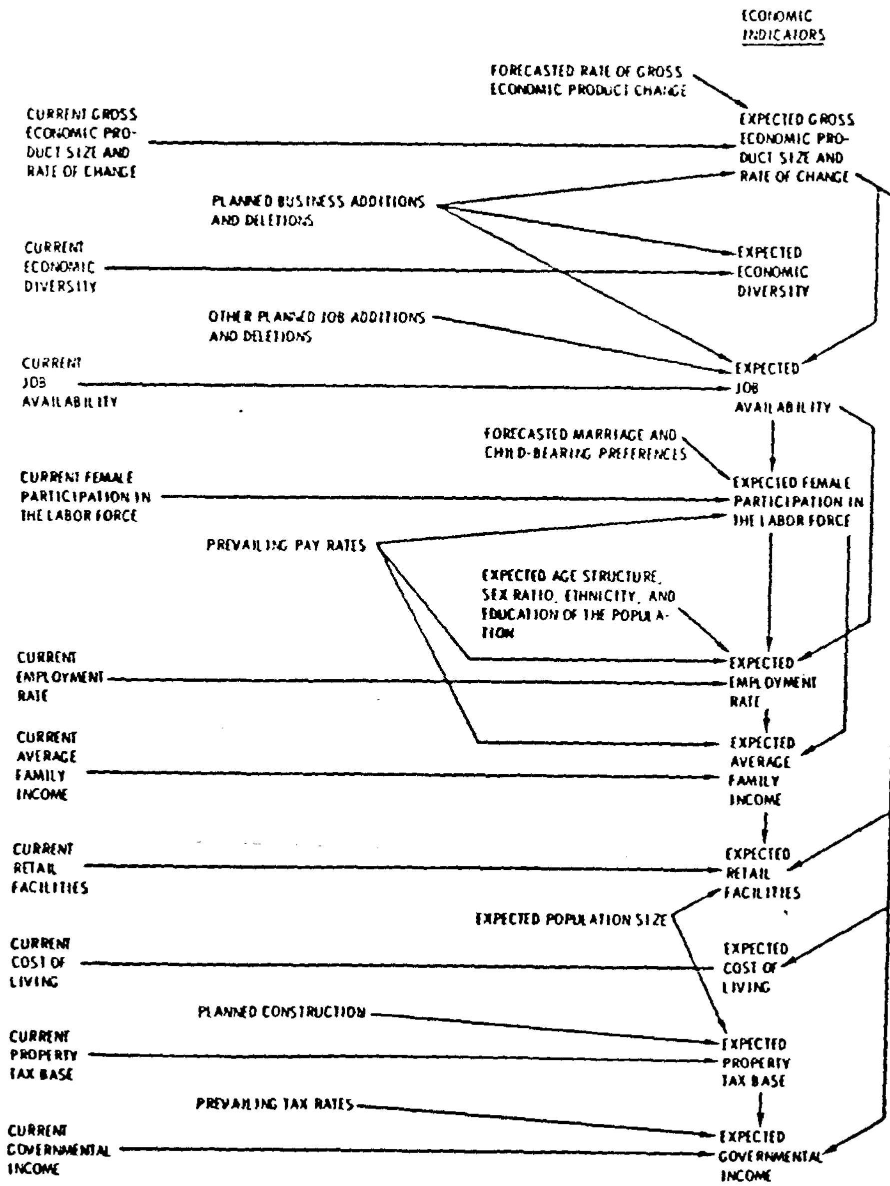


Figure 28: Economic Flow Chart without the Proposed Project (Olsen, Melber and Merwin, 1981)

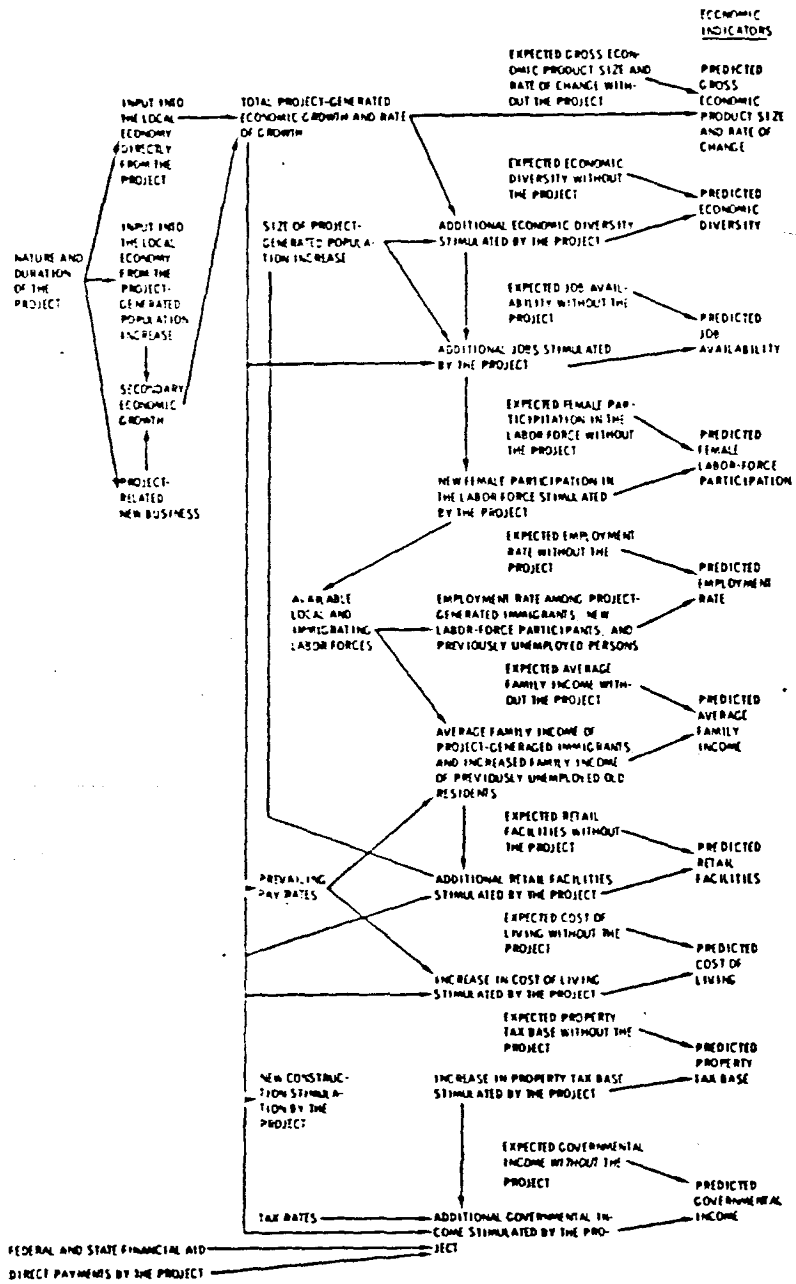


Figure 29: Economic Flow Chart with the Proposed Project (Olsen, Melber and Merwin, 1981)

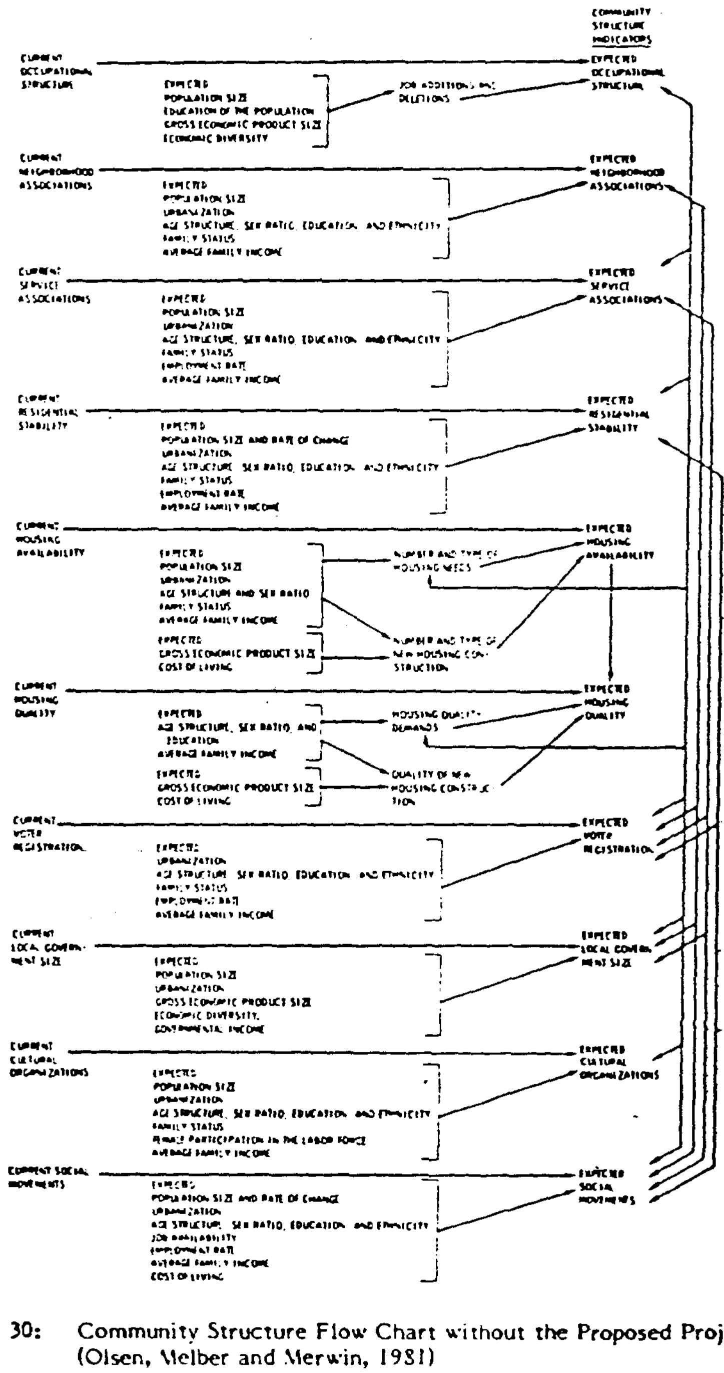


Figure 30: Community Structure Flow Chart without the Proposed Project (Olsen, Melber and Merwin, 1981)

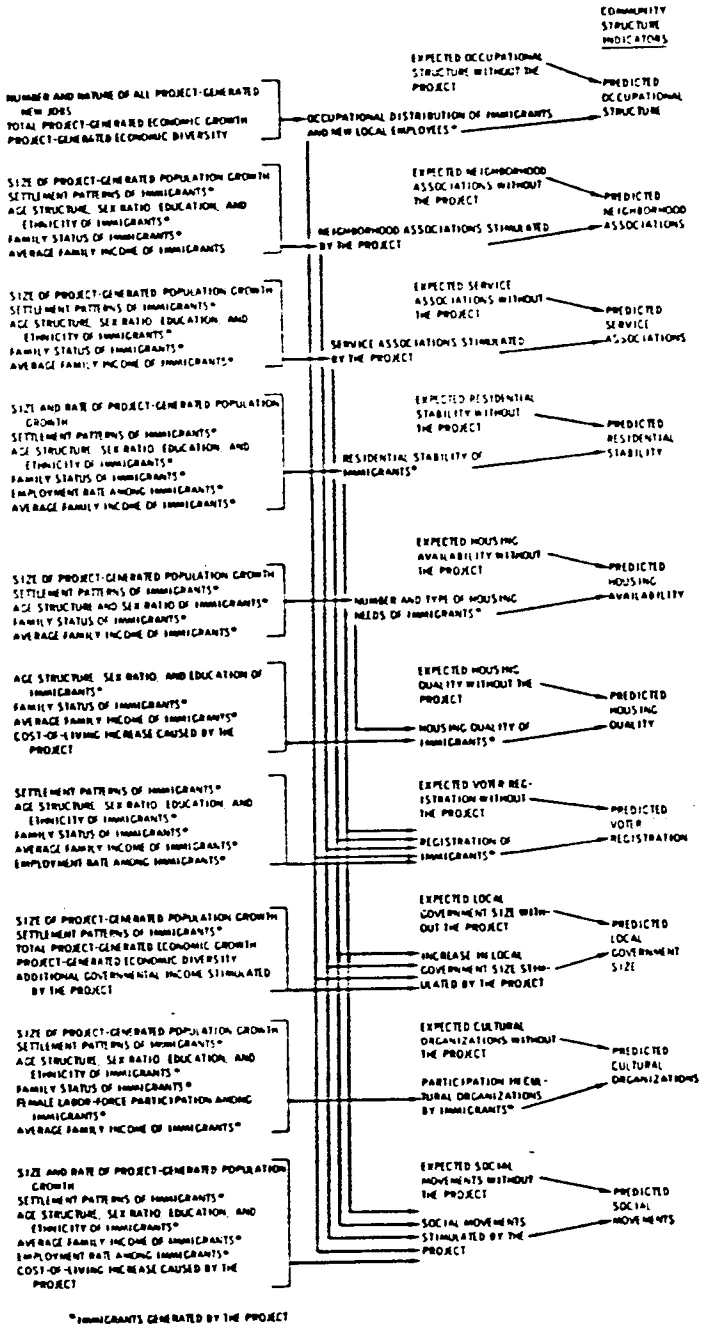


Figure 31: Community Structure Flow Chart with the Proposed Project (Olsen, Melber and Merwin, 1981)

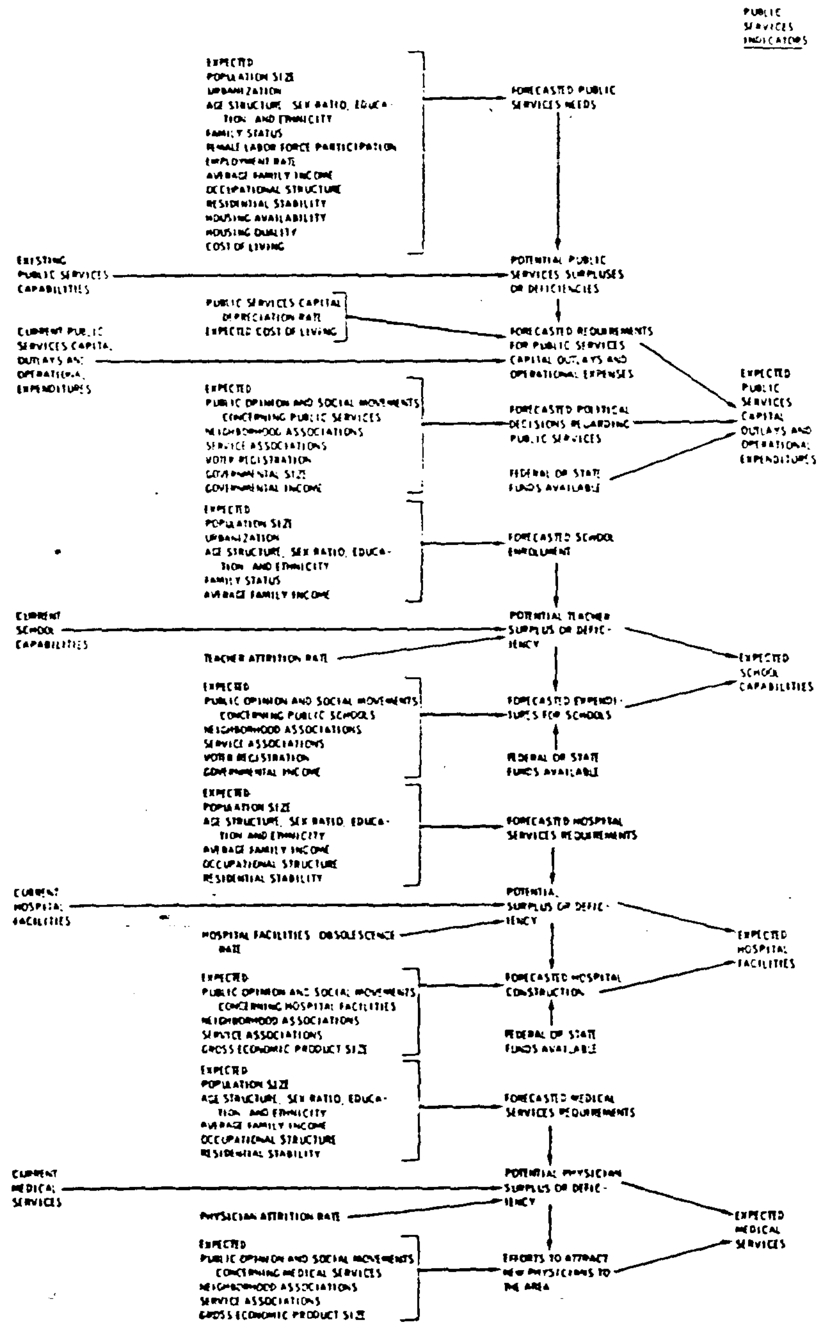


Figure 32: Public Services Flow Chart without the Proposed Project (Olsen, Melber and Merwin, 1981) (continued)

