2.2 Macro-Economic Model

2.2.1 Analysis Model

The structure of the model used to analyze the influence of the implementation of this project on the Indonesian economy is shown in Figure 8-2-1. It is composed of the real expenditure block, the nominal expenditure block and the price block that relates both of them. The mechanisms of this model wii be explained in the following.

Real private consumption, fixed capital formation and imports are first determined from real GDP. Each deflator with wholesale price index as its end-point is then determined for each of these factors on the basis of exogenously given exports and government consumption. Finally, nominal expenditure items are identified based on real expenditure items are fed back to once again determine each deflator.

Although the structure of this model is very simple in comparison with general, short-, medium- and long-term macro-economic models that are used for economic forecasting, it is considered sufficient to grasp the multiplier effect of public investment.

In this connection, a list of variables and real values prepared and collected for framing this model are shown in Tables 8-2-2 and 8-2-3.
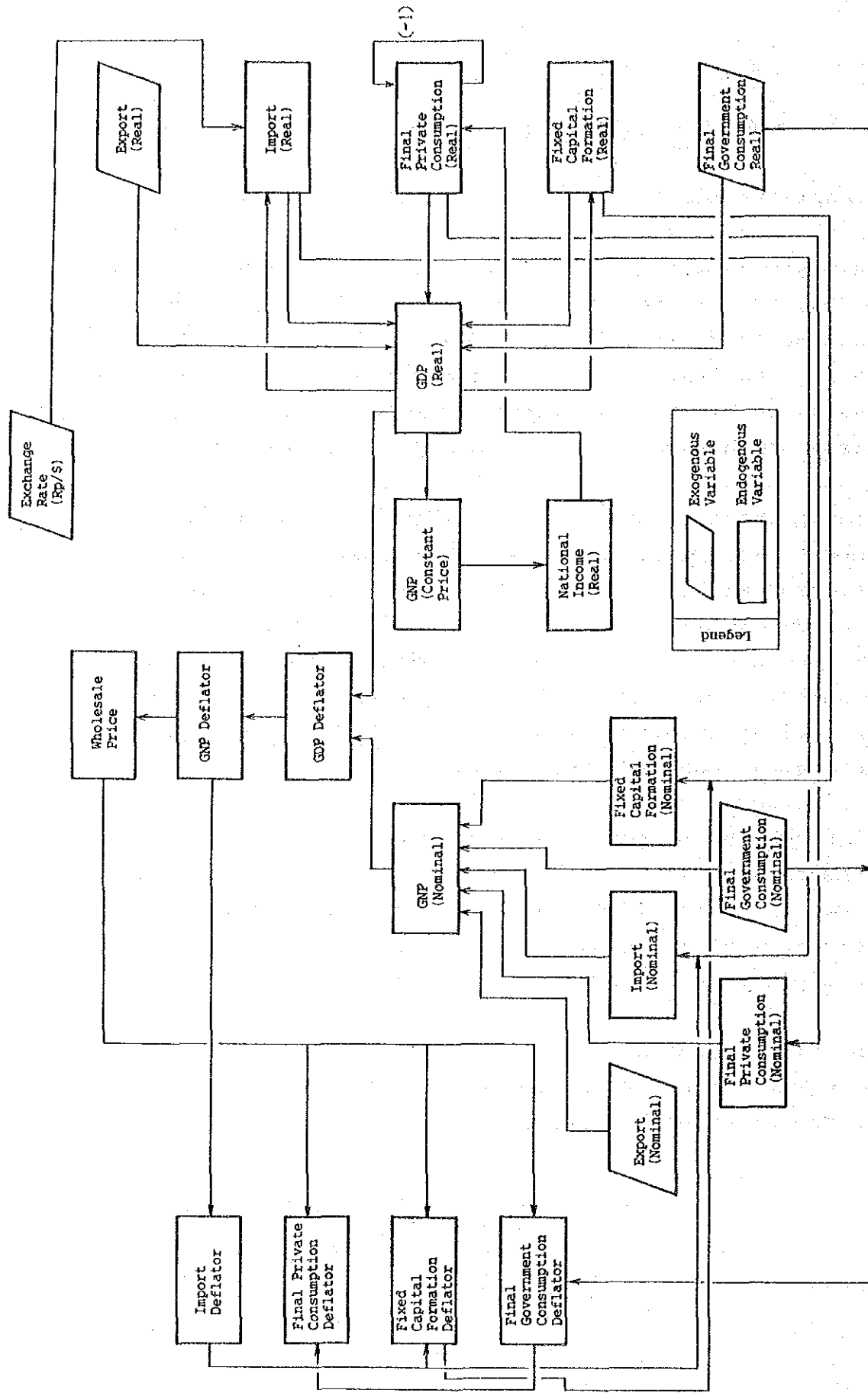
Figure 8-2-1 Structure of Macro-economic Model

