CHAPTER V
ENERGY AND MINERALS

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I. ENERGY SUPPLY

Introduction

Energy policy was first formulated in 1976, following the so-called energy crisis, when the Indonesian government recognized the need for a policy to optimize the benefits of oil exports to the country and its people.

The basic law of the state prescribed that natural resources, including energy, should be managed by the state and be utilized for the maximum benefit of the whole people of the country. Following this objective, energy policies were derived from the main guidelines of state policies and the development policies of the five-year development plans. These guidelines and the development policies are formulated by the National Assembly of Peoples Representatives, which meets every five years.

The fourth five-year development plan (1984/1985 - 1988/1989), which is a continuation of the previous plans, has the following objectives: (1) a more equitable distribution of development and its gains, leading to the welfare of the entire population; (2) a sufficiently high economic growth, and (3) a sound and dynamic national stability. In supporting these goals, an energy policy has been adopted: (1) to assure a gradual shift from an economy which is strongly dependent on one energy source to a poly-energy one; (2) to assure the availability of energy for the domestic market at reasonable prices, and (3) to ensure a continuous and positive contribution to the balance of payments and public revenues(1).

To implement these policies, measures have been taken to intensify and extensify surveys and explorations of energy resources; to diversify energy development and utilization; to use non-renewable and exportable resources primarily as a means of increasing foreign exchange earnings; to develop renewable and non-exportable sources of energy for domestic use, and to develop energy supply for rural needs with due consideration of the environmental impacts; to conserve energy, especially oil; and to choose the optimal utilization of certain energy forms for certain applications in the various sectors of the economy.

To reach these goals a certain target of an energy mix has been formulated and programs will be implemented (2).

1. Petroleum Production

Crude oil

Crude oil production peaked in 1981. In 1985 it reached an average of 1.181 million b/d, about nine per cent lower than the 1984 figure. The condensate production increased by 8.4 per cent from the previous year. After a significant drop in the production in 1982, production has been stabilized at the level of 1.18 million barrels a day (see Table 1).

The drop in the production of crude oil and condensate was due to a drop in demand for oil on the international market. Although the number of wells diminished from 702 in 1984 to 656 in 1985, the footage drilled showed an increase of 6.7 per cent. Three new contracts were signed. This showed a continuing interest in Indonesian exploration and development work. This is partly also due to the 50 basins already known to have prospective reserves of oil and gas, of which only 18 have been explored intensively and 10 are producing. It is expected that with the signing of new contracts for oil exploration, production could be maintained in the future. The development of oil arrangements between the government and foreign oil companies has been discussed elsewhere (4).

Proven recoverable reserves of crude oil were stated as 8.50 billion barrels compared to 8.65 billion barrels in 1984, a depletion of 1.7 per cent in 1985. This was discussed recently in the Petroleum Report Indonesia (5).

Table 1 Crude Oil and Condensate Production, Indonesia
1980 - 1985 (in thousand barrels)

	Crude oil	Condensate	Total
1980	NA	NA	577,015.9
1981	577,800.8	27,037.6	584,838.4
1982	460,471.9	27,717.1	484,189.0
1983	454,531.1	35,952.3	490,483.4
1984	486,512.6	48,477.4	516,989.9
1985	431,237.7	52,530.6	483,786.2

Source: (3)

The low oil price has also affected spending and investment in the oil industry in Indonesia. This might not have an impact on oil production, since the country is producing below its capacity.

Refined products

Eight refineries were producing in 1985, all of them belonging to the state oil company, Pertamina. One refinery in Cepu is used for training purposes. The increased refining capacity was in accordance with the policy of self-sufficiency in petroleum products.

Total refined products output in 1985 was 213,891,036 barrels, of which 21,056,089 barrels was refined in Singapore. This showed a 7.2 per cent increase from 1984. Except for avgas and avtur, all products showed an increase varying from 6.8 per cent for kerosene to 67.0 per cent for diesel oil. The development of fuel output of refineries during the past six years is shown in Table 2. The extension of the distribution system of petroleum products has also contributed to the increase of the refineries' output.

Table 2 Fuel Output of Refineries, Indonesia, 1980 - 1985 (in thousand barrels)

	1980	1981	1982	1983	1984	1985
Avgas	149.7	124.4	87.3	104.6	91.5	1.5
Avtur	1850.7	1655.1	1949.5	2759.8	4914.7	3845.3
Gasoline	24036.7	24924.2	23464.4	12875.3	19470.3	23617.5
Kerosene	34138.1	36025.9	33980.7	31668.7	35943.4	38382.9
ADO	27143.2	26270.7	29516.6	32397.9	35353.7	41268.1
Diesel Oil	6982.8	5992.8	5799.0	5124.0	5263.5	8791.8
Fuel Oil	19062.1	20941.0	19314.3	13855.0	17202.2	19006.2
Total	113363.3	115934.2	113932.4	98785.2	118239.1	134913.4

Source: (3).

The domestic sales development is shown in Table 3.

Table 3 Domestic Sales of Petroleum Products, Indonesia, 1979 - 1985 (in thousand kiloliters)

	1979	1980	1981	1982	1983	1984	1985
Avgas	21.33	20.00	16.50	15.59	13.21	11.66	10.34
Avtur	581.34	518.33	592.10	617.69	584.29	694.79	619.01
Super 98	98.24	74.45	62.24	37.48	38.80	82.82	116.94
Premium	3385.82	3707.35	4077.29	4082.27	3684.87	3948.42	3997.32
Kerosene	7227.73	7783.37	8244.71	8235.95	7648.31	7183.80	6983.29
Automotive Diesel	5500.63	6366.67	7089.05	7756.07	7851.94	7628.42	7491.50
Industrial Diesel	1205.48	1211.67	1511.73	1453.94	1565.81	1615.54	1612.25
Fuel Oil	2166.34	2365.36	2666.04	2904.39	3338.49	3673.61	3361.78
Total	20186.91	22047.20	24268.66	25101.38	24725.72	24839.06	24192.38

Source: (3).

The slowing down of the economic activity and the diversification of energy resources has its impact on the domestic demand of the petroleum products (6).

The yearly supply of petroleum products was adjusted to the yearly estimated demand for each product. Since 1983 a declining trend has been observed.

The demand for fuel oil and diesel oil in the industrial sector was decreasing due to the lowering of the demand for electric power generation which was more and more using hydropower, coal and natural gas (7).

The declining demand for kerosene were among others caused by the increasing sale of LPG and the progress reached by the rural electrification program. A more efficient use of kerosene and an increasing use of biomass might also be unnegligible.

The unbalanced demand for automotive diesel oil compared to industrial diesel oil is still exist due to the different supply facilities available.

The increasing demand for gasoline and avtur were in pace with the increasing number of cars and planes, the growing road network and flight frequencies.

It is expected that an increase in fuel oil demand could be felt due the declining of several water reservoir for power generation. A shift to the use of small diesel cars has been observed so that a slower growth of gasoline demand could be expected.

2. Natural Gas

Large reserves of natural gas were discovered in 1972 at Arun (Sumatra) and at Badak (Kalimantan), which were followed by further discoveries. Most of them are associated gas, since practically no gas exploration has been undertaken. These wells are spread out over the country with various sizes, purities, associated wit oil or non-associated. Only 2, the largest reserves, could be developed for LNG production at present.

Various studies on how to optimize the utilization of the gas reserves are still on-going. Without its utilization gas reserves remain a potential reserve.

Table 4 shows the development of natural gas production during the past five years.

The supply of natural gas has been growing steadily. This was related to the increasing

demand for LNG production and for city gas distribution. The flared gas was also decreasing due to this increase of demand.

Table 4 Natural Gas Production, Indonesia, 1980 - 1985
(in billion cubicfeet)

	1980	1981	1982	1983	1984	1985
Total	1045.7	1123.7	1111.9	1106.4	1521.4	1580.0

Source: (3)

Recent estimate accounts for 217 TCF of recoverable natural gas which includes the whole range of geological occurrence possibilities, from measured available proven reserves to speculative estimated quantities in undrilled sedimentary basins. The estimated remaining proven recoverable reserves of natural gas is 80 TCF of which 85 per cent are non-associated and can be produced independently from oil.

Approximately 0.85 TCF or 56.2 per cent of the 1985 output was produced to fulfill export agreements of LNG.

The production of LNG has been constantly increasing. Although the volume of LNG export has been increasing in 1985, its value has decreased.

The LPG production, its volume and export value has been decreasing in 1985.
The development of LNG export is shown in Table 5.

Table 5 Export of Liquid Natural Gas, Indonesia, 1981 - 1985
(in billion BTU)

	1981	1982	1983	1984	1985
LNG Export	446,276	468,199	499,680	738,391	779,086

Source: (3).

3. Coal

Recently, a number of private companies have engaged in the development of coal mines in the eastern and southern part of Kalimantan. In addition to the national private companies, since 1981 eight foreign companies have signed production-sharing contracts with the government. The two largest coal mines are Ombilin and Bukit Asam.

After the start-up of a program to raise production in excess of 1.0 million tons per year, the Ombilin mine produced 770,751 tons of coal in 1985, an increase of 32 per cent from the 1984 figure. Peak production of 624,212 tons in 1930 was surpassed. Of the total production, 35 per cent was sold domestically and the rest was exported.

The development of Bukit Asam, a 3.0 million tons per year coal mine, started in early 1982. In 1985 it produced 729,301 tons of coal, up 44 per cent from 1984 production. Nearly 80 per cent of the production was sold to the Suralaya steam power plant in West Java. With the nearby coalfields, its reserves permit an increase of production to 5.0 million tons per year.

Although the price of oil was steadily declining in 1985 and 1986 and the economy in general

faced adverse conditions, coal development in Indonesia has made significant progress.

The development of coal production is shown in Table 6.

Table 6 Coal Production, Indonesia, 1980 - 1985 (in tons)

	1980	1981	1982	1983	1984	1985
Coal Production	303,989	350,380	480,987	648,241	1,468,154	1,942,135

Source: (3).

The rehabilitation and expansion of coal mines in Ombilin and Bukit Asam in Sumatra, together with the development of small private coal mines in Kalimantan and Bengkulu, Southern Sumatra, resulted in an increase of production from 1.468 million tons in 1984 to 1.942 million tons in 1985. It is expected that the figure for 1986 will be around 2.490 million tons.

Due to delays in the transportation project, since 1985 Indonesia has had to import part of its coal needs for the Suralaya power plant. But higher grade coal and anthracite have been exported to several countries, which amounted to 1.033 million tons in 1985 and is expected to reach 1.3 million tons in 1986.

Coal exploration results recently revealed 1.7 billion tones of proven reserves, while total indicated and inferred reserves amounted to another 6.25 billion tons.

4. Biomass

Several studies have indicated that biomass energy still plays an important role in the supply mix of energy in Indonesia (1). Some estimates gave a figure of up to 34 per cent of the total energy consumption as coming from biomass.

The biomass supply figures varied widely due to different methods of accounting. Several surveys (8) indicated that the role of biomass is very important in the supply of heat for cooking. There are very few provinces in the country which show a deficit of biomass. The supply demand balance of biomass should be considered if the present situation is to be maintained or even improved.

According to these surveys, woody biomass, which is mostly used for cooking in the rural areas, came from home yards. A large part of the population used biomass which could be collected free of charge. Agricultural wastes are used only when fuelwood is in short supply.

The total production forest area of the country was about 64.6 million hectares. The forest area allocated for conversion to another purpose was estimated at about 30.8 million hectares (10). The potential of forests is vast indeed, as Table 7 shows. The growth of wood per hectare per year covers a wide range of values, from as low as 10 m^3/ha per year to more than 60 m^3/ha on fertile lands with enough rainfall, with an average of 22 m^3/ha/year.

Fuelwood and charcoal have the potential to contribute significantly to the energy supply in Indonesia on a sustainable basis if the depletion of the fuelwood resource base can be halted. Despite the technical and economic feasibility, however, substantial efforts will be required.

Recent surveys of biomass supply in West Java (8) (11) (12) gave the following information: the highest fuelwood supply per unit of area has come from the so-called village lands. Fuelwood supply is that portion of the fuelwood potential which can be harvested as fuelwood per year, on a sustainable basis, which means not exceeding the average annual biomass increment. This finding was the result of the predominance in the village lands of tree crops which were maintained to produce fruit, timber and fuelwood. The fuelwood supply from these lands was estimated to be about 27 m^3/ha/yr.

Table 7 Growth and Energy Content of Fast Growing Species in Indonesia

Species	Stocking density (m)	Rotation (yrs)	Yield (m^3/ha/yr)	Wood density (Weight/Vol.)	Energy production (GJ/ha/yr)
Causuarina junghuhniana	2 x 3	10	25.0	1.04	452.5
Eucalyptus justigata	2 x 2	8	24.5	.76	352.8
---------- maculata	2 x 2	8	28.0	1.05	512.0
---------- maedenii	2 x 2	8	27.5	.70	388.3
Calliandra calothyrsus	1 x 1	5	32.0	.70	384.0
Leucaena leucocephala	1 x 2	5	21.0	.82	309.0

Source: (9).

The second largest supplier of fuelwood is home yards, which supplied 22 m^3/ha/yr, higher than the previous estimate of 7-9 m^3/ha/yr (9). In these gardens more fruit trees were planted than any other kind of trees. The biomass potential varied from one region to another due to the type of fruit trees planted.

Agricultural fields were the next largest fuelwood supplier. The tree species cultivated in these fields were usually leguminosae, which were planted as a shade tree, for fodder production and for the maintenance of soil fertility. The biomass output as fuelwood supply is estimated to 18 m^3/ha/yr, compared to a low 2.3 m^3/ha/yr in an older survey (9).

Other fuelwood supply came from estates, and was mostly available on the market. The people's estates supplied the major part of this supply (11).

Information on agricultural wastes was still scattered. An attempt to establish a systematic inventory of potential energy from agricultural wastes has been made for the Province of West Java (13).

The total biomass potential was estimated to be 434.7 million m^3 from the forest and 59.1 million m^3 from agricultural activities. Another report gave a total potential of biomass wastes of 246.9 million tons per year (14).

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II. MINERALS DEVELOPMENT

The development of minerals production in Indonesia has been affected by the slackening of mineral commodities in the world market. Metals mining production in general has been declining (1). Non-strategic mining products are still being promoted due to their role in regional development and employment creation.

The most important mineral products in the past five years were tin, copper and nickel, as shown in Table 8.

Continuous investment in the mining sector in general has created hope for further development of this sector in the future.

Table 8 Mineral Production in Indonesia, 1980 - 1985 (in tons)

	1980	1981	1982	1983	1984	1985
Tin	32,527	35,391	33,806	26,554	23,223	21,759
Copper Concentrates	186,087	188,472	223,704	205,015	190,349	232,399
Nickel ore	1,537,442	1,543,219	1,640,922	1,278,031	1,066,816	961,876
Nickel matte	20,533	19,940	13,744	18,570	22,815	25,269
Ferronickel	18,314	19,314	21,501	20,708	22,774	23,789

Source: (1).

Tin

Tin was produced by five companies. The foreign companies operated under contract-of-work agreements with the government. Several small national companies acted as contractors to the state tin company, PT. Tambang Timah.

Overall output of tin ore dropped around 13 per cent annually in the last four years. A significant drop has been felt since 1982.

A tin smelter produced 20,909 tons of tin metal, which was lower than the previous figures. The largest part of the production was exported.

Copper

Freeport Indonesia Inc. is the only producer. Its production was not constant but shows a slight increasing trend. The average copper content of the ore was 1.98 per cent, a decrease of 2.09 per cent the year before. The dry concentrate also contained 10.2 g/ton of gold and 154.7 g/ton of silver. Of the 232,399 tons total production of dry concentrate, 225,598 tons has been exported.

Nickel

Three companies produced nickel in Indonesia, which consisted of wet ore, nickel matte, and ferronickel ingot and shot. Of the 961,876 tons of ore production, one-third was fed to a ferronickel plant.

Other minerals

Other minerals produced included bauxite, gold and silver, iron sands, lead and zinc con-

centrates and other non-metal minerals like limestone, granite, quartz sands and kaolin as the most important ones.

Minerals import

Several minerals were imported, which the most important are shown in Table 9.

Table 9 Minerals Import, 1980 - 1985 (in tons)

	1980	1981	1982	1983	1984	1985
Roasted Iron Pyrites	-	112,652	178,786	60,450	126,843	1,188,126
Iron Ore Concentrates	285,047	7,701,574	121,039	127,999	198,460	132,850
Manganese Ore and Concentrates	11,968	9,513	4,890	2,889	1,545	1,153
Other Base Metals and Concentrate	34	613	1,031	2,942	11,596	1,399

Source: (2)

An increase of the domestic demand has affected not only the export of mineral ores, especially tin, but also import. The increase of iron ore imports rose with the expansion of the Krakatau Steel complex.

Since 1982 the export value of the Indonesian mining products has been declining. The decrease was 14.6 per cent in 1985 compared to 1984. An increase has occurred only for coal and nickel. Non-oil minerals export represented only 2.94 per cent of the total export value of the country in 1985 (2).

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III. A COMPARISON OF VARIOUS PROJECTIONS OF ENERGY DEMAND

Introduction

1. MAED Projection

This demand study is one of several made in connection with the long-term energy demand in Indonesia. Emphasis is placed on electricity demand. The general concepts and procedure of the MEDEE method of long-term energy demand appraisal are used, together with the MAED computer model for energy demand prospects up to the year 2000 and 2015 (1).

The first step in this study was the collection of data to construct a reference energy balance for the main sectors for 1982, which was also suitable for use as a MAED data base and to analyze in detail the trends over the last 10 years of the main energy demand determinants.

The second step consisted of an elaboration of two scenarios, based on a qualitative description of the main features of two scenarios provided by Indonesian experts and a quantification of scenario design linked with MEDEE-type models. The last step consisted of improvement of the MAED computer model for the purpose of this study, execution of various runs and the interpretation of the final results.

The energy demand forecasts were based upon a socio-economic development using the on-going Five-Year Development Plan objectives, which are extrapolated to the years 2000 and 2015 with a favorable environment for energy export. Two scenarios were built upon assumption concerning GDP growth, changes in the GDP structure and the oil price evolution. The industrial growth is supported by basic industries.

The results show a growth rate of energy consumption of around 4.4 per cent p.a. for the year 1982 to 2000 and a smaller figure beyond. The energy/GDP elasticity would be in the range of 1.18 per cent up to 2000, and around 0.9 per cent beyond. Industry is expected to have a greater role in the energy demand from the present 21 per cent to a range from 34 to 39 per cent in 2000 and from 44 to 51 per cent in 2051; but this demand is very sensitive to scenario assumptions. The share of the household sector would continuously decline and the transportation sector would also decline or remain stable.

The scenario on the supply side assumes maintaining an oil consumption of under 60 MTCE by 2000 and between 80 and 90 MTCE by 2015 by developing rapidly the production of gas and coal.

Electricity demand would continue to grow fast. Demand for PLN would increase at a rate of 12 to 13 per cent p.a. up to the year 2000 and around 8 per cent beyond.

The overall energy consumption figures associated with both scenarios for the years 2000 and 2015 are consistent with the level of development and industrialization assumed for these years in these scenarios. But due to the strong relation between industrialization and the development of basic industries, small differences in GDP growth assumptions produce large differences in industrial energy demand and consequently in the total energy demand evolution.

It has been proposed that these preliminary results be followed by a further analysis conducted within the overall planning procedure. Improvement should be made through (1) updating information on energy consumption, demand determinants, production and transportation; (2) improving scenario design procedure, and (3) adopting end-use models suitable for developing countries.

2. World Bank Projection

This study (2) aimed to review the options available for providing energy other than petroleum to meet the future energy demand in Indonesia, with main focus on Java. This was based on the conclusion that nearly two-thirds of electricity and three-quarters of commercial fuels will be used in Java. And while Java is energy-deficient, Sumatra and Kalimantan have abundant energy resources and are large energy exporters.

The energy requirements were forecast based on projected macroeconomic scenarios corresponding

to two oil production and price scenarios. This has an indicative character and should not be regarded as a precise estimate.

Sectorial growth rates were then assumed. It was assumed that the manufacturing sector would play an important role and that its share in the GDP would grow from 8.9 per cent in 1985 to 14 per cent in 2000. Growth in the transportation sector was projected based on an elasticity for transport demand to GDP of around 1.1. In the household sector, the growth rate was expected to be fairly low, at about 4 per cent per year.

The commercial energy demand was forecast using the MAED model. Apart from a difference in the base year figure for energy, different assumptions such as population growth rates, oil scenarios and the share of the manufacturing sector in the GDP were used.

The total final commercial energy consumption will grow at a rate of 3.1 per cent p.a. up to 1990 and gradually increase to around 6.5 per cent p.a. beyond. The major contribution will come from increased electricity consumption in the manufacturing, household, and services sectors. The figures for the total final energy demand for 1990 and 2000 excluding feedstock uses are respectively 192.0 million BOE and 341.6 million BOE for the base case. The alternative case is 2.3 per cent and 13 per cent higher for the respective years.

3. MARKAL Projection

This integrated study includes macroeconomic development, energy demand and an optimized energy supply analysis (3). Three computer models, namely, MACRO, ANALYSIS, and DEMI, were applied for the macroeconomics and energy demand analysis, and the MARKAL model was used to optimize the future energy supply. For this purpose, a minimization model using discounted cost, security and slope functions as objective functions was used.

The macroeconomic model employed the Input/Output table for Indonesia as a basis and estimated the level of economic activities as well as the GDP. The energy demand was then calculated for the industrial sector, which was broken down in 21 subsectors, the transportation, the agriculture, and the residential sectors.

Historical energy intensities were calculated using the ANALYSIS model. With production values obtained from the MACRO model energy demand was then calculated. The energy demand for mining industries was not included, since this would depend upon the strategy chosen from the outcome of the optimization model.

The MACRO model employed an oil price scenario which was assumed to play a decisive role in the performance of Indonesian economic growth. This was projected at around 4 to 5 per cent from 1990 to 2010.

A preliminary result has been published for a high scenario with three cases, namely, a reference case, a case with limited oil production to save for future utilization, and a reference case but using the BPPT/Bechtel Study (4).

The study covers 30 years, divided in 6 periods of 5 years. 1984 data was used as the base. The result shows an energy demand of an average of 502.3 million BOE p.a. for the years between 1994 and 1998, and an average of 572.8 million BTU p.a. for the years between 1999 and 2003.

4. KAYA Projection (See IV of this chapter.)

5. Concluding Remarks and Policy Implications

It has been recognized that the projections made so far have weaknesses and need improvement. Validation of models requires more detailed data and statistics, which are often not available without scrutiny and further analysis.

Indonesia faces the problem of choosing between the options available in meeting requirements within the existing constraints. In defining a plan of action, lack of capital is one of them. Consequently, a pragmatic approach such as optimizing sub-sectoral planning or least-cost criteria has been adopted.

The World Bank Study (2) was originally meant to integrate different existing sub-sectoral studies. A thorough demand analysis is not provided in this study, which should relate demand development with the supply possibilities, including cost and consequences.

One of the outcomes was a recommendation to distinguish among issues and options for the short-, medium- and long-term periods. In evaluating the eventual implementation of this, different approaches have to be taken and different precisions of information should be utilized. Adjustment of policy measures has to develop accordingly.

Since energy is utilized to provide different services, energy policy should not be developed in isolation. Past experience has shown that many energy programs with non-energy objectives have already been implemented.

On the demand side, energy conservation and fuel substitution policies could have an impact on the growth of energy requirements, due to the expected growth of new energy utilizing installations. These policies will interact with structural changes in the economy through energy prices and the application of new technologies and processes. Although the impact will not be felt immediately, a demand management policy will be needed. The MAED model (1) could be extended by using improved methods of demand analysis.

Scenarios of supply related to its cost and implications have to be drawn up to support a medium-term policy. A long-term scenario beyond the horizon of electric power planning should also be drawn up to enable to formulate a consistent policy. A better understanding of the roles of these approaches in energy planning and policy development should be promoted. The World Bank Study (2) gives a good starting point and could be used with the MARKAL model (3) to make an iteration to explore future supply options.

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IV. ENERGY MODEL AND THE ANALYSIS

1. Introduction

The decade of 1970s caused significant changes to the Indonesian economy as the result of oil price increase. In particular the following factors are very important and noticeable: (1) the increase of production of oil and gas, (2) the encouragement of the inflow of foreign capital and (3) the rising confidence in improving the standard of living in Indonesia. Thus by the end of the 70's the Indonesian economy had been transformed from the old agrarian economy to the industrializing low-middle income economy. The pattern of supply and demand of energy also changed in Indonesia.

Development increases domestic energy consumption in addition to the exports, so that the study of energy demand becomes more interwoven with the domestic economic activities. This stimulated the modeling work on the energy economy. There have been a number of studies in this area, other than the one of ours presented here, such as I-O energy data base by PERTAMINA undertaken in cooperation with JICA, BPPT with Bechtel, BATAN Nira for the assessment of nuclear power for electricity, Dinamika II by LIPI and the study done by BPPT and KFA, Germany. Each one of them uses the mathematical formulation of energy economy in combination of some macro-economic models of Indonesian economy.

2. The Flow of Energy

Our model deals with the national energy situation, and the primary sources of energy are divided into 6 categories: 1. crude oil, 2. natural gas, 3. coal, 4. hydro power, 5. geothermal energy, 6. nuclear energy as a future possibility. The final consumption is divided into the following 13 categories: 1. gasoline, 2. jet fuel, 3. kerosene, 4. ADO, 5. IDO, 6. HFO, 7. naphtha, 8. LPG, 9. others, 10. electricity, 11. NGL, 12. LNG, and 13. city gas.

All of them are domestically produced and go to refinement or conversion and transported or transmitted to the end users. Each line of the network diagram shows the activity process. The final demand is derived from the demand side model. The demand sectors are classified as: 1. primary, 2. agriculture, 3. mining, 4. cement and ceramics, 5. iron and steel, 6. other industries, 7. transportation, 8. residence and commerce. The conversion sectors are : 1. refinery, 2. electricity generation, 3. NGL plant and 4, city gas production. The primary sector mentioned above consists of 1. domestic production, 2. export and 3. import.