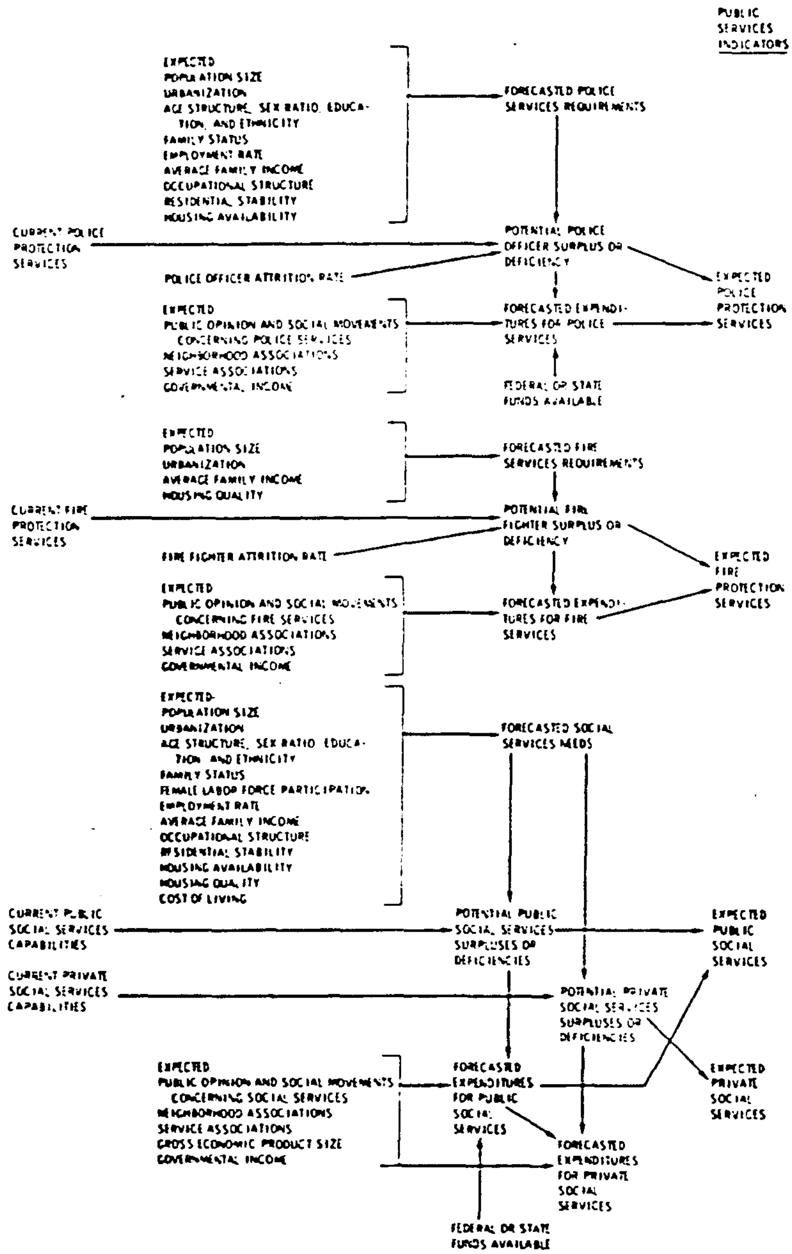


Figure 32: (continued)

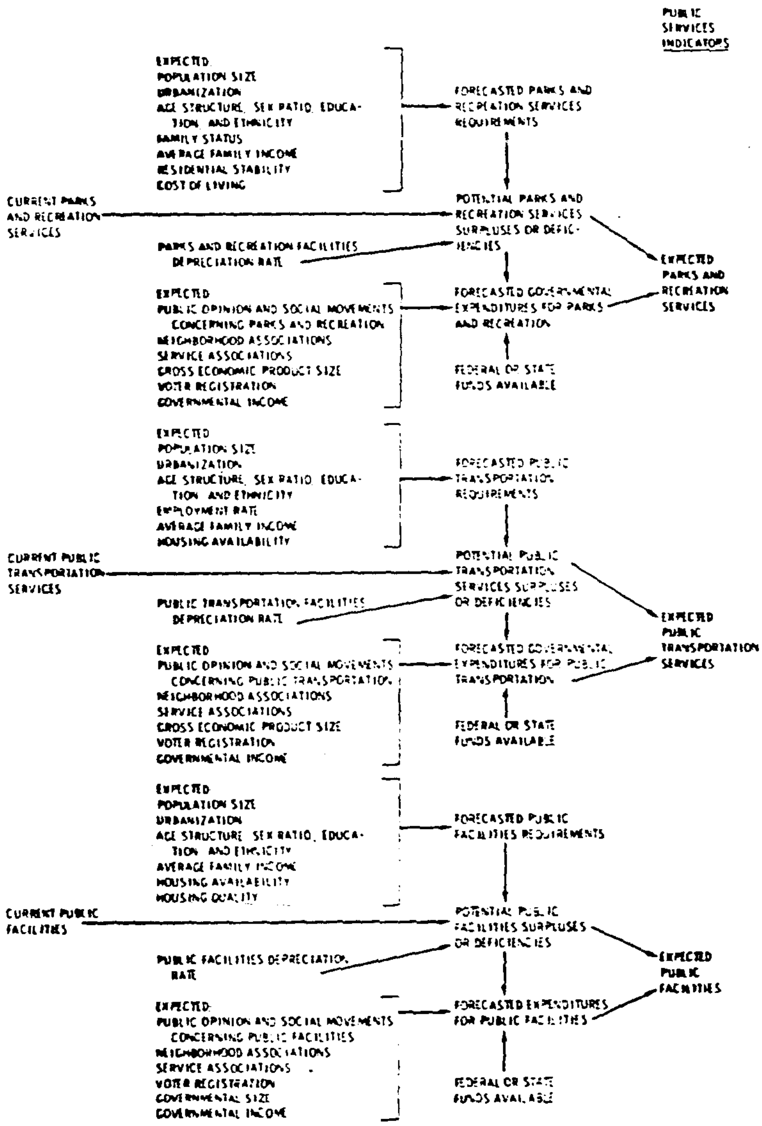


Figure 32: (continued)

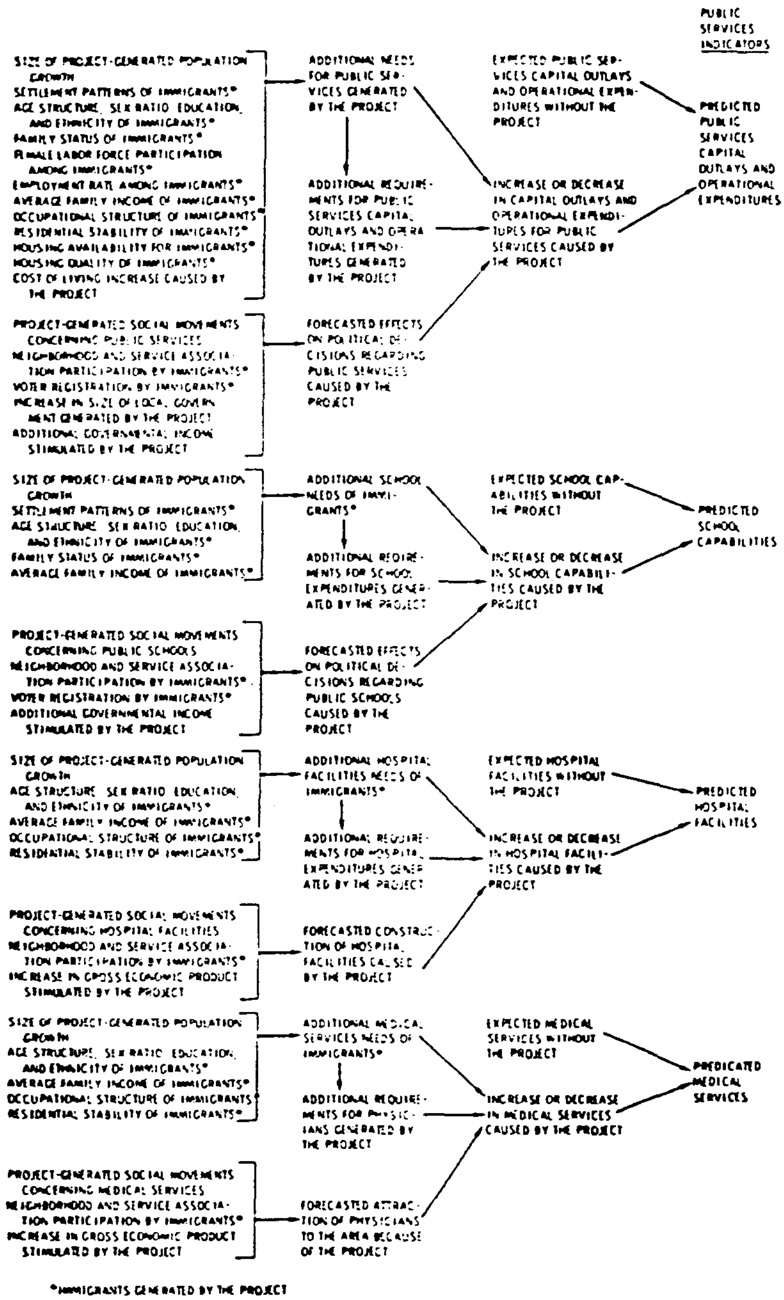


Figure 33: Public Services Flow Chart with the Proposed Project (Olsen, Melber and Merwin, 1981)

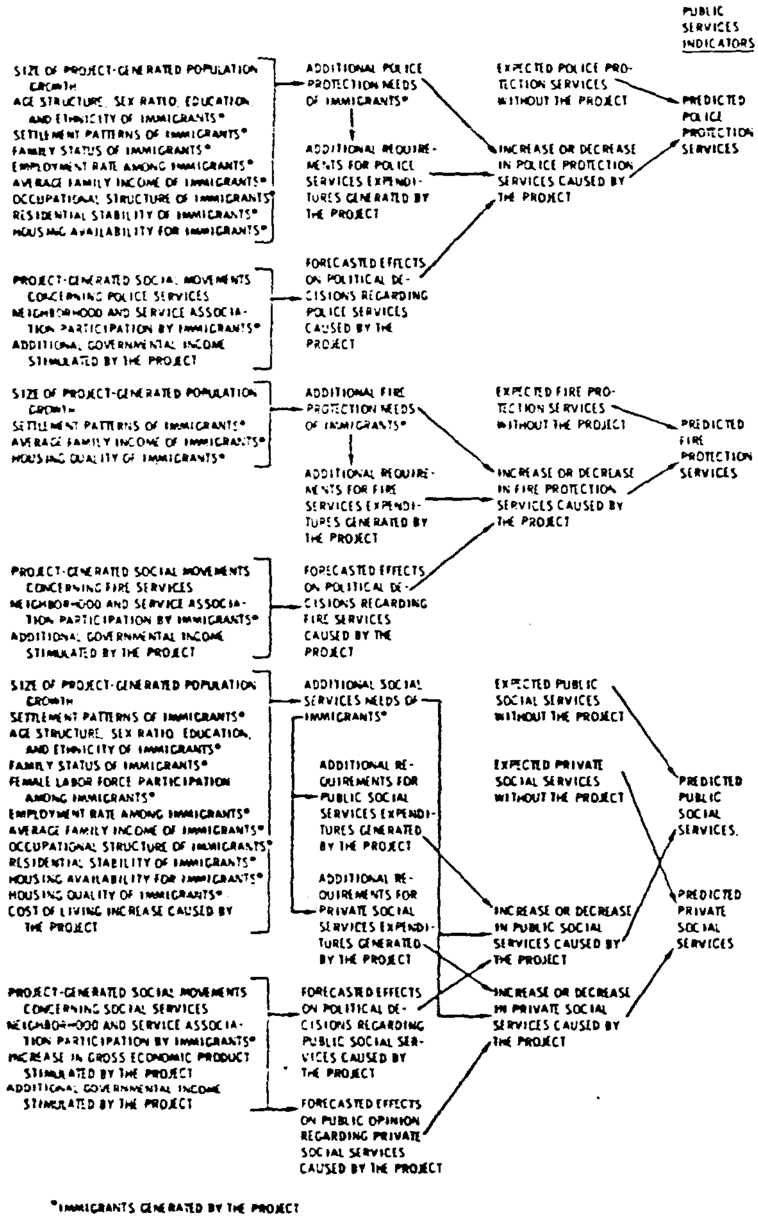


Figure 33: (continued)

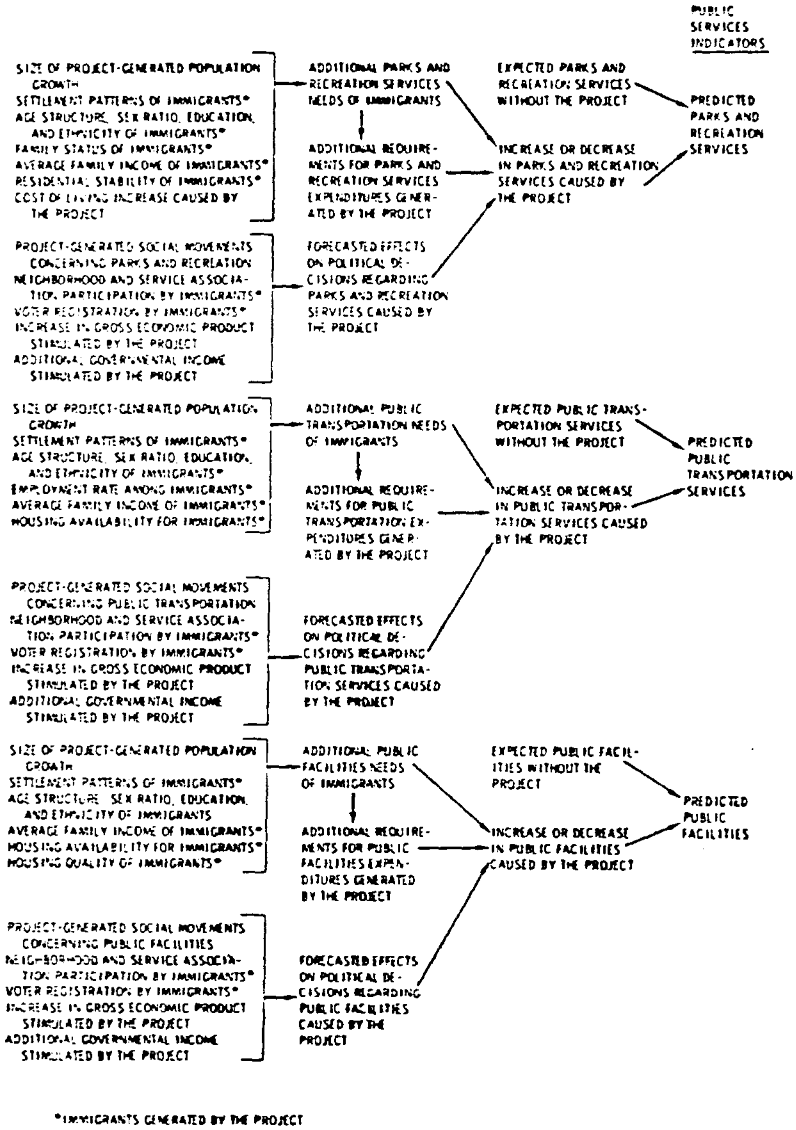


Figure 33: (continued)