Table 8-2-2 List of Variables

Number	Name of Variable	Type	Description	Unit
1	GDP.RI	Endogenous	Real gross domestic product	1983 price Bil. Rp
2	CP.RI	Endogenous	Real final private consumption	"
3	CG.RI	Endogenous	Real final government consumption	"
4	IP.RI	Endogenous	Real fixed capital formation	"
5	E.RI	Endogenous	Real export	"
6	M.RI	Endogenous	Real import	"
7	GNP.RI	Endogenous	Real gross national product	"
8	NI.RI	Endogenous	Real national income	"
9	GDP.NI	Endogenous	Nominal gross domestic product	Bil. Rp
10	CP.NI	Endogenous	Nominal final private consumption	"
11	CG.NI	Exogenous	Nominal final government consumption	"
12	IP.NI	Endogenous	Nominal fixed capital formation	"
13	E.NI	Exogenous	Nominal export	"
14	M.NI	Endogenous	Nominal import	"
15	PGDP.I	Endogenous	Gross domestic product deflator	1983 = 100
16	PCP.I	Endogenous	Final private consumption deflator	"
17	PCG.I	Endogenous	Final government consumption deflator	"
18	PIP.I	Endogenous	Fixed capital formation deflator	"
19	PE.I	Endogenous	Export deflator	"
20	PM.I	Endogenous	Import deflator	"
21	PGNP.I	Endogenous	Gross domestic product deflator	"
22	WPI.I	Endogenous	Whole sale price index	1980 = 100
23	DER.I	Exogenous	Exchange rate	Rp/month
24	GNP.NI	–	Nominal gross national product	Bil. Rp

Source: Statistics Yearbook of Indonesia

Note: Data from 1977 to 1985

Table 8-2-3 Actual Value List

Year (Period)	1 CP.NI	2 CP.RI	3 PCP.I	4 CG.NI
1977	12458.4 (0.0)	27537.5 (0.0)	45.24 (0.0)	2077.3 (0.0)
1978	15184.5 (21.9)	29447.9 (6.9)	51.56 (14.0)	2658.9 (28.0)
1979	19513.7 (28.5)	33669.8 (14.3)	57.96 (12.4)	3733.4 (40.4)
1980	27502.9 (40.9)	37958.5 (12.7)	72.46 (25.0)	4688.2 (25.6)
1981	35560.0 (29.3)	44301.4 (16.7)	80.27 (10.8)	5787.9 (23.5)
1982	41670.3 (17.2)	45791.0 (3.4)	91.00 (13.4)	6831.7 (18.0)
1983	44739.3 (7.4)	44739.3 (-2.3)	100.00 (9.9)	8077.3 (18.2)
1984	51100.8 (14.2)	46793.1 (4.6)	109.21 (9.2)	9220.2 (14.1)
1985	54600.3 (6.8)	49091.3 (4.9)	111.22 (1.8)	11423.7 (23.9)

Year (Period)	5 CG.RI	6 PCG.I	7 IP.NI	8 IP.RI
1977	4626.3 (0.0)	44.90 (0.0)	3826.4 (0.0)	8887.1 (0.0)
1978	5440.5 (17.6)	44.87 (8.8)	4670.7 (22.1)	10225.7 (15.1)
1979	5957.9 (9.5)	62.66 (28.2)	6704.3 (43.5)	10677.7 (4.4)
1980	6598.4 (10.8)	71.05 (13.4)	9485.2 (41.5)	12694.0 (18.9)
1981	7269.0 (10.2)	79.62 (12.1)	11553.4 (21.8)	14107.6 (11.1)
1982	7867.5 (8.2)	86.83 (9.1)	13467.1 (16.6)	15940.7 (13.0)
1983	8077.3 (2.7)	100.00 (15.2)	18973.8 (40.9)	18973.8 (19.0)
1984	8412.4 (4.1)	109.60 (9.6)	19805.9 (4.4)	17980.3 (-5.2)
1985	9233.2 (9.8)	123.72 (12.9)	19613.5 (-1.0)	17189.5 (-4.4)

Year (Period)	9 PIP.I	10 E.NI	11 E.RI	12 PE.I
1977	43.06 (0.0)	4639.4 (0.0)	20691.5 (0.0)	22.42 (0.0)
1978	45.68 (6.1)	4973.9 (7.2)	21075.0 (1.9)	23.60 (5.3)
1979	62.79 (37.5)	9628.7 (93.6)	21048.4 (-0.1)	45.75 (93.8)
1980	74.72 (19.0)	13849.2 (43.8)	19862.0 (-5.6)	69.73 (52.4)
1981	81.90 (9.6)	14927.9 (7.8)	19387.2 (-2.4)	77.00 (10.4)
1982	84.48 (3.2)	13345.2 (-10.6)	16685.1 (-13.9)	79.98 (3.9)
1983	100.00 (18.4)	20447.7 (53.2)	20447.7 (22.6)	100.00 (25.0)
1984	110.15 (10.2)	23551.8 (15.2)	21022.7 (2.8)	112.03 (12.0)
1985	114.10 (3.6)	21764.7 (-7.6)	19225.1 (-8.6)	113.21 (1.1)

Year (Period)	13 M.NI	14 M.RI	15 PM.I	16 GDP.NI
1977	3970.6 (0.0)	8237.3 (0.0)	48.20 (0.0)	19256.4 (0.0)
1978	4742.0 (19.4)	9522.1 (15.6)	49.80 (3.3)	22746.0 (18.1)
1979	7554.7 (59.3)	11658.8 (22.4)	64.80 (30.1)	32025.4 (40.8)
1980	10079.8 (33.4)	13421.5 (15.1)	75.10 (15.9)	45445.7 (41.9)
1981	13802.2 (36.9)	17053.3 (27.1)	80.94 (7.8)	54027.0 (18.9)
1982	15681.7 (13.6)	18452.8 (8.2)	84.98 (5.0)	59632.6 (10.4)
1983	21235.1 (35.4)	21235.1 (15.1)	100.00 (17.7)	73697.6 (23.6)
1984	20287.9 (-4.5)	17887.4 (-15.8)	113.42 (13.4)	87535.5 (18.8)
1985	20186.9 (-0.5)	16895.7 (-5.5)	119.48 (5.3)	96066.4 (9.7)