The combination of these supply with demand sectors produces 19 * 14 transaction matrix which is shown as Figure 1. In this matrix only 91 elements are meaningful for the time period under our study. In the industry ADO is used for heating. IDO is for power generation, and HFO for steam power generation. Kerosene is used mainly for cooking at home.

The model used in our study is Linear Programming type, and it has 45 slack variables and consists of 136 equations as is shown below.

3. Methodology

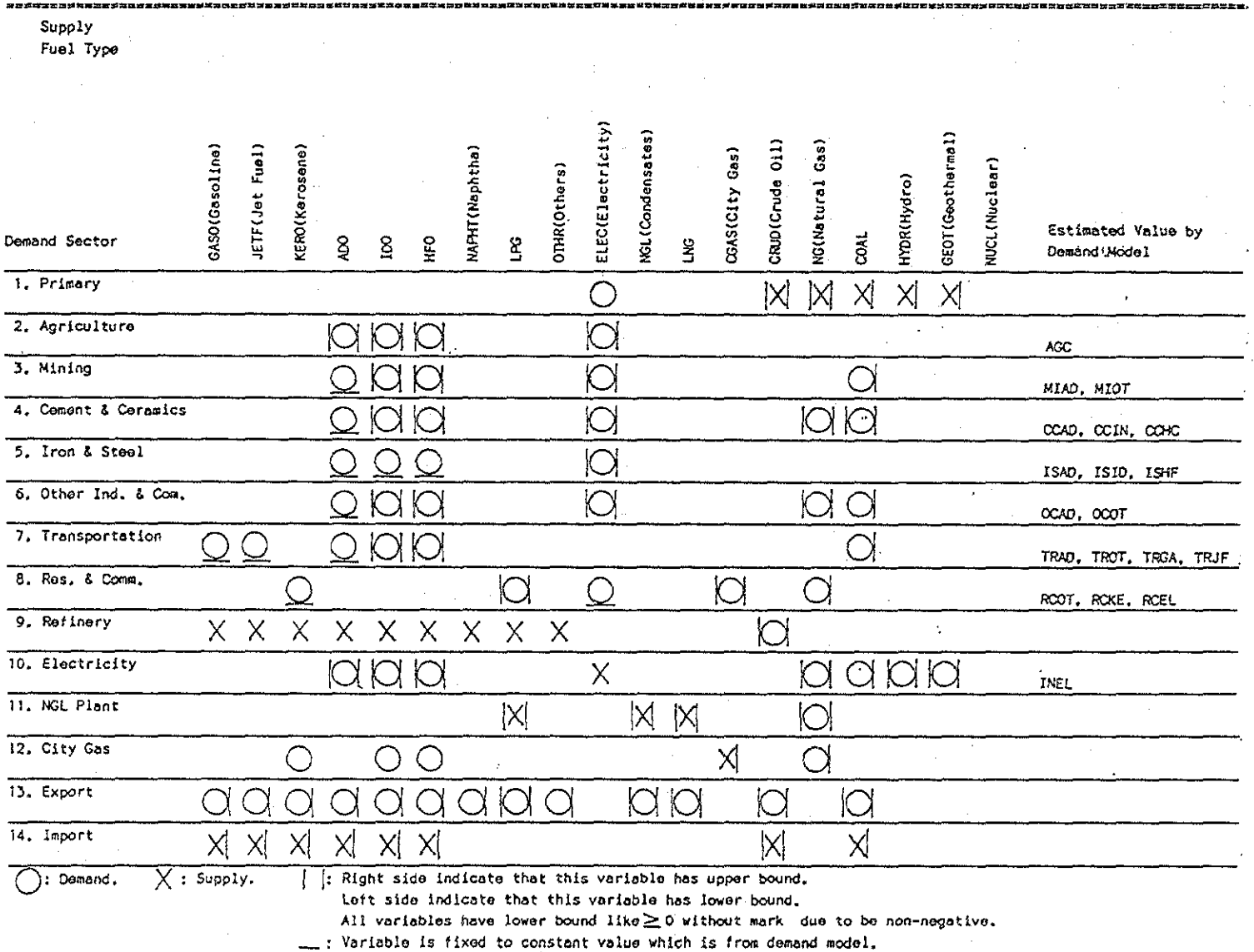
Our model proceeds its analysis in two steps.

First, it analyzes the demand for energy, and second, it tries to derive the optimum way of supplying to satisfy this demand.

A. Demand study

There are three kinds of statistics available for Indonesian energy, and they are considerably different from each other. They are: 1) UN Energy Balances, 2) IEA Energy Balances, and 3) the

Figure 1 Figure of Energy Flow with Variable Here Employed



results of JICA/MIGAS study. JICA/MIGAS study was conducted during the 70's in co-operation with Japan Institute for Energy Economics and completed in 1981. Its objective was to construct detailed energy balance sheets and analyze the characteristics of energy demand by sector.

Although the data from the study are only from 1969 to 1979, we use them for the following analysis they are consistent and much more detailed than other two statistics. However, it is worth noticing that the differences among the three are significant. The average growth rate of the total energy demands (only commercial energy) in the 70's is, (UN) 9.3%, (IEA) 6.2%, and (JICA/MIGAS) 13%. Accordingly, its GDP elasticity is (IEA) 1.1, (JICA/MIGAS) 1.6, considerably high.

Reduction of these discrepancies is one of the important research targets in the future.

Similar to other developing countries Indonesia consumes a vast amount of non-commercial energy consisting of firewoods and agricultural wastes (about half of the total energy demand) mainly in agricultural and residential sectors, but the consumption in the former sector has been decreasing rapidly due to modernization of agriculture. The data on non-commercial energy are apparently available but not reliable enough for the detailed analysis. Therefore, only commercial energy is analyzed in the following section.

The regression analysis has been employed for estimating the energy demand with the data of 11 years from 1969 to 1979. Classification of kinds and uses of energy is shown in Table 1. As for the forms of demand functions, initially choice was made to use log-linear functions with constant elasticities with regard to exogenous variables. However, the results show that the elasticities of demands with regard to economic outputs are much higher than unity in several sectors as Table 2 shows. This is partly because of inappropriate selection of exogenous variables but mainly due to the unusual increase in energy demands. If these equations are used for the long term forecast, energy demands will go up unrealistically. Observations in other countries indicate that the high output elasticities of demands can be sustained only for a limited period. On this account our decision was changed to use linear equations rather than log-linear ones.

Table 1 Classification of Energy Demands

	Auto Diesel Oil	Ind. Dies. Oil	Heavy Dies. Oil	Coal	Natur. Gas	LPG. City Gas	Keros.	Gasol.	Jet Fuel	Elect.
Agriculture	AGC									
Mining	MIAD	MIOT								
Cement & Ceramic	CCAD	CCIN	CCHC							
Iron & Steel	ISAD	ISID	ISHF							INEL
Other ind. & Con.	OCAD	OCOT								
Transportation	TRAD	TROT						TRGA	TRJF	
Residential & Commercial					RCOT		RCKE			RCEL

The demand functions finally adopted after a number of trials are shown in Table 3, together with the definitions of variables. The numbers in parentheses are those of t-statistics, and D.W. is the Durbin-Watson ratio. Those variables with (-1) are lagged variables; namely, x(-1) is the x of the previous year.

It is seen in Table 3 that variables on the right side of equations are economic outputs of corresponding sectors, energy prices and lagged variables.

Table 2 Elasticity of Energy Demand with Regard to Economic Outputs

Sector	Kinds of energy		Exogenous variables representing economic outputs	Value of elasticity
Agriculture	Diesel oil	AGC	GDP in agriculture	7.05
Mining	Auto diesel oil	MIAD	GDP in mining	.75
Cement & ceramics	Auto diesel oil	CCAD	Value added in cement and ceramics sector	1.56
	Heavy fuel oil & coal	CCHC	Value added in cement and ceramics sector	.48
	Industrial diesel oil	CCIN	Value added in cement and ceramics sector	1.23
Iron & steel	Auto diesel oil	ISAD	GDP in manufacturing	3.47
	Industrial diesel oil	ISID	GDP in manufacturing	5.25
	Heavy fuel oil	ISHF	GDP in manufacturing	3.61
Other industry & construction	Auto diesel oil	OCAD	GDP in manufacturing & construction	1.13
	Other energy	OCOT	GDP in manufacruing & construction	1.38
Transportation	Auto diesel oil	TRAD	Number of trucks & buses	1.55 *
	Gasoline	TRGA	Number of passenger car & moter cycles	.57 *
	Jet fuel (per person)	TRJF	GDP per capita	3.60
Residential & commercial	Kerosine	RCKE	Private consumption expenditure	1.42
	Gas	RCOT	Private consumption expenditure	2.96
	Electricity	RCEL	Private consumption expenditure	1.43
Industrial	Electricity (Per GDP of manufacturing)	INEL	Heavy industry ratio	.59 *

Note: * means that the exogenous variable is not that of economic outputs, and therefore the value in the column of 'elasticity' does not correspond to the elasticity of demand with regard to economic outputs.

Table 3 Estimated Equations

Equations for Energy Demand

Total commercial energy demand in agriculture sector,

AGC = -568.95 + .24550*AGO + .58263*AGC(-1)
(-2.0) (2.1) (2.2)
R*R = .9277 (.9070) D.W. = 2.3 INTV = (70-79)

Mining sector,

-Automobile diesel oil,

MIAD = +18.308 + .40298E - 01*GCF
(4.7) (16.5)
R*R = .9680 (.9644) D.W. = 1.7 INTV = (69-79)

-Others (Industrial diesel oil, fuel oil and coal)

MIOT = 1.5*MIAD

Cement and ceramic industry sector,

-Automotive diesel oil,

CCAD = -15.264 + 5.4947*CCO
(-1.5) (7.3)
R*R = .9307 (.9134) D.W. = 2.0 INTV = (73-78)

-Fuel oil and coal,

CCHC = +245.75 + 16.178*CCO
(19.4) (20.5)
R*R = .9883 (.9860) D.W. = 1.7 INTV = (73-79)

-Industrial diesel oil and natural gas,

CCIN = +3.7556 + 17.259*CCU
(.1) (6.9)
R*R = .9041 (.8849) D.W. = 1.1 INTV = (73-79)

Iron and steel industry,

-Automotive diesel oil,

ISAD = -46.754 + .82193E -01*MFIO
(-4.8) (7.9)
R*R = .9124 (.8978) D.W. = 1.3 INTV = (72-79)

-Industrial diesel oil,

ISID = -44.500 + .81089E - 01*MFIO
(-5.3) (9.1)
R*R = .9329 (.9217) D.W. = 2.2 INTV = (72-79)

-Fuel oil,

ISHF = -110.44 + .17064*MFIO
(-3.6) (5.2)
R*R = .8200 (.7900) D.W. = 1.2 INTV = (72-79)

Others industry and construction sector,

-Automotive diesel oil,

OCAD = -81.223 + .28601*MFCO + .59846*OCAD(-1)
(-.6) (1.5) (1.5)
R*R = .7790 (.7159) D.W. = 1.7 INTV = (70-79)

-Others (Industrial diesel oil, fuel oil, coal and natural gas),

OCOT = -226.65 + .71202*MFCO + .60081*OCOT(-1)
(-1.2) (1.9) (2.0)
R*R = .9503 (.9361) D.W. = 1.6 INTV = (70-79)

Electricity in industry sector,

INEL/MFIO = +.15797 + .14957*ICISI
(6.5) (9.2)
R*R = .9440 (.9328) D.W. = 2.3 INTV = (73-79)

Transportation sector,

-Gasoline,

IRGA = +1392.2 + 1.0698*(NOPC + NOMC) - 630.31*PRGA/WPI
(8.3) (34.1) (-1.4)
R*R = .9975 (.9969) D.W. = 1.4 INTV = (69-79)

-Jet fuel,

TRJF/POP = -6.5337 + .17541*GDP/POP
(-16.4) (24.8)
R*R = .9856 (.9840) D.W. = 1.6 INTV = (69-79)

-Automotive diesel oil,

TRAD = -349.58 + 10.003*(NOTR+NOBS)
(-1.1) (8.4)
R*R = .8876 (.8751) D.W. = .5 INTV = (69-79)

-Others (Industrial diesel oil, fuel oil and coal),

TROT = 623.2727

Residential and commercial sector,

-Kerosene,

RCKE = -1170.7 + .64962*HHEX + .66614*RCKE(-1)
(-4.6) (4.4) (6.2)
R*R = .9985 (.9981) D.W. = 2.4 INTV = (70-79)

-Electricity,

RCEL = -102.09 + .56731E - 01*HHEX
(-4.1) (12.6)
R*R = .9463 (.9403) D.W. = .7 INTV = (69-79)

-Others (LPG, Natural gas and city gas),

RCOT = -73.947 + .23052E - 01*HHEX
(-8.0) (13.7)
R*R = .9542 (.9491) D.W. = 1.6 INTV = (69-79)

Equations for Economic Activities

MFIO = -200.43 + .65119*MFIO(-1) +.72696E - 01*GDP
(-5.0) (8.2) (5.6)
R*R = .9995 (.9993) D.W. = 2.9 INTV = (70-79)

CCO = -28.005 + .62115*CCO(-1) + .42041E - 02*GDP
(-4.1) (3.5) (4.1)
R*R = .9944 (.9907) D.W. = 2.7 INTV = (74-79)

ISO = -1.4046 + .21736E - 03*GDP
(-2.5) (3.2)
R*R = .6749 (.6099) D.W. = 1.6 INTV = (73-79)

LOG(HHEX) = -.63154 + .69847*LOG(GDP) + .35263*LOG(HHEX(-1))
(-2.6) (4.8) (2.4)
R*R = .9954 (.9941) D.W. = 1.9 INTV = (70-79)

LOG(GCF) = -4.2655 + .95109*LOG(GDP) + .43130*LOG(GCF(-1))
(-2.2) (2.7) (2.6)
R*R = .9966 (.9956) D.W. = 2.3 INTV = (70-79)

Equations for Social Activities

NOPC -.9*NOPC(-1) = -87.186 + 2.7637*GDP/POP
(-5.8) (10.6)
R*R = .9335 (.9252) D.W. = 1.9 INTV = (70-79)
NOMC -.9*NOMC(-1) = -674.64 + 16.923*GDP/POP
(-8.5) (12.3)
R*R = .9497 (.9435) D.W. = 1.7 INTV = (70-79)
NOTR -.6*NOTR(-1) = -127.06 + .30644E - 01*GDP
(-4.6) (8.5)
R*R = .9003 (.8878) D.W. = 1.5 INTV = (70-79)
NOBS -.7*NOBS(-1) = -15.593 + .40950E - 02*GDP
(-3.6) (7.2)
R*R = .8655 (.8487) D.W. = .9 INTV = (70-79)

Variable Names

AGC : Energy demand of ADO (automotive diesel oil), IDO (industrial diesel oil) & HFO (heavy fuel oil) in agricultural sector.
AGO : Gross domestic product in agricultural sector.
MIAD : Energy demand of ADO in mining sector.
GCF : Gross domestic capital formation.
MIOT : Energy demand of IDO, HFO & coal in mining sector.
CCAD : Energy demand of ADO in ceramics & cement sector.
CCO : Gross domestic product in ceramics & cement sector.
CCHC : Energy demand of HFO & coal in ceramics & cement sector.
CCIN : Energy demand of IDO & NG (natural gas) in ceramics & cement sector.
ISAD : Energy demand of Ado in iron & steel sector.
MFIO : Gross domestic product in manufacturing industry.
ISID : Energy demand of IDO in iron & steel sector.
ISHF : Energy demand of HFO in iron & steel sector.
OCAD : Energy demand of ADO in other manufacturing industry & construction.
MFCO : Gross domestic product in manufacturing industry & construction.
OCOT : Energy demand of IDO, HFO, coal & NG in other manufacturing industry & construction.
INEL : Energy demand of electricity in industry.
ICISI: Index ratio of (CCO & ISO)/MFIO (%).
TRGA : Energy demand of gasoline in transportation sector.
NOPC : Number of passenger cars.
NOMC : Number of motor cycles.
PRGA : Price of gasoline.
WPI : Wholesale price index.
TRJF : Energy demand of jet fuel oil in transportation sector.
POP : Population.
GDP : Gross domestic product.
TRAD : Energy demand of ADO in transportation sector.
NOTR : Number of tracks.
NOBS : Number of buses.
TROT : Energy demand of IDO, HFO & coal in transportation sector.
RCKE : Energy demand of kerosene in residential & commercial sector.
HHEX : Private consumption expenditure.
RCEL : Energy demand of electricity in residential & commercial sector.
RCOT : Energy demand of LPG, NG & city gas in residential & commercial sector.
ISO : Gross domestic product in iron & steel sector.

B. Supply side model

There are two models on the supply side. The first one is the model which estimates the future capacity of conversion process and predict the future magnitude of reserves for each energy resource. These are the important assumptions when we want to run the LP model. The second one is the LP model with the supply and demand constraints. First on demand constraints: In the agricultural area, we do not have any data of the classified demands for ADO, IDO and HFO, so that we use the constraint on the total of these three sources in this sector. One of the constraints in the mining sector is the supply availability of ADO. In other cases, they are the constraints on the sum of, IDO and HFO. The constraints in the ceramic and cement industries are the supply availability of ADO, and that of the sum of IDO and HFO plus coal. Furthermore, we put the constraints on the total usage of these fuels in these three industries. In case of other industries and construction, the demand for ADO and for the sum of ADO, HFO, LNG and coal are treated separately. The constraints in this sector is the same as those of agriculture. Constraint on electricity is analyzed separately in the industrial sectors. In the transportation sector, constraints on ADO, gasoline, jet fuel are independently treated. While the other constraint is the sum of IDO, HFO and coal.

In the residential and commercial sector, electricity constraint is treated independently, while the other constraint is on the sum of LPG, city gas and natural gas.

The other kind of constraints are on the balance relations typically appeared in the energy balance table. In the primary sector, there are constraints on export and import of city gas, hydro, geothermal, nuclear and others. There are only export constraints on naphtha, NGL and LNG. Besides NGL plant product (export possibility only), both export and import possibilities are included. Furthermore, the demand for NGL product is determined by the long-term contract between buyer and the government.

The efficiency factors are also taken into account in constructing this LP model. The demand for electricity in dry season is supposed to be satisfied with the electricity generated by the natural gas power plant.

There are two factors in the objective function. The first one is the export earning (to be maximized) and the second factor is the total cost (to be minimized) which includes the capital cost.

4. Model Structure

Objective function:

$$W1 \sum_{I=1}^{n+k} \left\{ EXP(I) - IMP(I) \right\} - W2 \sum_{I=1}^{m} TC(I)$$

where : W1 = weighting factor for net export
W2 = weighting factor for total cost
TC(I)= plant cost (facility cost plus operation cost)
n = number of import energy types
n+k = number of export energy types
m = number of kinds of plants

Supply constraints:

(1) Refinery plant

a). $y = \sum_{I=1}^{n} U(I)$

b). $e_{(I)min.}\ y \leq U(I) \leq e_{(I)max.}\ y$

where : U(I) = I-th refinery products
y = Crude oil intake to refinery
n = Energy type number of refinery products
$e_{(I)}$ = Yield for I-th refinery product

(2) Electricity

The following equation holds both for peak and base plants.

$$Y = c \sum_{I=1}^{n} X_i$$

Where : n = number of generation types
X_i = I-th power plant (bounded variable)
c = conversion factor for electricity
Y = total electricity demand

(3) NGL Plant

$$0.9.\ Y = \sum_{I=1}^{n} X_{(I)}$$

Where: n = number of NGL Plant products
Y = natural gas intake to NGL Plant
X = NGL Plant products I-th type (bounded (I) variable)

(4) City Gas Plant

$0.0 \leq CGAS \leq CGAS\ max.$

$$1.5\ CGAS = \sum_{I=1}^{n} X_{(I)}$$

Where : $X_{(I)}$ = I-th raw fuel used into city gas plant (bounded variable)
CGAS = total output of city gas.

Demand constraints :

(1) Production policy for refinery products

$X_i > 0.80\ D_i$

Where : X_i = I-th refinery product
D_i = demand for I-th refinery product

(2) Demand supply balance

$X_i + M_i = D_i + E_i$

Where : X_i = I-th fuel product
M_i = Import for I-th product
D_i = Demand for I-th product
E_i = Export for I-th product

(3) Constraints by demand model

$$\sum_i D_{ij} = PD_j$$

Where : D_{ij} = Demand for I-th fuel in j-th industrial sector ($D_i = D_{ij}$)
PD_j = Predicted demand for j-th industrial sector by Demand model.

5. Analysis of Computational Results

A. Future scenarios for energy demand

Table 4 Growth Rate Assumption Here Employed

	Actual in 1979 (10**9 Rupiah)	1980-1984			1985-1989			1990-1999		
		P	M	O	P	M	O	P	M	O
GDP	9990(100)	5.5	5.5	5.5	4.5	5.0	5.5	5.0	5.5	6.0
AGO	3260 (33)	3.5	3.5	3.5	3.3	3.5	3.7	3.5	3.5	3.7
MIO	1047 (10)	0.5	0.5	0.5	0.2	0.5	0.7	0.2	0.5	0.7
MFIO	1295 (13)	9.0	9.0	9.0	8.0	9.0	9.5	8.5	9.5	10.0
CONO	563 (6)	9.5	9.5	9.5	7.5	8.0	8.5	7.5	8.0	8.5
TRO	541 (5)	8.5	8.5	8.5	6.5	7.0	7.5	6.5	7.0	7.5

Notes: P: Pessimistic
M: Moderate
O: Optimistic
AGO: Gross domestic product of agriculture
MIO: Gross domestic product of mining sector
MFIO: Gross domestic product of manufacturing sector
CONO: Gross domestic product of construction sector
TRO: Gross domestic product of transportation & communication sector.

Future scenarios of energy demands in Indonesia were derived from simulation runs of the demand model built in the preceding sect. Three types of scenarios were considered corresponding to different economic growth paths by 1999. The values of exogenous economic variables in these scenarios (called pessimistic, moderate and optimistic scenarios) are shown in Table 4. As is seen in Table 3 the gross domestic product of manufacturing industries (MFIO) can be generated endogenously from the model but the government target was adopted here for MFIO in 1989 and 1999.

Table 5 Predicted Future Energy Demand Value in Each Sector

(10^3 ton coal equivalent)

		Actual	1989			1999		
		1979	Pessimistic	Moderate	Optimistic	Pessimistic	Moderate	Optimistic
Agriculture	AGC	473	1201 (10)	1220 (10)	1239 (10)	2245 (6)	2280 (6)	2378 (7)
Mining	MIAD	114	251 (8)	259 (9)	267 (9)	541 (8)	604 (9)	674 (10)
	MIOT	167	376 (8)	388 (9)	401 (9)	812 (8)	906 (9)	1011 (10)
	SUB.T	281	627 (8)	647 (9)	668 (9)	1353 (8)	1510 (9)	1685 (10)
Ceramic/cement	CCAD	51	579 (28)	614 (28)	635 (29)	1593 (11)	1860 (12)	2023 (12)
	CCIN	462	1871 (15)	1979 (16)	2045 (16)	5056 (10)	5895 (12)	6405 (12)
	CCHC	685	1996 (11)	2097 (12)	2159 (12)	4981 (10)	5768 (11)	6246 (11)
	SUB.T	1198	4446 (14)	4690 (15)	4839 (15)	11630 (10)	13524 (11)	14674 (12)
Iron/steel	ISAD	53	194 (14)	205 (14)	211 (15)	497 (10)	578 (11)	622 (11)
	ISID	52	193 (14)	204 (15)	210 (15)	492 (10)	572 (11)	615 (11)
	ISHF	132	389 (11)	413 (12)	425 (12)	1019 (10)	1186 (11)	1278 (12)
	SUB.T	237	776 (13)	822 (13)	846 (14)	2009 (10)	2336 (11)	2515 (12)
Other industries	OCAD	1045	2495 (9)	2577 (9)	2626 (10)	5711 (9)	6393 (10)	6823 (10)
	OCOT	2362	6178 (10)	6384 (10)	6507 (11)	14226 (9)	15930 (10)	17004 (10)
	SUB.T	3407	8673 (10)	8961 (10)	9133 (10)	19938 (9)	22323 (10)	23827 (10)
Transportation	TRAD	3903	9670 (9)	9912 (10)	10159 (10)	18167 (7)	19649 (7)	21225 (8)
	TROT	503	623 (2)	623 (2)	623 (2)	623 (0)	623 (0)	623 (0)
	TRGA	4419	8290 (6)	8408 (7)	8527 (7)	13204 (5)	14095 (5)	15033 (6)
	TRJF	823	1682 (7)	1751 (8)	1821 (8)	3217 (7)	3561 (7)	3929 (8)
	SUB.T	9648	20265 (8)	20694 (8)	21130 (8)	35211 (6)	37929 (6)	40810 (7)
Residential commercial	RCOT	87	222 (10)	229 (10)	236 (11)	426 (7)	465 (7)	506 (8)
	RCKE	9355	19314 (8)	19668 (8)	20027 (8)	34789 (6)	37381 (7)	40139 (7)
	RCEL	359	627 (6)	644 (6)	661 (6)	1129 (6)	1223 (7)	1325 (7)
	SUB.T	9801	20163 (7)	20541 (8)	20924 (8)	36344 (6)	39069 (7)	41970 (7)
Electricity Industry	INEL	630	2117 (13)	2235 (14)	2305 (14)	5520 (10)	6419 (11)	6956 (12)
Total		25675	58268 (9)	59810 (9)	61085 (9)	114249 (7)	125389 (8)	134816 (8)

The simulation results are summarized in Tables 5 and 6. It is seen that the share of industrial energy demand will increase steadily, while that of residential and commercial sectors will decrease. Table 7 exhibits the pattern of energy supply under the condition that little substitution will occur among different fuels (for example between coal and petroleum). It is seen that the position of petroleum products will be dominant even around the year 2000, but

further exploitation of natural gas and coal which depends heavily on the government policy may give rise to a considerable change in the pattern of energy supply. Taking into account that the petroleum resources in Indonesia are limited we should do much efforts for diversification of domestic energy supply.