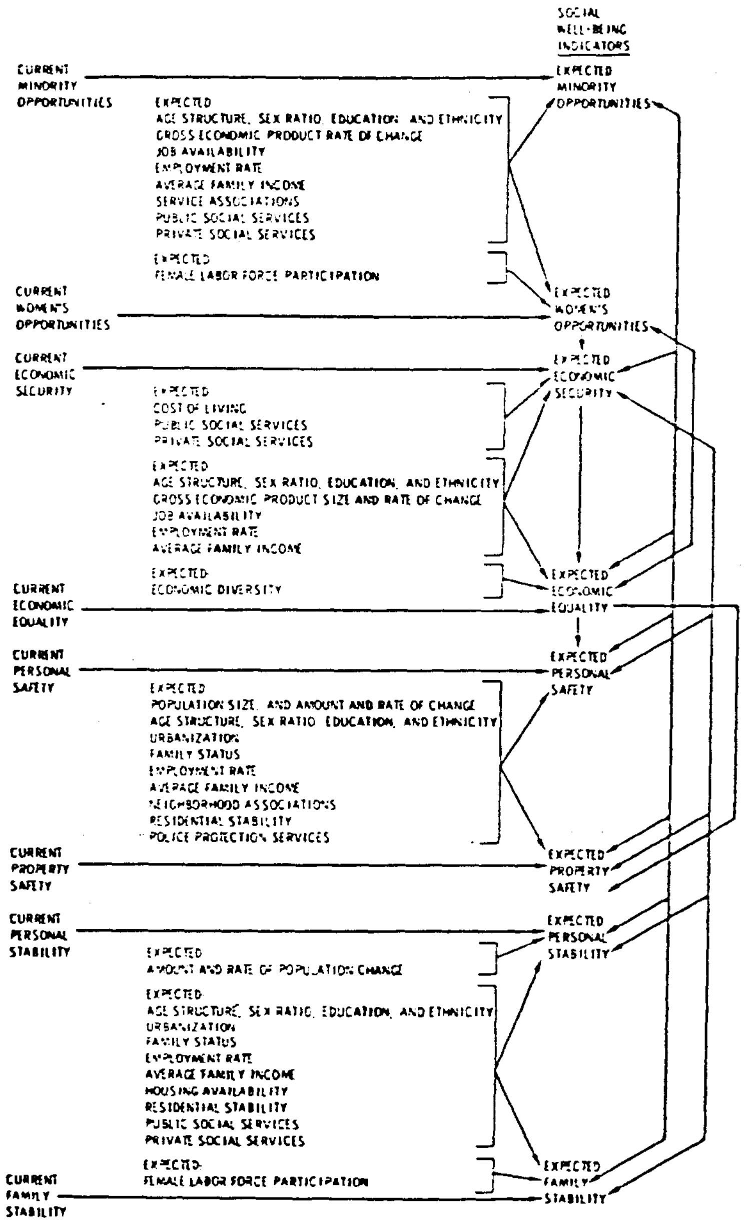


Figure 34: Social Well-Being Flow Chart without the Proposed Project (Olsen, Melber and Merwin, 1981)

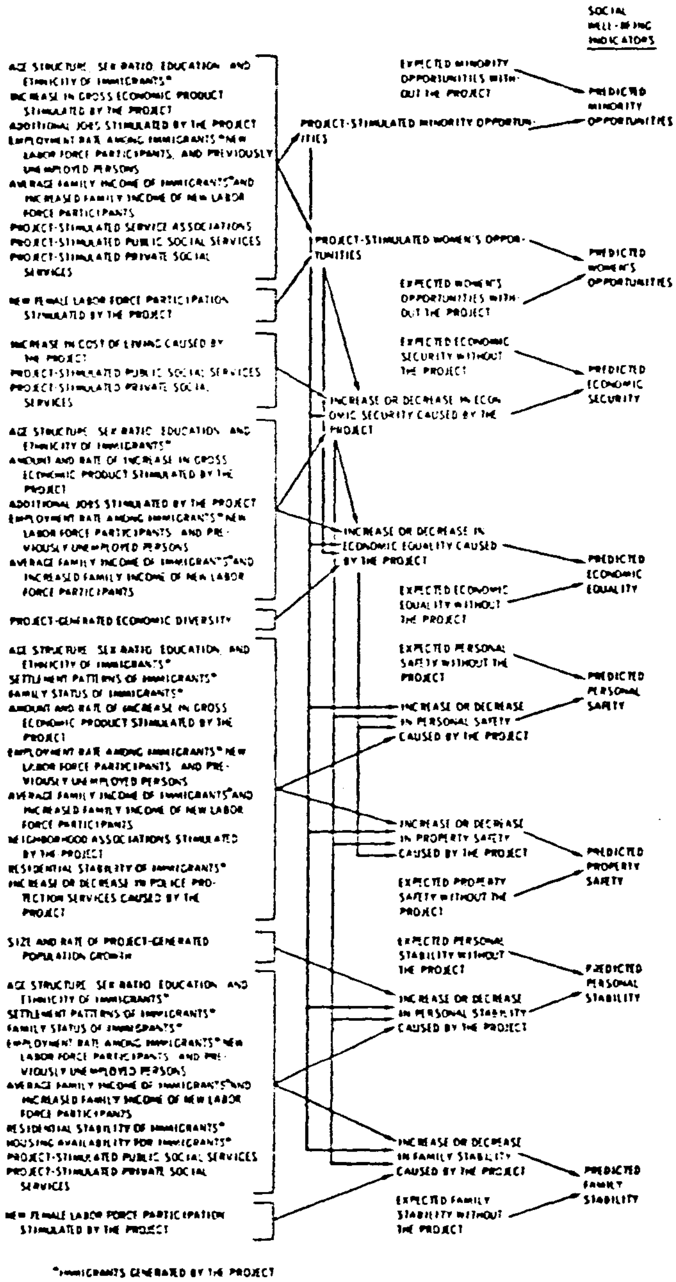


Figure 35: Social Well-Being Flow Chart with the Proposed Project (Olsen, Melber and Merwin, 1981)

APPLICATION OF EIA TO SITTING AND CONSTRUCTION OF INDUSTRIAL PLAN

1. Industrial needs and potential resources of the environment
2. Adaptive environmental assessment and management (AEAM)
3. Initial environmental evaluation (IEE)
4. Impact assessment on industrial construction project.

Industrial needs and potential resources of environment (Case study urea fertilizer industry)

Industrial main needs

a. Raw materials for production (natural gas, fresh water, air, etc.)

b. Energy (electricity)

c. Assessibilities/transportation (road, railway, water, etc.)

d. Man-power (skill labour and unskill labour)

e. Etc.

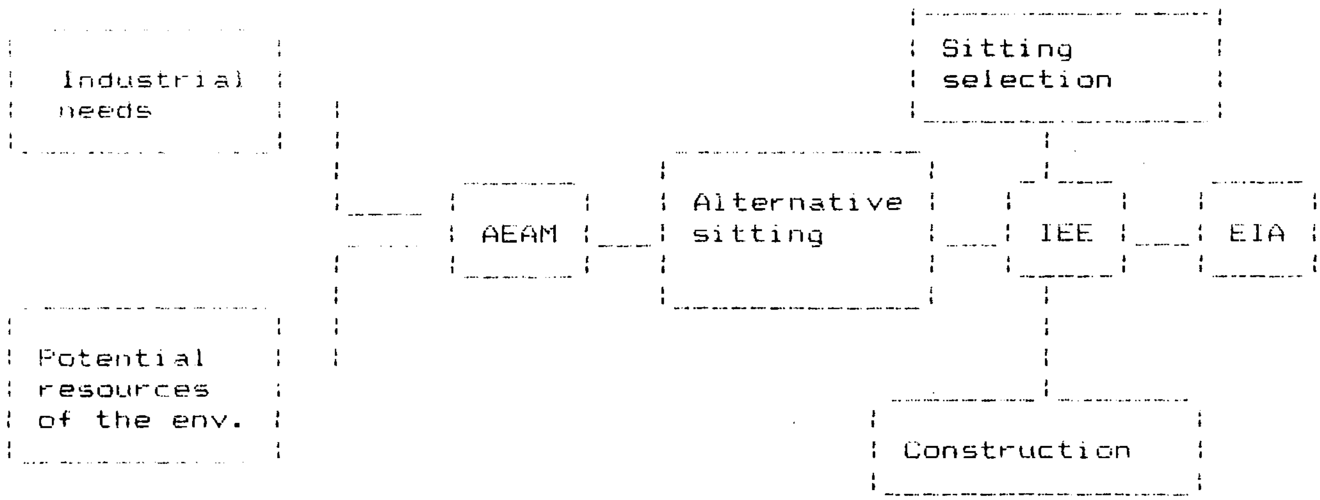
Potential resources of the environment

a. Raw materials for production (quality, quantity, distance, etc.)

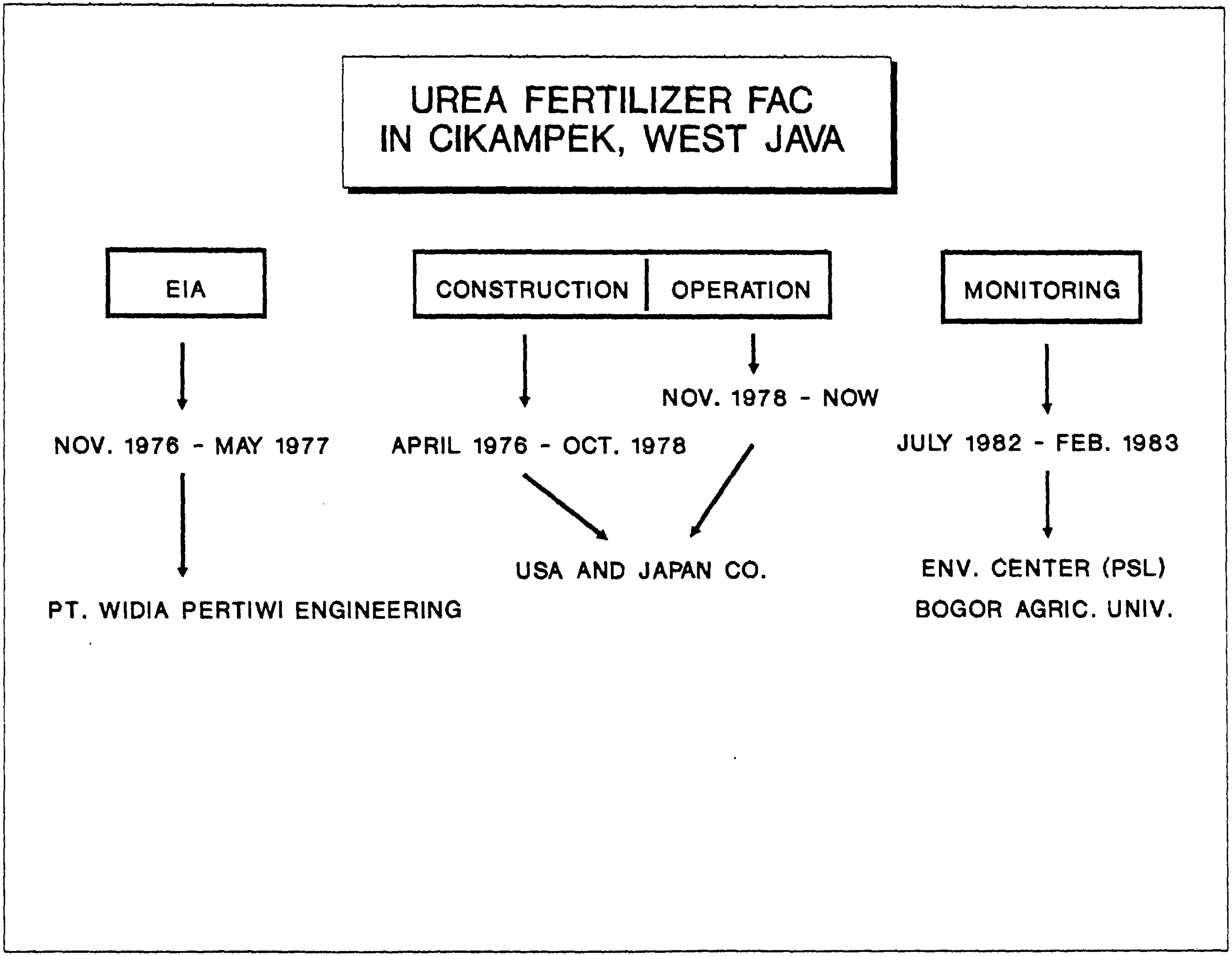
b. Public supply on energy (quality, quantity, distance, etc.)