Year (Period)	17 GDP.RI	18 PGDP.I	NI.RI	DER.I
1977	49642.6 (0.0)	38.79 (0.0)	43752.6 (0.0)	0.00 (0.0)
1978	53049.7 (6.9)	42.88 (10.5)	46389.6 (6.0)	634.00 (0.0)
1979	56368.1 (6.3)	56.82 (32.5)	48559.4 (4.7)	632.00 (-0.3)
1980	61937.3 (9.9)	73.37 (29.1)	53099.0 (9.3)	634.00 (0.3)
1981	66847.2 (7.9)	80.82 (10.2)	58152.2 (9.5)	643.00 (1.4)
1982	68348.9 (2.2)	87.25 (7.9)	59668.3 (2.6)	692.00 (7.6)
1983	73697.6 (7.8)	100.00 (14.6)	65513.5 (9.8)	994.00 (43.6)
1984	78213.8 (6.1)	111.92 (11.9)	69500.2 (6.1)	1076.00 (8.2)
1985	79679.1 (1.9)	120.57 (7.7)	70219.3 (1.0)	1131.00 (5.1)

Year (Period)	GNP.NI	GNP.RI	PGNP.I	WPI.I
1977	18566.1 (0.0)	48546.4 (0.0)	38.24 (0.0)	0.00 (0.0)
1978	21879.3 (17.8)	51520.1 (6.1)	42.47 (11.0)	0.00 (0.0)
1979	30541.0 (39.6)	54032.1 (4.9)	56.52 (33.1)	0.00 (0.0)
1980	43435.0 (42.2)	59113.0 (9.4)	73.48 (30.0)	232.66 (0.0)
1981	52102.1 (20.0)	64623.1 (9.3)	80.62 (9.7)	259.22 (11.4)
1982	57675.1 (10.7)	66280.0 (2.6)	87.02 (7.9)	276.62 (6.7)
1983	70337.9 (22.0)	70337.9 (6.1)	100.00 (14.9)	327.00 (18.2)
1984	83369.3 (18.5)	74540.5 (6.0)	111.84 (11.8)	396.00 (21.1)
1985	92389.3 (10.8)	76601.5 (2.8)	120.61 (7.8)	337.00 (-2.3)

2.2.2 Structure Equation

Next, the structural equation of this model is estimated. The endogenous variables in this model are given below. However, those variables which are fixed as defined are excluded.

① Real Final Private Consumption   CP.RI

② Real Fixed Capital Formation   IP.RI

③ Real Import   M.RI

④ Real Gross National Product   GNP.RI

⑤ Real Gross National Income   NI.RI

⑥ Gross National Product Deflator   PGNP.I

⑦ Wholesale Price Index   WPI.I

⑧ Final Private Consumption Deflator   PCP.I

⑨ Fixed Capital Formation Deflator   PIP.I

⑩ Import Deflator   PM.I

The estimation of the structural equation with the above variables is presented in the following pages.

. ( ):   T value

. r^2:   Determination coefficient

. s: Standard error

. d: Durbin-Watson ratio

For details, refer to ANNEX VII, 1.

① Real Final Private Consumption Expenditure

$$CP.RI = 5380.60 + 0.16574 \cdot NI.RI + 0.67899 \cdot CP.RI_{-1}$$
$$\quad\quad\quad (0.83) \quad\quad (0.52) \quad\quad\quad\quad (1.83)$$

$$r^2 = 0.894, \quad s = 2272.64, \quad d = 1.449$$

② Real Fixed Capital Formation

$$IP.RI = -5399.22 + 0.32921 \cdot GNP.RI_{-1}$$
$$\quad\quad\quad (-1.57) \quad\quad (5.90)$$

$$r^2 = 0.828, \quad s = 1377.30, \quad d = 1.59$$

③ Real Import

$$\log(M.RI) = -14.070 + 2.48417 \cdot \log(GDP.RI)$$
$$\quad\quad\quad\quad (-2.74) \quad\quad (3.91)$$
$$\quad\quad\quad\quad - 0.58345 \cdot \log(DBR.I)$$
$$\quad\quad\quad\quad (-1.62)$$

$$r^2 = 0.787, \quad s = 0.12, \quad d = 1.642$$

④ Real Gross National Product

$$GNP.RI = 1307.52 + 0.94137 \cdot GDP.RI$$
$$\quad\quad\quad\quad (1.05) \quad\quad (51.29)$$

$$r^2 = 0.997, \quad s = 473.67, \quad d = 1.984$$

⑤ Real National Income

$$NI.RI = -5057.93 + 0.98940 \cdot GNP.RI$$

$$r^2 = 0.993, \quad s = 762.22, \quad d = 1.616$$

⑥ Gross National Product Deflator

$$PGNP.I = -0.52871 + 1.00471 \cdot PGDP.I$$
$$\quad\quad\quad\quad (-3.07) \quad\quad (512.46)$$

$$r^2 = 0.999, \quad s = 0.14, \quad d = 2.397$$

⑦   Wholesale Price Index

$$WPI.I = -33.8708 + 3.62939 \cdot PGNP.I$$
$$\quad\quad\quad (-0.96) \quad\quad (10.02)$$

$$r^2 = 0.952, \quad s = 14.92, \quad d = 2.680$$

⑧   Final Private Consumption Deflator

$$PCP.I = 22.8964 + 0.56415 \cdot PCG.I + 0.056184 \cdot WPI.I$$
$$\quad\quad\quad (3.49) \quad\quad (4.64) \quad\quad\quad\quad (2.89)$$

$$r^2 = 0.979, \quad s = 3.23, \quad d = 1.508$$

⑨   Fixed Capital Formation Deflator

$$PIP.I = 6.73653 + 0.83495 \cdot PM.I + 0.0239820 \cdot WPI.I$$
$$\quad\quad\quad (1.44) \quad\quad (9.83) \quad\quad\quad\quad (1.85)$$

$$r^2 = 0.993, \quad s = 1.99, \quad d = 2.094$$

⑩   Import Deflator

$$PM.I = 11.3549 + 0.88866 \cdot PGNP.I$$
$$\quad\quad\quad (3.57) \quad\quad (24.52)$$

$$r^2 = 0.988, \quad s = 2.56 \quad d = 1.410$$

2.2.3 Analysis of the Income Multiplier

Based on the results of the procedures described in 2.2.1
and 2.2.2, the macro-economic model used to analyze the
income multiplier of the public investment is shown in
Table 8-2-4. An analysis of the income multiplier effect
of this project is carried out based on this model in the
following manner.