Table 6 Future Scenarios: Moderate Case
-- Share by Sector; Final Consumption of Commercial Energy --

Sector	1979	1989	1999
Industry	24	31	39
Agriculture	2	2	2
Mining	1	1	1
Cement/ceramics	5	8	11
Iron/steel	1	1	2
Other sectors	13	16	18
Electricity	2	4	5
Transportation	38	35	30
Residential/Commercial	38	34	31
	100	100	100

Table 7 Future Scenarios: Moderate Case
-- Share by Kinds of Energy --

	1979	1989	1999
Petroleum	96	95	94
Gasoline	17	14	12
Automobile diesel oil	20	23	23
Kerosine	36	33	30
Other petroleum products	23	25	29
Gas	.3	.3	.4
Electricity	4	5	6
	100	100	100

B. Overall scenarios

Optimization methodology The model is a multi-objective optimization model with the following two objectives. The first is to minimize the total expenditure for energy use, or the sum of

capital costs for primary energy production and conversion, and prices of imported energy (It is almost the same as the cost to satisfy domestic demand). The second is to maximize the net energy export (export minus import) so that Indonesia may get larger earnings of foreign exchange.

Let

J1 = total expenditure for energy use.
J2 = energy export - energy import (in nominal term)

Then objective function of the model is expressed as

$$J = W*J2 - (1-W)*J1 \text{ ------> max} \qquad (1)$$

where W is the weighting parameter. By changing W from 0 to 1 we can generate a set of different scenarios, which provide guidelines for decision makers to design appropriate energy policies.

Since outputs of a model depend entirely on input data, we should always notice how sensitive outputs are to changes in the values of key parameter of the model.

Computer outputs : base case First two types of scenarios are generated, one with W = 0 or of minimizing the total cost for energy use, and the other with W = 1 or of maximizing the net energy export.

The principal results are shown in Table 8, where you will see that both scenarios are very similar in character. In both scenarios crude oil production is maximized while crude oil export is minimized. It means that the amount of crude oil intake to domestic refineries is maximized. This result is not surprising. In the max-export scenario the increase in net export of petroleum products is a strategy better than the increase in crude petroleum export because petroleum products include larger value added than crude petroleum does. In the min-cost scenario the increase in domestic production of petroleum products contributes more to the criterion than the expansion of crude petroleum export, because prices of imported petroleum products are higher than those of petroleum products domestically produced.

The total production of crude oil in these two scenarios is around 180 million ton coal equivalent, or 2.3 MBD which is roughly twice the present production level. Whether this high production level can be attained by the year 2000 is a question to be discussed in a broad context (Physical potential of petroleum reserves, political constraints in relation to OPEC, etc).

Computer outputs : reduced import price case It is seen in the above analysis that prices of imported petroleum products are one of key parameters in the model. We do not know exactly how these prices will change in future when compared to those of domestic petroleum products. To examine the effect of these parameters on the generated scenarios, the min-cost scenario has been generated with prices of imported petroleum products reduced by half. Main variables in this scenario are shown again in Table 8. It is to be noted that the level of crude petroleum production is much lower than the former two scenarios; the level is about 120 MTCE, or 1.5 MBD slightly higher than the present level. On the contrary, import of petroleum products is much higher, because a cheaper way of satisfying domestic demands is to import cheaper petroleum products than domestic ones.

The max-export scenario is almost the same as the former one, because max-export is realized by minimizing import regardless of import prices.

The min-cost scenario in this case is an extreme scenario in the sense that the national economy depends heavily on imported energy. From the view point of nation's security, the scenario may not be acceptable at least as it is. It indicates that the scenario which lies between max-export and min-cost scenarios may be the most practical. The scenario of this kind

can be generated by setting the weighting parameter W to be around 0.5. Details of the computational outputs in this scenario are not shown, but two important observations are described in the following.

Table 8 Main Results: The Year 1999

Objective	T.cost min.	(e-m) max	T. cost min. (Pm 50% decrease)
(e-m)	194995	205365	120300
T.cost	201415	202432	178077
Crude (1)	177819 (1.0)	177819 (1.0)	117560 (.575)
Crude (9)	130312 (.409)	130312 (.409)	70053 (.148)
Crude (e)	53507 (.0)	53507 (.0)	53507 (.0)
NG (1)	51573 (.735)	55628 (.794)	51577 (.735)
LNG (e)	26745 (.179)	30388 (.887)	26745 (.179)
COAL (1)	11088 (.438)	11247 (.444)	7281 (.288)
COAL (e)	40 (.0)	200 (1.0)	40 (.0)
GASO	e 12124 (.226)	e 12133 (.226)	e 0 (.0)
	m 0 (.0)	m 0 (.0)	m 0 (.0)
JFE	e 0 (.0)	e 0 (.0)	e 0 (.0)
	m 1300 (.365)	m 1300 (.365)	m 2346 (.659)
KER	e 4337 (.051)	e 4354 (.051)	e 0 (.0)
	m 0 (.0)	m 0 (.0)	m 14953 (.400)
ADO	e 0 (.0)	e 0 (.0)	e 0 (.0)
	m 2416 (.078)	m 2407 (.078)	m 15690 (.507)
IDO	e 0 (.0)	e 0 (.0)	e 0 (.0)
	m 5553 (.527)	m 5552 (.527)	m 10259 (.974)
HFO	e 0 (.0)	e 0 (.0)	e 0 (.0)
	m 3341 (.260)	m 3337 (.260)	m 9813 (.763)

First, the values of key variables in this scenario lie between those in max-export scenario and those in min-cost scenario. In other words the scenario is a typical "compromise" - type scenario which may be acceptable from a practical view point.

Second, the crude petroleum export is almost maximized in the scenario, while it is always minimized in other scenarios. This situation occurs because import minimization expels import petroleum products, while the total production of crude petroleum can stay between its upper and lower bounds due to equal consideration of two criteria. For max-export purpose the production should be as large as possible but for min-cost purpose it should be as small as possible. In other words max crude petroleum export policy can be adopted only when the two criteria are equally taken into consideration and with much reduced import prices. We should be aware that

the strategy of expanding crude petroleum export is not an almighty for future Indonesia but recommendable only in the above limited situation.

Coal strategy In order to investigate penetrability of coal in the future market, a scenario with the objective of maximizing coal use has been generated. The computational results show that coal production can increase but only by 50% when compared to that in other scenarios. 50% is in a sense a large amount, but you should notice that the amount is economically not a validated potential but merely a physical potential. This is because use of coal is still limited to electric power plants and some parts of industries. Really needed are the efforts for expanding demand for coal, in parallel with those for expanding coal supply.

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V. ELECTRIC POWER DEMAND AND SUPPLY*

Introduction

Electric power demand and supply constantly draw attention, although they have frequently been studied and discussed. This is due to a close-linkage between electric power and economy, manufacturing, education, social welfare, settlement, energy development, natural resources, technology, etc.

Electric power may be very beneficial for the community's welfare, both directly as supporting energy to production and daily life, and indirectly as the support to energy development and other sectors. To exploit electric power maximally, it is necessary to stipulate a policy, strategy, and the efforts based on the concept of electric power characteristics, and the efforts required supply.

Demand forecast, an initial step in electric power supply planning, should principally originate from the data processing and assumptions directed by the policy and strategy. This forecast should constantly be revised in line with new developments. In view of the limited data available, the variety of assumptions and methods, and the fact that policy and strategy still require confirmation and elaboration, it is reasonable that many scenarios have been presented. These can be categorized as high, medium, and low scenarios.

This paper approaches the basic demand and supply for electric power by identifying the role played by the electricity sector in development, formulates and elaborates the objectives and target of electric power development, the policy, and the strategy, and identifies the efforts needed to achieve the objectives effectively and efficiently.

A brief description of the condition of electricity nowadays and a medium scenario are presented to give a quantitative picture of the possible development of electricity in the future.

1. The Current Situation

According to Law Number 15 of 1985, electric power supply undertaking shall be conducted by the state, and implemented by the state-owned company established under legislative regulation as the Electric Power Exploitation Authority (PKUK). Until now PLN is the only PKUK. To meet electric power needs and to increase the state's capacity for electric power supply both for the public interest and, as long as they do not disadvantage the state's interest, for their own interest, cooperatives and other companies can be authorized to supply electric power under an Electric Power Exploitation License. So, electric power can be supplied by an Electric Power Exploitation License Holder for the Public Interest (PIUKU) and by an Electric Power Exploitation License Holder for Self Interest (PIUKS).

Electric power for public interest in Indonesia is supplied by PLN as PKUK and by cooperatives as PIUKU, and for self-interest by various agencies and companies as PIUKS. In 1986, the total electric consumption was 32.6 TWH., of which 14.6 TWH was supplied by PLN, 0.02 TWH by cooperatives, and the rest by the users. Of this total consumption, 6.4 TWH or 19.7 per cent was used by households; 23.4 TWH or 71.7 per cent by manufacturing companies; 1.2 TWH or 3.7per cent by commercial users; 1.6 TWH or 4.9 per cent was used for public interest (public buildings and road illumination). Of the total electric power for households, 5.5 TWH or 85.9 per cent was supplied by PLN; 0.02 TWH or 0.3 per cent by cooperatives; and around 0.9 TWH or 14 per cent by other entities. For industries, 6.3 TWH or 27.0 per cent was supplied by PLN. Almost all electric power for commercial and public interest was supplied by PLN. The consumption per region or province is shown in Table. 1.

Table 1 Electricity Consumption by Regency/Province 1986

	Regency/Province	PLN		Non PLN		Total		Population	KWh/CAP
		TWh	%	TWh	%	TWh	%	(million)	
I.	Aceh	0.09	0.61	0.75	4.19	0.84	2.58	3.08	272.73
II.	North Sumatera	0.84	5.74	2.37	13.23	3.21	9.86	9.66	332.30
III.	West Sumatera	0.34	2.32	0.96	5.36	1.30	3.99	3.85	202.18
	Riau							2.58	
IV.	South Sumatera	0.50	3.42	0.89	4.97	1.39	4.27	5.58	93.92
	Bengkulu							0.98	
	Lampung							6.42	
	Jambi							1.82	
V.	West Kalimantan	0.08	0.55	0.26	1.45	0.34	1.04	2.82	120.57
VI.	South Kalimantan	0.33	2.25	0.31	1.73	0.64	1.97	2.33	123.55
	Central Kalimantan							1.16	
	East Kalimantan							1.69	
VII.	North Sulawesi	0.14	0.96	0.06	0.33	0.20	0.61	2.41	49.88
	Central Sulawesi							1.60	
VIII.	South Sulawesi	0.33	2.25	0.76	4.24	1.09	3.35	6.67	139.92
	Southeast Sulawesi							1.12	
IX.	Maluku	0.05	0.34	0.13	0.73	0.18	0.55	1.66	108.43
X.	Irian	0.06	0.41	0.02	0.11	0.08	0.25	1.36	58.82
XI.	Bali	0.28	1.91	0.18	1.00	0.46	1.41	2.71	48.47
	West Nusa Tenggara							3.11	
	East Nusa Tenggara							3.05	
	East Timor							0.62	
	Java								
	East Java	2.74	18.72	1.75	9.77	4.49	13.79	31.64	141.91
	Western Part of Java								
	Central Java & Yogja	1.74	11.89	1.34	7.48	3.08	9.46	30.66	100.46
	Jakarta Raya	4.57	31.22	2.52	14.06	7.09	21.78	8.16	868.87
	West Java	2.55	17.42	5.62	31.36	8.17	25.09	31.88	256.27
Indonesia		14.64	100.00	17.92	100.00	32.56	100.00	168.62	193.10

Source: -DJL
-PLN
-BPS.

To supply this electric power, in 1986 PLN had 784 systems with an installed capacity of 5403 MW. The cooperatives in the same year had an installed capacity of 5.7 MW, and other entities (including private ones) had an installed capacity of about 5,379 MW. The installed capacity of each region or province in 1986 is shown in Table 2.

Table 2 Installed Capacity by Regency/Province 1986

	Regency/Province	PLN MW	PLN %	Non PLN MW	Non PLN %	Cooperation MW	Cooperation %	Total MW	Total %
I.	Aceh	47.20	0.87	264.10	4.61			311.30	2.78
II.	North Sumatera	398.40	7.31	828.70	14.47			1227.10	10.97
III.	West Sumatera	198.00	3.63	336.60	5.88			534.60	4.78
	Riau								
IV.	South Sumatera	235.90	4.33	313.90	5.48			549.80	4.91
	Bengkulu								
	Lampung					1.70	29.82	1.70	0.02
	Jambi								
V.	West Kalimantan	48.00	0.88	90.30	1.58			138.30	1.24
VI.	South Kalimantan	136.30	2.50	109.60	1.91			245.90	2.20
	Central Kalimantan								
	East Kalimantan								
VII.	North Sulawesi	80.70	1.48	24.90	0.43			105.60	0.94
	Central Sulawesi								
VIII.	South Sulawesi	170.50	3.13	268.10	4.68	2.10	36.84	440.70	3.94
	Southeast Sulawesi								
IX.	Maluku	30.80	0.56	48.10	0.84			78.90	0.71
X.	Irian	32.80	0.60	8.10	0.14			40.90	0.37
XI.	Bali	137.70	2.53	62.10	1.08			199.80	1.79
	West Nusa Tenggara								
	East Nusa Tenggara					1.90	33.33	1.90	0.02
	East Timor								
Java									
	East Java	650.40	11.93	552.60	9.12			1173.00	10.48
	Western Part of Java	3274.90	60.06					3274.90	29.27
	Central Java & Yogja	7.10	0.13	402.60	7.03			409.70	3.66
	Jakarta Raya			758.20	13.23			758.20	6.78
	West Java	4.30	0.08	1691.00	29.52			1695.30	15.15
Indonesia		5453.00	100.00	5728.90	100.00	5.70	100.00	11187.60	100.00

Sources: -DJL, -PLN.

Compared to the electricity tariff in ASEAN countries, the tariff of PLN for the public interest since 1986 has been the least expensive, as provided in Table 3.

In addition to this electric power supply, for the last several years some small-scale private companies have supplied electricity for the public interest, but without a proper operation license. Most of them do not comply with technical and administrative requirements, and many of them have been short-lived long. Their numbers, capacity, and production are therefore not properly known, but it was estimated that in 1985 their capacity reached 58.4 MW[1)]. As the supply still far from meets the requirements, it is not yet considered to comply with the community's demand.

Therefore, in this paper, the private parties' supply figures for public interest are not used in the discussion.

Since the commencement of development in PELITA I (1969/1970) the supply of electric power has gradually grown at a sufficiently high annual rate as indicated in Table 4.

Table 3 Averaged Electricity Fares of Neighboring Countries in 1985 and 1986

Table 3 Averaged Electricity Fares of Neighboring Countries in 1985 and 1986

Name of Companies	Averaged Electricty Fares (RP/kWh)								Exchange Rate	
	Household		Commercial		Industry		Averaged			
	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986
PUB Singapore	94.45	124.61	94.68	122.39	77.87	188.28	86.73	113.38	1 US$ = Sin $ 2,26	1 US$ = Sin$ 2,223
Meralco Philippins	68.96	93.54	133.64	198.21	138.47	196.79	188.31	155.19	1 US$ = 18.62 Pesos	1 US$ = 28,98 Pesos
MEA/PEA Thailand	78.97	98.88	84.16	129.78	74.63	181.68	74.49	182.73	1 US$ = 27.74 Baht	1 US$ = 26.15 Baht
NEB Malaysia	96.63	136.14	112.38	158.34	92.83	111.29	108.87	138.86	1 US$ = Mal$ 2,48	1 US$ = Mal$ 2,56
CLPC Hong Kong	91.50	126.67	86.96	113.54	78.47	111.58	88.76	128.67	1 US$ = HK$ 7,88	1 US$ = HK$ 7,88
KEPCO South Korea	83.37	133.98	178.46	248.34	72.46	181.94	84.87	123.76	1 US$ = 868.5 Won	1 US$ = 881.8 Won
PLN Indonesia	101.99	108.14	165.41	163.78	77.39	72.86	97.82	95.45	1 US$ = RP 1123.-	1 US$ = Rp 1644.-

Table 4 Electricity Consumption Volume and Rate of Growth

Year	PLN		Non PLN		Total	
	TWh	%	TWh	%	TWh	%
1969/1970	1.40	-	1.60	-	3.00	-
1970/1971	1.60	14.29	1.90	18.75	3.50	16.67
1971/1972	1.80	12.50	2.10	10.53	3.90	11.43
1972/1973	1.90	5.56	2.20	4.76	4.10	5.13
1973/1974	2.20	15.79	2.50	13.64	4.70	14.63
1974/1975	2.40	9.09	3.20	28.00	5.60	19.15
1975/1976	2.80	16.67	4.10	28.12	6.90	23.21
1976/1977	3.10	10.71	4.60	12.20	7.70	11.59
1977/1978	3.50	12.90	4.80	4.35	8.30	7.79
1978/1979	4.30	22.86	5.10	6.25	9.40	13.25
1979/1980	5.30	23.26	5.40	5.88	10.70	13.83
1980/1981	6.50	22.64	5.60	3.70	12.10	13.08
1981/1982	7.80	20.00	5.60	0.00	13.40	10.74
1982/1983	9.10	16.67	12.65	125.89	21.75	62.31
1983/1984	10.00	9.89	14.70	16.21	24.70	13.56
1984/1985	11.00	10.00	16.31	10.95	27.31	10.57
1985/1986	12.60	14.55	16.78	2.88	29.38	7.58
1986/1987	14.60	15.87	17.92	6.79	32.52	10.69

Sources: -DJL.
-PLN.

Although there has been rapid progress in the supply of electric power, the consumption is still relatively low for the income per capita. This is obvious from Table 5.

This consumption level is also low compared with the demand. In other words, not all demand for electric power can be met (even though the consumer is able to pay). This is obvious in the high growth rate of PIUKS, the development of electric power supply for public interest which

cannot comply with the standards, as mentioned in paragraph 10.

This condition, frequently called "suppressed demand" is caused by the limitation of the existing supply system both in capacity and coverage.

Table 5 International Indicators of Electricity Consumption, 1981

	GDP/Capita (1981 US$)	Energy Consumption/Capita (kgoe)	Electricity Consumption/Capita (KWh)	Share of Electricity in Total Consumption ($)	Electrification Ratio ($)	Energy Consumption/Unit of GDP (kgoe/$)	Electricity Consumption Unit of GDP (kWh/$)
East Asia							
Philippines	730	260	390	37	43	.36	.53
Thailand	759	238	355	37	41	.31	.47
Korea	1,661	1,180	1,204	26	95	.77	.72
Malaysia	1,793	703	676	24	61	.39	.38
South Asia							
Bangladesh	134	33	33	25	4	.25	.25
India	239	148	191	32	14	.62	.80
Srilanka	295	90	124	34	9	.31	.42
Pakistan	334	167	190	30	24	.50	.57
Mediteranean							
Egypt	584	389	549	35	42	.67	.94
Morocco	710	237	269	28	28	.33	.38
Turkey	1,267	537	577	27	75	.42	.46
Tunisia	1,268	455	463	25	56	.36	.37
Indonesia (1983)*	560	183	99	16	12	.33	.18

*) Including electricity generation from captive power plants.

Source: 1981 power/energy data sheets, World Bank Energy Department, march 1984; and World Bank staff estimate for Indonesia.

2. Policy and Strategy of Electricity Development

Law Number 15 of 1985

To give a legal basis to the increases in the supply of electric power in sufficient and even quantity, with good quality service and at a price within the reach of the community, Law No. 15 of 1985 was enacted on December 30, 1985. The principal provisions of this law stipulate the basis and objectives of electricity development and electricity undertakings, the relationship between the Electric Power Exploitation Authority and Electric Power Exploitation License Holder for Public and the community interest, the requirements of supply and exploitation of electric power, promotion and supervision by the government, as well as criminal sanction and investigation.

The objectives of electricity development

According to Law Number 15 of 1985, the objectives of electricity development shall be to enhance people's prosperity and welfare justly and equally, and to propel the improvement of economic activities.

The principles of electricity development

The electricity development principles shall be:
(1) Advantage, that is, electricity development should be exploited maximally for the people's welfare and prosperity.
(2) Equality and justice, that is, the results of electricity development should be enjoyed evenly by all people.
(3) Self-confidence, that is, all efforts and activities in electricity development should be able to generate self-support and self-confidence.
(4) Electricity development should be performed by observing the balance between natural resources and preservation of the living environment.

The policy on electricity development

The final target of the electricity development shall be the continuous and even electric power service and supply throughout the Republic of Indonesia with sufficient quality and reliability, and in sufficient quantity and at a price within the reach of the community.

Based on the provisions of Law Number 15 of 1985 and the role expected of electric power supply, the policy on electricity development shall be as follows:
(1) Electricity development constitutes an integral part of national development, that is, it should always be harmonious, compatible and synchronous with the phase of national development, meaning that in each national development phase, the electricity development target shall always support the national development target to improve the community welfare and drive the economy.
(2) In the framework of dissemination there shall be an increase in the electric power supply to rural community.
(3) Electricity development constitutes a part of the general policy in the energy sector (KUBE) focussing on the efforts of energy intensification, diversification, conservation and indexation.
(4) In electricity development, domestic goods and services shall be used as much as possible.
(5) Electricity development shall be harmonized with the living environment policy, regional development, and other national-level policies.

The medium-term electricity development target

In accordance with the electricity development policy and the National Development Phasing contained in GBHN (Outlines of State Philosophy), the medium-term electricity development target shall be to provide: electric power supply and service which can support the creation of the basic frame in PELITA IV, to be stabilized later in PELITA V, so that in PELITA VI the Indonesian Nation can take-off to accelerate the development leading to a just and prosperous society based on Pancasila.

The electricity development strategy

All electric development strategies shall be directed to the achievement of the electricity development objectives with the final target of the national electricity development by implementing the electricity development policy.

To direct the activities of all elements in the electric power sub-sector, and serve as a reference for other agencies and the community, the electricity development strategy should clarify the principles of electricity development, such as: quality and reliability, price, dissemination, and others.

Electricity development strategy is a set of mutually supporting strategies, inter alia, on:
(a) supply;

(b) quality and reliability;
(c) price;
(d) institutionalization;
(e) technology;
(f) supplying facilities;
(g) generating energy;
(h) manpower;
(i) equipment;
(j) auxiliary services;
(k) exploitation;
(l) research and development;
(m) study;
(n) engineering and design;
(o) standardization;
(p) regional development;
(q) funding;
(r) management;
(s) arrangement and promotion.

To prepare the appropriate strategy, the electricity role and essence should be identified in order to exploit the electric power maximally for the prosperity of the people. The role played by the electric power sector based on the Electricity Development Policy shall be:

(a) increasing the economic growth;
(b) increasing the community's welfare (supporting the dissemination policy);
(c) serving as a means of energy intensification by exploiting energy sources, including the non-tradable.
(d) serving as an energy diversification means;
(e) supporting energy indexation;
(f) supporting the energy conservation policy;
(g) supporting regional development;
(h) supporting goods manufacturing and electricity services development;
(i) supporting the living environment preservation;
(j) supporting the employment opportunity expansion policy and manpower intake.

The supply strategy has two targets:

(a) to meet the need for electric power, which means that the supply shall always be commensurate with the quantity, quality, and electric power reliability required in each phase of the National Development;
(b) to disseminate electric power consumption, adjusted to the electricity target required in each phase or stage of national development.

Both the electric power demand and dissemination will be affected by: (a) the availability; (b) the supply quality and reliability; (c) the electric power tariff. These in turn will depend on the policy, strategy, and capability of the government and its sets.

The development of electric power supply facilities will require considerable time, beginning with the engineering, design, funding, and construction, as well as all the required procedures. Therefore, in order to supply electric power commensurate with the supply target mentioned above, planning will need to be initiated based on a sufficiently long-term demand forecast, that is, of ten years or more.

The supply strategy is expected to provide a stable direction for the demand forecast composition. For this purpose, it is necessary to stipulate general provisions on quality and reliability, and the price and electric power dissemination target, which should not be based on the internal condition of the electric power sub-sector, which can frequently be questioned, but

on a comparable benchmark.

It is highly recommended that the following principles should apply:

(a) the quality and reliability should be adjusted to the user's requirements, if necessary with a network specialization by types of users for example manufacturing;

(b) the competitive price to the cost of electric power procurement or substitute energy by the prospective users;

(c) the dissemination target shall be stipulated by the Government on the basis of supply coverage and purchasing power of the community the electricity tariff for this community group shall be adjusted to its purchasing power based on the data from the Central Bureau of Statistics.

Based on Law Number 15 of 1985, to achieve the electricity development target an objectives, there should be:

(a) exploitation of the total electricity potentials incorporated in the National Electric Power System (STLN), consisting of: the Sub-System of Electricity Exploitation Authority (PKUK); the Sub-System of Electricity Operation License Holders for Public Interest (PIUKU); and the Sub-System of Electricity Operation License Holders for Self-Interest (PIUKS);

(b) the overall STLN optimization.

The Sub-System of Electricity Exploitation Authority (PKUK) constitutes the STLN back-bone, in the sense that:

(a) PKUK shall supply electric power on behalf of the State pursuant to paragraph 1 Article 4 of Law Number 15/1985;

(b) The services areas of PKUK shall basically cover the entire territory of the Republic of Indonesia;

(c) PKUK shall meet the electric power demand at the price stipulated by the Government;

(d) PKUK shall disseminate the electric power in accordance with the target stipulated by the Government;

(e) PKUK shall carry out government policy on electricity in accordance with the prevailing legislative regulations.