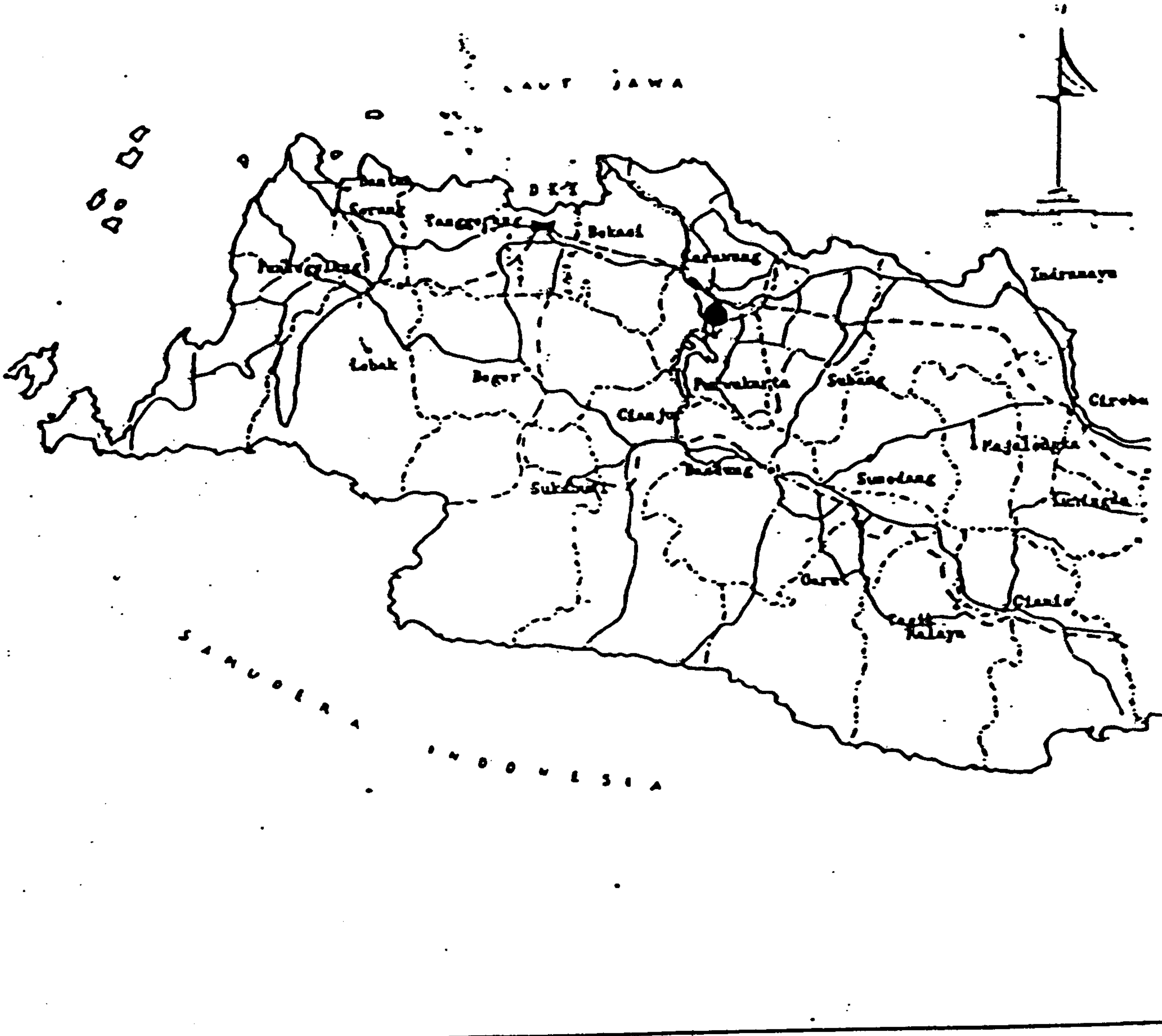
c. Transportation available (quality, areas connected, etc.)

d. Man-power (education, social culture, social economic, number, etc.).



APPLICATION OF EIA TO SITTING AND CONSTRUCTION


UREA FERTILIZER FAC
IN CIKAMPEK, WEST JAVA
EIA
CONSTRUCTION
OPERATION
MONITORING
NOV. 1976 - MAY 1977
APRIL 1976 - OCT. 1978
NOV. 1978 - NOW
JULY 1982 - FEB. 1983
PT. WIDIA PERTIWI ENGINEERING
USA AND JAPAN CO.
ENV. CENTER (PSL)
BOGOR AGRIC. UNIV.


LAUT JAWA
DKI
Serang
Bekasi
Indramayu
Lebak
Bogor
Purwakarta
Subang
Cianjur
Sumedang
Majalengka
Garut
Ciamis
SAMUDERA INDONESIA

Project description

1975 constructed

Production: 570,000 ton per year

3,379,047 m2 (37.720 m2 office, 37,900 m2 plant site,
280,000 m2 houses, the rest is still open
for development) (± 350 ha)

Investation/capital: US $ 171,000,000 + Rp 34,000,000,000
(± $ 250,000,000)

Water resource: from the river/irrigation 9 km from the
location

Raw material: Natural gas 60 MMCFD

Water: 1,000 m3/hour

Aie: 1,000,000 NM3/day

Energy: 9.5 MW

Number of employee: 1,434 (65% from the local people)

9.7% Primary school

12.6% Secondary school

64.1% High school

7.0% Bachelor degree

6.6% Master degree

Contractor labor (especially for product transportation)
936 people

Scoping

1. Construction

1.1. Liquid waste

1.2. Gas and particle waste

1.3. Noise

1.4. Social economic.

2. Operation

2.1. Liquid waste

2.2. Gas and particle waste

2.3. Noise

2.4. Social economic.

Impact assessment

1. Construction

1.1. Liquid waste

1.1.1. Oil from the heavy equipment

1.1.2. Oil and particles from truck washing.

All oil and particles will go to the river.

1.2. Gas and particle waste

1.2.1. Dust or particles from the land clearing and platting or levelling the soil

1.2.2. Air pollution (gas and particles) from the project transportation/equipments.

1.3. Noise

1.3.1. Noisy will increase to 75-85dBA from the equipments.

1.3.2. Noisy from the transportation (in the road) not much increase but in longer period.

1.4. Social-economic

1.4.1. Rurelization, from Jakarta to Cikampek

1.4.2. Economic activities increase:

- land transaction
- construction material transport
- food transport

1.4.3. Hotel, house/room rent, restourant

1.4.4. Intertainment increase

1.4.5. New settlement area.

2. Operation

2.1. Liquid waste

2.1.1. Ammonia and chromite leakage accident, especially during blow down process will pollute Cikaranggelam river

2.1.1. Down stream of Cikaranggelam river was used for rice field (400 ha) irrigation, rice plantation in this area will be affected.

2.2. Gas and particles wastes

2.2.1. Ammonia and urea leakage might be erappen. It can be happen too during blow down it produces bad smell, human health and neg to plantation.

2.3. Noise

2.3.1. Five hundreds meters from the fac. the noise will be 63-65 dBA, it is already above the standard from rural settlement.

2.4. Social-economic

2.4.1. Difference of income between local people with employee of the fac. will create a conflict

2.4.2. New urban settlement in the rural center will produce social culture change

2.4.3. Very little positive impact on employment to the local people because of low education (unskill).

Critiques to the impact assessment during construction

Focussing on:

During scoping the team had been pugatten to assess a very big impact during constructions comparing other impact, that is:

1. Landed the equipments
2. Transported all heavy equipments from the harbour to the project location
3. Natural gas pipe line construction (7 km)
4. Water pipe line construction (9 km).

Slide show

Average impact during construction

1. Behind the beautiful landscape in West Java there is a story about a very important project for increasing the agricultural production that is urea fertilizer fac. by Pupuk Kujang Company
2. In the offshore of Cilamaya (north parth) there is natural gas deposite, not far from the project area. The project located in the 2 villages (Dawuhan and Kahuripan)

3. Site selection was bases on the:

   a. Natural gas resource location

   b. Hydropower location

   c. Transportation facilities (truck road and rail road)

4. Soil/land preparation started in 1976

5. Beginning of July 1976 heavy duty equipment arrived. Not less than 1,000,000 m3 of soil had been removed. Land clearing and flattering finished in the end 1976

6. Temporary port should be developed ± 30 km from the project area (July 1976 - June 1977)

7. All heavy equipment and construction equipments and the machines imported from abroad were landed in this port

8. Office for immigration/costume should be developed too in this area

9. First step: 250 ton equipment landed and should be pulled/carried out tug-pond-yard. Road and bridges from the port to project area (30 km) should be constructed heavily

10. Five hundred bridges should be reconstructed for transportation with 500 ton weight (19 July 1976 - May 1977)

11. CO_2 streifer very important part of the factory on the way. The weight of this equipment 175 ton and 46.2 m length. Dolitruck was passing a bridge with 350 ton weight and 35 metter length

12. CO_2 absurb yard on the lowboy truck passing a bridge May 1977, weight 146 ton and 54.9 m

13. Ammonia carpenter equipment: 325 ton with 32 m length

14. June and July 1977 erection of the equipment/factory
15. August 1977 construction 36%
16. February 1978 construction 84%
17. October 1978 construction 99%
18. September 1977 water pipe line from Citarum to the project area were constructed. Using 2 pumping machines, length of the pipe line is 9 km
19. March 1978 water pumping machines began operation
20. Natural gas pipe line were constructed in the same time, length of the pipe line is 7 km, discharge of the gas is 40 - 60 million cubic feet per day. Gas pipe line construction finish on April 1978
21. Before trial operation boiler unit utility day and might to produce water stream. The steam used for cleaning all pipes in the fac.
22. November 1, 1978 ammonia unit success fully produced ammonia
23. November 7, 1978 all the employee were very bussy, where the 60 meter tower indicating that the first urea particles were going to be born
24. 9.20 p.m. November 7, 1978 the white urea particles was poured out like a snow in Canada. All the employee were so happy
25. The rea pertilizer than were packed in 25 kg bad
26. Loaded in the truck and distributed to the farmer
27. Besides trucks, it had been used special rail road to the public rail road, located 2 km from the project

28. The opening ceremony had been done by President Republic of Indonesia, Mr. Suharto.

ADAPTIVE ENVIRONMENTAL
ASSESSMENT AND MANAGEMENT
(AEAM)

EXPECT THE UNEXPECTED

AEAM : IS A COLLECTION OF CONCEPTS, TECHNIQUE AND PROCEDURES INTENDED FOR THE DESIGN OF CREATIVE RESOURCE MANAGEMENT AND POLICY ALTERNATIVES.

EARLY 1970 BY C.S. HOLLING AND WALTERS

DEFINITION OF AEAM

1. A METHODOLOGY FOR MAKING BETTER ENVIRONMENTAL ASSESSMENTS (DETWILLER, 1981).

2. A TRACT ON PHILOSOPHY AND LOGIC (SIMMONS, 1979).

3. ENVIRONMENTAL MANAGEMENT FROM THE PERSPECTIVE OF SYSTEM ANALYSIS (DYKSTRA, 1980).

COMPONENTS IN THE AEAM

1. THE CONCEPT OF ADAPTIVE MANAGEMENT. RECOGNIZING UNCERTAINTIES AND DESIGNING POLICIES OR MANAGEMENT STRATEGIES.

2. THE METHODS OF SYSTEMS ANALYSIS. THE COLLECTION OF QUANTITATIVE AND QUALITATIVE TOOLS USED TO CHARACTERIZE, MIMIC AND SIMPLIFY DYNAMIC SYSTEMS.

3. THE PROCEDURES OF MODELLING WORKSHOPS.
   INTENSIVE, LIGHLY FOCUSED "BRAINSTORMING" SESSIONS WHICH DEVELOP AND USE SIMULATION MODELS FOR COMMUNICATION AND COLLABORATIVE.

MAJOR ACTIVITIES

1. METHODOLOGY USES A WORKSHOP PROCEDURE
   - ↓
   - A. KNOWLEDGE GAPS
   - B. PEOPLE GAPS

2. A SIMULATION MODEL
   - ↓
   - A FOCUS → LINKS BETWEEN PEOPLE
   - A FOCUS → SYNTHESIZE EXISTING INFORMATION

3. GAPS ARE STRUCTURED FROM BOTH SCIENTIFIC AND POLICY PERSPECTIVE.

AEAM PROJECT

1. INITIAL MEETING

- ABOUT FIVE PEOPLE
- PROJECT LEADER + SOME STAFF
- GENERAL FEATURES OF THE PROBLEMS
- RESPONSIBILITIES
- KEY PARTICIPANTS IDENTIFIED FOR A WORKSHOP

2. FIRST WORKSHOP

- ABOUT 20 TO 25 PEOPLE
- KNOWLEDGE EXPERTS, MANAGERS, AND POLICY PEOPLE
- QUANTITATIVE AND QUALITATIVE TECHNIQUE ARE USED
- ABOUT 5 DAYS
- PRODUCING
    - A. MODEL
    - B. POLICY INTERVENTIONS
    - C. CONSEQUENCES OF INTERVENTIONS

- LINKS OF COMMUNICATION, MISSING INFORMATION, RESPONSIBILITIES AND ELEMINATE THE GAPS.

3. INDEPENDENT WORK

4. SECOND WORKSHOP

   - CONENTRATE ON

     A. TECHNICAL ISSUES

     ↓

     B. POLICY ADVISORS AND CONSTITUENCIES

AEAM'S KEY FEATURES :

1. ECOLOGICAL AND ENVIRONMENTAL KNOWLEDGE IS INCORPORATED WITH ECONOMIC AND SOCIAL CONCERNS AT THE BEGINNING.

2. TECHNIQUES OF SIMULATION MODELLING, QUALITATIVE MODELLING, POLICY DESIGN AND EVALUATION ARE CHOSEN TO REFLECT THESE FEATURES.

3. SCIENTISTS, MANAGERS AND POLICY PEOPLE ARE INVOLVED _____ PROBLEM SOLVING

4. DIRECTION, DESIGN AND UNDERSTANDING IN THE HANDS OF A GROUP CONSIST OF SCIENTISTS, MANAGERS AND POLICY PEOPLE RATHER THAN A SEPARATE GROUP.

5. PREDICTION CAN BE IMPROVED. UNCERTAIN AND UNEXPECTED LIE IN THE FUTURE OF EVERY DESIGN.

THE APPROPRIATENESS OF AEAM :

1. BIAS FOR ACTION

2. CLOSE TO THE CUSTOMER

3. AUTONOMY AND ENTREPRENEURSHIP

4. PRODUCTIVITY THROUGH PEOPLE

5. HANDS ON, VALUE DRIVEN

6. STICK TO THE KNITTING

7. SIMPLE FORM, LEAN STAFF

8. SIMULTANEOUS LOOSE TIGHT PROPERTIES

CONCLUTION (N.C. SONTAG)

1. SATISFY THE CRITERIA FOR A STRATEGIC SCOPING METHODOLOGY.
2. QUICK TO APPLY
3. EFFICIENT OF PEOPLE, TIME AND MONEY
4. CREATIVE OPTIONS IN ENVIRONMENT ARE GENERATED
5. PROMOTES COMMUNICATION AND UNDERSTANDING
6. TESTED METHODOLOGY IN A VARIETY OF SETTINGS

Development and Use of Water Quality Guidelines

Prepared for

Regional Training Seminar
on the Application of
Environmental Impact
Analysis in Appraisal
of Development
Project Planning

Bandung, Indonesia

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Development and use of water quality guidelines.

Introduction

Environmental impact assessments are done to assess whether there could be adverse effects on the environment caused by proposed developments, both during construction and after operations begin.

Developments can be of many types: eg, mining, road building, new industries (large and small). power generation, forest practices, new town development. They can have many different effects, physical disturbances causing erosion, the addition of toxic chemicals in industrial effluents, the misuse of pesticides, additions of untreated or treated municipal waste or the indiscriminant use of rivers as latrines.

When the effects have been determined, guidelines are needed to decide whether the effects will be detrimental to existing and proposed uses of the environment.

The subject of this paper is the freshwater aquatic environment and the quality of water which is necessary for the major uses of water. The paper discusses the development of guidelines for water quality for the various uses of water, and then briefly mentions guideline use for specific purposes at a particular site or study area, how guidelines could play a part in assessing the impact of a proposed development and then as part of the monitoring program for water quality after construction and subsequently, operations have begun.

I have been involved in Canada over the last 15 years or so with the water quality requirements of various uses of water and the effects of toxic chemicals and physical disturbances on the freshwater aquatic environment. My main work is to write water quality guidelines which contain recommendations for chemical concentrations and physical conditions that should not affect a use of a waterbody if they are not present above these recommendations. I also provide guidance to water resource managers in the federal and provincial governments.

This paper will first describe the development of water quality guidelines and then discuss their use.

Definitions

There are a number of definitions used around the world for the terms water quality criteria, guideline, objective and standard. The definitions used in Canada by the Canadian Council Of Resource and Environment Ministers are as follows:

Figure 1

Criteria: scientific data evaluated to derive the recommended limits for water uses. Criteria give the scientific information that is needed to write water quality guidelines, an example of this information is the fate ie. what happens to a heavy metal, when it is in water of a certain pH, alkalinity, and temperature. For example, the solubility of the heavy metal will be different in water of different hardnesses.