① First, a simulation of the analysis, called the
Standard Case, is performed under the assumption
that this projct does not exist. The term of the
simulation is assumed to be from 1986 through 1995.
The presumed exogenous values for this period are as
follows.

Growth in real government consumption

4.0 percent/year

Growth in nominal government consumption

10.0 percent/year

Growth in real export   4.0 percent/year

Growth in nominal export   10.0 percent/year

Devaluation rate in foreign exchange

5.0 percent/year

② Next, a simulation study, similar to ① above, is
conducted using the optimal route, Plan-1B, with the
project cost being proportionately added to the
fixed capital formation for two years, 1991 and
1992. The period is fixed for 1991 and 1992 because
the expenditure of the project cost is concentrated
with in these two years. This is called the Plan-1B
Case. The results of the simulation on the Standard
Case and the Plan-1B Case are shown in Table 8-2-5.

Based on the results given in Table 8-2-5, the
influence that the project expenditure for Plan-1B
(about 7 billion Rupiah) will exert on the
macro-economy for the two years, 1991 and 1992, is
summarized as follows.

Increase in fixed capital formation 8 (Bil. Rp)

Increase in private consumption   3 (Bil. Rp)

Increase in import   6 (Bil. Rp)

Note: Total effect from 1991 to 1993

Thus, expenditure on the domestic demand sector
(consumption and investment) increases about 11
billion Rupiah (including 7 billion Rp public
investment) due to this project. However, because
economic activities become brisk and imports
increase, it is understood that the increase in GDP
will be limited to about 5 billion Rupiah. This
highlights the important point tha the Indonesian
industrial structure will shift from primary
industries to manufacturing industries.

Table 8-2-4 Macro-Economic Model System

<Structural Equation>

    CP.RI = 5382.6 + 0.16574*(NI.RI) + 0.67899*(CP.RI(-1))

    IP.RI = -5399.22 + 0.32921*(GNP.RI(-1))

    LOG(M.RI) = -14.0707 + 2.48417*(LOG(GNP.RI))
                -0.58343*(LOG(DER.I))

    NI.RI = -55057.93 + 0.98940*(GNP.RI)

    GNP.RI = 1307.52 + 0.94137*(GDP.RI)

    PGNP.I = -0.52871 + 0.94137*(PGDP.I)

    WPI.I = -33.8708 + 3.62939*(PGNP.I)

    PCP.I = 22.8964 + 0.56415*(PCG.I) + 0.561841*(WPI.I)

    PIP.I = 6.73653 + 0.83495*(PM.I) + 0.023982*(WPI.I)

    PM.I = 11.3549 + 0.88866*(PGNP.I)

<Definition Expression>

    GDP.RI = CP.RI + IP.RI + CG.RI + E.RI - M.RI

    PGDP.I = (CP.NI + IP.NI + CG.NI + E.NI - M.NI)/
             (CP.RI + IP.RI + CG.RI + E.RI - M.RI) * 100.0

    CP.NI = PCP.I*CP.RI/100.0

    IP.NI = PIP.I*IP.RI/100.0

    M.NI = PM.I*M.RI/100.0

    PCG.I = CG.NI/CG.RI*100.0

Table 8-2-5 Simulations on Macro-Economic Models

(Billion Rp)

Standard Case	1985	1991	1992	1993	1994	1995	1995/85
GDP.RI	79679	93406	95952	98536	101169	103861	2.7
CP.RI	49091	57865	59132	60390	61649	62917	2.5
IP.RI	17190	21419	22203	22994	23798	24617	3.7
CG.RI	9233	11683	12150	12636	13142	13667	4.0
E.RI	19225	24326	25299	26311	27363	28458	4.0
M.RI	16896	21886	22832	23795	24782	25798	4.3
GDP.RI	100.0	100.0	100.0	100.0	100.0	100.0	
CP.RI	61.6	62.0	61.6	61.3	60.9	60.6	
IP.RI	21.6	22.9	23.1	23.3	23.5	23.7	
CG.RI	11.6	12.5	12.7	12.8	13.0	13.2	
E.RI	24.1	26.0	26.4	26.7	27.0	27.4	
M.RI	21.2	23.4	23.8	24.1	24.5	24.8	

Case Plan-1B	1985	1991	1992	1993	1994	1995	1995/85
GDP.RI	79679	93409	95954	98537	101170	103861	2.7
CP.RI	49091	57866	59133	60391	61649	62918	2.5
IP.RI	17190	21423	22206	22995	23798	24617	3.7
CG.RI	9233	11683	12150	12636	13142	13667	4.0
E.RI	19225	24326	25299	26311	27363	28458	4.0
M.RI	16896	21889	22834	23796	24783	25798	4.3
GDP.RI	100.0	100.0	100.0	100.0	100.0	100.0	
CP.RI	61.6	62.0	61.6	61.3	60.9	60.6	
IP.RI	21.6	22.9	23.1	23.3	23.5	23.7	
CG.RI	11.6	12.5	12.7	12.8	13.0	13.2	
E.RI	24.1	26.0	26.4	26.7	27.0	27.4	
M.RI	21.2	23.4	23.8	24.1	24.5	24.8	