3. Electric Power Demand

The definition of demand for and supply of electric power should be confirmed. The demand for electric power in developed countries will certainly be different from that in developing countries. In a developed country, the electric power supply is able to serve each location throughout the country, but in a developing country only a small part of the country can be reached. In a developed country the people have long recognized and perceived the benefit of electricity, and the consumption of electricity has grown almost to saturation; while in a developing country most of the population have not yet recognized electricity, the consumption level of which is still low, and the growth of which is still soaring. Moreover, there is a difference in viewpoint between the government and the electricity company concerning demand. The government has an interest in meeting the electric power demand in order to support national development targets (for instance, take-off condition), while the electricity companies (particularly PIUKU) are profit-oriented.

The electric power demand depends on several factors, as follows:

(a) the income of the community;

(b) the capability to exploit electric power, such as the electrical appliances and the manufacturing and commercial mechanization level;

(c) the electric power sales tariff;

(d) the availability of electric power for public interest, namely, from PKUK and PIUKU (availability here means that supply meets the quality and reliability requirements).

The income and electric appliances factors shall be determined ("given") by the party outside the Electric Power Sub Sector.

The price and availability factors shall depend on the efforts capability of the Electric Power Sub-Sector. If PKUK and PIUKU cannot supply the electric power for all the necessities, a part of the demand cannot be fulfilled. This condition can also be due to the supply not meeting the quality and reliability requirements. Those with unfulfilled demand will set up their own power generation (PIUKS). This condition also means that supply for public interest will not meet the requirements mentioned earlier. The industrial users whose demand cannot be met by PKUK, either due to the limitation of supply, price, or quality and reliability, can generally meet their needs by establishing their own power generation. Therefore the "suppressed demand" of the manufacturers should be presumed to be small. For the household, commercial, and general users who cannot supply electric power for their own needs, due to the too high cost, space limit, or environmental factors, the "suppressed demand" will be larger. For these users, the government target, strategy and policy will influence their demand.

The problems encountered in the demand forecast composition so far are, inter alia:

(a) limited historical data, particularly on the electricity outside PLN;

(b) to what extent the available historical data constitute the forecast composition means, in view of the fact that the electric power supply in the past was the consequence of "the suppressed demand";

(c) the low electricity consumption level both nationally and regionally will result in instability of the demand pattern; therefore, besides the macro approach, it is extremely necessary to implement a micro approach for each regions and systems;

(d) the growth of the national economic condition, which cannot be separated from the world economic development, is difficult to estimate;

(e) the electricity development strategy and policy which should still be supplemented and clarified.

One of the efforts necessary for an accurate demand forecast composition is to compose an accurate Electricity Development Strategy and Policy. This strategy and policy should also be sufficiently clear to serve as guidelines for all of the electricity elements in planning and implementing their activities.

With a more stable electricity development strategy, the supply and demand forecast composition can also be more stable. The forecast composition methodology of the government will consider the following:

(a) the national situation (not only PLN);

(b) population and settlement;

(c) economic development, particularly manufacturing industries, etc.;

(d) the influence/effect of electricity availability;

(e) the influence/effect of electricity tariff;

(f) physical development;

(g) regional development from market surveys;

(h) the final users' development (and use);

(i) the dissemination target;

(j) energy development in general.

Several studies already implemented, among others, by BAKOREN, PTE, the Directorate General of Electricity and New Energy, BPPT, BATAN, and PLN have revealed several forecasts which can be categorized as follows:

	Electric Power Consumption Year 2000 (TWH)
Low scenario	60 - 75
Medium scenario	75 - 90
High scenario	more than 90

To obtain a picture of the possible electric power development in the future, Table 6 presents an electric power demand forecast based on the outcome of scenario B of the "ENPP Study for Indonesia", which is a medium scenario by the above criteria.

4. Electric Power Supply

As mentioned earlier, the electric power supply strategy shall be:
(a) to meet the electric power demand for all needs throughout the territory of Indonesia;
(b) to expand the electric power consumption.

The constraints encountered in the electric power supply in Indonesia are, inter alia:
(a) the geographical condition of Indonesia, which comprises thousands of islands;
(b) the lay-out gap between settlement areas and energy sources, which causes a problem of energy transportation;
(c) eighty per cent of the people reside in rural areas, spread across the country; and their low consumption level will bring about a distribution problem because they need an extensive network with a low load density;
(d) the limitation of funds;
(e) the limitation of the community's purchasing power generally, which in turn requires a solution in determining the right tariffs to support electric power supply dissemination;
(f) the limitation of trained and qualified personnel in the electricity sector, which requires a serious improvement of manpower (including technicians).

The supply problem is, in short, that of how to comply with the electric power demand: (a) within the coverage of PKUK and PIUKU; and (b) beyond the coverage of PKUK and PIUKU.

Coverage requires a clearer definition. In this paper, coverage means the region/territory where demand for electric power connection with a certain power limit can be met within the normal service period. This area should be defined, inter alia to decide an exploitation are for PIUKU. Each PIUKU should have an exploitation area, where it is given a monopoly but obliged to meet all electric power demand therein. It would be better if the exploitation area of a PIUKU were the same as its potential coverage.

In the coverage area of PKUK and PIUKU, the problem is how to meet the connection demand and render services pursuant to the quality and reliability requirements, so as to prevent the emergence of PIUKS. However, based on the experience of the last several years, the existence of PIUKS cannot in fact be avoided, because:
(a) the quality and reliability requirements cannot be fulfilled by PKUK;
(b) the capability of PKUK in a certain area cannot accommodate industrial requirements in the same area;
(c) the industrial estates are far from the physical coverage of PKUK;
(d) the energy source (for example, steam is used for needs other than electrical power generation);
(e) PUKS is the investment for PMA;
(f) PIUKS applies low cost energy.

For areas outside the coverage of PKUK and PIUKU, the efforts are:
(a) to expand the already existing system coverage;
(b) to build new systems.

In this second item, the cooperatives and private sector participation will serve as PIUKU and PIUKS.

If a demand forecast has been prepared, it is necessary to prepare an investment program for facilities development of electric power supply. The PKUK investment program constitutes an important part, as the electric power supply and dissemination will basically be implemented by PKUK, in conformity with Law Number 15 of 1985. In addition, it is also expected that PKUK can

become the main implementor of the electricity development policy, pursuant to its role as the back-bone of STLN.

The problems in preparing an investment program to achieve the electricity development target effectively and efficiently are:

(a) the uncertainty of funds availability;

(b) the uncertainty of demand, energy prices, and various expense elements.

The preparation of an investment program optimally to provide electric power supply facilities is very important in view of the fact that economic life-time of such facilities can reach thirty years, whereas the construction time (lead time) thereof can reach ten years.

To achieve the electricity development target in line with the electricity development policy effectively and efficiently, a strategy is needed for accurate investment. In view of the limitation of funds, the electric power investment should dim for:

(a) the efficient use of the entire national potential

(b) the optimization of the national electric power system.

In view of the advantages of the interconnection system, such as the large-scale economy, better reliability and load factor, if appropriate, it is necessary to aim for interconnection. Therefore, it is necessary to study possible interconnections among the systems owned by PKUK or PIUKS. If necessary, they can then cooperate to overcome an emergency and to improve reliability and efficiency.

In addition, the effort to exploit the community's potential in achieving the electricity development target includes, among others, giving PIUKS isolated from the system of PKUK the opportunity to become PIUKU, if PKUK cannot yet serve the are in question.

To optimize the National Electric Power System (STLN), it is necessary to develop each system optimally, that is, with a least-cost system.

In general, industrial users utilizing electricity on a large scale have facility funds and sufficient capability. Therefore they are able to supply electric power for their own needs.

Therefore, the supply target by PKUK should mainly be directed to other users who cannot generally supply their own needs for electricity. PKUK is also given the task of supplying electric power for public needs, particularly social needs, and of disseminating electric power. PKUK should certainly make an effort to serve industries to improve their exploitation efficiency, that is, to obtain a large-scale economy and a better load factor. For this purpose, the services of PKUK for industries should be competitive with the supply for self-interest or need.

The factors determining the cooperation among PKUK, PIUKU, and PIUKS are:

(1) the electric power sales/purchase prices;

(2) the right and obligation arrangement between the two parties;

(3) the technical implementation.

Conclusion

From the above, we can draw the following conclusions:

(a) Electric power is useful for production facilities, enhancing life welfare, and supporting the general policy in the energy sector.

(b) Although progressing rapidly, electric power supply in Indonesia is still low compared with the demand.

(c) The demand for electric power depends greatly on the community's income, the electric power sales price, capability of exploiting the electric power sales price, capability of exploiting the electric power, and the electric power availability for public use.

(d) The electric power supply target is to meet the demand for and electric power disseminate it in accordance with the electricity development policy.

(e) To achieve this target effectively and efficiently, it is necessary to exploit all

national potentials, namely, the government, cooperatives, and the private sector.

*) This paper was presented at the Seminar of National Energy III, National Committee of Indonesia, World Energy Conference on July 21-24, 1987 in Jakarta.
1) Source: BPS.

CHAPTER VI
MANUFACTURING INDUSTRY: ANALYSIS AND POLICY*

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I. INTERNATIONAL COMPARISON ON THE INDUSTRIALIZATION PROCESS

According to a publication by UNIDO, in the last decade Indonesia has become one of the largest producers of manufactured products among developing countries.[1]

With a manufacturing value added share of 0.29% in the world in 1981, Indonesia was ranked seventh among developing countries as shown in Table 1.

Table 1 Survey of Manufacturing Activity in Selected Developing countries

(unit: %)

	Contribution to World Mfg Value Added.		Share of Mfg Value Added in G.D.P.		Average Annual Rate of Growth
	1973	1981	1973	1981	1973-1981
Brazil	1.99	2.41	29.68	28.16	6.2
Mexico	1.08	1.47	23.13	23.48	6.9
India	0.79	0.91	16.48	17.16	5.1
Korea, Republic of	0.25	0.52	23.83	33.79	13.4
Argentina	0.74	0.51	32.63	25.82	−0.8
Turkey	0.73	0.39	20.02	18.64	3.4
Indonesia	0.12	0.29	7.61	12.92	14.6
Philippines	0.22	0.28	25.76	25.66	6.6
Thailand	0.13	0.23	17.54	20.82	10.9
Pakistan	0.13	0.17	17.42	18.38	6.5
Singapore	0.08	0.13	26.71	27.62	10.0

Source : T. M. Roepstorff, Industrial Development Indonesia, Bulletin of Indonesian Economic Studies, Vol.21, p.33 1985.

Around a decade earlier, Indonesian manufacturing accounted for only a 0.12 percent share of world manufacturing value added, and was ranked seventeenth. Clearly, the Indonesian manufacturing sector has expanded rapidly in the last decade.

The share of manufacturing value added in the Indonesian GDP increased from 9.6 percent in 1973 to 10.8 percent in 1981 according to the Central Bureau of Statistics (BPS) of Indonesia. However, this share of manufacturing is much smaller than those in neighboring developing countries, i.e, Philippines (25.7%), Thailand (20.8%) and Singapore (27.6%) (UN Statistics). The share is even smaller than that of India (17.7%), Turkey (18.6%) and Pakistan (18.4%).

This is evidence of the relatively low level of Indonesia's industrialization stage. Some aspects of Indonesian manufacturing industrial development will be further examined by comparison with other ASEAN countries, using the International Input-Output Table for ASEAN countries of 1975 compiled by Institute of Developing Economies in Japan.

1. International Comparison of Sectoral Structure

Using an International Input-Output Table for ASEAN Countries, sectoral structure in terms of value added share for each country is shown in Table 2.

Table 2 Sectoral Structure of Value Added
in Million US $, and %

	Indonesia	Malaysia	Philippines	Singapore	Thailand
1. Agriculture	8,532 (26.04)	1,598 (19.07)	4,256 (26.93)	127 (2.48)	4,148 (24.31)
2. Mining	6,141 (18.74)	289 (3.56)	413 (2.61)	6 (0.12)	255 (1.49)
3. Manufacturing	4,754 (14.51)*	2,269 (27.93)	3,064 (19.93)	1,883 (36.82)	3,771 (22.10)
4. Others	13,342 (40.72)	3,969 (48.85)	8,070 (51.07)	3,098 (60.58)	8,888 (52.09)
Total	32,769 (100.00)	8,125 (100.00)	15,803 (100.00)	5,114 (100.00)	17,062 (100.00)

Source: Institute of Developing Economies, International Input-Output Table for ASEAN Countries 1975, Tokyo, 1985.

*) This share seems high compared to the National Income Statistics, which are only around 8.9 % based on current prices and 11.1 % based on 1973 constant prices.

In Table 2, the mining sector of Indonesia holds a very high share compared with other countries.

The Indonesian agricultural sector also has a comparatively high share among ASEAN countries. The high shares of these two sectors reduce the share of manufacturing sector in Indonesia. If Indonesia produced little oil and gas, as do the other ASEAN countries, its manufacturing share would be much larger than the present one .

Therefore, it may be misleading simply to compare the share of Indonesian manufacturing sector with those of other countries. The share of Indonesian agricultural sector (26.0%) ranks second to that of Philippines (26.9%), and is a little higher than that of Thailand (24.3%). However, we should note that Philippines and Thailand have a very small mining sector, 0.1 % and 1.5 %, respectively.

On the contrary, Indonesia has large share of mining, 18.7 %. If Indonesia's production of oil and gas were very small, the share of the agricultural sector would be much larger than at present.

Similarly, the share of manufacturing would be higher though still smaller than those of Malaysia, Philippines, Thailand, and Singapore.[3)]

Mining activity in Indonesia is, as explained, very high compared to other ASEAN countries. Despite of the high share of mining, specifically oil, in the GDP, it should be noted that the oil and gas sector's "backward linkage" is one of the lowest. (Linkage analysis will be discussed in more detail later). Low backward linkage means low incentive compared to other industries. Of course, this is not intended to be little the contribution that oil has made to the development process of Indonesia.

2. Structural Characteristics of The Manufacturing Sector

In this section we will analyze in more detail the characteristics of the Indonesian manufacturing sector. For the shake of analysis, total output and value added of each manufacturing industry in Indonesia will be compared with those of other ASEAN countries.

Total Output

The Indonesian manufacturing sector is the largest among the five ASEAN countries. As is shown in Appendix 1, in 1975 Indonesian manufacturing activities in terms of total output were approximately double those of Singapore and Malaysia, and 1.4 times larger than that of Philippines and Thailand.

However, more than half of the Indonesian manufacturing output consists of consumption goods, such as food and textiles. Appendix 2 shows that the Indonesian food industry has a 53.9 % share in total manufacturing, the highest figure among ASEAN countries.

In other countries the food industry does not exceed fifty percent. Shares of machinery and metal products in Indonesia, on the other hand, are the lowest among ASEAN countries: 2.4 % for machinery and 3.6 % for metal products.

Appendix 3 shows the distribution of manufactured products among four ASEAN countries. Indonesian share of total manufacturing sector is 29.9 %.

The Indonesian transport equipment industry, where two thirds of input is derived from motor vehicle assembly and motorcycle manufacturing, is conspicuously high among ASEAN countries (45.93%).

The composition of manufacturing output in developing countries has drastically changed between 1963 and 1975 as a UNIDO report points out.[4)]

According to UNIDO, with the exception of plastic products, all branches of light industries declined in importance in this period. These declines were compensated by gains in heavy manufacturing, especially in industrial chemicals, petroleum, refinery, machinery and transport equipment. In the case of the transport equipment industry, the share of output in the manufacturing sector of all developing countries increased to 7.6 % as a result of industrialization between 1963 and 1975. Approximately the same is true of the share of the transport equipment industries of ASEAN countries as seen in Appendix 2.

It is notable that Indonesian output of transport equipment is almost half that of total ASEAN output and is 11% of its total domestic manufacturing output. Table 3 shows the output composition of the transport equipment industry in Indonesia.

Table 3 Output Composition of Transport Equipment Industry in 1983 (%)

	(%)
Shipbuilding	13.1
Motor Vehicle, assembly	38.1
Motorcycle	36.9
Bicycle	18.4
Motor, Vehicle, body and equipment	5.4
Others	5.5

Source: Biro Pusat Statistik, *Statistik Industri* 1983.

As shown in Table 3, motorvehicle assembly and motorcycle products have occupied two thirds of the output of transport equipment industry in Indonesia. The food product industry in Indonesia also has an above average share (38.7%), whereas other manufactured products (12.2%), machinery (13.0%), petroleum and petroleum products (16.2%) and metal products (17.0%) are in the lowest group, far below the average ASEAN sectoral composition.

Value Added

The significance of a country's manufacturing sector can be seen in the mere size of its value added. The Indonesian manufacturing sector total value added shown in Appendix 4 is the largest figure among the five ASEAN countries.

The ratio of value added should be particularly noted. Appendix 4 shows that Indonesian value added is 2.1 times larger than that of Malaysia, whereas Indonesian total output is 2.7 times larger than that of Malaysia, as we also observed in Appendix 1. This difference can be explained by two factors; i.e., value added ratio of each industry (Appendix 5) and output composition (Appendix 2), which differ considerably between these two countries.

Another perspective of the manufacturing sector, which also serves to reflect the level of industrialization, is gained by using the idea of value added with Hoffmann's ratio.

Hoffmann proposed to divide the manufacturing industry into two groups, namely, consumption and capital goods. According to Hoffmann's analysis of actual data for more than twenty countries, the consumption good industry is a leading sector at the early stage of industrialization. However, compared to capital goods, its share gradually diminishes as industrialization develops. Evidence of the above rule was commonly found in the industrialization process in almost every country. Hoffmann then proposed ratios to classify four stages of industrialization as follows.

Table 4 Hoffmann's Ratio for ASEAN Countries Using a Value Added Basis

Country	Ratio of Industrial Consumption Goods Value Added Over Industrial Capital Goods Value Added
Indonesia	3.2
Malaysia	2.0
Philippines	4.1
Singapore	1.1
Thailand	3.2
ASEAN average	2.7

Source: Institute of Developing Economies [1982]

Table 4 shows Hoffmann's ratio for ASEAN countries based on Appendix 6.6)

Hoffmann's rule may oversimplify the structure of the economy. However, it may be still useful for an overview of the development stage. According to Hoffmann's rule, Philippines is in the first stage of industrialization. Indonesia and Thailand are in the second stage, which Malaysia and Singapore are found in the third stage.

II. INDUSTRIAL DEVELOPMENT

1. Value Added, Employment and Industrial Growth

The Structure of Value Added

Industrial growth during the 1970's diversified the structure of the manufacturing sector. Sectors such as iron and steel, electric machinery, and fabricated metal products, for example, which were relatively capital intensive, had a very high growth rate as seen in Table 5. The sectors which were related to the agriculture sector, i.e., food products, beverages and tobacco accounted for 63.8% of total manufacturing value added in 1971, and then declined to 31.7% in 1980. The important contribution of the textile industry in the early 1970's also declined slightly by 1980.

On the contrary, chemicals, wood products, transport equipment, other non-metallic mineral products, electrical machinery, rubber products, fabricated metal, iron and steel products exhibited a high growth rate, and thus, gained higher shares of total manufacturing value added.

Domestic markets for most of the consumer goods were saturated after 1975. Consistent with the trend in NICS, especially after 1978/1979 with ample foreign exchange earnings from the oil boom, industrial development took place more in upstream basic industries, machinery and component manufacturing industries producing spare parts for automobiles, motorcycles and airplanes.

Thus, the pattern of structural change within manufacturing sectors entailed a gradual shift from consumer goods to intermediate and capital goods. The share of consumer goods in total manufacturing declined from 80.8% in 1971 to 47.6% in 1980. Shares of intermediate and capital goods sectors dramatically increased from 13.1% in 1971 to 35.5% in 1981 and from 6.1% in 1971 to 16.9% in 1981, respectively. The main sources of industrial growth were increases in domestic demand and import substitution activities which had taken place during this period. With the development of the consumer goods industry, markets for intermediate and capital goods grew. That situation in combination with the environment or investment climate in the period fostered the development of intermediate and capital goods industries relative to consumer goods industry.

Light consumer goods such as food, beverages and cigarettes showed a slower growth rate, while new, more capital and technological intensive industries producing intermediate, durable consumer and capital goods, such as iron, steel, and machineries, developed with higher growth rates to satisfy the increasing demand.

Table 5 Structural Changes of Value Added in Selected Manufacturing Sectors 1971 and 1980

ISIC Code	ISIC Description	Share of Total[a] 1971 (%)	Share of Total[a] 1980 (%)	Average Annual Growth of MVA 1970-1981[b] (%)
Mainly Consumer Goods		80.8	47.6	-
3110	Food Products	33.9	11.1	13.61
3130	Beverages	2.0	1.5	9.26
3140	Tobacco	27.9	19.1	9.64
3210	Textiles	13.2	12.4	10.83
3220	Wearing apparel (except, footwear)	0.1	0.4	12.56[c]
3240	Footwear (except rubber or plastic)	0.6	0.8	9.05
3320	Furniture, except metal	0.3	0.2	18.72[d]
3420	Printing and publishing	2.0	1.5	34.32[c]
Mainly Intermediate Goods		13.1	35.5	-
3230	Leather products	0.3	0.2	31.48[d]
3310	Wood products, except furniture	1.4	7.0	19.15
3410	Paper and products	2.0	1.5	14.73
3510	Industrial Chemicals	0.8	4.3	19.62
3520	Other chemicals	3.8	7.1	4.53
3550	Rubber products	1.3	4.8	22.21
3560	Plastic products	0.5	0.7	33.23[d]
3620	Glass and products	0.5	1.1	17.56
3690	Other non-metallic mineral products	2.5	5.9	27.79
3710	Iron and Steel	-	3.1	51.35
Mainly Capital Goods		6.1	16.9	-
3810	Fabricated metal products	2.3	3.5	18.86
3820	Machinery, except electrical	0.4	1.6	19.01
3830	Machinery electric	2.5	5.3	29.20
3840	Transport equipment	0.9	6.4	7.31
	Total manufacturing	100.0	100.0	11.88

[a] Based on Rp in current prices
[b] Based on constant 1975 prices
[c] 1970-75
[d] 1970-76

Note: Figures in this table sometimes are significantly different from the ones obtained from input-output tables used throughout in this paper due to differences in definition.

Source: Roepstorff [1985]

Employment Structure

According to official statistics, small and cottage scale industry in Indonesia together accounted for 87% of total manufacturing employment in 1974-75 and for 80% in 1979.

Table 6 Number of Establishments, Employment and Value Added in Manufacturing Sector

	Number of Establishment		Employment (persons)		Value Added (billion Rp)	
	1974/75	1979	1974/75	1979	1974/75	1979
Large and Medium	7,091 (0.55)	7,960 (0.52)	661,704 (13.49)	870,019 (19.39)	476.9 (77.86)	1,660.5 (77.62)
Small	48,186 (3.74)	113,024 (7.33)	343,240 (7.00)	827,035 (18.41)	53.0 (8.65)	187.3 (8.76)
Cottage	1,234,511 (95.91)	1,418,802 (92.14)	3,899,856 (79.55)	2,794,833 (62.22)	82.5 (13.47)	291.4 (13.62)
Total	1,289,788 (100.0)	1,538,786 (100.0)	4,904,800 (100.0)	4,491,887 (100.0)	612.5 (100.0)	2,139.2 (100.0)

Large =100 or more Small =5 to 19 persons
Medium=20 to 99 Cottage=less than 5

Sources: Biro Pusat Statistik

As shown in Table 6, the small and cottage scale establishments absorbed most of the laborers in the manufacturing sector, but contributed very little to total value added. On the contrary, the large and medium firms employed only 19% of the manufacturing laborers, but contributed 78% to the total value added in this sector in 1979. The share attributed to small manufacturing firms is 18% in terms of employment and 9% in value added, while the cottage industries absorbed 62% of the laborers and contributed more than 13% overall value added in manufacturing sector.

These, data clearly show that the large and medium manufacturing establishments in Indonesia contributed significantly to value added, while small and cottage scale manufacturing industries have absorbed more labor than the large and medium scale industries.

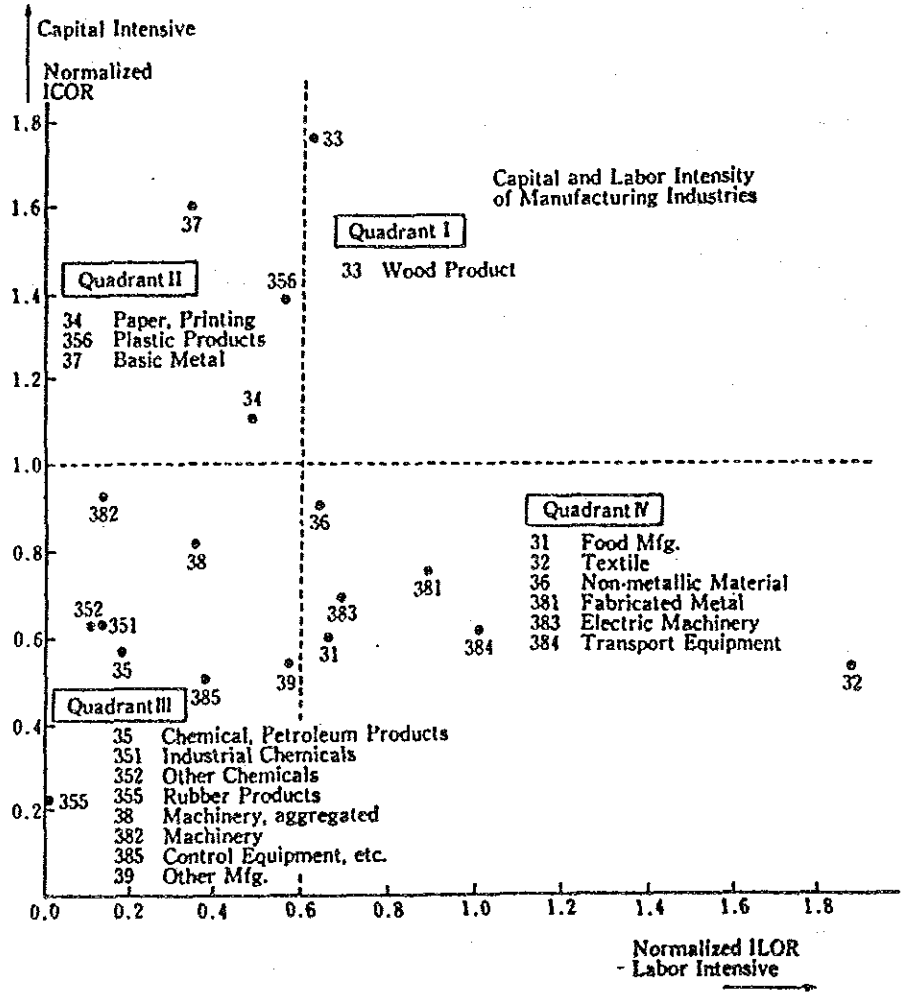
The small and cottage scale establishments, which accounted for only slightly more than 20% of manufacturing value added, have played an extremely role in the employment of laborers. This extreme heterogeneity which exists between value added and employment in the manufacturing industry is a characteristic feature of that sector in Indonesia. Depending upon the actual situation, employment promotion might be better oriented to the small and cottage scale sectors, while growth oriented policy might be more wisely focused on the large and medium firms in the modern sectors. Under such circumstances, policy makers might find themselves in a dilemma over employment and growth.