The water quality criteria also discuss the results of experiments which show the toxicity of pollutants to fish and other aquatic animals and plants, farm crops and humans. The experiments discussed in water quality criteria are done in the laboratory and field. Examples of the type of toxicological information which is needed to develop water quality guidelines are the chronic effects of a pollutant on the growth rate, behaviour, reproductive capabilities etc. of organisms. Information on acute toxicity, such as the concentration of a pollutant which will kill 50% of the experimental fish, the LC50, is not very useful. It can be used as a rough guide to the toxicity, but what it is saying is that 50% of the fish will die. The information which is needed is what concentration of a pollutant would not affect the feeding and reproduction of the fish. However, the LC50 is used routinely to test industrial effluents and is a standard test for this purpose.

Guidelines for irrigation water have to consider, amongst other factors, the type of soil, whether it is sandy loam or clay as this affects the availability of chemicals to plants. Different crops have different sensitivities to chemicals.

Water quality guideline: numerical concentration or narrative statement recommended to support and maintain a designated water use. Guidelines are written using the information that is found in the water quality criteria. The water quality guidelines give the concentrations of chemicals, which if they are present in water at that concentration, will not harm the fish or plant crop. If the chemicals are present above the stated concentrations , they will have detrimental effects such as slowing down the growth rate, stopping reproduction or possibly killing the organism. The guideline can also be a narrative statement. Water quality guidelines do not take local water quality into consideration.

Water quality objective: a numerical concentration or narrative statement which has been established to support and protect the designated uses of water at a specified site. Objectives are developed for a specific part of a river or lake, or maybe for a river basin. Water quality objectives use the information which is present in the water quality guidelines and also consider the local water quality, for example, is it hard or soft; the use that is to be made of the water, and the socio-economics of a region. Maybe there is already a large number of industries present, or only agriculture, or the area is forested. A water quality objective for a particular parameter may be different from the water quality guideline for that parameter. The concentration could be either higher or lower depending on local conditions. If there are a number of uses to be made of a river, the water quality objectives applied to it are for the most sensitive use.

Water quality standard: a water quality objective that is recognized in enforceable environmental control laws of a level of government.

Development of water quality guidelines.

When writing water quality guidelines the following categories are considered, inorganic, organic, physical, biological and radiological.

Figure 2.

There are five uses of water which have water quality guidelines:

1. Raw drinking water supplies;
2. Recreation and aesthetics;
3. Aquatic life;
4. Agricultural - irrigation and livestock watering;
5. Industry.

Figure 3.

The water quality guidelines which will be discussed are for freshwater, not for estuaries or coastal water. The water chemistry for seawater is very different from freshwater and some of the uses are different. Water quality guidelines for freshwater cannot be applied to the marine situation.

The steps to develop guidelines are as follows:

1. Identify the use that is to be considered.

2. Identify the parameters that are of concern to that use.

Figure 4.

The development of water quality guidelines is not easy and takes many years, so in Canada, to save time, we looked at guidelines that were available from other countries such as Australia, Europe and the USA. The water quality criteria and rationale that these countries used to make their decisions were studied. Canadian research and water quality data were then used to determine whether the decisions of other countries, for their water quality guidelines, were relevant to Canadian conditions. If the guideline from another country was relevant to Canda, the same concentration was adopted as a Canadian guideline.

If it was decided that the concentration was not relevant to Canadian conditions, the scientific literature was studied to try and find information that could be used to bring the concentration closer to one that would be more suitable for Canada.

If enough information could not be found, it was recommended that research be done to give Canadian information so that the guideline could be modified or a new one developed.

Once the draft guidelines for a particular use of water had been written, they were sent to research scientists in the federal Department of Environment and the appropriate department for that water use. For example, for aquatic life guidelines, the draft was sent to the Department of Fisheries. The draft was also sent to all the Canadian provinces for review by their appropriate ministries. All the comments on the draft were considered, discussed and changes made if necessary. Other departments and ministries which were consulted were the Departments (federal) and Ministries (provincial) of

Health, Agriculture and Industry. Administrators who are concerned with water management in the provinces also reviewed the guidelines.

Approximately 140 scientists across Canada took part in the review of the drafts.

Figure 5

Identification of chemical species to be used in water quality guideline development

There is considerable debate about the form (species) of an element that should be used as the guideline eg. the US. Environmental Protection Agency (EPA) recently recommended acid-soluble copper, even though the method of analysis has not yet been approved, (but stated that until then, total copper should be used). The EPA believes that the acid-soluble method more closely approximates the concentrations used in toxicity tests as well as the fraction of the element that is considered bioavailable. Canada has taken the approach that the total element in an unfiltered sample should be used. This is protective of the environment because it measures the total quantity of the substance. For example, substances adsorbed on suspended particles could be transported and later dissolved under different environmental conditions. Both methods have advantages, there is no "best" method at present.

Updating water quality guidelines.

The science behind the development of water quality guidelines is continually advancing and discovering new facts about the behaviour of pollutants in water and their toxic effects on water uses. This information is examined by scientists who write water quality guidelines and water quality objectives. Existing guidelines may be amended using new information, thus water quality standards will also change. New chemicals will require water quality guidelines and research is needed to provide the relevant information.

Research into the fate of chemicals in the aquatic environment and on their toxicological effects is not an easy task. It is very difficult or impossible to apply results from laboratory experiments to a lake or river and expect to know exactly what is happening. There are too many uncontrollable variables in a river or lake. Conditions in laboratory studies are very simple compared to the river situation as variables can be controlled. For example light, pH, dissolved oxygen, temperature, and ionic composition of the test water are controlled variables.

Examples of water quality guidelines for one parameter.

Water quality guidelines for the use "aquatic life", using copper as an example, will be discussed to illustrate how various countries have taken climate, water type and differences between biota into consideration when proposing guidelines for the country, or region of the country.

Some agencies are able to designate many resources to monitoring and research, and have proposed time periods over which the water quality guidelines have to be met. It is very important to know the availability of human and financial resources so that they are not over extended.

United States

In order to develop a guideline for freshwater aquatic life the following information is needed (Stephan et al. 1985).

1. Results of acute tests with at least one species in at least eight different families which have to include:
   a) a cold water fish in the family Salmonidae;
   b) a second species of fish, preferably warm water and commercially important, eg. channel catfish;
   c) a third family either fish or amphibian;
   d) a planktonic crustacean eg. cladoceran;
   e) a benthic crustacean eg. amphipod, crayfish;
   f) an insect;
   g) another phylum, eg. an annelid, mollusc; and
   h) a family or order of insect or a phylum not already represented.
2. Acute-chronic ratio in at least three different families, at least one fish, at least one invertebrate and at least one acutely sensitive species.
3. An acceptable test with a freshwater alga or vascular plant. If plants are the most sensitive, results using other plant species are needed.
4. At least one bioconcentration factor determined with appropriate freshwater species.

If these conditions are not satisfied, a guideline is not proposed

For copper the above data are required and expressed using a formula for water hardness as this has a large effect on toxicity. The values are:

hardness	50	100	200	mg/L $CaCO_3$
4-day average	6.5	12	21	ug/L Cu
1-hour average	9.2	18	34	ug/L Cu

The US considers averaging the concentrations over time periods of 24 hours and 4 days. These concentrations may be exceeded once every 3 years on average.

Canada

In Canada, a single maximum value is used, as the frequency of monitoring cannot support 24-hour or 4-day average guidelines. Besides not being able to monitor sufficiently frequently to have 4-day and 24-hour averages, Canada felt that by allowing the concentration of the toxicant to exceed the guideline by an unspecified amount every three years on average, as allowed in the US, the aquatic community might be placed in a perpetual state of recovery rather than allowing it to recover.

The data which Canada requires to be used to develop water quality guidelines do not have to be as comprehensive as in the United States. Usually Canada uses data which show that a) there are no negative effects in life-cycle or early-life-stage tests of chronic toxicity; b) give thresholds for the tainting of fish flesh, and c) concentrations in water which would result in acceptable concentrations in the edible portions of marketable fish (or to protect natural consumers, eg. birds and mammals) When there is insufficient chronic toxicity data available, short-term toxicity data multiplied by an application factor (AF) is used as a second choice. The AFs are taken from the Ontario Ministry of the Environment Water Quality Objectives, 0.05 of the 96-h LC50 for the most sensitive species for materials that are non-persistent or have non-accumulative effects, and 0.01 of the 96-h LC50 for the most sensitive biotic species for materials that require additional caution because data are extremely limited, and where the chemicals are persistent (OME 1979). Further details can be obtained from the Canadian Water Quality Guidelines (CCREM 1987).

The Canadian guideline for copper takes Canadian toxicity data and water hardness into account, the recommended concentration is to protect salmonids which are very sensitive, cold-water fish.

0-60	mg/L CaCO3 (soft water)	2 ug/L
60-120	mg/L CaCO3 (medium)	2 ug/L
120-180	mg/L CaCO3 (hard)	4 ug/L
>180	mg/L CaCO3 (very hard)	6 ug/L

Europe

EIFAC (European Inland Fisheries Advisory Commission) guidelines for European fish proposed numerical limits expressed as the 50- and 95 percentile concentrations of soluble copper as 0.05 and 0.2 of the threshold LC 50 respectively, taking water hardness into consideration.

	50 percentile	95 percentile
10 mg/L CaCO3.	1 ug/L	5 ug/L Cu
50 mg/L CaCO3	6 ug/L	22 ug/L
100 mg/L CaCO3	10 ug/L	40 ug/L
300 mg/L CaCO3	28 ug/L	112 ug/L

(Alabaster and Lloyd 1984)

Thailand

The water quality guideline for copper for aquatic life found in Thailand waters is stated as "the concentration which would occur naturally without contamination from man-made sources". Only the summary document was available (NEB 1986), but the rationale document has been requested. If this is only available in Thai, it is hoped that information on the scientific criteria used to develop the water quality guidelines can be obtained from the authors.

Malaysia

Malaysia, a tropical country, has guidelines for copper ranging from 12-42 ug/L. Water hardness and the toxicity of copper to Malaysian fish species were taken into account, but insufficient data on the toxicity of copper was available to be able to avoid using some temperate data. In the Malaysian guideline, the concentration never to be exceeded at any time, is:

50 mg/L CaCO3	12 ug/L Cu
100 mg/L CaCO3	25 ug/L Cu
200 mg/L CaCO3	42 ug/L Cu (AIT 1986)

Indonesia
The Indonesian water quality standard for copper, using a water hardness of 100 mg/L $CaCO_3$, is 20 ug/L (KLH 1988).

Australia
Australia has recommended that research be undertaken to determine the acute toxicity of copper to sensitive Australian aquatic organisms and then an application factor of 0.05 should be applied to this data. Until sufficient Australian data is available, the water quality guidelines in soft water with low complexing capacity should be 5 ug/L for filterable copper. This could be increased in hard waters or those with high complexing capacity. (Hart 1982)

Use of water quality guidelines.

As explained earlier, water quality guidelines written for Europe and America cannot always be used in Canada, even though all are temperate countries.

Temperate water quality guidelines have to be examined very closely before they can be used in tropical countries where differences between temperate and tropical water bodies , aquatic organisms and crops are even greater. This needs accurate information on water quality, water chemistry, the sensitivities of local plants and animals. For example, some parameters such as temperature and the dissolved oxygen content of water are very different from the conditions found in colder climates. Both laboratory and field information is needed.

Figure 6

Water quality guidelines can be used for a number of purposes. Some are as follows:

Water quality guidelines are used to develop site-specific water quality objectives and pollution control regulations.

The toxicological information contained in the guidelines will help to indicate whether the water can support a good fishery in the river or whether the quality could cause a reduction in growth rate and hence a loss in financial returns to the fishermen; or whether there would be a build up of toxic chemicals, such as mercury, in the fish.

For irrigation an indication could be given whether crop yield would be affected, for example, a nutrient imbalance causing luxurious growth but poor grain production.

If the water is to be used as a drinking water source for a new town, the guidelines will help to determine how much treatment would be needed to make the water safe for drinking.

When conducting an EIA, information contained in water quality guidelines will be able to determine whether there would be an adverse impact, as long as the present receiving water quality is known, and also information projected for the proposed development. For example the composition of the industrial effluent discharge, or mine tailings, or thermal effluent should be available from the engineering design. The uses of the river would determine which water quality objectives would be calculated using local information, and from these a good idea of future impacts could be determined. If necessary, changes may have to be made at the design stage if it is decided that the impact would be detrimental and too great to allow the impact to happen.

Figure 7

Establishment of site-specific water quality objectives.

In order to establish site-specific water quality objectives, knowledge of the chemical, physical and biological characteristics of the local water body is needed, for example, pH, hardness, ionic composition, flow rate, suspended sediment load, bottom sediment types and many other characteristics. Uses that are to be made of the water must be determined, for example, if the area is to have industrial development, or industry is already present, the quality of the effluents has to be known. For example, chemicals could be introduced into the water that are harmful to fish, so either effluent treatment sufficient to remove the pollutants would have to be put in place, or the decision made not to worry about toxicity and not to use the river as a fishery. It might be that treatment would remove the chemicals to levels that are not lethally toxic, but still present. The information in the guidelines would indicate whether the fish could reproduce with the chemicals present at a certain concentration. On-site studies may be necessary.

Socio-economic factors are taken into consideration when developing site-specific water quality objectives. If fisheries are important, or a sensitive crop is to be irrigated, certain industries may not be able to establish themselves on a river. If the industry will provide a lot of employment and bring money to the area, the decision makers, local government, may decide that industry is more important and that the fishery will be given up in favour of the industry.

The above information allows the authorities to make an informed decision

Water quality standards.

Water quality objectives are written for a specific site; they can be made into water quality standards with the force of law behind them.

Countries have different approaches to the use of water quality standards and they may or may not apply water quality standards to rivers and lakes. In Canada there are no water quality standards for ambient water quality, only water quality objectives. The quality of rivers and lakes are affected by many factors which cannot be controlled, such as rainfall and the heavy metal content of the rocks through which, and over which, the water flows.

Some factors can be affected by human activity, for example, cutting a forest down to the river bank will remove the shade effect of trees and so raise water temperature; removing natural vegetation increases erosion and the suspended and settleable sediment loads in a water body. Emissions from an industry can add sulphur and nitrogen compounds to air and cause acid precipitation. Emissions and effluents from a point source can be controlled by emission standards and poor forestry and construction practices can be improved.

Effluent quality guidelines will be briefly discussed. There are a number of ways of developing and using effluent quality guidelines. Ideally they should be developed taking the receiving water quality into account, but this is not usually feasible, but where water is of good quality, quite stringent (strict) effluent treatment is used.

The two methods most often used are 'best practicable technology' (BPT) and 'best available technology' (BAT). As developed, these do not consider receiving water quality.

One of the Canadian provinces, Ontario (which has a large financial base to work from), has recently introduced a new law to control pollution from both industry and municipalities. The law is particularly aimed at toxic chemicals which do not break down in the environment, are toxic in very small amounts, accumulate in organisms and pass through the food web to affect fish, fish- eating birds and mammals, particularly humans. Amendments will be made to the law depending on the experience of industry, the Ontario Ministry of the Environment and comments from the public.

Each industry has to monitor its effluent regularly and send duplicate samples to the Ministry if they are requested. The Ministry may make unexpected visits and take samples of effluents. Municipalities which take industrial effluents for treatment will also be monitored.