2.3   Input-Output Model

The cost for this submarine cable project is composed
largely of costs for procuring materials and equipment,
and costs for installation and consulting fees. However,
materials and equipment are procured from abroad, so
there will be no effects propagated by these costs to the
industries or economy of Indonesia. On the other hand,
installation and consultants' activities are expenditures
paid within Indonesia, and these costs should induce
effects. Thus, the output that will result within each
of the Indonesian industrial sector due to the execution
of this project should be determined first, followed by a
quantitative analysis of the influence that the increase
in output will exert on employment conditions.

2.3.1   Industrial Structure

(1)   Input-output table

An input-output table is essential for any analysis
of production inducement, and because it was the
most recent available, the 1983 table is used here.
Its details are as follows.

. There are two kinds of input-output tables,
i.e., a producer's price list and a purchaser's
price list. Here, the purpose is evaluating
production inducement, so the producer's price
list is used.

. Furthermore, for imports, there are competitive
and non-competitive import types. Competitive
import types, in which competition between
domestic products and imports is presupposed, is
adopted here.

. For intermediate sectors, sectors from the
19-sector input-output table of 1983 is
increased to 20 with the addition of the
communication sector. (Refer to Table 8-2-6.)

The input-output table (expressed in values) for
this analysis and an input coefficient table are
presented in Appendix VII, 1. The following is a
summary of an analysis of Indonesian industrial
structure based on these materials.

. The total output of Indonesia in 1983 was 76,300
billion Rp, consisting of 28,000 billion Rp in
the intermediate demand sector, 58,800 billion
Rp in the final demand sector, and 10 trillion
5.4 billion Rp in the import sector. The import
to total demand ratio was about 12 percent.

. Next, for the input structure, the intermediate
input sector is 28,000 billion Rp and the value-
added sector is 48,300 billion Rp. The rate of
value added is as high as 63 percent. This
figure indicates that labor intensive industries
are the backbone of the Indonesian industrial
structure, suggesting that labor productivity
can be increased in the future by introducing
capital intensive industries.

. The output of the communications sector that
this project concerns is 265 billion Rp; a small
share of the country's total output. The mining
industry sector accounts for the highest share
at 18.3 percent with an output of 14,000 billion
Rp. This industry exports 11,300 billion Rp out
of its total output, being the most important
foreign currency acquiring industry of Indonesia.

. The intermediate input rate of the communications sector is about 43 percent, exceeding the average of all industries. Industries that have relatively high input coefficients include, other manufacturing industries (9.8%), construction (7.5%), transportation (6.0%), real estate (5.7%) and service (5.7%). Furthermore, the sum total of personnel expenses and fixed capital depletion accounts for 87 percent of the total value added in the communications sector. Finally it can be said that the industry is .
closed to the capital intensive sector.

. Regarding final demand in the communication sector, while communication expenses amount to 109 billion Rp and 34 billion Rp in the household and government sectors, respectively, its ratio to all final demand amounts is also small (0.24%). Communication expenses in Indonesia are still regarded as small, which can be attributed to the minimal supply capacity of the communication equipment. Further development of machinery industries is desired.

Table 8-2-6 Category of Industry

No.	Category	No.	Category
1	Paddy		(Final Demand)
2	Other food crops	301	Private expenditure
3	Other agricultural crops	302	Government expendigure
4	Livestock and its product	303	Fixed gross formation
5	Forestry	304	Change in stock
6	Fishery	305	Export of goods
7	Mining and quarrying	306	Export of service
8	Food beverage and tobacco	309	Total final demand
9	Other industries	401	Import of goods
10	Oil refinery	402	Import sales tax
11	Electricity, gas and water supply	403	Import duty
12	Construction	404	Subsidy
13	Trade	405	Import of service
14	Restaurant and hotel	409	Total import
15	Transport	600	Total output
16	Communication	700	Total supply
17	Financing, real estate and business service		
18	Public administration and defence		
19	Service		
20	Unspecified sector		
190	Intermediate total		
	(Service Section)		
201	Wage and salary		
202	Operating surplus		
203	Depreciation		
204	Indirect tax		
205	Subsidy		
206	Gross value added		
210	Total input		

(2) Inverse matrix table

An inverse matrix table is prepared on the basis of
the input coefficients shown in the ANNEX section.
The method is as follows.

Output is obtained by Intermediate Demand + Final
Demand - Import, expressed in a numerical formula as

$$A \cdot X + Fd + Fe - \hat{M} = X \qquad \dots\dots\dots\dots \text{(1)}$$

where,

A: input coefficient matrix

Fd: matrix of final demands, except export

Fe: export vector

$\hat{M}$: import vector

X: output vector

If import is induced by domestic demand, import
coefficient is expressed as

$$\hat{M} = \hat{M} / (A \cdot X + Fd) \qquad \dots\dots\dots\dots \text{(2)}$$

where,

$\hat{M}$: import coefficient matrix (opposite angle
matrix)

$\hat{M}$ in (1) is substituted by (2), giving and the
following expanded expression

$$A \cdot X + Fd + Fe - \hat{M} \cdot (A \cdot X + Fd) = X$$

$$A \cdot X - \hat{M} \cdot A \cdot X + Fd + Fe - \hat{M} \cdot Fd = X$$

$$X - A \cdot X + \hat{M} \cdot A \cdot X = Fd - \hat{M} \cdot Fd + Fe$$

$$[I - (I-\hat{M}) \cdot A] \cdot X = (I-\hat{M})Fd + Fe$$

$$X = [I - (I-\hat{M}) \cdot A]^{-1} \cdot \{(I-\hat{M}) \cdot Fd + Fe\}$$

An inverse matrix table prepared by the above procedure is shown in Table 8-2-7.