2. Capital and Labor Intensity

Capital and labor intensities are useful measures for analyzing the characteristics of industries and establishing development strategies. In the case of Indonesia, the incremental capital output ratio (ICOR) and the incremental labor output ratio (ILOR) are available for manufacturing industries from the Indonesia Ministry Industry.[7] The following analysis will be based on these data. ICOR is defined as the ratio of investment with changes in output with some time lag. Likewise with ILOR as the ratio of changes in labor with changes in output.

Appendix 8 is calculated to compare ICOR and ILOR for each manufacturing industry. Also, ICOR and ILOR have been normalized with the average of unity and shown in Figure 1. The area in Figure 1 is divided into 4 quadrants with the boundary lines 1.0 for ICOR and 0.6 ILOR. The choice of these boundary lines is purely a matter of convenience.

Figure 1 Normalized ICOR and ILOR of Indonesian Manufacturing Industries



In the case of developing countries, savings for capital accumulation are generally scarce and most capital goods must be imported from abroad. Therefore, less capital intensive industries are desirable in terms of availability of savings and limitations of foreign exchanges. On the other hand, labor intensive industries are desirable to developing countries, where large surpluses of labor exist.

From this point of view, the most desirable industries are classified in quadrant IV of Figure 1, where industries are less capital intensive and more labor intensive than the industrial average. These industries are, namely, textile, transport equipment, fabricated metal, electric machinery, food manufacturing and non-metallic mineral. Among these, the textile industry has a significantly high ILOR, i.e., 2,605 person per Rps 1 billion, and its ICOR is one

of the lowest. Therefore, the textile industry is especially suitable for the industrialization of the country. Industries in quadrant III are neither labor intensive nor capital intensive. These industries include chemical and petroleum products (industrial chemicals, other chemicals and rubber products), machinery (control equipment) and other manufacturing.

These industries may also be desirable. However, their labor requirement is smaller than industries in quadrant IV. Industries in quadrant II are more capital intensive and less labor intensive. Industries in quadrant I are more capital intensive as well as more labor intensive. In that quadrant, only the wood product industry is included. Industries in quadrant I and II may not be desirable in terms of ICOR and ILOR. However, some of these industries are exporting their products intensively. Therefore, we should keep in mind that evaluation by ICOR and ILOR is only one method of evaluation. Others are still useful and necessary. Industry in the quadrant I includes wood products, while industries in the quadrant II include basic metals, plastic products and paper printing. Industries in the quadrant III are neither labor intensive nor capital intensive.

As we observed, the transportation equipment industry had a relatively significant role in Indonesia in terms of output among ASEAN countries and its capital and labor intensity seems desirable. The rubber product industry also performs well in terms of export, and the normalized ICOR of this industry (0.226) is the lowest of the Indonesian manufacturing industries. However, the normalized ILOR is also the lowest (0.026). Therefore, unlike the transportation equipment industry, much employment may not be expected from this industry.

III. INTERNATIONAL LINKAGE ANALYSIS FOR MANUFACTURING SECTORS

1. International Input-Output Table Framework

Figure 2 International Input-Output Table

Export \ Import	Sector	Country A 1 ····· n	Country B 1 ····· n	Country C 1 ····· n	Final Demand	Total Output
Country A	1 ⋮ n	X^{AA}	X^{AB}	X^{AC}	F^{A}	X^{A}
Country B	1 ⋮ n	X^{BA}	X^{BB}	X^{BC}	F^{B}	X^{B}
Country C	1 ⋮ n	X^{CA}	X^{CB}	X^{CC}	F^{C}	X^{C}
Gross Value Added		V^{A}	V^{B}	V^{C}		
Total Input		X^{A}	X^{B}	X^{C}		

An input-output table for a country describes inter-industrial transactions among its domestic industries. However, transactions between domestic industries and foreign countries (or outside regions) are treated in lump sums under the names of import and export. Therefore, this table does not clarify to which foreign industry the export is done and from which country (or region) the import is done. In order to analyze international (or inter-regional) trade in terms of international division of labor and interdependent economic relationship, the input-

output relationship should be clarified by industry as well as by country. An International (inter-regional) input-output table, Figure 2, has been formulated for the analysis.

Hatched areas X^{AA}, X^{BB} and X^{CC} in Figure 2 correspond to domestic input-output tables of countries A, B and C, respectively. X^{AB} and X^{AC} are exports of country A to countries B and C, X^{BA} and X^{CA} are imports country A from countries B and C. In other words, areas X^{RS} (R not equal S) correspond to trade matrices. Final demands F^{A}, F^{B} and F^{C} are each country's final demands. Therefore, X^{A}, X^{B} and X^{C} in the right hand column are each country's total outputs. Finally, V^{A}, V^{B} and V^{C} are gross value added in each country.

2. International Dependency of Industrial Development

International Dependency

Let us suppose that final demand occurs in country A. To satisfy this final demand, direct and indirect demands, are induced according to the technological structure of the country A's industries. These direct and indirect demands will first affect domestic industrial activities. Further, if domestic supply cannot sufficiently meet these demands, imports (competitive imports) are induced from country B and other countries. In another case (non-competitive imports), let us suppose that final demand for product P (automobile, for example) occurs in country A. To produce this product P, parts Q (diesel engine for automobile) are required due to the technological structure in country A. Since parts Q are not produced in country A, and they are produced in country B, import of parts Q from country B is induced by country A.

In either case, final demand of country A will affect economic activities of all industries in country A, as well as B and other countries. In others words, final demand of a country relates directly and indirectly to each country's industrial activities.

W. W. Leontief and W. Isard formulated an international (inter-regional) input-output model. By applying this model to the problem stated above, we can determine how much ultimate demand will be induced in each country by the final demand of a country. Therefore, this model clarifies quantitatively the degree of international dependence of industries.

Let us suppose that production of industry i in country A depends on final demands of countries A, B and C. Then K^{AA} K^{AB} and K^{AC} represent factors in showing how industry i ultimately depends on these final demands. These ultimate degrees of dependence are defined as:

$$K_i^{AA} = \left(\sum_{j=1}^{n} b_{ij}^{AA} f_j^{A} \right) \Big/ X_i^{A}$$

$$K_i^{AB} = \left(\sum_{j=1}^{n} b_{ij}^{AB} f_j^{B} \right) \Big/ X_i^{A}$$

$$K_i^{AC} = \left(\sum_{j=1}^{n} b_{ij}^{AC} f_j^{C} \right) \Big/ X_i^{A}$$

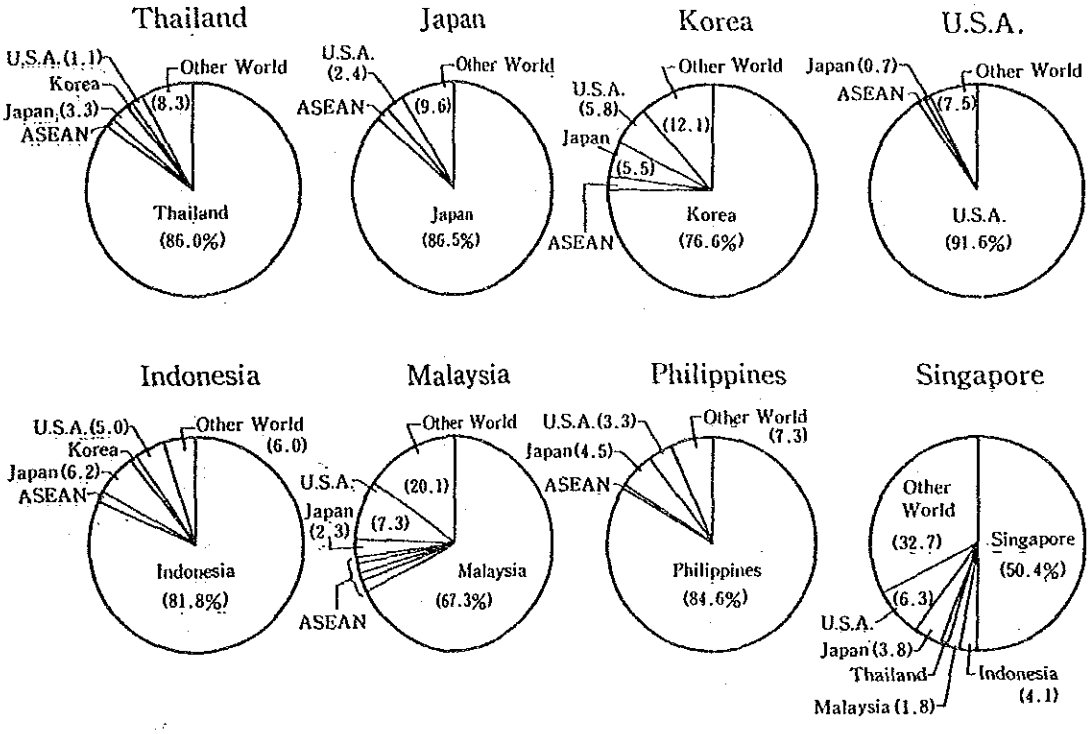
The term b_{ij}^{RS} is an element of Leontief inverse matrix of the international (inter-regional) input-output model. The term f_j^{R} shows final demand of product j in country R and X_j^{R} shows production of industry j in country R.

Figure 3 shows how each country's total production depends ultimately on domestic and foreign final demands. This figure is determined from the international input-output table for five ASEAN countries, Japan, USA and Korea. As shown in Figure 3, Singapore has the highest ultimate degree of dependence of its total production on foreign final demand (49.6%). The second highest country is Malaysia (32.7%). The third is Korea (23.4%) and the lowest is USA (8.4%).

Singapore's dependence on foreign countries is close to 50%. The Singapore domestic economic condition is, therefore, affected considerably by the world business cycle. Any protectionistic

tendency in the world market due to this business cycle actually amplifies the damage into the economy of that country. At the same time, domestic economic policy only has a small influence on Singapore's economy. Such a country must strengthen international competitiveness of its domestic industries. In contrast, USA and Japan have approximately 90% dependence on their own final demands. These two most industrialized countries have highly interrelated industries within their own borders.

Figure 3 Ultimate Degree of Dependence of Total Outputs in the Eight Countries on Final Demands of Each Country



Malaysia's dependence on foreign demand is greater than 30%, which is the next highest to that of Singapore. Foreign dependence of Indonesia is slightly below 20%. This percentage is relatively low among ASEAN countries. Thailand and Philippine have similar foreign dependence, around 15%. These three countries are, not as exposed to foreign economies as Singapore and Malaysia.

The industrialization strategy for Indonesia, Philippines and Thailand emphasize export promotion to industrialized countries, such USA and Japan. Korea has 5.5% and 5.8% of its gross output generated by final demands of Japan and USA, respectively. Additionally, it should be noted that intra-ASEAN economic activities are still small.

As is shown in Figure 3, the ultimate degree of interdependence of total output among ASEAN countries is very small except for Singapore. Each ASEAN country's ultimate dependence on other ASEAN countries is smaller than their dependence on USA and Japan. The Indonesian ultimate degree of dependence is shown in detail in Appendix 7. The data in Appendix 7 show that Indonesia depends less on the other four ASEAN countries than on Japan and USA for all products except rubber products, for which dependence on Japan is minor. The Indonesian ultimate degree of dependence on domestic final demand is generally high at more than 90%, excluding petroleum and rubber products. Petroleum depends especially on Japanese demand (27.8%) and rubber depends

mainly on American demand (39.85%).

Export structure

Almost all ASEAN countries export their manufacturing products to USA and Japan more than to other ASEAN countries. Table 7 shows the ASEAN countries' percentage of exports to other ASEAN countries as well as to Japan, Korea and USA. Korea, USA and Japan are conspicuously large in their share. Again, intra-ASEAN trade of manufactured products is very small.

Table 7 Exports of Manufacturing Products of ASEAN Countries in 1975 (%)

To From	Indonesia	Malaysia	Philippines	Singapore	Thailand	Japan	Korea	U.S.A.	Total
Indonesia	—	1.28	0.05	22.01	0.31	41.73	0.75	33.85	100.00
Malaysia	0.93	—	0.33	19.29	1.65	16.08	6.01	55.71	100.00
Philippines	1.02	0.32	—	1.66	0.52	42.79	1.16	52.54	100.00
Singapore	24.65	11.72	0.60	—	3.40	25.64	0.33	33.66	100.00
Thailand	2.80	7.26	2.71	7.85	—	52.30	1.87	25.21	100.00

Source: Institute of Developing Economies [1982]

Nevertheless, the inter-ASEAN trade is worth analyzing as it sheds light on the potential for expansion of Indonesian exports.

In order to analyze intra-ASEAN trade, coefficients on intensities of export and import linkage of each country will be introduced. In the case of Indonesia, intensity of import linkage is an indicator which depicts the degree of Indonesia's importance to the other ASEAN countries as a supplier of a product. By way of example, take food as an example in Thailand. Appendix 9 shows that around 47.83% of all food imported by Thailand from other ASEAN countries originates from Indonesia. Percentage calculated in this manner is called the intensity of import linkage (IIL) between these two countries.

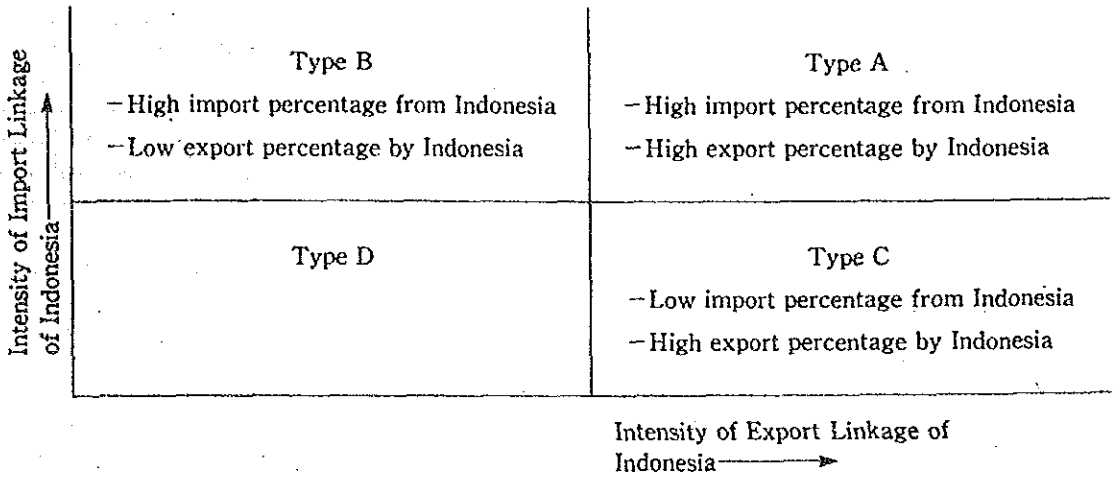
Intensity of export linkage defined by commodity is an indicator which reflects the degree of the other ASEAN countries' significance to the Indonesian economy. In the example above, 9.8% of all food exported by Indonesia to other ASEAN countries is imported by Thailand. Percentage calculated in this manner is called the intensity of export linkage (IEL) between two countries.

These coefficients can be defined both by commodity and by types of demand, i.e., food product for intermediate demand, or textile for final demand, and so on.

Usage of these coefficients for international economic analysis will be demonstrated with Figure 4.

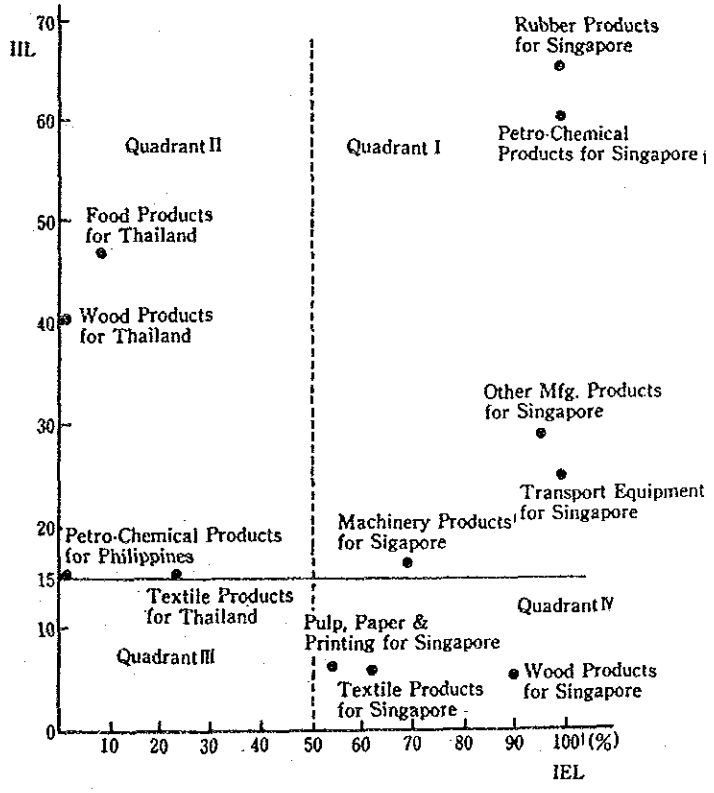
The presence of Indonesia exports in international trade and thus in type A, B and C countries is, in some manner, an indication of the competitiveness of Indonesian products. This product can also be promoted to type D countries. Type A and B countries are, of course, very important customers that rely largely on imports from Indonesia. This is also a source of variation in export earnings of Indonesia if the economy of that type A country happens to have some fluctuations. For a better indication of competitiveness, several other factors need to be considered, such as performance of Indonesian exported products over time, prospect of world competition, etc.

Figure 4 Intensities of Export and Import Linkages



Note : In Figure 4 countries are categorized into 4 types: A, B, C and D.

Figure 5 Intensities of Export and Import on Indonesian Commodities



Classification of Indonesian Commodities with respect to International Trade for the Partner Countries

	for Singapore	IIL	IEL
Quadrant I. (IIL High) (IEL High)	Rubber Products	65.41%	99.97%
	Petro-Chemical	61.77	95.20
	Other Mfg.	29.64	94.18
	Transport Equip.	25.47	100.00
	Machinery Products	17.41	69.16
	for Thailand	**IIL**	**IEL**
Quadrant II. (IIL High) (IEL Low)	Food Products	47.82	9.83
	Wood Products	40.48	1.99
	Textile	16.20	24.00
	for Philippines		
	Petro-Chemical	16.36	2.30
	for Singapore	**IIL**	**IEL**
Quadrant IV. (IIL Low) (IEL High)	Wood products	5.90	90.64
	Textile	6.27	61.97
	Paper, Pulp & Print	7.24	56.52

Figure 5 and the accompanying data show the classification method for A, B, C and D. Since each product type attached to the country name, we can see which products have high intensity of import and export linkage for these countries. It is should be noted that Singapore is in Quadrant I in this figure. Yet, products exported to Singapore might be reexported to others countries as well.

The intensities of import and export linkage calculated above are based on the total of intermediate and final demands, excluding changes of inventories. However, export and import are analyzed in more detail by classifying them into two groups. One group is the commodity exported and imported for final demand (excluding changes of inventories), and the other group is that of intermediate demand use. We do not perform analysis concerning the distinction between intermediate and final demands. Interested readers may further analyze the intensities based on data shown in Appendix 8.

3. International Comparison of Inter-Industrial Linkage

In the industrialization process of developing countries, investment in new industries have two kinds of repercussion effects. First, investment in a new sector, occurring from the purchase of another sector's products as intermediate goods, stimulates other sector to increase their production. This effect is called backward linkage. Second, investment in a new sector provides intermediate goods for other user production. Thus, other sectors are induced to increase their production. This is called forward linkage. Therefore, concentrating investment on sectors which have high forward and backward linkages can accelerate industrialization of developing countries.

We can identify the important industrial sectors for economic development by reference to the backward and forward linkage multipliers. And, of course, we should consider cost and efficiency aspects to complement this linkage analysis, so as to avoid inefficiency in the development process.

In this section, we analyze characteristics of industries in each country by international comparison of the linkage coefficients calculated by the Japan-USA-ASEAN International input-output model.

The backward linkage coefficient, which indicates relative size of backward linkage of an industry, can be expressed as follows:

$$B_j^s = \frac{\sum_{r=1}^{k} \sum_{i=1}^{n} b_{ij}^{rs}}{(1/nk) \sum_{r=1}^{k} \sum_{s=1}^{k} \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij}^{rs}}$$

Where k is the number of countries.

The numerator of this equation is a vertical sum of j th column elements of the Leontief inverse matrix. The denominator is average of the vertical sums of all industries. In the same manner forward linkage can be expressed as:

$$D_i^r = \frac{\sum_{s=1}^{k} \sum_{j=1}^{n} b_{ij}^{rs}}{(1/nk) \sum_{r=1}^{k} \sum_{s=1}^{k} \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij}^{rs}}$$

Linkage coefficients provide useful information to identity important industries for economic development policy. In the case of the international input-output table, the average of linkage coefficients of all industries in all countries is unity.

Therefore, in some countries the average of linkage coefficients of all industries is more than unity, and in other countries it is less than unity.

Here, let us compare backward linkage coefficients of manufacturing industries calculated by the ASEAN-Japan-Korea-USA international input-output table.

Table 8 shows that backward linkage coefficients of all industries are more than unity in Japan, USA, Korea and Singapore and less than unity in the four ASEAN countries.

Table 8 International Comparison of Backward Linkage Coefficients for Manufacturing Industries, 1975

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Japan	Korea	U.S.A.
Food Manufacturing	1.033	1.070	1.125	1.157	1.090	1.320	1.224	1.642
Textile and Its Products	1.202	1.124	1.234	1.068	1.186	1.386	1.496	1.166
Wood and Wood Products	1.024	0.913	1.099	1.289	1.014	1.281	1.259	1.055
Pulp, Paper and Printing	0.948	0.983	0.936	1.002	1.003	1.356	1.276	1.049
Chemical	1.024	1.141	1.058	1.220	1.059	1.377	1.303	1.100
Petro-chemical	1.050	0.599	0.696	0.680	0.642	0.803	0.726	1.378
Rubber Products	1.132	1.020	1.170	1.529	1.048	1.276	1.395	1.105
Non-ferrous Mineral Products	0.899	0.916	1.086	1.112	1.029	1.211	1.118	1.041
Metal Products	1.131	1.031	1.201	1.203	1.180	1.453	1.575	1.187
Machinery Products	1.015	1.084	1.216	1.169	1.105	1.360	1.328	1.058
Transportation Equipments	1.081	1.163	1.215	1.114	1.193	1.435	1.334	1.218
Total Economy Average	0.886	0.874	0.952	1.040	0.910	1.159	1.075	1.104

Note: In deriving the linkages, the above countries are interlinked together, while the rest of world is treated as exogenous.

Source: Institute of Developing Economies [1982]

In descending order of backward linkage coefficients are Philippines,Thailand, Indonesia and Malaysia. In general, the more a country is industrialized, the higher the average of backward linkage coefficients of all industries becomes.

Now let us look at the backward linkage coefficients in the main sectors of manufacturing industry in the five ASEAN countries. In the food sectors Singapore has highest coefficient, followed by Philippines, Thailand, Malaysia and Indonesia, in that order. In the textile and textile products sector, Philippines has the highest coefficient, followed by Indonesia, Thailand and Malaysia and Singapore. In the chemical sector, the highest is Singapore, then Malaysia, Thailand, Philippines and Indonesia follow. In the petrochemical sector, Indonesia stands out, followed by Philippines, Singapore, Thailand and Malaysia. In metal products, Korea has the

highest backward linkage coefficient; Singapore comes first among the five ASEAN countries, followed by Philippines, Thailand, Indonesia and Malaysia. In both the machinery products and transaction equipment sector, Philippines has the highest and Indonesia has the lowest coefficient. Singapore, Thailand and Malaysia are ranked in between those two countries. However, in the transport equipment sector, Thailand, Malaysia and Singapore rank in descending order.

In Japan, the sectors which have the highest backward linkage coefficients among the eight countries are pulp, paper and printing, chemical, non-ferrous mineral, and machinery products. Additionally, the transportation equipment, and machinery product sectors have conspicuously high coefficients. These large values correspond with the fact that these sectors led Japan's economic growth during 1970's.

USA has two sectors, food manufacturing and petrochemicals, which hold the position of highest backward linkage coefficient among the eight countries. The pulp, paper and printing and transportation equipment sectors have the third largest coefficients. Chemical, non ferrous mineral, and metal products sectors both have the fifth largest coefficients. Coefficients of the textile and textile products sector are sixth and seventh among the eight countries.

The aforementioned observation helps to explain the background of the 1970's economic situation in high chemical, metal products, machinery and other sectors contributed to the development of Japan and certain NICs, such as Korea and Singapore. Stagnation in the US economy in the 1970's, to a certain degree, might be a reflection of these observations.