Results from monitoring the effluent are confidential (in some provinces the results are not confidential). Two industrial sectors are presently under the new laws, the petroleum and organic chemical industries. Nine to ten months after the monitoring program has begun, the abatement regulations are introduced. These regulations will establish the BAT standards for the industry. Sensitive and confined aquatic areas receiving effluent will require more stringent effluent control. Each of these areas will be monitored regularly and the effluent standards set to keep the aquatic quality up to the ambient water quality objectives. The effluent standards are set following an environmental assessment study. There will be regular monitoring to ensure that the environmental impact is not greater than was forecast in the initial study.

Effluent standard violations will be known to the Ministry as dischargers are required to notify the government; Ministry staff look at the monitoring data submitted by the industry and also make inspections and collect data themselves. Violations will be evaluated to see if a prosecution should be started.

As new technology is developed, toxic loadings will be further reduced. A comprehensive data base will provide a register of toxic contaminants in municipal and industrial effluents. Uniform application of BAT and water quality impact approaches will allow for greater economic and administrative efficiency in the application of full environmental protection measures.

The majority of governments, especially those without the financial resources to enforce regulations like MISA, usually use BPT to control pollution from industry and municipalities.

Environmental impact assessments and effluent quality standards.

To use the water quality impact assessment approach to calculate effluent limits, the following are involved: collection and analysis of data on water quality, effluent quality, sediments, aquatic life, local stream flow, lake currents etc. This information is worked into modelling and other assessment techniques to evaluate impacts on the receiving water body that correspond to a given set of effluent limits. The effluent limits required for the protection of receiving water quality at a given site will be determined by this process.

Monitoring.

In order to do environmental impact assessments, to develop and monitor water quality objectives, and know the quality of effluents, it is very important to have monitoring programs which are relevant to the situation. If the program is not designed to answer the questions, or the samples are not taken correctly, treated and transported to the laboratory correctly, it is a waste of time and money to analyze them. Regular quality control analyses in the laboratory must be carried out as inaccurate data have no value.

Conclusion.

The science of water quality is complex, very time consuming and demands a great deal of knowledge and care on the part of the people involved. Many types of people work together, field and laboratory technicians, biologists, chemists, engineers, policy makers. The outcome should be a well-managed water resource.

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Figure 1

DEFINITIONS

CRITERIA	- SCIENTIFIC DATA EVALUATED TO DERIVE THE RECOMMENDED LIMITS FOR WATER USES
GUIDELINE	- NUMERICAL CONCENTRATION OR NARRATIVE STATEMENT RECOMMENDED TO SUPPORT AND MAINTAIN A DESIGNATED WATER USE
OBJECTIVE	- NUMERICAL CONCENTRATION OR NARRATIVE STATEMENT WHICH HAS BEEN ESTABLISHED TO SUPPORT AND PROTECT THE DESIGNATED USES OF WATER AT A SPECIFIED SITE
STANDARD	- AN OBJECTIVE THAT IS RECOGNIZED IN ENFORCEABLE ENVIRONMENTAL CONTROL LAWS OF A LEVEL OF GOVERNMENT

Figure 2

PARAMETER CATEGORIES

INORGANIC

ORGANIC

PHYSICAL

BIOLOGICAL

RADIOLOGICAL

Figure 3

WATER USES

* RAW WATER FOR DRINKING WATER SUPPLY
* RECREATIONAL WATER AND AESTHETICS
* FRESHWATER AQUATIC LIFE
* AGRICULTURAL WATER SUPPLIES - IRRIGATION
  - LIVESTOCK WATERING
* INDUSTRIAL WATER SUPPLIES

Figure 4

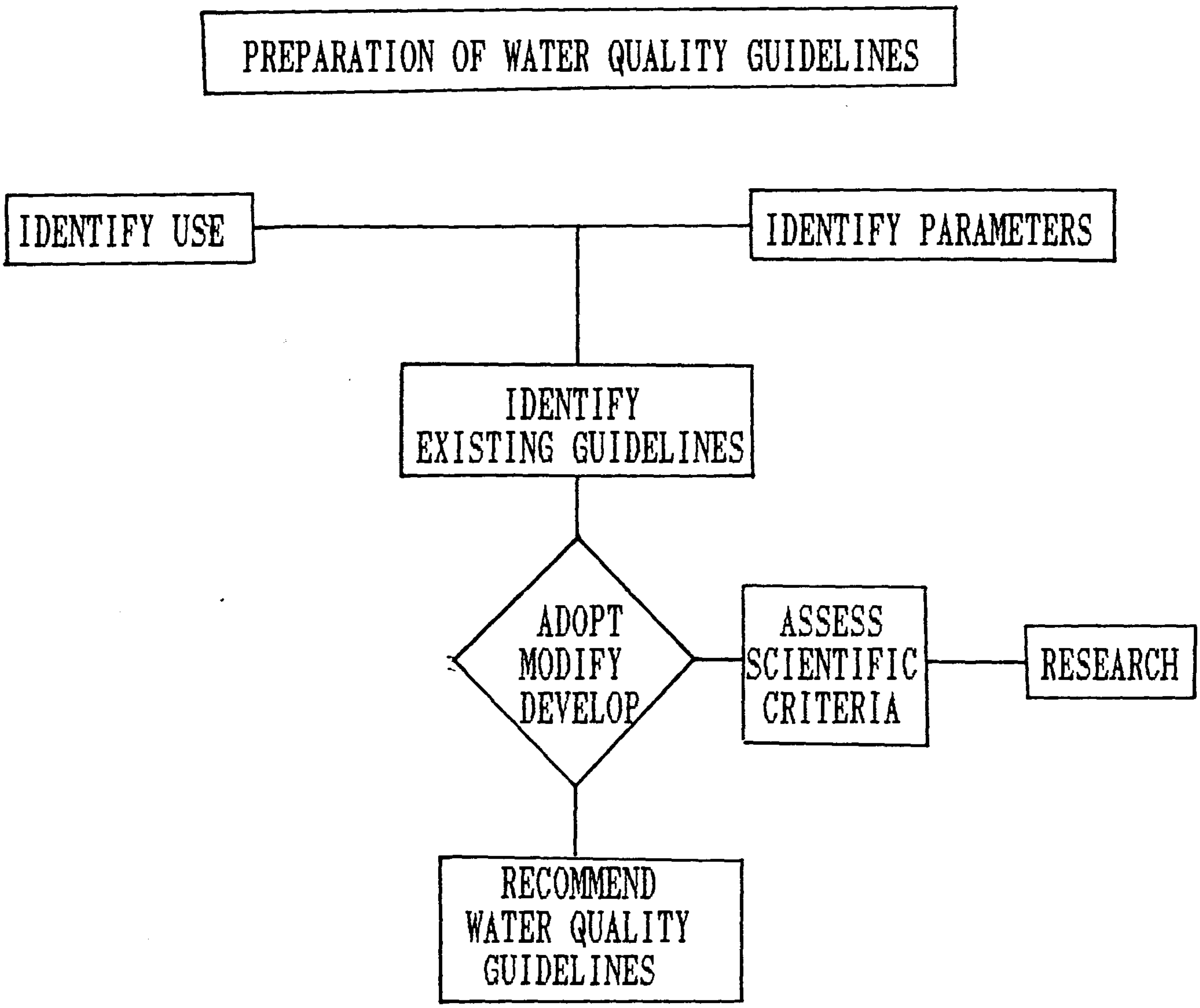
PREPARATION OF WATER QUALITY GUIDELINES
IDENTIFY USE
IDENTIFY PARAMETERS
IDENTIFY EXISTING GUIDELINES
ADOPT MODIFY DEVELOP
ASSESS SCIENTIFIC CRITERIA
RESEARCH
RECOMMEND WATER QUALITY GUIDELINES

Figure 5

CONTENTS OF GUIDELINE DOCUMENT

GUIDELINE CHAPTERS

1. RAW WATER FOR DRINKING WATER SUPPLY
2. RECREATIONAL WATER QUALITY AND AESTHETICS
3. FRESHWATER AQUATIC LIFE
4. AGRICULTURAL USES (IRRIGATION, LIVESTOCK WATERING)
5. INDUSTRIAL WATER SUPPLIES

ASSOCIATED CHAPTERS

* PARAMETER-SPECIFIC BACKGROUND INFORMATION
* GLOSSARY
* FACTORS TO CONSIDER IN GUIDELINE USE

Figure 6

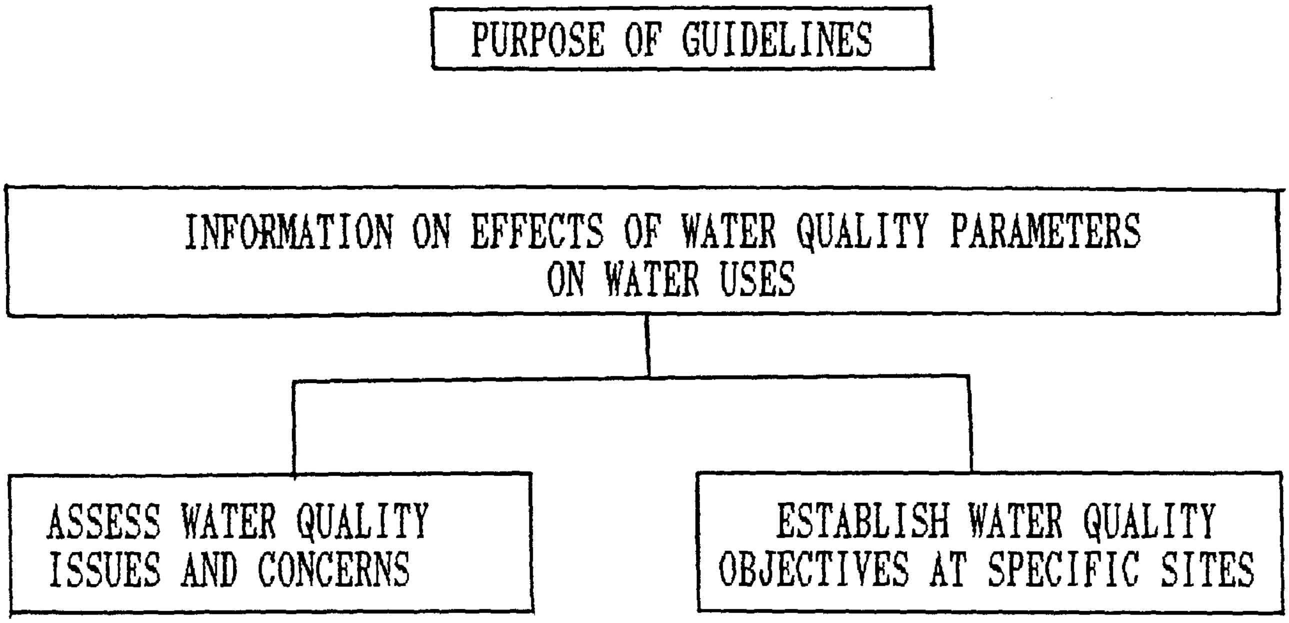
PURPOSE OF GUIDELINES
INFORMATION ON EFFECTS OF WATER QUALITY PARAMETERS ON WATER USES
ASSESS WATER QUALITY ISSUES AND CONCERNS
ESTABLISH WATER QUALITY OBJECTIVES AT SPECIFIC SITES

Figure 7

USE OF GUIDELINES IN DEVELOPING OBJECTIVES

GUIDELINES

* ASSESS WATER QUALITY ISSUES AND CONCERNS
* ESTABLISH WATER QUALITY OBJECTIVES AT SPECIFIC SITES
* DEVELOP SITE-SPECIFIC POLLUTION CONTROL REQUIREMENTS

ESTABLISHMENT OF WATER QUALITY OBJECTIVES

* CHEMICAL, PHYSICAL, BIOLOGICAL CHARACTERISTICS OF SPECIFIC WATER BODIES
* EFFECTS OF WATER QUALITY CHARACTERISTICS ON WATER QUALITY PARAMETERS
* SOCIO-ECONOMIC FACTORS

ENVIRONMENTAL IMPACT ASSESSMENT CONSIDERATIONS
FOR A PROPOSED MINING PROJECT

prepared for presentation at

Regional Training Seminar on the Application
of Environmental Impact Analysis
in Appraisal of Development Projects

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INTRODUCTION

This paper focuses on mining from the perspective of Environmental Impact Assessment (E.I.A.) study needs. It should be noted that very rarely would a mining project proceed without the need for an E.I.A. Even small (artisanal) mining projects have caused significant pollution problems. This paper focuses on the environmental issues generally associated with mining projects as well as the mitigative measures necessary to protect the environment.

Of prime importance at the beginning of any project, is the need for the "scoping" of the project environmental issues. "Scoping" is defined as the identification of the most important environmental issues associated with a particular project. This enables a thorough examination of these concerns and the identification of the mitigative measures that will effectively protect the environment while allowing the project to proceed. The Terms of Reference for an E.I.A. study should be based on the results of a thorough "scoping" exercise. Effective "scoping" allows for the most efficient utilization of the money available to carry out the environmental impact studies.

Project environmental considerations must be included in overall project planning from the very earliest stages of the project. The figure presented on page 2 of this paper illustrates, in a somewhat simplified manner, the relationship between project phases and the various components of an all-encompassing environmental study. It should be noted that the phases of the "environmental process" as illustrated, are consistent with the requirements of the recently developed Indonesian legislation regarding environmental impact assessment as it relates to mining industry projects. This subject is discussed in more detail later in the "Introduction" of this paper.

INTEGRATION OF ENVIRONMENTAL PROCEDURES INTO PROJECT PLANNING

PROJECT PHASE	ENVIRONMENTAL PROCESS
Concession	Environmental Reconnaissance
Reconnaissance Survey	
Target Area Drilling	
Feasibility Study	Environmental Impact Assessment
Basic Engineering	
Construction	Environmental Management Plan
Operation	Environmental Monitoring Plan
Reclamation	Environmental Review
Closure	

Government of Indonesia Regulation No.29 (June, 1986) requires that mining industry projects and other environmentally significant projects (e.g. oil and gas development, pulp and paper, hydroelectric power, etc.) must undergo an E.I.A. Subject to this Regulation, a report was prepared entitled "Technical Guidelines for an Environmental Impact Analysis of a Proposed Mining Industry Project". Appended to this paper is a copy of these "Technical Guidelines". These guidelines were prepared by this writer while working for the Department of Mines and Energy in Jakarta as a consultant-advisor during 1987. These guidelines address two particularly important subjects:

- -they contain a Table of Contents that would be applicable to most new mining projects; and
- -they identify the type of information that would generally be provided in a mining E.I.A.

In this paper, two very important subjects that must be addressed thoroughly in an environmental impact assessment study are the focus of attention. They are:

-the definition of environmental issues; and

-an evaluation of effective pollution control practices (i.e. mitigative measures that should be implemented to protect the environment).

The major environmental concerns generally associated with a mining project include the following:

-changes to landform and land-use;

-water pollution; and

-socio-economic and socio-cultural impacts.

The following environmental issues, although generally of lesser concern, must also usually be addressed:

-atmospheric emissions;

-visual impacts; and

-noise.

Each of these subjects is discussed in the text that follows. Mitigative measures necessary to protect the environment are also described. It is important to note that specific environmental protection practices for mining industry projects must be developed on a case-by-case or site specific basis.

ENVIRONMENTAL ISSUES AND ENVIRONMENTAL PROTECTION PRACTICES

In the text that follows, environmental issues and environmental protection practices are discussed. It is always important to note that these subjects are site and project specific.