Next, the meaning of the inverse matrix is examined.

$$B = [I - (I - \hat{M}) \cdot A]^{-1}$$

$$B = \begin{bmatrix} b_{11} & \cdots\cdots\cdots\cdots & b_{n1} \\ b_{12} & & b_{n2} \\ \vdots & \cdots\cdots b_{ij} \cdots\cdots & \vdots \\ \vdots & & \vdots \\ b_{1n} & \cdots\cdots\cdots\cdots & b_{nn} \end{bmatrix}$$

where, b_{ij} ($i \leq n$, $j \leq n$) represents the ultimate production volume needed for industry i against one unit final demand for industry j. Therefore, each column in the inverse matrix table, for example, column j, expresses the output of each product induced by a demand for one unit of industry j. Thus clarifying the extent of the production inducement effect resulting in each industry. In this case, the effect of a sector upon itself is a direct effect of one unit, but there are also indirect propagating effects upon a given sector through other sectors, so the value becomes more than 1.

Next, based on this inverse matrix table, influence coefficients and sensitivity coefficients are calculated by the following expressions.

Influence coefficient for sector j

$$= \sum_{i=1}^{n} \cdot bij \Big/ \frac{1}{n} \sum_{i} \sum_{j} bij$$

Sensitivity coefficient for sector i

$$= \sum_{j=1}^{n} \cdot bij \; / \; \frac{1}{n} \sum_{i} \sum_{j} bij$$

That is, influence coefficient has a total effect
on all industries, occurring when the sum of the
columns of the table shows there is one unit of
final demand in sector j. Thus, influence coeffi-
cient can be regarded as an index which measures
the extent of the total effect on each sector.
Alternatively, sensitivity coefficient is an index
which measures the extent of influence on sector i,
when the sum of the table's rows shows there is one
unit of final demand in each sector. However, there
is actually no situation where there is one unit
final demand in each sector, and in this case,
sensitivity coefficient has no practical meaning.
Both the coefficients are shown in Table 8-2-8,
which reveals that the influence on the foods
industry, oil refining, and the hotel and restaurant
industry is large, and that on the grain industry,
foreign trade and the mining industry is small. The
communication industry has a coefficient of more
than 1 (1.0903) suggesting that although its share
is small, the production inducement effect is
sufficient.

Table 8-2-7 (1/3)   Inverse Matrix Table

SECTOR	DESCRIPTION	1 PADDY	2 FOOD CROPS	3 AGRI CROPS	4 LIVESTOCK	5 FORESTRY
1	PADDY	1.018332	0.251762	0.000468	0.026091	0.000342
2	OTHER FOOD CROPS	0.000058	1.030772	0.000719	0.010446	0.000325
3	OTHER AGRICULTURAL CROPS	0.000956	0.000808	1.188890	0.017028	0.000725
4	LIVESTOCK & ITS PRODUCT	0.002538	0.006573	0.003106	1.354032	0.000716
5	FORESTRY	0.001099	0.001263	0.004771	0.001336	1.029622
6	FISHERY	0.000013	0.000014	0.000093	0.000534	0.000116
7	MINING & QUARRYING	0.001884	0.001455	0.005630	0.002025	0.006554
8	FOOD BEVERAGE & TOOBACCO	0.000270	0.000397	0.000715	0.055210	0.000629
9	OTHER INDUSTRIES	0.039890	0.026291	0.046241	0.009976	0.024539
10	OIL REFINERY	0.000700	0.000687	0.005411	0.002083	0.007597
11	ELECTRICITY, GAS, WATER SUP	0.000425	0.000363	0.002967	0.001351	0.003188
12	CONSTRUCTION	0.001461	0.002640	0.009123	0.004504	0.013584
13	TRADE	0.005272	0.012655	0.033209	0.050838	0.009210
14	RESTAURANT & HOTEL	0.000256	0.000268	0.001799	0.001369	0.002030
15	TRANSPORT	0.006098	0.005611	0.028242	0.019443	0.006081
16	COMMUNICATION	0.000145	0.000155	0.000747	0.000535	0.000609
17	FINANCING, REAL ESTATE ETC	0.008230	0.005106	0.015235	0.011036	0.018369
18	PUBLIC ADMIN. & DEFENCE	0.000000	0.000000	0.000000	0.000000	0.000000
19	SERVICE	0.001448	0.001323	0.019068	0.004906	0.029989
20	UNSPECIFIED SECTOR	0.000000	0.000000	0.000000	0.000000	0.000000
	TOTAL CHECK	1.089075	1.348146	1.366436	1.572745	1.154224