Next, let us internationally compare forward linkage coefficients in Table 9. The forward linkage coefficient is a supplementary factor to the backward linkage coefficient. The forward linkage coefficient indicates how strongly an increase in production of a sector stimulates production in other sectors.

Table 9 International Comparison of Forward Linkage Coefficients for Manufacturing Industries, 1975

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Japan	Korea	U.S.A.
Food Manufacturing	0.777	1.236	0.926	1.090	1.033	1.175	0.964	1.159
Textile and Its Products	0.898	0.818	0.863	0.694	1.050	1.403	1.181	1.025
Wood and Wood Products	0.724	0.845	0.765	0.830	0.716	0.870	0.683	0.707
Pulp, Paper and Printing	0.882	0.712	0.746	0.671	0.744	1.852	0.923	1.232
Chemical	0.691	0.789	0.909	0.985	0.807	3.538	1.406	2.282
Petro-chemical	0.786	1.095	1.484	1.118	1.190	1.848	1.517	1.345
Rubber Products	1.172	0.832	0.657	1.030	0.713	0.721	0.636	0.653
Non-ferrous Mineral Products	0.625	0.733	0.661	0.816	0.684	0.985	0.754	0.802
Metal Products	0.715	0.914	1.025	0.818	0.955	4.964	1.504	2.426
Machinery Products	0.661	0.653	0.671	0.874	0.818	1.909	0.810	1.721
Transportation Equipments	0.757	0.674	0.695	0.786	0.711	1.482	0.679	0.837
Total Economy Average	0.840	0.826	0.867	0.850	0.850	1.559	0.925	1.284

Source: Institute of Developing Economies [1932]

The forward linkage coefficients calculated by the ASEAN-Japan-USA-Korea international input-output table are more than unity for Japan and USA, less than unity for the other countries, though the average of all industries in all countries is unity.

Let us analyze forward linkage of the five ASEAN countries by the primary manufacturing sectors. In the food sector, Malaysia has the largest forward linkage coefficient, exceeding even Japan and USA. It is followed by Singapore, Thailand, Philippines, and Indonesia. In textile products, the coefficient is largest in Thailand, then Indonesia, Philippines and Singapore in descending order. Among the five ASEAN countries, Singapore has the transportation equipment sectors. Philippines has the largest coefficient in petrochemical and metal product sectors.

Further, among the eight countries, Japan has the largest forward linkage coefficients in the textile and textile products, chemical, petrochemical, metal products, machinery, and transportation equipment sectors. In contrast, Indonesia and Malaysia have low coefficients in chemical, oil, metal products, machinery and other sectors.

Notice that Korea and Singapore, the two newly industrializing countries, have, in general, high forward linkage coefficients in strategic sectors.

IV. FUTURE ASPECTS OF INDUSTRIALIZATION

1. Towards an Industrial Society

Industrial development is regarded as an essential part of economic development for raising the standard of living. In this process the industrial sector is expected to develop and become stronger, as reflected in stronger linkages between small, medium and large industries, and higher competitiveness that enable it to contribute much more significantly to the foreign exchange earnings of the country. Promotion of manufactured export products is essential for sustaining development and should be regarded as a national goal to be thoroughly implemented. Efforts to strengthen export product competitiveness in international markets with respect to price, quality and services should be made continually.

Given the unfavourable prospect of oil, foreign exchange earnings from oil should not be expected to rise significantly. To earn foreign exchange, promotion of non-oil and non-LNG should be stressed. Policies to promote non-oil and non-LNG exports should be aimed at achieving fundamental changes in the export structure through strengthening the competitiveness of Indonesian export products in foreign markets.

Export promotion policies should be formulated within the framework of structural change in the overall economy which will realize a higher rate of growth for the industrial sector relative to the agricultural sector.

Monetary, fiscal and trade policy measures should be directed to complement industrial policy in such a way that the manufactured products become more competitive with respect to price, quality, time delivery and other services.

The rupiah-foreign currency exchange rate should be maintained at a level which does not reduce (and may actually increase) the international competitiveness of Indonesia products.

2. Future Trends of Industrialization

Based on the objectives identified in the Guidelines of State Policy (GBHN) and other considerations, including an economic and industrial structure in line with the previous section, industrialization in the coming years, specifically in Repelita V (The Fifth National Development Plan), and perhaps in some years beyond that, should focus on some priorities, such as machinery industries, high linkage industries, industries for export, labor intensive industries, small scale industries, and certain industries which are considered to be strategic for national security.

Machinery industries, as pointed out, are lagging far behind those in the neighboring

countries, not only in terms of the percentage shares in manufacturing value added or in the economy as a whole, but also in terms of their absolute output value. As shown in Appendix 1, and reflected in Appendix 3, the output of Indonesia's machinery and metal products industry was quite small. It was less than Thailand, and much less than Malaysia and Singapore, despite of the smaller sizes of those countries.

The report also analyzed various types of industries in terms of backward and forward linkages both for direct and total linkages. This linkage consideration is very important. A lot of the stimulus coming from elements of final demand has not been translated into more output, employment or other related aspects, but instead gone to imports, because of the lack of linkages. Yet, it is also important to realize that linkages can also give rise to inefficiency if they are not properly exploited. Inefficiency from one type of industry can be transferred and disseminated to other parts of the industry through linkage which eventually result in lower competitive power of the industry as a whole.

It is clear that the availability of foreign exchange is very important for the self-sustaining development process. Perhaps it is not an exaggeration to say that one of most binding constraints of the development of Indonesia in the coming year will be foreign exchange. Approximately two thirds to three quarters of the foreign exchange from exports has been coming from oil and gas. Oil and gas also contributed around one half to two thirds of the domestic government revenue. But the future of the oil industry is very uncertain, affected by so many variables both on the demand and supply side. According to many forecasts, the prospect of oil in the next few years does not look very bright. Recognizing this situation several years ago, the government of Indonesia decided to strive for diversification and adopted policies to foster the export of non-oil and non-LNG related manufactured products. It is clear that to be able to export, one of the necessary conditions is competitiveness of the products vis-a-vis products in the world market. Efficiency, therefore, is extremely significant in this matter.

In Repelita IV, it is estimated that there are 9.3 million new entrants to the labor force. This requires employment creation in all areas of economic activity including manufacturing. The majority of employment in manufacturing activities is in small scale industries. These small scale industries also contribute to foreign exchange earning and a large number of them are located in rural areas, creating a higher income for the people in those areas.

Electronics industries are on the priority list and are considered strategic. Moreover, they are generally labor intensive. Yet, the very fast technological changes in some industries have also affected some segments of these electronic industries. In other countries some segments of these industries have been robotized, resulting in lower product cost. Products produced by the labor intensive technique have become less competitive. The strategic nature of these industries, their contribution to employment and the effect of technological changes on them, of course, affects how these industries should be developed. Engineering design is one of the fields in which Indonesia is still lagging behind. The government realizes the importance of this field and has put it on the priority list. Some other industries which are considered strategic are also on the priority list, such as steel, electronic and other industries related to security and defense. As already briefly discussed, these priorities are interconnected, and are not necessarily all consistent with each other.

The analysis in Kaneko, Tampubolon and Yanagi (1986) showed that exported manufactured products, for example, have tended to be capital instead of labor intensive. Proper exploitation of linkages is critical to actually achieve economic advantages and benefits and not lead to lower competitive power, and thus, to fewer exports. It is worth noting that developing these various priority industries should be selected judiciously, taking into account such important elements as efficiency, equity, ability to sustain growth, etc., especially in consideration of the possibility of an oil glut and the protracted world economic recession that have been affecting the Indonesian economy.

Various elements involved in the industrial structure of a nation have been presented here. These elements should be taken into consideration to increase the effectiveness and efficiency of future development efforts.

NOTES

*) This paper is a part of the work on the quantitative macro economic study at the National Development Planning Agency (BAPPENAS) under Japanese technical assistance programme by Japan International Cooperation Agency (JICA). The authors gratefully acknowledge Dr. Mooy of BAPPENAS and Prof. S. Ichimura of Kyoto University who supervised the quantitative study at BAPPENAS and Mr. E. Yanagi of Ministry of Indonesia for his computational assistance.

1) UNIDO, Prospects for Industrial Development and for a capital goods in Indonesia, IS. 479 and Add. 1 and 2, July 1984.

2) Note that the value added share in this table is somewhat different from that of UN Statistics mentioned above due to a different method of calculation.

3) If there were no mining activities in Indonesia, the total value added of the manufacturing sector would be 18 %. This share is still smaller than those of the other ASEAN countries.

4) United Nations Industrial Development Organization, World Industry in 1980, pp.51-2, New York, 1981.

5) Hoffman, W. G., The Growth of Industrial Economics (German Original, 1931), expanded and revised English version, Manchester University Press, 1958.

6) The definition of capital goods and consumption goods industries is not clearly established. Subtotals in Appendix 6 are used for the outputs of these two industries for the shake of our analysis.

7) Indonesia Ministry of Industry, Perhitungan Capital Output Ratio Sektor Industri, 1983, and Perhitungan Labor Output Ratio Sektor Industri,1983. Data for petroleum and its products are not available in these books.

8) Hirschman, A.(1958). Hirschman pointed out that "The knowledge of the approximate ranking of industry from the point of view of forward and backward linkage effects as derived from existing developed economies through their input-output tables is, I believed, useful to the economist-planner in underdeveloped areas. It is something to be added to his criteria-box ". Thus, e suggested that these coefficients are useful to find industries for development strategy. However, as Hirschman cautioned, disturbance factors may arise in the economic development process in developing countries that are designed to stimulate forward and backward linkages. For example, stimulation for development may be totally absorbed into imports and cause problems in balance of payments. In another case this stimulation may hit the ceiling for input production capacity and inflation. In addition comparative cost is not considered at all when selection of key industries is done by linkage coefficients.

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Appendix 1 Total Output of ASEAN Countries, 1975 (1,000 US$)

	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN Total
Food, beverage, and tobacco	8,509,071	2,215,957	5,277,601	1,122,639	4,853,464	21,978,732
Textile, leather, and its products	1,456,968	370,688	1,079,905	545,669	1,756,888	5,210,118
Lumber and wooden products	496,070	386,456	470,740	408,728	423,146	2,185,140
Pulp, paper and printing	292,121	151,211	410,585	128,824	310,752	1,293,493
Chemical products	508,153	239,773	565,014	355,902	488,287	2,157,129
Petroleum and its products	854,604	373,213	1,206,724	2,018,759	827,479	5,280,779
Rubber products	504,120	869,148	132,600	324,506	295,669	2,126,043
Non-metallic mineral products	313,838	175,755	287,711	198,454	279,374	1,255,132
Metal products	568,828	998,877	703,682	351,610	730,419	3,353,416
Machinery	380,030	519,330	365,714	1,209,742	448,101	2,922,917
Transport equipment	1,735,926	154,480	573,821	539,761	775,589	3,779,577
Other manufacturing products	160,480	201,703	215,728	347,859	391,369	1,317,139
Total of Manufacturing Sectors	15,780,209	6,656,591	11,289,825	7,552,453	11,580,537	52,859,615

Source: Institute of Developing Economies [1982]

Appendix 2 Percentage of Output by Manufacturing Industry in ASEAN Countries, 1975

Industry	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN Total
1. Consumption Goods						
Food, beverage, and tobacco	53.92	33.28	46.75	14.86	41.92	41.60
Textile, leather, and its products	9.23	5.57	9.55	7.23	15.16	9.86
Lumber and wooden products	3.14	5.81	4.18	5.41	3.64	4.14
Pulp, paper and printing	1.85	2.27	3.63	1.71	2.69	2.44
Chemical products	3.22	3.61	5.01	4.70	4.22	4.09
Petroleum and its products	5.42	5.61	10.68	26.73	7.15	9.98
Rubber products	3.20	13.93	1.17	4.30	2.56	4.03
Subtotal	79.98	69.21	80.96	64.94	77.34	76.15
2. Capital Goods						
Non-metallic mineral products	1.99	2.64	2.56	2.63	2.40	2.36
Metal products	3.61	15.02	6.24	4.65	6.30	6.34
Machinery	2.41	7.79	3.24	16.02	3.88	5.52
Transport equipment	11.00	2.31	5.09	7.15	6.70	7.14
Other manufacturing products	1.01	3.03	1.91	4.61	3.38	2.49
Subtotal	20.02	30.79	19.04	35.06	22.66	23.85
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: The same as Appendix 1.

Appendix 3 Total Output of Each Manufacturing Industry in ASEAN Countries, 1975

(%)

	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN Total
Food, beverage, and tobacco	38.72	10.08	24.01	5.11	22.08	100.00
Textile, leather, and its products	27.96	7.11	20.73	10.47	33.72	100.00
Lumber and wooden products	22.70	17.69	21.54	18.70	19.36	100.00
Pulp, paper and printing	22.58	11.69	31.74	9.96	24.02	100.00
Chemical products	23.56	11.12	26.19	16.50	22.64	100.00
Petroleum and its products	16.18	7.07	22.85	38.23	15.67	100.00
Rubber products	23.71	40.88	6.24	15.26	13.91	100.00
Non-metallic mineral products	25.00	14.00	22.92	15.81	22.26	100.00
Metal products	16.96	29.79	20.98	10.49	21.78	100.00
Machinery	13.00	17.77	12.51	41.39	15.33	100.00
Transport equipment	45.93	4.09	15.18	14.28	20.52	100.00
Other manufacturing products	12.18	15.31	16.38	26.41	29.71	100.00
Total of Manufacturing Sectors	29.85	12.59	21.36	14.29	21.91	100.00

Source: The same as Appendix 1.

Appendix 4 Value Added of Each Industry in ASEAN Countries, 1975 (1,000 US$)

	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN Total
Food, beverage, and tobacco	2,316,940	704,172	1,451,911	317,703	514,665	6,305,391
Textile, leather, and its products	459,871	116,542	300,123	206,559	584,525	1,667,620
Lumber and wooden products	197,921	187,260	141,739	71,295	168,436	766,651
Pulp, paper and printing	133,560	58,285	212,115	45,748	118,980	568,688
Chemical products	198,859	69,980	178,373	67,994	178,372	693,578
Petroleum and its products	207,628	81,845	138,487	233,275	102,770	864,005
Rubber products	120,265	293,265	40,523	53,727	111,953	619,733
Non-metallic mineral products	168,108	77,477	89,564	71,980	110,981	518,110
Metal products	164,625	328,748	204,249	110,570	217,740	1,025,932
Machinery	123,045	182,748	107,338	388,235	145,379	946,745
Transport equipment	610,348	44,113	144,679	236,158	209,548	1,244,846
Other manufacturing products	53,725	124,397	54,997	79,901	207,912	520,932
Total of Manufacturing Sectors	4,754,895	2,268,832	3,064,098	1,883,145	3,771,261	15,742,231

Source: The same as Appendix 1.

Appendix 5 Value Added Ratio of Each Industry in ASEAN Countries, 1975 (%)

	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN Total
Food, beverage, and tobacco	27.23	31.78	27.51	28.30	31.21	28.69
Textile, leather, and its products	31.56	31.44	27.79	37.85	33.27	32.01
Lumber and wooden products	39.90	48.46	30.11	17.44	39.81	35.08
Pulp, paper and printing	45.72	38.55	51.66	35.51	38.29	43.97
Chemical products	39.13	29.19	31.57	19.10	36.53	31.15
Petroleum and its products	24.30	21.93	11.48	11.56	24.50	16.36
Rubber products	23.86	33.74	30.56	15.56	37.86	29.15
Non-metallic mineral products	53.57	44.08	31.13	36.27	39.72	41.28
Metal products	28.94	32.91	29.03	31.45	29.81	30.59
Machinery	32.38	35.19	29.35	32.09	32.44	32.39
Transport equipment	35.16	28.56	25.21	43.75	27.02	32.94
Other manufacturing products	33.48	61.67	25.49	22.97	53.12	39.55
Total of Manufacturing Sectors	30.13	34.08	27.14	24.93	32.57	29.78

Source: The same as Appendix 1.

Appendix 6 Percentage of Value Added by Manufacturing Industry in ASEAN Countries, 1975

Industry	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN Total
1. Consumption Goods						
Food, beverage, and tobacco	48.73	31.04	47.38	16.83	40.16	40.02
Textile, leather, and its products	9.65	5.12	9.78	10.97	15.50	10.57
Lumber and wooden products	4.14	8.23	4.64	3.78	4.47	4.86
Pulp, paper and printing	2.84	2.58	6.90	2.42	3.16	3.61
Chemical products	4.20	3.08	5.82	3.61	4.74	4.41
Petroleum and its products	4.34	3.62	4.53	12.38	5.37	5.51
Rubber products	2.56	12.92	1.34	2.85	2.98	3.96
Subtotal	76.46	66.59	80.39	52.89	76.38	72.94
2. Capital Goods						
Non-metallic mineral products	3.52	3.40	2.93	3.83	2.93	3.31
Metal products	3.46	14.50	6.64	5.87	5.77	6.51
Machinery	2.63	8.10	3.50	20.62	3.84	6.01
Transport equipment	12.82	1.93	4.74	12.55	5.56	7.92
Other manufacturing products	1.11	5.48	1.80	4.24	5.51	3.31
Subtotal	23.54	33.41	19.61	47.11	23.62	27.06
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: The same as Appendix 1.

Appendix 7 Indonesian Ultimate Degree of Dependence of Total Production on Each Country's Final Demand, 1975

	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN excluding Indonesia	Japan	Korea	U.S.A.	Other World	Total Output
Food, beverage, and tobacco	97.49	0.07	0.00	0.06	0.02	0.15	0.39	0.07	0.33	1.67	100.00
Textile, leather, and its products	98.81	0.03	0.00	−0.02	0.04	0.05	0.50	0.07	0.17	0.68	100.00
Lumber and wooden products	94.78	0.03	0.01	0.14	0.01	0.19	1.08	0.11	0.59	4.22	100.00
Pulp, paper, and printing	93.51	0.03	0.01	0.10	0.02	0.16	1.34	0.30	0.68	4.38	100.00
Chemical products	93.41	0.11	0.01	0.29	0.12	0.53	0.97	0.21	1.58	3.83	100.00
Petroleum and its products	48.29	0.10	0.12	1.92	0.09	2.23	27.87	0.34	8.53	12.36	100.00
Rubber products	24.29	0.38	0.06	9.77	0.22	10.43	3.48	0.09	39.58	9.06	100.00
Non-metallic mineral products	98.30	0.03	0.01	0.03	0.01	0.08	0.50	0.77	0.38	1.07	100.00
Metal products	82.00	0.04	0.04	0.21	0.06	0.35	5.07	0.15	4.21	8.90	100.00
Machinery	86.99	0.66	0.07	1.35	0.03	2.11	3.85	0.12	2.94	3.99	100.00
Transport equipment	94.52	0.02	0.01	0.15	0.01	0.19	1.51	0.19	0.84	2.74	100.00
Other manufacturing products	92.34	0.16	0.01	1.32	0.07	1.56	1.44	0.22	0.87	2.89	100.00
Total of Manufacturing Sectors	91.15	0.08	0.02	0.53	0.04	0.67	2.44	0.13	2.34	3.03	100.00

Source: The same as Appendix 1.

Appendix 8 Incremental Capital/Output Ratio (ICOR) and Incremental Labor/Output Ratio (ILOR) of Each Manufacturing Industry in Indonesia

ISIC	Industry	ICOR	Normalized ICOR	ILOR*)	Normalized ILOR
31	Food Manufacturing	2.47	0.607	557	0.403
32	Textiles	2.19	0.538	2,605	1.886
33	Wood Products	3.32	1.754	851	0.616
34	Paper, Printing	4.48	1.101	672	0.487
35	Chemical, Petro-products	2.34	0.575	237	0.299
351	Industrial Chemicals	2.58	0.634	172	0.125
352	Other Chemicals	2.59	0.636	1,449	1.049
355	Rubber Products	0.92	0.226	36	0.026
356	Plastic Products	5.62	1.381	1,059	0.767
36	Non-Metallic Mineral	3.70	0.909	885	0.641
37	Basic Metal	6.50	1.597	470	0.340
38	Machinery	3.32	0.816	486	0.352
381	Fabricated Metal	3.06	0.752	1,232	0.892
382	Machinery	3.75	0.921	187	0.135
383	Electric Machinery	2.79	0.686	960	0.695
384	Transport Equipment	2.50	0.614	1,394	1.009
385	Control Equipment etc.	2.06	0.506	512	0.371
39	Other Manufacturing Products	2.20	0.540	797	0.577
	Total Manufacturing	4.07	1.000	1,381	1.000

Source: Departemen Perindustrian dan Biro Pusat Statistik, 1983. *Penghitungan Capital Output Ratio Sektor Industri.*
Departemen Perindustrian dan Biro Pusat Statatistik, 1983. *Penghitungan Labor Output Ratio Sektor Industri.*
*) Person/billion Rp.

Appendix 9 Intensities of Export and Import Linkages on Indonesia Commodities, 1975

IEL = Intensity of Export Linkage
IIL = Intensity of Import Linkage (%)

Commodity	Food Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	35.81	5.41	48.77	15.60	44.46	10.38
Philippines	0.05	0.65	0.55	0.25	0.38	0.26
Singapore	56.46	3.51	39.79	5.40	45.33	4.41
Thailand	7.69	43.41	10.89	49.58	9.83	47.82
ASEAN Total	100.00	4.23	100.00	7.33	100.00	5.90

Commodity	Textile Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	3.63	1.57	74.38	6.28	14.03	3.78
Philippines	—	—	—	—	—	—
Singapore	70.23	18.7	14.05	0.31	61.97	6.27
Thailand	26.14	20.84	11.57	4.14	24.00	16.20
ASEAN Total	100.00	7.92	100.00	1.35	100.00	4.61

Commodity	Wood Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	5.96	7.99	42.42	2.35	7.37	5.22
Philippines	—	—	—	—	—	—
Singapore	93.19	6.92	27.27	0.44	90.64	5.91
Thailand	0.85	58.33	30.30	33.33	1.99	40.48
ASEAN Total	100.00	6.63	100.00	1.10	100.00	5.55

Commodity	Paper, Pulp & Printing					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	28.57	1.61	66.67	0.41	43.48	0.25
Philippines	—	—	—	—	—	—
Singapore	71.43	0.74	33.33	0.68	56.52	0.72
Thailand	—	—	—	—	—	—
ASEAN Total	100.00	0.26	100.00	0.38	100.00	0.30

Commodity	Metal Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	2.66	0.20	—	—	2.17	0.11
Philippines	—	—	—	—	—	—
Singapore	72.95	2.11	51.61	2.00	69.03	2.09
Thailand	24.40	1.81	48.39	4.09	28.80	2.18
ASEAN Total	100.00	0.64	100.00	0.72	100.00	0.65

Commodity	Machinery Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	19.44	5.54	39.21	5.96	30.84	5.84
Philippines	—	—	—	—	—	—
Singapore	80.56	17.68	60.79	17.16	69.16	17.41
Thailand	—	—	—	—	—	—
ASEAN Total	100.00	6.81	100.00	5.64	100.00	6.08

Commodity	Transport Equipment					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	—	—	—	—	—	—
Philippines	—	—	—	—	—	—
Singapore	100.00	15.81	100.00	34.79	100.00	25.47
Thailand	—	—	—	—	—	—
ASEAN Total	100.00	2.55	100.00	2.25	100.00	2.33

Commodity	Other Manufacturing Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	1.94	1.55	12.02	2.19	4.13	1.90
Philippines	—	—	—	—	—	—
Singapore	97.52	38.44	82.09	14.94	94.18	29.64
Thailand	0.53	1.25	5.90	0.88	1.70	0.95
ASEAN Total	100.00	21.91	100.00	4.68	100.00	12.20

Commodity	Chemical Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	21.86	2.38	35.63	4.37	24.56	2.73
Philippines	0.60	0.66	1.23	5.80	0.72	6.32
Singapore	49.82	10.00	48.89	8.20	49.64	9.60
Thailand	27.72	12.73	14.25	2.64	25.08	8.93
ASEAN Total	100.00	3.61	100.00	3.53	100.00	3.59

Commodity	Petrochemical Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	2.88	0.42	1.53	0.42	2.30	0.42
Philippines	1.18	16.55	3.78	16.28	2.30	16.36
Singapore	95.72	62.51	94.51	60.80	95.20	61.77
Thailand	0.22	2.48	0.18	2.98	0.20	2.65
ASEAN Total	100.00	3.25	100.00	5.84	100.00	4.02

Commodity	Rubber Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	0.01	3.33	0.21	3.85	0.01	3.40
Philippines	0.01	3.88	0.21	4.65	0.01	4.00
Singapore	99.97	65.97	99.47	29.92	99.97	65.41
Thailand	0.01	2.65	0.11	0.18	0.01	1.55
ASEAN Total	100.00	64.80	100.00	23.47	100.00	64.00

Commodity	non-Metallic Mineral Products					
Type of demand	Intermediate		Final		Total	
	IEL	IIL	IEL	IIL	IEL	IIL
Malaysia	100.00	0.59	100.00	8.33	100.00	0.81
Philippines	—	—	—	—	—	—
Singapore	—	—	—	—	—	—
Thailand	—	—	—	—	—	—
ASEAN Total	100.00	0.19	100.00	0.48	100.00	0.23

Source: The same as Appendix 1.