Changes to Landform and Land-use

Mining operations result in a number of physical changes to the environment as a result of the following activities:

-stripping of topsoil and vegetation in preparation for mining activities;

-construction of roads, processing facilities and buildings;

-development of tailings, waste rock, and overburden storage facilities;

-where applicable, the development of the open pit mine;

-the construction of concentrate (product) storage facilities;

-when associated with a project, the construction of marine terminal facilities; and

-in some cases, the development of a camp or townsite.

These activities, in some form are necessary for a project to proceed. It is necessary to consider all environmental factors when designing a project. Efforts should be directed at the following:

-to minimize the size of the area affected by the development;

-to minimize impacts on important wildlife habitat;

-to protect endangered species;

-to minimize impacts on other terrestrial resources of the area including agriculture, forestry, heritage and archaeological values etc.

-to develop an effective reclamation program for the operating phase and the abandonment phase of the project;

-to consider siting factors in order to minimize impacts;

-to use landscaping on a continuous basis (i.e. operational phase reclamation) to minimize landform changes; and

-the utilization of buffer zones to minimize visual impacts.

Water Pollution Control

One of the most important concerns that must be addressed relates to acid mine drainage (AMD). Acid generation occurs when ore, waste rock and tailings contain high concentrations of sulfur compounds (generally in the form of pyrite or pyrrotite) and limited buffering capacity. Test procedures have been developed to determine whether an acid generation problem is likely to occur. Requiring a mining company to carry out these tests at an early stage in the overall development process is an essential step in avoiding major aquatic environmental problems. The following types of environmental problems are often associated with AMD effluent discharges:

-fish mortality or fish avoidance;

-a reduction of invertebrate biomass and diversity;

-development of a simplified food chain;

-many macrophyte (plant) species are eliminated; and

-certain sensitive types of algae are eliminated, etc.

AMD containing environmentally significant heavy metal concentrations can continue long after a mine has ceased operations and even after an area has been restored. AMD can reduce the amenity value of rivers and lakes and may render the water quality unsuitable for many industrial, domestic and recreational uses. No economical treatment can return a receiving stream back to its previous condition while AMD and metals are being discharged. Treatment does help but it is a poor second to the implementation of well engineered pre-development abatement techniques. Careful pre-mine planning to control drainages within the mine development site in combination with operational phase and post-mining reclamation are essential to reduce AMD problems to manageable levels. The means to prevent or minimize impacts do exist provided they are implemented early in the development of a project. The most important procedures that can be implemented to protect the environment include the following:

-accurate definition of the materials that are acid generating;

-segregation of acid generating materials in an area or, if necessary, a number of areas such that the volume of surface water run-off (i.e. potentially contaminated leachate) will be minimized and these streams can be treated and controlled;

-ensuring that acid generating materials are not used for activities such as road building and tailings dam construction;

-treatment of effluent streams that are in contact with acid generating materials. This usually involves neutralization to control pH and precipitate heavy metal pollutants. It is important to note that treatment may be an effective approach during the operating life of the mine but maintaining the effectiveness of these facilities after the mine has closed down is costly as it requires staff to remain on site to operate these facilities in perpetuity. The diversion of surface water run-off away from acid generating materials is the most preferred approach.

Although beyond the scope of this paper, the design and operation of marine tailings disposal systems as a method of preventing AMD problems has been effective at some mine sites. Seawater contains high buffering capacity important in minimizing the environmental impact of the AMD. To be feasible, the mine site must be in close proximity to the marine environment. In addition, other factors must be taken into account such as physical, chemical and biological oceanography, localized marine resource harvesting, etc.

Even at mine sites where acid generation does not occur, liquid effluent discharges from mining operations are a concern. Effluent streams can contain, at times, the following:

-heavy metals such as copper, zinc, lead, mercury, arsenic, etc. that are either toxic to fish and other aquatic organisms and/or are bio-accumulating;

-radio-nuclides such as Ra-226 that are toxic and could enter the food chain;

-ammonia, cyanide, and other toxic substances;

-nutrients that could cause downstream algal blooms;

-high concentrations of suspended solids that could result in downstream sedimentation problems e.g. smothering of benthic invertebrates, aesthetic impacts, fish avoidance reactions, drinking water quality problems, etc.; and

-downstream pH problems as a result of the discharge of either highly acidic or highly basic effluents.

It is usually necessary to treat liquid effluent discharges prior to their discharge to the environment. The type of treatment required depends upon the pollutant or pollutants of concern. Generally, settling ponds are required to treat run-off streams that contain high concentrations of suspended solids. If cyanide is present, it must be destroyed using one of a number of methods that have proven to be successful. Heavy metals must be precipitated from solution. Tailings must be contained in properly designed and operated containment facilities (discussed further in the text below). The recycling of treated effluent, when technically feasible, provides another important environmental safeguard. When these approaches are implemented and, in addition, erosion control practices are implemented, downstream water pollution risks will be minimized.

Tailings impoundments should be designed so as to provide sufficient capacity for the anticipated volume of tailings to be accumulated over the anticipated life of the mine or, alternatively, should be designed and operated to provide staged increases in capacity (i.e. generally by increasing the dam height) over the life of the mine. Tailings impoundment systems should be designed and operated to provide the following functions:

-removal from the effluent stream and perpetual storage of the tailings solids;

-maintenance of pH suitable for heavy metal precipitation;

-retention of wastewater treatment precipitates and other finely divided materials;

-oxygen transfer for stabilization of oxidizable waste constituents;

-capacity for balancing storm water and other fluctuations; and

-minimization of seepage of contaminated waters.

A study carried out in Canada indicated that the size of the average tailings impoundment is approximately 20 hectares for every 1000 tonnes per day of milling capacity for base metal mines. The control of pH is often required in order to ensure the effective precipitation of heavy metals. As an example, in order to precipitate copper, lead, zinc and nickel, a pH of between 9.5 and 11 is required.

Effluent standards have been developed and implemented in many countries. These standards have been developed based upon proven mining industry wastewater treatment technology. The table that follows illustrates the regulations that were developed in Canada (i.e. by Environment Canada) for effluents from base metal mining operations. It is important to note that the numerical limits developed are based upon a study a number of the more effective mine tailings disposal systems operating in Canada at the time of the study and upon a comprehensive effluent quality data base.

AUTHORIZED LEVELS OF SUBSTANCES

Substance	Maximum Authorized Monthly Arithmetic Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic	0.5 mg/L	0.75 mg/L	1.0 mg/L
Copper	0.3 mg/L	0.45 mg/L	0.6 mg/L
Lead	0.2 mg/L	0.3 mg/L	0.4 mg/L
Nickel	0.5 mg/L	0.75 mg/L	1.0 mg/L
Zinc	0.5 mg/L	0.75 mg/L	1.0 mg/L
Total Suspended Solids	25.0 mg/L	37.5 mg/L	50.0 mg/L
Radium 226	10.0 pCi/L	20.0 pCi/L	30.0 pCi/L

NOTE: The concentrations are given as total values with the exception of Radium 226 which is a dissolved value after filtration of the sample through a 3 micron filter.

The Canadian mining industry effluent regulations also specify that the minimum authorized pH must not be lower than 5.0. Guidelines developed in support of these regulations specify that the effluent discharges from mines must also be non-toxic to fish. In Canada, compliance with these requirements, in many cases, resulted in significant improvements in downstream water pollution problems.

Socio-economic and Socio-cultural Impacts

Socio-economic and socio-cultural considerations relative to people and communities within the area of impact of a project must always be addressed. These impacts can be either positive or negative in nature. Subjects addressed will generally include the following:

-impacts on existing facilities and infrastructure, e.g. transportation systems, recreation, education, health care etc.;

-impacts on indigenous people including religious and cultural considerations, adat law implications

- direct and indirect employment opportunities for local people;
- an increased national, provincial, and community tax base;
- impacts upon recreational, historical and archaeological sites and other sites of importance;
- conflicts with the established way of life in the community or communities affected by the project;
- impacts on existing land and resource uses;
- the best interests of the country, the province or the community; and
- impacts of induced developments.

During the course of the environmental impact studies, efforts must be made to maximize positive impacts and, at the same time, to minimize negative impacts. Solutions to problems that are identified must be developed as early as possible during the planning phase of a project. As discussed previously, project planning and environmental impact assessment must proceed in unison.

Atmospheric Emissions

Particulate (dust) emissions are generally the most significant atmospheric emission from mining operations. Dust particles are emitted from a number of the activities associated with mining projects. During the development phase of a project, dust emissions result from road development, the construction of project related buildings, the development of the tailings pond and the preparation of the ore body. During the operating life of the mine, dust emissions are associated with a number of operations including ore and concentrate trucking, the operation of the open pit mine, crusher emissions, etc.

The degree to which dust is a problem is directly related to the moisture content of the soil, ore, etc. In wet areas dust is often not a concern. In dryer areas it may be necessary to spray water on roads to control dust emissions as well as wetting down ore and concentrate trucks, ore and concentrate storage facilities, etc. The timing and the extent to which these mitigative measures are necessary are usually dependent on local and short term weather conditions, regional health requirements and on the proximity of local communities to the mine site. Decisions regarding the required mitigative measures are site specific. It is possible at a particular site that no dust control procedures are necessary. Although possible, the latter situation would occur at a very small percentage of mine sites.

Other atmospheric emissions of concern at many mine sites include the following:

- power plant emissions containing pollutants such as carbon monoxide, nitrogen oxides, hydrocarbons, particulates, etc.;

- emissions from vehicles;

- when present, emissions from ore roasting plants; and

- emissions from the burning of refuse; etc.

At most mine sites, atmospheric emissions are a lesser concern than landform and land-use changes, aquatic concerns and socio-economic and socio-cultural concerns. Emissions would generally be addressed in an environmental impact assessment but rarely would an extensive baseline study be carried out. The emphasis would usually be placed on defining the mitigative measures that provide the necessary environmental protection.

Visual and Noise Impacts

Visual and noise impacts occur as a result of the following:

- construction phase operations such as the development of roads, preparation of the mine, construction of the mill and other buildings, etc.;

- blasting operations;

- noise associated with milling, e.g. the operation of the crusher;

- noise created by the transportation of ore, concentrate, chemical delivery vehicles etc.; and

- visual affects as a result of the construction of the various facilities associated with the project.

Visual and noise impacts are site specific and generally a function of the proximity of the mine site to local communities, and other major land users. Visual impacts can be minimized by locating facilities where they are least noticeable, shaping and contouring the site, the use of unobtrusive colours on the exterior of buildings, the use of natural barriers and screens, operational and post-operational phase site restoration, etc.

Noise ameliorating methods include limiting blasting to a specific time period of the day (i.e. blasting is generally only allowed during daytime), good siting practices, the use of absorbing equipment and natural barriers to absorb noise created by milling operations, etc. The extent of a noise problem is a direct function of its intensity, duration and frequency, as well as the proximity of the source to the individuals who are affected.

It should also be noted that noise can have adverse affects on certain wildlife species. The degree of concern is directly related to the species involved, the uniqueness of the area, the life cycle activity for which the area is being used, etc. Many wildlife species adjust to man made noise and learn to live with it without a major problem occurring. Other species avoid affected areas completely. This can be a significant concern if the area affected represents uniquely important habitat.

SUMMARY

The following are a few of the important points that should be noted when carrying out an environmental impact assessment study of a proposed mining project:

-defining environmental issues (i.e., scoping) and developing effective environmental protection practices are the two most important parts of an E.I.A. study and often the components most poorly completed;

-the environmental baseline study developed must recognize the results of the scoping exercise. Environmental baseline studies must be designed to provide information that is relevant to the identified important environmental issues, information that will assist in identifying the needed environmental protection practices, and information that will assist in determining whether impacts have occurred over the life of the project. Gathering irrelevant data is both time consuming and costly;

-the most significant environmental issues generally associated with mining industry projects are impacts on land-use and landform, water pollution concerns, and socio-economic and socio-cultural concerns. Issues that are usually also addressed, but are generally of lesser concern, include the following: atmospheric emissions, and visual and noise impacts;

-acid mine drainage poses the most significant aquatic environmental concern and this problem must be addressed early in the mine development planning process;

-the implementation of an effective water pollution control program is essential if downstream resources and the rights of downstream water users are to be protected. Compliance with industry specific effluent standards is an important step toward accomplishing this goal;

-effective environmental planning including the development of a comprehensive reclamation program for both the operational and abandonment phases of a mining project is essential for minimizing land-use and landform impacts as well as socio-economic and socio-cultural concerns; and

-environmental protection practices must be developed on a site specific basis. The significance of a particular environmental concern varies from site to site as does the effectiveness and cost efficiency of various pollution control practices.

APPENDIX 1

TECHNICAL GUIDELINES

FOR AN ENVIRONMENTAL IMPACT ANALYSIS

OF

A PROPOSED MINING INDUSTRY PROJECT

Department of Mines and Energy
Jakarta, June 1987

FOREWORD

These technical guidelines have been prepared to assist proponents of mining industry projects by providing a guide to what will generally be included in an environmental impact analysis (ANDAL) report for this industry sector. It is important to recognize that not all subjects discussed in these guidelines will appear in each ANDAL report as the contents of a particular ANDAL report are both project and site specific. Therefore, it is not intended that these guidelines be followed verbatim but rather used as a guide by a proponent and proponent consultants. The Technical Committee, established to address the environmental aspects of mining industry projects by the Central Commission of the Department of Mines and Energy, is available to discuss and clarify specific situations as required. However, in general terms, it is believed that adhering closely to these guidelines will result in compliance with the intention of Regulation PP 29 and facilitate project decision making.

A Table of Contents applicable to mining industry ANDAL studies is presented on the following page and is intended to serve as a guide to proponents of mining projects. For each subject listed in the Table of Contents, a brief explanation of the subject matter to be discussed under that heading is then presented.

TABLE OF CONTENTS

DISCUSSION OF ANDAL REPORT CONTENTS

In the text that follows, the subject matter that will generally be discussed under each heading of the Table of Contents is addressed. In a specific ANDAL report, the detail presented for a specific subject will depend upon the nature of the proposed mining development and also to a large extent upon site specific considerations.

1.0 SUMMARY

The summary should consolidate the important findings of the report and should be written in such a manner as to allow reviewers to focus immediately on items of concern. It should be written in terms understandable to the general public and in a format that allows it to be extracted directly for publication by the media (if this is required), or for use by senior executives requiring a quick appraisal of the situation.

The summary should briefly describe the project, the probable major environmental impacts, the ameliorating and mitigating measures to be implemented by the proponent, and the significance of the residual unmitigated environmental impacts. Any aspects of the development which might stimulate public concern should be described. The summary should also clearly identify data gaps or knowledge deficiencies, and the limitations they have imposed on the environmental assessment. Major project related positive impacts should also be summarized.

2.0 INTRODUCTION

The evolution of the project should be discussed beginning with its early stages and including subjects such as the formulation of the idea, policy for resource development, feasibility studies completed to date and an introduction to the interrelationship between the proposed development and the environment. More specifically, the following subjects should be addressed in the Introduction:

a. The background of project development relative to the issues discussed in the Environmental Impact Analysis report,

b. Procedures followed in completing the studies and the report,

c. Any environmental regulations, guidelines, etc. that are in force and applicable to the proposed project.

3.0. PROJECT RATIONALE

3.1. Declaration

The proponent should reveal his identity in connection with the implementation of the proposed project. It should be clearly stated that the proponent is responsible for the statements and judgements presented in the ANDAL report. Background information with respect to the proponent company should be supplied. The individuals who actually participated in the preparation of the report should be identified and their qualifications should be listed.