SECTOR	DESCRIPTION	6 FISHERY	7 MINING QUARRYING	8 FOOD BEVERAGE	9 INDUSTRIES	10 OIL REFINERY
1	PADDY	0.003545	0.000414	0.385000	0.002081	0.001580
2	OTHER FOOD CROPS	0.001262	0.000514	0.071307	0.000805	0.001184
3	OTHER AGRICULTURAL CROPS	0.002387	0.000836	0.170323	0.030549	0.002035
4	LIVESTOCK & ITS PRODUCT	0.000898	0.000920	0.008527	0.007769	0.003496
5	FORESTRY	0.010632	0.001034	0.002365	0.031497	0.001658
6	FISHERY	1.086402	0.000168	0.005975	0.000180	0.000709
7	MINING & QUARRYING	0.009112	1.027514	0.006294	0.053144	0.696327
8	FOOD BEVERAGE & TOOBACCO	0.009218	0.000891	1.053351	0.004452	0.003566
9	OTHER INDUSTRIES	0.038394	0.024698	0.042548	1.329928	0.037647
10	OIL REFINERY	0.008129	0.003108	0.005636	0.011521	1.004894
11	ELECTRICITY, GAS, WATER SUP	0.001665	0.000870	0.004040	0.009673	0.013703
12	CONSTRUCTION	0.003742	0.006968	0.004427	0.005640	0.010833
13	TRADE	0.038338	0.004171	0.061238	0.078703	0.010724
14	RESTAURANT & HOTEL	0.001441	0.004579	0.022954	0.003713	0.020724
15	TRANSPORT	0.013291	0.004877	0.022681	0.035849	0.013074
16	COMMUNICATION	0.000453	0.000714	0.001080	0.001489	0.002817
17	FINANCING, REAL ESTATE ETC	0.014432	0.029176	0.016275	0.016261	0.039195
18	PUBLIC ADMIN. & DEFENCE	0.000000	0.000000	0.000000	0.000000	0.000000
19	SERVICE	0.004190	0.009362	0.007469	0.009839	0.013164
20	UNSPECIFIED SECTOR	0.000000	0.000000	0.000000	0.000000	0.000000
	TOTAL	1.247531	1.120613	1.871489	1.633094	1.877331

Table 8-2-7 (2/3) Inverse Matrix Table

SECTOR	DESCRIPTION	11 ELECTRICTY SUP	12 CONSTRUCTION	13 TRADE	14 RESTAURANT	15 TRANSPORT
1	PADDY	0.000959	0.003327	0.000716	0.069602	0.002282
2	OTHER FOOD CROPS	0.000681	0.000517	0.000565	0.052153	0.001709
3	OTHER AGRICULTURAL CROPS	0.002293	0.005441	0.000839	0.056521	0.002509
4	LIVESTOCK & ITS PRODUCT	0.002061	0.002337	0.001529	0.153487	0.004760
5	FORESTRY	0.004207	0.066321	0.000929	0.006387	0.002846
6	FISHERY	0.000349	0.000245	0.000309	0.033290	0.000636
7	MINING & QUARRYING	0.095144	0.069182	0.004294	0.012686	0.041045
8	FOOD BEVERAGE & TOOBACCO	0.001923	0.001842	0.001563	0.161455	0.005117
9	OTHER INDUSTRIES	0.075866	0.219954	0.013672	0.036575	0.057097
10	OIL REFINERY	0.121803	0.040847	0.005021	0.015186	0.055331
11	ELECTRICITY, GAS, WATER SUP	1.165947	0.004712	0.007594	0.030638	0.009383
12	CONSTRUCTION	0.039099	1.006634	0.008992	0.017263	0.018100
13	TRADE	0.036711	0.148859	1.005320	0.072329	0.017680
14	RESTAURANT & HOTEL	0.009298	0.006644	0.008703	1.003979	0.011253
15	TRANSPORT	0.020709	0.038459	0.014132	0.028161	1.099536
16	COMMUNICATION	0.002470	0.002435	0.005995	0.005701	0.005503
17	FINANCING, REAL ESTATE ETC	0.022690	0.024327	0.033856	0.030115	0.040610
18	PUBLIC ADMIN. & DEFENCE	0.000000	0.000000	0.000000	0.000000	0.000000
19	SERVICE	0.023621	0.010659	0.012229	0.016905	0.130799
20	UNSPECIFIED SECTOR	0.000000	0.000000	0.000000	0.000000	0.000000
	TOTAL CHECK	1.625830	1.652742	1.126257	1.802435	1.506198

SECTOR	DESCRIPTION	16 COMMUNICATION	17 FINANCING	18 PUBLIC ADMIN.	19 SERVICE	20 UNSPECIFIED
1	PADDY	0.001647	0.001020	0.000000	0.005096	0.000000
2	OTHER FOOD CROPS	0.001221	0.000622	0.000000	0.007560	0.000000
3	OTHER AGRICULTURAL CROPS	0.003303	0.001261	0.000000	0.005553	0.000000
4	LIVESTOCK & ITS PRODUCT	0.003290	0.001704	0.000000	0.010936	0.000000
5	FORESTRY	0.007547	0.004448	0.000000	0.004895	0.000000
6	FISHERY	0.000554	0.000329	0.000000	0.001835	0.000000
7	MINING & QUARRYING	0.002891	0.006722	0.000000	0.012228	0.000000
8	FOOD BEVERAGE & TOOBACCO	0.003177	0.002017	0.000000	0.008866	0.000000
9	OTHER INDUSTRIES	0.105753	0.029523	0.000000	0.154263	0.000000
10	OIL REFINERY	0.023825	0.005260	0.000000	0.009151	0.000000
11	ELECTRICITY, GAS, WATER SUP	0.018037	0.008758	0.000000	0.024325	0.000000
12	CONSTRUCTION	0.081876	0.061055	0.000000	0.015891	0.000000
13	TRADE	0.034713	0.014595	0.000000	0.055030	0.000000
14	RESTAURANT & HOTEL	0.013240	0.009002	0.000000	0.005607	0.000000
15	TRANSPORT	0.072789	0.014218	0.000000	0.022356	0.000000
16	COMMUNICATION	1.012287	0.007873	0.000000	0.004082	0.000000
17	FINANCING, REAL ESTATE ETC	0.060758	1.026623	0.000000	0.027169	0.000000
18	PUBLIC ADMIN. & DEFENCE	0.000000	0.000000	1.000000	0.000000	0.000000
19	SERVICE	0.067852	0.017041	0.000000	1.037652	0.000000
20	UNSPECIFIED SECTOR	0.000000	0.000000	0.000000	0.000000	1.000000
	TOTAL	1.534759	1.212069	1.000000	1.412494	1.000000