CHAPTER VII
GOVERNMENTAL BUDGET AND TAXATION

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I. A BRIEF HISTORY OF GOVERNMENT FINANCE

II. FISCAL POLICIES IN ECONOMIC DEVELOPMENT

1. Balanced Budget Policy in Development Planning

2. The Share of Oil Revenues

3. Allocation of Resources Through the Government Budget

III. TAXATION SYSTEM

1. Recent Development Which Require New Measures

2. The Old Tax System

3. The New Tax System

4. Preliminary Result of the Tax Reform

IV. GOVERNMENT EXPENDITURES

I. BRIEF HISTORY OF THE GOVERNMENT FINANCE

The Indonesian public finance has been a key factor to long-lived high economic growth since 1969. With little industrial base and infrastructure, the government had to play a leading role in transforming the agrarian economy only with oil resources to industrializing economy until the self-sustaining growth would become possible. This primary goal has not yet fully realized. Nevertheless, the government-led growth has been very successful in terms of the rate of growth, being greatly helped by the oil price hikes in the 70's. As the result, the Indonesian economic structure has made a dramatic change so that it is beginning to require a modification of the old financial system and regulations established soon after the independence. The fiscal system has also become out of date and needs an overhaul to sustain further growth For this purpose, a tax reform was forcefully proposed and adopted in 1984. This is an important transition from the old to the new fiscal policy which tries to rely less on oil related revenues. In this connection, it is to be remembered, the President stressed the "take off" as a medium-term goal in his grand vision on the Indonesian economy toward the end of this century.

The Indonesian government revenue up to 1971/72 depended on the oil sector by less than one fifth. The non oil domestic revenue was the main source of the government revenue. Development revenues financed from the external sources were the next largest. The rupiah devaluation in 1971-1972 and the oil export expansion made the oil revenue rapidly increase. In 1972/73, the oil revenue became the second largest source.

Table 1.1 shows the ratios of oil-LNG revenues and exports to GDP, total exports and total domestic revenues. Since the beginning of Repelita I (Five Year Development Plan I) in 1969/70, the share of oil-LNG in the GDP has increased dramatically from less than 8 percent in 1969/70 to more than 24 percent in 1981/82, before it declined slightly due to the oil price drop in recent years. Similarly, the ratio of oil-LNG exports to the total export value has risen from 36 percent to 82 percent in 1981/82.

Since the oil industry is owned by the State, and all of the revenues incurred there were treated as domestic revenues, the oil revenue became the most influential source in the budget during the entire Repelita II period (1974/75-78/79) and henceafter. Its share in the total revenue was approximately 45 percent in the Repelita II period. The 1979 oil price increase made a further contribution to the budget in the Repelita III period (1979/80-83/84). During the Third Five Year Plan period, the oil receipts exceeded a half of the entire central government revenues, and in 1981/82 it was about 71 percent of the total domestic revenues. As Table 1.2 shows, during the period of the first three five year plans, the total government revenue grew almost 55 times larger in size. Non oil domestic revenues and oil receipts expanded by 25 and 198 times, respectively. Clearly the oil related revenues became crucial to the government financing.

On the expenditure side, the total spending grew almost in parallel to the actual government receipts due to the balanced budget principle adopted by the New Order government. As long as the budget can be kept balanced, it is possible for the government to exceed the expenditure target when the revenue is higher than estimated. The actual spending, therefore, far exceeded the budget level in 1973 and 1979. In those years, the budget surplus were intentionally distributed to the development expenditures. The development expenditure grew faster than the routine expenditure. This has an implication that in case the actual revenue can not reach the budget level because of the recession or the declined oil price, the development budget needs to be reduced. The routine payments, covering expenditures on personnel, transfers to regions, subsidies and interest payments on foreign debt and others, were mostly predetermined and thus difficult to be adjusted.

Table 1.1 Role of Oil-LNG in Indonesian Economy (%)

FY	Oil-LNG	Oil-LNG exports
	GDP	Total exports
1969/1970	7.8	36.8
1970/1971	7.5	36.8
1971/1972	9.1	42.9
1972/1973	10.2	49.8
1973/1974	12.1	47.3
1974/1975	21.8	71.7
1975/1976	19.1	73.8
1976/1977	18.2	68.9
1977/1978	18.3	67.7
1978/1979	18.1	65.0
1979/1980	20.7	66.7
1980/1981	24.3	75.6
1981/1982	24.3	81.9
1982/1983	21.5	79.0
1983/1984	20.8	72.9
1984/1985	21.7	70.3
1985/1986	21.2	66.8
1986/1987	21.5	50.9

In Repelita I the routine expenditure exceeded the development expenditure by more than half, but in Repelita II and III the latter often surpassed the former. A large portion of the development spending was the government investment, so that it implied the government effort for high economic growth.

These expansionary trends in revenues and expenditure have accompanied several critical consequences. The high government capital formation was made possible by the receipts from oil exports, the entire economy became exceedingly dependent on the government spendings. Once the oil receipts decline, the government expenditure must be reduced also. This may lead to the undesirable policy of contraction at the time of recession. As a matter of fact, this heavy dependence on oil led to the sluggish inflow of non-oil domestic revenues as well due to the indirect effects of government expenditure. As long as the fiscal source depends solely on the external oil market, the autonomy of the fiscal policies becomes questionable. When the oil price falls, it is possible to devalue the domestic currency and offset the dollar shortage. But this means a risk of inflation. In addition, the government has borrowed a large amount of external funds to finance the development expenditures, which is going to be an eventual burden on the balance of payments.

In 1983 the government made a correct choice to enforce the non-oil domestic taxation system and announced a series of new measures of taxation reforms. The timing coincided with the deterioration of oil prices so that these new measures served for two purposes. The first was to offset the reduction in the oil/LNG receipts, and the second was to establish the fiscal autonomy. The government demonstrated a firm attitude to tackle with the undesirable practices associated with tax collection. All these new development appeared during the transitional stage from the Repelita III to the Repelita IV.

Table 1.2 Oil Revenue and Total Domestic Revenues

(in billion of Rupiahs)

Fiscal Year	Oil Revenues		Total Domestic Revenues	
	Budget	Realization	Budget	Realization
FYP I				
1969/1970	62.8	177.9	228.0	243.7
1970/1971	95.1	245.4	320.6	344.6
1971/1972	126.3	287.3	415.9	428.0
1972/1973	241.2	360.1	573.6	590.6
1973/1974	303.7	585.5	671.0	967.7
FYP II				
1974/1975	673.0	796.5	1,363.4	1,753.7
1975/1976	1,508.9	993.9	2,496.1	2,241.9
1976/1977	1,674.2	1,270.7	2,803.2	2,906.0
1977/1978	1,929.1	1,586.7	3,484.2	3,535.4
1978/1979	2,067.4	1,957.4	3,970.0	4,266.1
FYP III				
1979/1980	3,344.8	4,259.6	5,440.5	6,696.8
1980/1981	6,430.1	7,019.6	9,055.3	10,227.0
1981/1982	8,575.2	8,627.8	12,274.4	12,212.6
1982/1983	9,121.7	8,170.4	13,756.5	12,418.3
1983/1984	8,869.1	9,520.2	13,823.6	14,432.7
FYP IV				
1984/1985	10,366.6	10,429.9	16,149.4	15,905.5
1985/1986	11,159.7	11,144.5	18,677.9	19,252.9
1986/1987	9,738.2	6,337.6	17,832.5	16,140.6

II. FISCAL POLICIES IN ECONOMIC DEVELOPMENT

1. Balanced Budget Policy in Development Planning

In Indonesian development plans, the annual amounts of savings and investment funds are programmed. The savings come from three sources: government savings, private savings and foreign sources. Government savings, by definition, are domestic revenues minus routine expenditures. Aid or loans to the Indonesian government from foreign governments or international financial institutions are also included in the national budget (APBN). Foreign loans and direct investment to the private sector are still relatively small in Indonesia.

Table 2.1 Development Finance in the Fourth Five Year Development Plan (Repelita IV)
(in billion of Rupiahs at current price)

Gross Domestic Product	552,310
Average increase per annum	5.0 %
Investment	145,225
Investment as percentage of GDP	26.3 %
Source of financing :	
- Public savings	60,071
- Private national savings	62,016
- Foreign resources	23,138

Source : Repelita IV.

The balanced and dynamic national budget (APBN) adhered to by the Indonesian government means that the revenues are equal to expenditures. Since, however, foreign aid is counted as revenue, the balanced budget is actually budgetary deficit financed by foreign aid. The Indonesia government avoids, however, deficit financing from domestic sources loans from the private sector or the Central Bank. This is based on the lessons during the period of the Old Order, when deficit financing from the Central Bank caused an extreme inflation 650 percent in 1965. The policy has been stated in the Board Outline of National Goals (GBHN). The government needs to maintain the balance between revenues and expenditures, but if revenues exceed the original estimate, expenditures can be increased during the current year. In such a situation, the government needs only to report to the Parliament (DPR) on the final implementation of the national budget upon completion of the fiscal year (March 31) and needs no prior approval from the Parliament. The same principle has been applied, when there was a decrease in government revenue, as was the case since 1982.

Another feature of the Indonesian national budget is that it is a cash basis; namely, expenditures and revenues are kept in book when money is paid or received. This is important for understanding the occurrence of SIAP (carry-overs), which have become increasingly large since the beginning of the first 5 year development plan (Repelita I). This is also related to the increase in government revenue from the oil and gas sector particularly since 1974. Due to this sudden increase in revenues,in the middle of a budget year, adjustment of expenditure became rather difficult. New, additional projects were begun while existing unfinished projects continued to have guaranteed financing. As a result, there was actually a larger commitment, consisting of the national budget plus the carry-overs (SIAP) of the previous years. In fact, however, disbursements for projects, both new and old, have been delayed for various reasons.

2. The Share of Oil Revenues

In accordance with the 1945 Constitution, oil and natural gas are controlled by the government. Although exploration and exploitation of oil and natural gas resources are carried out mainly by foreign corporations through contract of work (COW) and production sharing (PS) agreements with the government of Indonesia, the oil and gas revenues are included in the national budget as domestic revenues along with tax revenues.

Table 2.2 shows that in the first oil shock period (1974-1978), the share of oil and liquefied natural gas (LNG) revenues increased from 39% to 54% of all domestic revenues, and that in the second oil shock period (1979-1981), it increased 71%. Although there was an extraordinary increase in national revenues, from one trillion rupiah in 1973/1974 to about 12 trillion in 1981/1982, the revenues became dominated by oil and LNG revenues. This situation has two

implications:
(1) a decrease in the price of oil will seriously reduce the level of government revenues;
(2) the basic character of national revenue from oil and gas exports is inflationary.

3. Allocation of Resources Through the Government Budget

The increased government funds were used for government projects, both sectoral and regional. The increase in investment activities in the private sector has been stimulated by the increase in business with the government sector.

Government development expenditures can be divided in three groups: expenditures for projects by various departments or agencies, expenditures for regional development chiefly in the form of INPRES programs and expenditures aimed at various state corporations largely in the form of government investment. The first expenditures are concerned with infrastructure and improvement of department and agency operations. The second expenditures take the form of subsidies for regional governments' projects to be determined by themselves. These expenditures are also used for special programs such as construction of elementary schools and hospitals and designed to even out development and income distribution among regions. The third expenditure aims at increasing activity in the business world, particularly state corporations. As for the first group, the government had to increase its expenditures on new projects, because disbursements for existing projects were not made as fast as expected. Therefore, the government not only guaranteed to finance the existing projects but also supported new projects. As a result, even several projects of low priority were financed.

This was also the case with the regional development budget and pressure to equal development among regions pushed the government to allocate the budget funds more than the regions' ability to absorb. Thus, many projects could not achieve the objectives; for example, elementary schools were located far from residential areas, public health centers (Puskesmas) were built with minimal standards, because supervision of the projects in remote regions was much more difficult than those in large urban areas.

Expenditures for state corporations are made much more flexibly than other forms of expenditure. The government offered capital to the state corporations not in the form of loan but in the form of government equity. With such an inexpensive source of capital, these government corporations could grow much faster than they would have if they had to borrow capital from banks. At the time of declining revenues from oil, however, this expenditure was reduced merely by informing the corporations that they were expected to seek loans from banks. Since many state corporations projects were capital-intensive, the decrease in government allocations had little effect on employment.

The increase in oil revenues affected also the government management of money supply. As of June 1983, supply of money was controlled mainly by administered credit ceiling to each bank. In Indonesia there was always some pressure to expand the supply of money, because the tax revenues were much smaller than the normal expenditures and the gap has to be fulfilled somehow. Increased foreign exchange earnings from oil exports were converted into rupiah and more than covered the current government expenditure, and gave an expansionary effect to the money supply. Moreover, the abundance of foreign exchange earnings allowed the state banks to the private sector.

Under the circumstance, banks, especially the state banks did not try to mobilize savings from the households. The interest rate on deposits was held too low to attract small depositors. In addition, the overvalued rupiah encouraged wealthy citizen to deposit their money offshore. After the price of oil declined at the end of 1982, the Indonesian government deregulated the banking sector by freeing the state bank to set their interest rate of deposits and loans and abolished the ceiling mechanism. The main reason for this major change was the shortage of resources on the part of the government. As a result, the interest rate of deposits and loans rose and it brought about a steep increase in bank deposits.

Table 2.2 Domestic Revenues, 1969/1970 - 1986/1987

(in billion of rupiahs)

Fiscal year	Oil Revenues		Tax Revenues		Non Tax Rev.		Total	
	amount	share	amount	share	amount	share	amount	share
FYP. I								
1969/1970	66	27	175	72	3	1	244	100
1970/1971	99	29	233	67	13	4	345	100
1971/1972	141	33	259	61	28	6	428	100
1972/1973	231	39	325	55	35	6	591	100
1973/1974	382	39	536	55	50	6	968	100
FYP. II								
1974/1975	957	55	730	41	67	4	1,754	100
1975/1976	1,248	56	884	39	110	5	2,242	100
1976/1977	1,635	56	1,152	40	119	4	2,906	100
1977/1978	1,949	55	1,442	41	144	4	3,535	100
1978/1979	2,309	54	1,766	41	191	5	4,266	100
FYP. III								
1979/1980	4,260	64	2,250	33	187	3	6,697	100
1980/1981	7,020	69	2,891	28	316	3	10,227	100
1981/1982	8,628	71	3,249	26	336	3	12,213	100
1982/1983	8,170	66	3,812	31	436	3	12,418	100
1983/1984	9,520	66	4,394	30	519	4	14,433	100
FYP. IV								
1984/1985	10,430	66	4,789	30	687	4	15,906	100
1985/1986a)	11,144	58	6,618	34	1,491	8	19,253	100
1986/1987a)	9,738	55	7,141	40	954	5	17,833	100

a) Budget

The government received foreign assistance, grants as well as credits. Its greater portion was obtained from Intergovernmental Group for Indonesia (IGGI) member countries in the form of soft and semi-soft loan, and commercial loans were very small. The windfall money from oil exports gave Indonesia a very flexible stance in assessing the strategy of borrowing. During the period of low interest rate on commercial loans, Indonesia increased her borrowing, but could tighten herself during the period of high interest rate.

III. TAXATION SYSTEM

1. Recent Development Which Require New Measures

Table 3.1 Percentage of Tax Revenue to GNP of Selected Countries

	1984	1985
Indonesia[1)]	7.0	7.5
Thailand	13.6	113.4
Malaysia	n.a	23.5
Singapore	n.a	20.3
Korea	16.5	17.1
U S A	17.8	17.8
Sweden	33.3	32.4
U K	n.a	33.1
Spain	n.a	23.4
France	39.8	39.5

1) Tax revenues in fiscal year (April 1 - March 31) GNP excluding oil and gas.

Source : Indonesia : Central Bureau of Statistic; Other nations: Government Financial Statistics Yearbook, 1985, IMF.

In recent years, tax and other non-oil revenue have amounted to less than 6% of the GDP, or about 8% of the non-oil GDP. This is extremely low compared with that in other developing nations. It is estimated that development through non-inflationary financing will need a tax revenue of 12% of the non-oil GDP or 10% of the total GDP, before the end of the fourth five-year plan (Repelita IV). By increasing non-oil revenue to 12% of the GDP by the 1989-1990 fiscal year, the effort to increase tax receipts will have approached the level of Thailand in 1984, while still remaining behind the level of most developing nations. Increasing the share of non-oil revenue from 8% to 12% of the non-oil GDP in 5 years is clearly not an easy task, even with a planned 5% rate of growth for the GDP during Repelita IV. To reach this goal, non-oil tax receipts will need to grow at a rate of 2.8 times the growth of real GDP. This is a difficult task. During the previous five years, non-oil revenue grew at a slower rate than GDP. Even with a growth rate of only 2 times the GDP growth rate, let alone the desired for growth rate of 2.8 times the GDP growth rate, the old taxation system would be unable to reach the objective. Revenue from custom duties can not be counted on. This is simply because Indonesia is attempting to domestically produce more of the goods which were previously imported. Export taxes on raw materials, which were an important source in Repelita II, will be less significant, because Indonesia is encouraging more exports of manufactured goods and export taxes on them are almost null. Finally, excise taxes collected on goods such as tobacco and alcohol only provide limited revenue since consumption cannot increase at a faster rate than the GDP. Therefore, the types of revenue which can be increased are in the areas of income tax and sales tax. Without improving systematically these important sources of revenue, development goals will be extremely difficult to achieve.

Table 3.2 Government Revenue Structure in Indonesia, 1982/1983
(in billion of Rupiahs)

	Amount	%	Share
Revenue from Oil and Gas	8,170.4	65.8	
1. Oil	7,449.8	60.0	
2. LNG	720.6	5.8	
Tax Revenues	3,812.3	30.7	100.0
1. Direct Taxes	1,734.4	14.0	45.5
1.1. Personal Income Tax	294.0	2.4	7.7
1.2. Corporation Income Tax	684.7	5.5	18.0
1.3. Withholding Tax	647.1	5.2	17.0
1.4. Wealth Tax	7.3	0.1	0.2
1.5. Tax on Interest, Dividend and Royalty	101.3	0.8	2.7
2. Indirect Taxes	2,077.9	16.7	54.5
2.1. Sales Tax	476.7	3.8	12.5
2.2. Sales Tax on Import	231.0	1.9	6.1
2.3. Excises	620.1	5.0	16.3
2.4. Import Duties	521.9	4.2	13.7
2.5. Export Tax	82.5	0.7	2.2
2.6. Land Tax	105.2	0.8	2.8
2.7. Stamp Duties	36.7	0.3	1.0
2.8. Auction Fees	3.8	-	0.1
Non Tax Receipts	435.6	3.5	
Domestic Revenues	12,418.3	100	
Foreign Aid	1,940.0		
1. Programmed Aid	15.1		
2. Project Aid	1,924.9		
TOTAL REVENUES	14,358.3		

In 1981/1982 revenues from oil and Liquefied Natural Gas (LNG) accounted for 71 percent of all domestic revenues, while tax revenues accounted for 26 percent and non-tax revenues accounted for 3 percent. As the result, the decrease in oil prices in late 1982 caused difficulties in funding new and old Industrial Development Projects. The government could not carry out tax reforms earlier, because it was politically difficult when the government revenue is at its peak to convince the populace of tax reform, and the society felt that tax obligations should be reduced. The study of tax reforms began in 1981/1982 and took 4 years to complete.

2. The Old Tax System

In the old system direct taxes consisted of individual income tax, corporate income tax, withholding tax, wealth tax, and taxes on interest, dividends and royalties, whereas indirect taxes consisted of sales tax, sales tax on import, import duties, excise, land tax, stamp duties and auction fees.

The income tax system (individual and corporate) was a holdover from the Dutch colonial era, which was basically a system for a developed nation. As such, these two taxes were extremely complicated to duplicate for a developing nation and gave rise to problems such as the following:

(a) The difference between an individual and a corporation caused problems because the definition of a corporation in Indonesia is not clearly understood, and it was covered by differing laws and regulations. For example, the status of a "foundation" has never been clearly defined by law, as similarly is the case with cooperatives. Furthermore, the informal sector in Indonesia was very large, to the extent that laws differentiating taxation for legal entities and non-legal entities gave rise to problems in interpretation of the tax laws and their handling. Differing rates of taxation for corporations and non-corporate businesses also caused extensive tax evasion.
(b) Individual income tax rates, which were divided into 12 rates based on income groups, actually were designed to aid in distributing income evenly. In practice, the enforcement of this system was extremely difficult and led to widespread tax manipulation. Such was also the case with various exemptions and deductions which were highly detailed, and became a subject of negotiation between tax collectors and taxpayers due to the complexity of these regulations.

Nevertheless, personal and corporate income taxes provided a big share in the government tax revenues. In 1982/1983 government receipts from the two taxes amounted to 25.7% of the total tax revenues, or 6.8% of the total domestic revenues.

Withholding tax was actually an advance payment for income tax and sales tax. The intention of this advance collection was to evenly distribute tax revenues throughout the year. Through withholding taxes on every transaction, including payment of salary or wages, a specified percentage was withheld by the treasury. At the end of the year, when the tax return was filled out, these withheld taxes were to be subtracted. In practice, this system did not work out as desired, because businesses often did not claim withheld taxes in order to cover up the value of transactions carried out. As a result, withholding tax became a separate tax from income tax or sales tax. In the fiscal year 1982/1983, government revenue in kind of withholding tax was 17.0% of the total tax revenues, or 5.2 percent of the total domestic revenues.

The old wealth tax was a personal tax and differed greatly from property tax such as the one known in the United States. This tax had a tax base of net wealth, that is assets minus liabilities. Included here in assets were all forms of property, mobile or immobile, including intangible assets such as expensive paintings. In practice there were two major problems:

(a) With insufficient awareness of law and inability to enforce laws, collection of personal taxes was extremely difficult. Tax collectors had to prove the existence of the assets owned by a tax payer, which were possibly distributed in a number of locations. This difficulty stemmed also from the fact that government statistics, among others those regarding ownership, were still far from complete, and there was no coordination between tax offices and other government offices with regard to collection of information on the wealth holding of tax payers. Furthermore, it was very difficult to prove the inaccuracy of a claim made by a tax payer of debt, which made net wealth very small.
(b) In practice, the only assets which could be taxed were immobile assets such as land and buildings, while mobile assets such as gold, stocks and so on were difficult to tax.

As a result, tax revenues from wealth were always so insignificant that serious questioning in the Parliament easily erupted. It was often questioned why wealth tax was not imposed to a greater degree. In 1982/1983, wealth tax revenues was only 0.2% of the total tax revenues, or 0.1% of all domestic revenues.

Tax on interest, dividends and royalties was also very small mainly because the government exempted interest on time deposits as well as dividends and royalties from taxation to encourage savings and investments. For example, in the 1982/1983 fiscal year revenues from this tax were 2.7% of the total tax revenues, or 0.8% of all domestic revenues.

With regard to sales tax, the law was in fact a translation of the related Dutch law which imposed tax on sales at the manufactured stage (single stage). As such, their enforcement was severely limited in operation. However, operative sales tax became a tax on all transactions (turnover tax). This was justified by interpreting the term "manufacture" as any action which increased the value of goods. Sales tax was collected on all transactions based on the total value of a commodity. This caused an extreme cascading effect. There were two major adverse effects of sales tax.

(a) Because this sales tax was collected on every transaction the tax burden on a finished good differed depending upon how many stages were involved in the production and transaction of the good. This served as a discriminatory measure against goods which must going through more steps in the production process.
(b) As an obvious reaction, businesses were pushed to carry out vertical integration to avoid unduly messy taxation. This vertical integration caused inefficiency in the economy.

To reduce the burden of taxation at effective rates, the government allowed a variety of tax exemptions. The original nominal rate consisted of 10 rates, ranging from zero to 40 percent, but due to these tax exemptions for a certain group of products or for a specified period, the effective rates became extremely varied to result in inefficiency.

The sales tax provided the government, however, with a significant amount of revenues since the tax base was equal to several times of GNP. Even if some products were taxed at a very low rate, say 2.5%, the final tax burden might accumulate to 10 to 15 percent because of the accumulated taxes through the whole production processes. In 1982/1983, sales tax revenues were 12.5% of the total tax revenues or 3.8% of the total domestic revenues.

Sales tax on import, in fact, did not have a direct connection with sales tax. Import sales tax was primarily levied firstly to protect domestic products from competition from imports and secondly to increase state revenues. As it developed, the rate of import sales tax became different from general sales tax and was tied to customs duties. As a result, the import sales tax became a special tax no longer based on regular tax laws. In 1982/1983 revenues from import sales tax accounted for 6.1% of all tax revenues, or 1.9% of all domestic revenues.

Excise duties were levied on cigarettes, distilled alcohol, sugar and beer, and were collected at the manufacturing stage on the basis of excise laws inherited from the Dutch. Excise tax on cigarettes and tobacco products was collected as a specified percentage of the tax stamp price. By law, the tax stamp price must be the same as the retail price. In practice, the tax stamp price determined by the government has always been lower than the retail price, particularly for "kretek" (clove) cigarettes. Adjustments of the tax stamp price to the sale price have always been followed by an increase in the sale price, and finally a certain brand of kretek cigarettes is replaced by a new brand with lower tax stamp price. This problem of complication has not been solved yet.

Another undeniable basis of this tax is to decrease cigarette consumption by raising the price. While the Ministry of Finance desires large excise revenues, the Minister of Health desires high rates of excise so as to reduce tobacco consumption. The Ministry of Industry and the Ministry of Manpower want to see the development of the cigarette industry, particularly labor intensive kretek cigarettes. Revenue from cigarette excise taxes in 1982-83 were 14.8% of total tax revenues or 4.6% of all domestic revenues. It is still hoped that cigarette excise

revenues will be hoped to still account for a considerable amount of revenue, because of the desirable growth of the cigarette industry and the ease of collection.

Sugar excise duties, distilled alcohol excise duties, and beer excise duties account for much smaller revenues than cigarette excise duties. In 1982/1983 these three forms of excise only accounted for about 1.4% of all tax revenues, or 0.4% of all domestic revenues. Sugar excise duties actually do not need to be collected any more because the original purpose by the Dutch was to reduce domestic consumption so that more sugar would be available for export to other nations. During the Dutch colonial era, sugar was an important international export commodity and Java was a vital sugar producer. Distilled alcohol and beer excise taxes serve also to reduce consumption.