3.2 Objectives and Benefits of the Project

The proponent should outline the history of the project and the objectives relative to project development. The benefits of the project should be discussed on a short-term and long-term basis. On a national, regional and local basis, the socio-economic and socio-cultural benefits of the project, should be discussed.

3.3 Implementation Alternatives

Where several alternatives are available for the implementation of the project, these alternatives should be presented. For each alternative put forward, the advantages and disadvantages relative to economic, socio-cultural and environmental impacts should be discussed.

The evaluation of alternatives may include the following :

a. alternative methods of mining and milling,

b. alternative methods of waste disposal,

c. alternative sites for the mill, the tailings pond, etc.

d. alternatives for infrastructure support facilities, etc.

3.4 Associated Projects

The relationship of the proposed mine development to other existing or proposed projects should be outlined. This discussion should include other projects proposed by the proponent and projects proposed by others. The probable spin-off benefits from the project should be discussed.

4.0. PROJECT DESCRIPTION

The project description should include all factors directly related to the planned activities. Maps of several scales should be provided to identify the location of the mine in relation to surrounding communities, industrial developments, either existing or planned, recreational areas and parks, water supplies and waste water treatment facilities, existing transportation routes, important agricultural land, forest reserve areas, etc.

4.1. Project Implementation Plan

Subjects addressed and information presented would generally include the following :

a. Project location,

b. Appropriate maps of the development area,

c. Site layout drawings,

d. Development and production schedules,

e. Expected economic life of the mine, and

f. A generalized project flow sheet.

4.2 Geology and Ore Reserves

Subjects addressed would generally include the following :

a. A discussion of the exploration program to date,

b. A description of the mineral resources of the area including depth, width, form, composition of the mineral resources, a discussion of overburden and waste rock, the chemical and radioactive properties of the ore etc.,

c. Maps of the reserve area and the feasibility of developing the reserve area,

d. Total known ore reserves,

e. The potential for other mineral resources,

f. Acid generation potential of the ore and waste rock, and

g. The physical and chemical properties of soils in the development area.

4.3 Mining Plan

Subjects addressed would generally include the following :

a. A description of the planned mining operations and the mining equipment required,

b. The degree of project development to date and an estimate of the degree of difficulty foreseen for the proposed development,

c. The location of mine adits, vents, etc., if appropriate,

d. An estimate of the requirements for materials such as water, wood, fuel, explosives, construction materials etc., which are required for project development,

e. The disposal of overburden and waste rock, e.g. the location of dump sites, quantity limitations and life expectancy for particular sites, etc.,

f. The possibility of processing and re-utilization of mining wastes, and

g. Mine water treatment and disposal practices.

4.4 The Process Plant

Subjects addressed would generally include the following :

a. A description of the method of milling supplemented by a mill flow sheet and a mill water balance,

b. An estimate of the total quantity of water required for milling, the source of the water, the type of pre-treatment required, etc.,

c. An evaluation of the type and quantity of mill reagents required;

d. A discussion of reagents that pose a significant environmental concern and/or are a concern from an occupational health perspective

4.5 Mine/Mill Waste Disposal

Subjects addressed would generally include the following :

a. A discussion of the various types of wastes produced:
   - domestic and industrial solid wastes,
   - liquid effluents including mine water, tailings, sewage, etc.
   - air emissions including power plant and incinerator emissions, dust, etc.

b. The physical and chemical characteristics of the tailings,

c. The radioactive properties of the tailings, if appropriate,

d. The toxicological properties of the tailings,

e. Tailings pond design considerations including dam design specifications, tailings pond retention capacity, supernatent recycle, etc.,

f. The possibility of re-utilization of the tailings in the future, and

g. Waste rock and overburden disposal practices.

4.6 Product Handling and Storage

Subjects addressed would generally include the following :

a. A description of the handling and storage of product, including space requirements, location, area characteristics, etc.,

b. The method(s) of transporting concentrate (product) from the processing plant to on-site storage facilities and to the smelter/refinery site, and

c. The need for and extent of infrastructure support facilities.

4.7 Storage of Hazardous Materials

Subjects addressed would generally include the following :

a. The type of hazardous materials stored, e.g., explosives, fuel oil, reagent chemicals, bioxides, etc.

b. The methods of handling and storing hazardous chemicals used in project operations, e.g. location, capacity, access, etc.,

c. Environmental and occupational safety considerations,

d. Staff training considerations, and

e. Location(s) of hazardous materials storage facilities.

4.8 Support Facilities and Related Projects

Subjects addressed would generally include the following :

a. A description of support facilities required such as power generation plants, water supply, sewage disposal, camp facilities, etc.,

b. A description of related projects such as harbour development and marine terminal facilities, roads, airport, etc., and

c. A discussion of community oriented facilities such as hospitals, recreation and educational facilities, etc., if upgrading is required as a result of the project.

4.9 Abandonment and Reclamation

Subjects addressed would generally include the following :

a. Building and other facilities to be removed/demolished when mining operations are terminated,

b. The control of seepage from the abandoned mining area, waste rock storage site, tailings pond, etc.,

c. Plans for the reclamation of the abandoned mine area, the waste rock, storage site, tailings pond, etc.,

d. Status of mine haul roads, terminal facilities, airports, etc. upon mine closure, and

e. Procedures to be implemented to ensure and safeguard public safety .

4.10 Project Development Schedule

The proponent should describe the activities that will be conducted during the various phases of the development and present a flow chart or bar graph illustrating the scheduling of project development events.

5.0 IDENTIFICATION OF POTENTIAL IMPACTS AND SCOPING

5.1 Introduction

Many environmental impact assessments contain information and data which are irrelevant. In addition, this information and data are time consuming and costly to collect. Proponents should utilize a "scoping" process to determine the issues and potential impacts that must be thoroughly addressed during the ANDAL studies. The scoping process is an effort to focus on major concerns and not waste time and resources on minor and irrelevant subjects.

5.2 Methods

The methods used to develop scoping criteria should be discussed and would generally include the following :

- Site visits,
- A preliminary evaluation of the environmental baseline conditions, land use, and socio-cultural factors in the vicinity of the project,
- Discussions with professionals familiar with the study area,
- A review of available literature pertaining to :
  1) the project type and
  2) the environmental resources in the area of the project, and
- Proponent and consultant experience.

5.3 Key Issues

Based on the activities defined in 5.2, the key issues should be identified. These issues and potential impacts then become the focal point for the environmental studies.

5.4 Study Scoping Results

A discussion of study scoping follows the identification of the key issues and potential impacts. Terms of reference are developed for the collection of important baseline environmental resource data. Investigations into the magnitude and significance of the impacts are formulated noting the following :

- A determination of the affected area (i.e. the geographic boundaries of the study based upon the possible extent of the impacts),
- The identification of the components of the environment that could be affected,
- An assessment of the significance of both primary and secondary impacts, and
- A determination of the ease or difficulty of controlling or managing potential impacts.

6.0. ENVIRONMENTAL DESCRIPTION

In this section, local environmental characteristics should be elaborated upon with an emphasis on the environmental components of significance relative to the proposed project. The natural resources of the area should be described quantitatively and/or qualitatively. The environmental description should also address the environmental resources of the area surrounding the actual project site when these resources could be affected by the project. The subjects addressed will provide information leading to one or more of the following :

a. Baseline information which can be used to determine project impacts over the life of the project,

b. Data that can be used in project design and in the design of project environmental protection practices,

c. Data that can be used to maximize positive project impacts.

The subject matter addressed in this section of the report will often be in summary form with the detailed information presented in the report "Appendix".

6.1 Micro-meteorology and Air Quality

The climatic conditions at the project site should be described. The information presented would generally be based on both site specific data and the extrapolation of regional data. Subjects discussed would generally include the following :

a. Rainfall including monthly and annual precipitation, duration and frequency of storm events, seasonality, etc.,

b. Information with respect to known major storm events, e.g. floods,

c. Wind speed, direction, frequency, seasonal variation, etc.,

d. Temperature regime, hours of sunshine, net evaporation/precipitation, etc.,

e. Local and regional air quality, and

f. Background noise levels.

Information with respect to the location of meteorological, air quality, and noise measurement stations should be mapped. The time period over which the data were collected should be defined.

6.2 Physiography

Subjects discussed would generally include the following :

a. The topography, geomorphology, geological structure and soil types in the area of the proposed development,

b. Chemical and physical characteristics of soils,

c. The location and extent of recognized hazard areas such as land slide areas, volcanos, high erosion areas, etc.

d. Seismic information, and

e. The identification of unique or sensitive landforms.

Important physiographic features should be mapped.

6.3 Hydrology and Water Quality

Subjects discussed would generally include the following :

a. The pattern of water flow in rivers and streams,

b. Seasonal variations in the hydrological regime of surface water streams,

c. The size of stream catchment areas,

d. The physical and chemical characteristics of surface water streams, lakes, etc.,

e. Information with respect to groundwater hydrology and quality,

f. Influence of tides and sea currents (if applicable), and

g. The bathymetry of lakes (if applicable).

The location of the hydrological and water quality sampling sites should be mapped. The time period over which the data were collected should be defined.

6.4 Biological Resources

6.4.1 Flora

Subjects discussed would generally include the following :

a. Terrestrial and aquatic plant communities by species composition, their relative abundance and their importance to fauna as habitat and food,

b. Susceptibility of terrestrial and aquatic plant communities - particularly to pollutants that could be released into the ecosystem by the proposed operation,

c. Relatively undisturbed, rare, or unique vegetation,

d. Plant life of special aesthetic or economic value,

e. Protected flora, and

f. Location of important economic resources (e.g. plantations, forests, rice fields, etc.).

Important resource information should be mapped. To facilitate the evaluation of impacts, the proposed sites of the various project components should also be included on the maps.

6.4.2 Fauna

Subjects discussed would generally include the following :

a. Relative abundance and distribution, within the area that could be affected by the proposed development, of those species of fish, amphibians, reptiles, birds, and mammals considered to have a high sport, commercial, scientific, or aesthetic value (listed by common and scientific names),

b. Susceptibility of fish and wildlife, particularly to pollutants that will/could be released into the ecosystem as a result of the proposed project,

c. Rare or endangered species in or near the project site,

d. Critical times and important locations for nesting, spawning, nursing, staging, migration, etc.

Important resource information should be mapped. To facilitate the impact assessment, the proposed sites of the various project components should also be included on the maps.

6.5 Socio-economic and Socio-cultural Considerations

Socio-cultural and socio-economic considerations with respect to people and communities within the area of impact of the proposed project should be addressed. Subjects addressed would generally include the following :

a. Characteristics of the population including distribution, density, population growth, way of life, livelihood, etc.,

b Indigenous people considerations, e.g. adat law implications, religion, etc.,

c. Land use considerations and land use planning,

d. Existing facilities and infrastructure, e.g. health care, recreation, education, etc.,

e. Sites of traditional (cultural) value including historical sites, archaeological sites, sites of religious importance, etc.,

f. The behaviour, values and perceptions of the different groups in the communities,

g. Direct employment opportunities for local people, and

h. Indirect employment opportunities for local people,

6.6 Utilization of Natural Resources

Subjects discussed would generally include the following :

a. Land use within the area that may be affected by the project,

b. Current water users e.g. industrial, domestic, etc.,

c. Projected water use in terms of commercial and recreational interests and values (e.g. farming, fishing, shipping, boating, etc.),

d. The utilization of aquatic and terrestrial biological resources,

e. Plans of the Regional (Provincial) Government with respect to the development of the area adjacent to the proposed project site, i.e. regional land use planning objectices, and

f. Forestry and agricultural resource considerations.

7.0. ENVIRONMENTAL ISSUES AND ENVIRONMENTAL PROTECTION PRACTICES

7.1 Environmental Issues

In the assessment of environmental issues, the following items should be taken into consideration and discussed :

a. The impacts which are expected to take place as a result of the project noting the mitigative measures available to reduce impacts,

b. The nature of short term and long-term impacts,

c. The selection/availability of procedures which can be implemented to avoid or to minimize negative or unfavourable impacts,

d. Positive impacts should be addressed and the procedures to maximize these impacts should be discussed,

e. The discussion of environmental impacts, should take into consideration the environmental, economic, social and cultural values, noting the project stages including development and construction, operations and maintenance, and decommissioning, and

f. The geographic extent of potential impacts should be discussed, i.e. either international, national, regional or local noting the size and location of the project and the sensitivity of the area.

In the text that follows, environmental, socio-economic and socio-cultural issues that are often associated with mining industry projects are presented. It is important to note :

1). that the list is not all-encompassing, and

2). that not all issues exist with respect to a particular project

Typical issues include the following :

a). Downstream water quality problems associated with increased heavy metals and suspended solids, a significant decrease in pH (where acid generation is a concern), etc.

b). The affects of heavy metals on downstream aquatic flora and fauna,

c). Changes in the flow regime of adjacent rivers and creeks resulting in water supply problems for downstream water users,

d). Impacts upon terrestrial wildlife and terrestrial wildlife habitat,

e). Dust and noise problems to local residents,

f). Localized air quality problems as a result of power plant and incinerator emissions,

g). The alienation of important forest and/or agricultural land, h). The increased risk of hazardous chemical spills,

i). Socio-cultural impacts upon the indigenous people of the area,

j). Impacts upon recreational, historical and archaeological sites, and other sites of importance, and

k). Positive impacts associated with the project such as new job opportunities, improvements to health care, recreation and educational facilities, etc.

7.2 Major Issues and Environmental Protection Practices

The proponent should discuss in detail the major potential impacts of the project on the biophysical, socio-economic and socio-cultural environments and the procedures to be implemented to reduce negative impacts. The impacts can be either long-term or short-term impacts. The nature of the impacts could be as follows :

a. Impacts that can increase, disturb, damage or destroy environmental resources,

b. Impacts that can cause conflicts with the established way of life in the communities affected,

c. Impacts that could affect the livelihood, health of the inhabitants, or that result in significant changes to the existing social environment.

The discussion of major environmental impacts and environmental protection practices should be detailed and address project design alternatives as well as environmental protection alternatives. The discussion would generally include :

a. A description of potential environmental impacts arising from the various components of the proposed mining project,

b. Mitigative measures proposed to eliminate or reduce unfavourable impacts,

c. Procedures to be implemented to maximize positive impacts,

d. A program to monitor the affects of the mining operation on the environment,

e. A plan for responding to accidents and environmental emergencies, such as a spill of flotation reagents, fuel oil, etc.,

f. A plan to increase the environmental awareness of project staff, through education, training etc.

8.0 RESIDUAL IMPACTS

Residual impacts are the impacts that occur as a result of a project after all practical measures to overcome these impacts have been taken. Residual impacts can be biophysical, socio-economic, or socio-cultural in nature. The residual impacts may include the extent and nature of the physical disturbance, water quality changes, water quantity changes, impacts on indigenous people, etc. Residual impacts will always be both project and site specific.

9.0 BIBLIOGRAPHY

In this section, the sources of data and information quoted in the project environmental impact assessment such as text books, journals, working papers, articles and other material should be provided. Information presented would include the following :

a. The name of the author and/or editor,

b. The title of the information source,

c. The year of publication, and

d. The name and location of the publisher.

10. APPENDIX

The proponent should provide, generally in a second report volume, copies of the various detailed reports completed relative to this environmental impact assessment study. In addition, the following may be included :

a. Photographs to illustrate the initial environmental conditions,

b. Appropriate diagrams, maps, graphs and tables which support the information presented in the text of the report, the sources of which must be referenced, and

c. Other information which the proponent feels is relevant and important to the overall evaluation of the environmental impact assessment report.