Customs duties were important in the revenue structure in the 1950's and 1960's. As the domestic industry developed, import of finished goods decreased and imports shifted to raw materials and capital goods. As a result, the role of customs duties gradually decreased. At present, the average nominal rate of customs duty is about 40%, and it will further decrease. In 1982/1983 customs duty revenues were 13.7% of tax revenues or 4.2% of domestic revenues. In the same year, the shares of finished good imports, raw material imports, and capital good imports were 10.3%, 44.5% and 45.2% of total imports respectively. About 22.7% of the import value consisted of project aid imports, which are free of customs duties.

Regional Development Fees (Ipeda) are the land tax traditionally used by the Dutch government. The tax base is the benefit enjoyed by the landowner above those for buildings, plants or other use of land. In effect, the actual tax base of Ipeda is assessed similarly to the market value of the land, because the benefit increases with road development and the resale price rises. Although Ipeda is a central government tax, all revenues are given to the regional government with the provision that they must be used for development projects and may not be used to finance current expenditures. Because of this, regional government official like village or subdistrict heads are always involved in the Ipeda collection. One benefit of Ipeda enforcement is the complete registration of all land ownership and its use throughout Indonesia by the Ipeda Directorate. Although the cost of collection is quite high, particularly in the country side, Ipeda collection is an excellent instrument to educate the general populace about contributing themselves to development, aiding the government in providing roads, electricity, etc. In 1982/1983, Ipeda revenues accounted for 2.8% of tax revenues, of 0.8% of all domestic revenues. The composition of Ipeda revenues shows that the largest share was from countryside Ipeda, followed by city Ipeda and mining Ipeda.

Export taxes were collected to increase government revenues. For a developing nation like Indonesia there is no acceptable justification for export taxation. The tax burden seems to be carried by Indonesia and cannot be shifted to the buyers abroad, because the size of Indonesian exports is relatively small in the international markets so that Indonesian exporters cannot set the prices. The only exception is the case of hard wood exports, in which Indonesia is the largest producer in the Asia Pacific region. Since 1979 Indonesia has gradually ended log shipments to development of the domestic wood industry. After 1986, log can no longer be exported. Recently export taxes have been reduced and their function has changed from a source of state revenue to a method of discouraging raw material exports. For example, the export tax on raw rattan is meant to encourage exports of processed rattan or rattan furniture. In 1982/1983 tax revenues from exports including additional export tax was 2.2% of all tax revenues or 0.7% of domestic revenues.

Apart from regular export taxes with rates ranging from 0% to 20%, in 1978 the government introduced additional export tax (PET) on certain commodities such as coconut oil and copra. This PET is intended to absorb a portion of extra profits when the world market prices for such commodities are increasing. In fact, however, a formula for PET is not convincing to justify, and it was received as a burden by exporting producers. With the recent global recession, PET is no longer applied at all and will not be effective in the future.

Stamp duties are also based upon an old law dating back to 1921. In 1982/1983, revenues from stamp duties accounted for 1.0% of tax revenues, or 0.3% of domestic revenues. With the develop-

ment of modern business and trade, this law became no longer appropriate, and was reformed in early 1986. Auction fees are also a small form of revenue. In 1982-1983 they accounted for 0.1% of tax revenues. Non-tax receipts are a group of various types of revenues, both regular and incidental, which cannot be classified as tax revenues. The largest portion of non-tax receipts consists of the government's share of profits from state owned enterprises, while the largest portion of these profits is gained from the state banks. Other forms of revenue are forest concession fees and a variety of fees for government services such as passport fees and license fees. Other small revenues come from rent of government-owned houses, sale of government assets, etc. In 1982/1983 non-tax receipts accounted for 3.0% of domestic revenues.

Foreign aid revenue in the national development budget (APBN) consists of two types, program aid and project aid. Program aid at the beginning of Repelita I had a significant role to hold back inflation by supplying essential commodities. It consisted of rice, wheat, fertilizer and cash to be used for importing finished goods and raw materials. With the increase in production of essential food and fertilizer production, program aid became less significant. The rupiah amount allocated in the APBN was not the program aid itself, but the sale of the program aid at the open market by the Central Procurement Agency (Bulog) minus market operation costs. With the achievement of self-sufficient in rice, food aid such as the PL-480 from the United State is no longer received, and program aid revenues are no longer visible. In 1982/1983 program aid was as little as 0.1% of domestic revenues.

The rupiah value of project aid in the budget is, however, the actual value in rupiah of aid received in the form of equipment, experts, etc, for various government projects and state enterprises. Thus, this aid is included in the equivalent amount as an expenditure. The project aid, therefore, does not affect the balance of the budget, even though it indicates the size of public investment financed by foreign aid and loans.

3. The New Tax System

Among the multiple objectives of the tax reform the most important is to reduce the dependence on the oil and natural gas sector and to enlarge the taxable base in other economic sectors. In 1969-1970, receipts from the oil and natural gas sector totaled 27.0 percent, whereas in 1984-1985 this total increased to 59.7 percent. Another objective is to simplify the system of taxation with fairness and certainty, while improving efficiency of tax collection, application and administration. One notable difference between the new and the old system is that the former uses self-assessment method. The taxpayer now possesses the right to calculate and remit the taxes. This prevents misuse of the system by tax officials and taxpayers. The taxpayers are liable to misreporting their taxes. Under this new system, the rates of income tax are limited to three rates, whereas the old system had a dozen of tax rates. The new sales tax uses only a single rate of 10 percent, even though it reserves to impose a special tax on some luxuries. This implication makes the administration far easier for tax officials.

Under the old laws the objective was to meet the needs of the colonial government, whereas the new tax laws are based upon Pancasila: the five basic principles of the Republic of Indonesia and the constitution. Hence, tax collection was to be regarded as a realization of national duty and national development in order to achieve social justice and prosperity for all. One concrete feature of the new taxation system is to stress the element of fairness. This means that those who can pay taxes must pay taxes, but those who are unable to pay taxes or whose incomes are below a certain level are not liable to pay taxes. The new taxation laws may psychological surprise some citizens but their reactions must remain temporary. Hence, the implementation of the new taxation laws need be carried out with firmness of purpose and responsibility and with strict discipline. The tax paying society must be established in Indonesia through an extensive, far reaching and intensified taxation campaign. Thus, the tax potential can be expanded, and the system taxation can be simplified and guarantee justice better.

The new tax laws were approved on December 31, 1983. They include the General Regulations on Tax Administration Law, the Income Tax Law, and the Value Added Tax for Goods and Services and

Luxury Goods Sales Tax Law. The income Tax Law was set effective on January 1, 1984, replacing the former income tax and corporate tax laws, while the Value Added Tax Law of 1984 came into effect on April 1, 1985. On January 1, 1986, the government enacted the Land and Buildings Tax Law and Stamp Duties Law. The first one replaces the old land tax law (Ipeda) and the Net Wealth Tax Law, and the second law replaces the old stamp duties law. The old taxation laws were largely residual from the colonial era, such as the Corporate Tax Ordinance of 1925, the Wealth Tax Ordinance of 1932, and the Income Tax Ordinance of 1944.

As a follow-up measure to the enactment of the new tax laws, a period of tax amnesty from April 18, 1984 through June 30, 1985 was granted in order to ensure a clean start, relying upon the openness and honesty of the tax paying society. Implementation of the new tax laws, has not yet demonstrated a drastic increase in tax revenue but shown an encouraging expansion in the number of tax-payers. While there were 651,014 registered taxpayers at the time of the enactment of the new tax laws, his number had increased to 1,035,989 taxpayers at the beginning of 1986.

Another task in carrying out this renovation of taxation is the implementation of the Value Added Tax and Tax on Luxury Goods. This involves an extensive reorganization of indirect taxes. The experiences of other nations show that the effective implementation takes time to educate procedures and attaining the consequences. The government have appropriately carried out a campaign to explain these new tax regulations, but the effects remain to be seen.

The new 1983 income tax law is a combination of the 1944 individual income tax law and the 1925 corporate income tax law. This combination, it is hoped, achieves a simplification to make the tax collection and the taxpayers' understanding much easier. The main features of the new law may be summarized as follows:

(a) The new system is based upon the self assessment method. Each taxpayer is given full responsibility for the accuracy of his tax calculation. Of course, this method carries the threat of legal punishment, particularly with a two percent monthly fine, if the taxpayer does not pay the appropriate amount of taxes.
(b) Coverage under the new income tax is far greater than under the old, including all economic benefits derived by the taxpayer, both from domestic sources as well as foreign sources.
(c) The tax rates under the new income tax consist of only three rates 15%, 25% and 35%. All are applied to both individual incomes and corporate incomes. Under the old system, there were 19 rates for individual income tax, ranging from 5% to 50%, and three rates for corporate income tax, 20%, 30%, and 45%.

The 1983 Value Added Tax Law replaces the 1951 Sales Tax Law and the Import Sales Tax. Compared to the income tax, the changes in favor of value added tax are drastic. A completely different form was introduction. A few major features are :

(a) The value added tax is applied through the self assessment method. It has been applied in an extremely careful manner and covers only registered manufactures at the present. The full application of the value added tax should cover all levels of the production processes, including manufacturers, wholesalers, and retailers, only in terms of the value added at each stage. It is planned that coverage can gradually be expanded to wholesalers and retailers. This will occur in accordance with the refinement of tax administration and improved retail accounting.
(b) It is possible to have tax credits for the taxes already paid input is purchase. There is cascading effect, and the negative effects of the old turnover tax could be eliminated. In the same manner, this system allows for tax clearance for goods to be exported.
(c) There is only a unified rate under the value added tax. This is ten percent, although possible exemptions are given for agricultural products. Besides the value added tax, there remains a sales tax for a limited number of luxury goods at the rate of 10% or 20%. This should be compared to the old sales tax, which consisted of ten rates, ranging up to 50%.

On January 1, 1986, the new Land and Building Tax Law (PBB) came into effect, along with the

Stamp Duty Law. The PBB is replacing the old land tax (Ipeda) and wealth tax. In its new form, this PBB is no longer a personal tax, but rather a property tax, because only land and buildings are subject to taxation. The tax base is the market value of the land and buildings, although the assessment value is tentatively set at only 20% of the market value to avoid causing a shock to the people. Therefore, with a tax rate of 0,5% the collection of this tax can not be expected to give significant revenues to the government in its first year of application. The strategy is to make the people familiar with this tax and paying taxes in an orderly manner. Gradually, assessment rates will be increased until they reach the level equivalent to the full market value.

The new Stamp Duty Law is replacing the old law of 1921. Other than adjusting to modern type of transactions, the new law provides also a much fewer rates of stamp duty. It is not ultimately intended to raise the government revenues, but is more toward facilitating business and legal activities.

4. Preliminary Results of the Tax Reform

In the execution of the budget of 1986/1987, deterioration in the crude oil market to a price level unthinkable previously led the government to foster the tax collection. However, the tax reform had not been completed yet. As it might be easily understood, a certain period for adjustment was needed before the full impact of the reform could be disseminated. The new income tax, which was enacted on January 1, 1984, has not demonstrated an impressive performance yet. Even though income tax revenues represented 35.8% of the total tax revenues in 1986/1987, it implied an increase of only 9.0% relative to the income tax revenue in 1984/1985. With an inflation rate of 5.7% and the real growth rate estimated at about 2% in 1984/1986, the increase has not satisfactorily reflected the expected result. However, it might be that the world recession, which was spilled over to Indonesia through lower demand for Indonesian commodities, had affected business income in Indonesia.

Table 3.3 Tax Revenue in 1984/85 - 1986/87

(in billion of Rupiahs)

	1984/85	1985/86	%	1986/87	%
1. Income Tax	2,171 *)	2,366 *)	9.0	2,270	-4.0
2. Value Added Tax/ Sales Tax	878	2,327	165.0	2,900	24.6
3. Import Duties	530	607	14.5	960	58.2
4. Excises	873	944	8.1	1,056	11.9
5. Ipeda/PBB	157	167	6.4	190	13.8
6. Export Tax	91	50	-45.1	79	58.0
7. Stamp Duties	61	96	57.4	137	42.7
8. Auction Fees	4	3	-25.0	4	33.3
9. Property Tax	23	57	147.8	-	-
Total Tax Revenues	4,788	6,617	38.1	7,596	14.8

*) Including other receipt based on tax pardon regulation.

With regard to the value added tax, it has shown a very impressive performance. The revenues from this tax in 1985/1986 was 165% higher than the revenues from sales tax and sales tax on imports in the previous year. It is true that the value added tax revenues include a significant

amount of revenue collected from the domestic sales of petroleum products, which has never been imposed.

However, even if we exclude those revenues there is still an increase of 104%. It must be noted that compliance rate of this tax was only about 35%. Since this result was in the first year of implementation and has not been sufficiently supported by efficient administration, more expectation can be put on this tax.

Other than export taxation, other performed modestly with rates of increase ranging 6 to 15% from the previous year. The new land and building tax which was put into effect at the beginning of January 1986 need more time before it can be a major source of the government revenue. The decrease of 45% from the previous year was seen for the case of export tax revenues. This disappointing performance may be partly attributable to the general down turn of the export commodity prices in 1985/1986. In all, the total revenues in 1985/86 was 38% higher from the total tax revenues collected a year earlier.

IV. GOVERNMENT EXPENDITURES

The government annual spending is recorded in the traditional form as given by Table 4.1. In the routine expenditures, personnel expenditures cover salaries and pensions, rice and food allowances, and other domestic personnel expenditures. Rice allowance is designed to provide either in-kind or cash to the government workers. In the rice shortage provinces, rice is given, whereas cash is given in the rice surplus provinces. In the case of in-kind provision, each family had entitled to receive 10 kg of rice per each of the family up to 1974. After 1975, the allowance has been reduced to at most three children plus adults. The budget for rice allowance was suddenly increased in 1980 because of the starting of the rice provision to Timor Timur. Domestic personnel expenditures include special expenditure on railroad workers, scholarships and others. External personnel expenditure cover the payments to diplomatic officials abroad.

Material expenditures consist of central and local government expenditure on goods and services. Those materials are supposed to be worn out within the fiscal year of the government. Travel expenditures on duty for material maintenance are included in this category. Subsidies to regions are used to support the operation of the regional government, as it might be easily understood from the large portion of the personnel expenses in the subsidies to regions, see Table 4.1. Interest and principal repayments are reported under a single item. Actually, principal repayments are supposed to be included in the development expenditures, if we categorize routine expenditures as current outlays and the development expenditures as capital outlays.

Other operating expenditures include general election, government import subsidy on rice which lasted until 1982, and subsidy on domestic sales of petroleum products. Among them, subsidy to Pertamina was once used to assist the rebuilding of the Pertamina finance after the Pertamina incidence in 1975. This assistance wash terminated in 1980 when that corporation fully paid back their loans. Today the government subsidy on imported rice has no significant meaning. Around the middle of Repelita III period, the Indonesian rice production realized self sufficiency. Since then, the rice import became irrelevant. It is the so-called oil subsidy that the government has been seriously maneuvering as the new burden. This item has occupied a significant portion in the budget after 1977. The Indonesian crude oil could be exported at the international price. Since the government artificially maintained lower oil price for the domestic uses, the difference has been subsidized by the government.

Table 4.1 Expenditure Classification, 1984/1985 - 1986/1987

(in billion of Rupiahs)

	1984/1985	1985/1986	1986/1987
Routine Expenditures	9,429.0	11,951.5	13,559.3
1. Personnel Expenditures	3,046.8	4,018.3	4,310.6
a. Rice Allowance	407.0	402.0	406.1
b. Wages and Salaries	2,206.6	3,072.6	3,330.0
c. Food Allowance	271.4	300.4	288.3
d. O t h e r	89.7	161.1	176.6
e. External	72.1	82.2	109.6
2. Material Expenditures	1,182.8	1,367.1	1,366.5
a. Domestic	1,134.2	1,309.5	1,293.6
b. External	48.6	57.6	72.9
3. Subsidies to Regions	1,883.3	2,489.0	2,649.7
a. Personnel Expenditure	1,680.1	2,247.6	2,410.2
b. Non Personnel Expend.	203.2	241.4	239.5
4. Debt Service Payments	2,776.5	3,323.1	5,058.1
a. Internal	39.3	20.0	-
b. External	2,737.2	3,303.1	5,058.1
5. Rice Stock	-	-	29.4
6. Other Routine Expenditures	539.6	754.0	145.0
a. Oil Subsidies	506.7	374.2	-
b. General Elections	-	40.0	85.8
c. Others	32.9	339.9 *)	59.2
Development Expenditures	9,951.9	10,873.1	8,332.0
I. Rupiah Financing	6,543.2	7,369.7	4,537.3
1. Dep./Institutions **)	3,474.4	4,466.5	2,003.5
2. Subsidies to Regions	1,526.2	1,502.6	1,466.5
a. Subs. to Villages	92.8	98.6	86.4
b. Subs. to Districts	194.6	188.6	188.1
c. Subs. to Provinces	253.0	287.3	293.1
d. Cons.of Prim.School	572.0	526.1	495.9
e. Pub. Health Centres	64.6	110.6	107.7
f. Inpres of Markets	25.5	4.4	11.5
g. Inpres of Replanting	61.2	42.5	30.6
h. Inpres of Road Facilities	101.2	70.1	74.9
i. Timor Timur	4.1	6.9	7.3
j. Land & Building Tax	157.2	167.5	171.0
3. Others Develop. Expend.	1,542.6	1,400.6	1,067.3
a. Fertilizer Subsidies	731.6	477.1	467.3
b. Govern.Particip.(equity) in state enterpr.	336.1	412.3	85.9
c. Others	474.9	511.2	514.1
II. Project Aids	3,408.7	3,503.4	3,794.7
Government Expenditures	19,380.9	22,824.6	21,891.3

*) Included Restitution of Tax amount Rp 299.8 billion.

**) Included Armed Forces.

This became more than 9 percent of the total government spending in 1981/1982. The subsidized oil products became relatively cheaper than the alternative energy sources. This induced the Indonesian to use more oil or oil products. Thus the voice for subsidy was strengthened furthermore. The strong advises to the government were made from various camps to eliminate this kind of subsidy. The government has started to reduce the subsidy by raising the domestic price of oil in 1983 to 1985, consecutively. Nonetheless, this subsidy could not be lowered below 1 % of the entire government routine spending in 1984/1985. See Table 4.2.

Table 4.2 Oil Subsidies, 1981/1982 - 1985/1986 (in billion of Rupiahs)

	1981/82	1982/83	1983/84	1984/85	1985/86
1. Oil Subsidies	1,316.4	961.5	928.1	506.7	374.2
2. Total Routine Expenditures	6,977.6	6,996.3	8,411.8	9,429.0	11,951.5
3. Total Government Expend.	13,917.7	14,355.9	18,311.0	19,380.9	22,824.6
- Ratio 1/2	18.9	13.7	11.0	5.4	3.1
- Ratio 2/3	9.5	6.7	5.0	2.6	1.6

The largest development spendings have been either managed by the departments or in the form of project aid. The former has been initiated by the Indonesian governmental body to increase the capital formation. The latter project aid is determined in the foreign currency units. Whenever the domestic currency is devalued, therefore,the rupiah value of the project aid automatically increases. For instance, when the rupiah depreciated in November 1978 and in March 1983, the rupiah value of project aid increased quite drastically.

Other major items in the development expenditures are various subsidies to the regional development and spendings for certain purposes such as education and health facilities. Subsidies to regions (or Inpres programs) are determined by the Presidential Decrees, and these funds are allocated to projects with specific aims such as primary schools, health centres etc.

Other development expenditures are government capital participation and subsidies on fertilizer. The former is the government's participation to various public companies and public projects which will eventually become public corporations. Such investments are usually financed through the state owned banking system. The fertilizer subsidies were once actively used to stimulate rice production. In the early part of development, planning, the government put an enormous emphasis on self-sufficiency of rice regarded it as one of the central goals. In Repelita II and III, this was repeatedly stressed as the most urgent task for Indonesian development or the foundation for development. This is the reason why the fertilizer subsidy has been placed in the development expenditure.

The basic characteristics of the Indonesian fiscal spending are also seen in Table 4.3, in which three ratios of revenues and expenditures are compared. Non-oil domestic revenue in proportion to routine expenditure is almost persistently declining. This demonstrates that the central government's efforts to strengthen the non-oil domestic revenue base have not been sufficiently caught up with a pace of the routine expenditures. The latter cannot probably be regarded excessively expansive, since the real wage of the government officials has been declining over the time period under consideration. The routine expenditure itself has been declining in relation to the domestic revenue. As already stated, the largest contribution to the domestic

revenue increase was the oil/LNG receipts. In this respect, the routine spending relative to the domestic revenue simply describes how dominant the oil/LNG earnings are in the fiscal structure and policy in Indonesia.

Table 4.3 Several Ratios Between Domestic Revenues and Routine Expenditures

(in billion of Rupiahs, %)

	Oil Revenues (a)	Tax Revenues (b)	Non Tax Revenues (c)	Total Domestic Revenues (d)	Routine Expenditure (e)	Ratio b/e	Ratio e/d	Ratio a/d
1978/1979	2,308.7	2,766.0	191.4	4,266.1	2,743.7	100.8	64.3	54.1
1979/1980	4,259.6	2,249.9	187.3	6,696.8	4,061.8	55.4	60.7	63.6
1980/1981	7,019.6	2,891.7	315.7	10,227.0	5,800.0	49.9	56.7	68.6
1981/1982	8,627.8	3,248.4	336.4	12,212.6	6,977.6	46.6	57.1	70.6
1982/1983	8,170.4	3,812.3	435.6	12,418.3	6,996.3	54.5	56.3	65.8
1983/1984	9,520.2	4,393.5	519.0	14,432.7	8,411.8	52.2	58.3	66.0

After deducting routine expenditures from the domestic revenues, the remainings were allocated to the development expenditures. Some caution at this stage is needed not to overestimate the government capital formation. Due to the unclear definition of the development spending, the development expenditure is very likely to include a fair portion of expenditures which should be classified as routine expenditures. However, it is practically impossible to extract that part, given the present system of data processing. Nevertheless, this does not discount the government's emphasis on the development policy. Whenever the oil revenues increased, the government could afford to allocate more resources to the infrastructure construction and other public projects. This external effect also helped immensely to reduce the dependence on the project aid financing.

As described briefly above, the classification of fiscal expenditures in Indonesia is not consistent with the standard economic analysis. In particular, when the government consumption and investment data are needed, some adjustments must be applied even though the routine and development expenditures are not so significantly different from the government consumption and investment, respectively. Table 4.4 compares the trends of the routine and development expenditures in the current value. These trends are also given in the ratio to GDP.

The government spending, including project aid, has been rapidly expanding since 1969. The economy had an enormous shortage in the industrial base and infrastructure, so that the government had to take a decisive initiative to fill such a gap. Nevertheless, during the period of Repelita I, the government depended on the domestic revenues, and its spending relative to GDP remained low. Under the circumstance during those years, the government could not simply allocate more to the development expenditures and about two thirds of the whole budget were used for the routine spending. This can be more characteristically described if CG and IG ratios are compared. The large proportion of the government investment was used to purchase the imported materials and equipments (project aid). As Table 4.4 shows, IG/GDP ratio was almost half of the CG/GDP ratio during the period of Repelita I.

The drastic change in the government budget was taken in 1974/1975. Since then, the develop-

ment expenditures, or government investments, became more than the routine budgets. The variety of infrastructures and industrial facilities were constructed a remarkable pace throughout the Repelita II and III years. Such an effort of the government can be seen even in the hard times, in 1982/1983 and 1983/1984. To resist the declined growth rate in those years, the government imposed a drastic measure to freeze the civil servants salaries and to more preserve strong investment policy to sustain the development activities. The government came to realize that the government-led industrialization will become eventually in consistent with the self-dependent development in the Repelita IV and henceafter. As long as the government promotes the development projects under the less promising environment in the world oil market, the balance of payments difficulty will always be threatening. An episode of rephasing the existing and forthcoming projects in 1983 is instructive forcefully to teach what is needed to save the balance of payments and external debts difficulties. The emphasis is now shifting from the government to the private sector. The tax reform is an indication that the government is to make a transition from the old policy. As a step, the non-oil exports promotion became an urgent policy. In the broad framework of the fiscal expenditures, such a change in the policy will be emphatically reflected in the spending scheme in the coming years.

Table 4.4 Routine and Development Expenditures and Their Ratios to the Gross Domestic Product

(in trillion of Rupiahs and percentage)

FY	Routine Expend.[1] (a)	Dev. Expend.[2] (b)	Total Expend. (c)	GDP[3] (d)	Ratio (%) (a/d)	(b/d)	(c/d)
1969/70	0.2	0.1	0.3	2.7	7.4	3.7	11.1
1970/71	0.3	0.1	0.4	3.2	9.4	3.1	12.5
1971/72	0.3	0.2	0.5	3.7	8.1	5.4	13.5
1972/73	0.4	0.3	0.7	4.6	8.7	6.5	15.2
1973/74	0.7	0.4	1.1	6.7	10.4	6.0	16.4
1974/75	1.0	0.7	1.7	10.7	9.3	6.5	15.9
1975/76	1.3	1.2	2.5	12.6	10.3	9.5	19.8
1976/77	1.5	1.9	3.4	15.5	9.7	12.3	21.9
1977/78	2.0	2.0	4.0	19.0	10.5	10.5	21.0
1978/79	2.4	2.2	4.6	22.7	10.6	9.7	20.3
1979/80	3.7	3.6	7.3	32.0	11.6	11.3	22.8
1980/81	5.5	5.3	10.8	45.4	12.1	11.7	23.8
1981/82	6.5	6.1	12.6	54.0	12.0	11.3	23.3
1982/83	6.4	6.4	12.8	59.6	10.7	10.7	21.4
1983/84	7.5	8.6	16.1	73.7	10.2	11.7	21.8
1984/85	8.1	7.9	16.0	87.0	9.3	9.1	18.4
1985/86	10.7	8.4	19.1	94.5	11.3	8.9	20.2
1986/87	11.0	5.4	16.4	96.5	11.4	5.6	17.0

1) excluding foreign debt amortization but including fertilizer subsidies.
2) including foreign aid less amortization and fertilizer subsidies.
3) at current prices.