Table 8-2-7 (3/3)   Inverse Matrix Table

SECTOR	DESCRIPTION	TOTAL CHECK
1	PADDY	1.774263
2	OTHER FOOD CROPS	1.182223
3	OTHER AGRICULTURAL CROPS	1.492258
4	LIVESTOCK & ITS PRODUCT	1.568679
5	FORESTRY	1.182856
6	FISHERY	1.131751
7	MINING & QUARRYING	2.074130
8	FOOD BEVERAGE & TOOBACCO	1.314658
9	OTHER INDUSTRIES	2.312856
10	OIL REFINERY	1.326191
11	ELECTRICITY, GAS, WATER SUP	1.307639
12	CONSTRUCTION	1.311834
13	TRADE	1.689595
14	RESTAURANT & HOTEL	1.106858
15	TRANSPORT	1.465606
16	COMMUNICATION	1.055090
17	FINANCING, REAL ESTATE ETC	1.439463
18	PUBLIC ADMIN. & DEFENCE	1.000000
19	SERVICE	1.417517
20	UNSPECIFIED SECTOR	1.000000
	TOTAL CHECK	28.153466

Table 8-2-8 Influence Coefficient and Sensitivity Coefficient

	Influence Coefficient	Sensitivity Coefficient
1. Paddy	0.7737	1.2604
2. Other food crops	0.9577	0.8398
3. Other agricultural crops	0.9707	1.0601
4. Livestock and its product	1.1173	1.1144
5. Forestry	0.8200	0.8403
6. Fishery	0.8862	0.8040
7. Mining and quarrying	0.7961	1.4734
8. Food beverage and tobacco	1.3295	0.9339
9. Other industries	1.1601	1.6430
10. Oil refinery	1.3336	0.9421
11. Electricity, gas and water supply	1.1601	1.6430
12. Construction	1.1741	0.9319
13. Trade	0.8001	1.2003
14. Restaurant and hotel	1.2804	0.7863
15. Transport	1.0700	1.0412
16. Communication	1.0903	0.7495
17. Financing, real estate and business service	0.8610	1.0226
18. Public administration and defence	0.7104	0.7104
19. Service	1.0034	1.0070
20. Unspecified sector	0.7104	0.7104

2.3.2 Analysis of Production Inducement

Based on the project costs for the optimum proposed route, Plan-1B, and the inverse matrix table described in paragraph 2.3.1, the production inducement effect of this project is calculated.

(1) Production inducement

Plan-1B, project costs which influence the industrial structure of Indonesia were shown in Table 8-2-1, which is given again below:

(Million Rp)

| | Final Demand | |
| | Final Consumption | Fixed Capital Formation |
Industry		
12. Construction	---	578
15. Transportation	193	---
19. Service	6417	---

The import coefficients for the transportation and service sectors are 4.3% and 1.4%, respectively. Therefore, production inducement brought about by this project is:

$$1.6527 \times 578 +$$
$$1.5062 \times 193 \times (1 - 0.043) +$$
$$1.4125 \times 6417 \times (1 - 0.014) = 10,171$$

(Million Rp),

which corresponds to 0.013 percent of the total production.

(2) Employment inducement

Employment inducement is examined based on a 1983
employment table (Table 8-2-9). The numbers of
employees per one million Rupiah in the construc-
tion, transportation and service industries are
0.209, 0.519 and 1.239, respectively, giving an
employment inducement effect of:

$$1.6527 \times 578 \times 0.209 +$$
$$1.5062 \times 193 \times (1 - 0.043) \times 0.519 +$$
$$1.4125 \times 6417 \times (1 - 0.014) \times 1.239 = 11,417$$
(persons)

Thus, employment of 11,417 persons will be newly
employed due to the implementation of this project.
This figure equals 0.02 percent of total employees.

Table 8-2-9 Employment Table (1983)

Number of Industry	Number of Employees (person)	Unit Employee (person/mil.Rp)
1. Paddy	9,815,521	2.856487
2. Other food crops	17,981,504	4.164009
3. Other agricultural crops	2,439,137	0.705948
4. Livestock and its product	1,224,714	0.637565
5. Forestry	511,776	0.314879
6. Fishery	844,157	0.834885
7. Mining and quarrying	368,864	0.026270
8. Food beverage and tobacco	1,212,491	0.188810
9. Other industries	4,164,614	0.477040
10. Oil refinery	23,027	0.014187
11. Electricity, gas and water supply	62,951	0.120255
12. Construction	1,578,467	0.209549
13. Trade	5,578,120	0.874909
14. Restaurant and hotel	1,353,099	0.584467
15. Transport	2,013,963	0.519429
16. Communication	287,989	0.103890
17. Financing, real estate and business service	2,022,547	0.819477
18. Public administration and defence	4,782,759	1.239851
19. Service	0	0.000000
Total	56,265,700	0.737376

3. SYSTEMATIC EVALUATION

The results of the financial and economic analyses of
this project are summarized as follows.

① This project combines great investment efficiency
with superior financial conditions and is proved to
be excellent by the financial analysis.

② With respect to the economic evaluation, the propa-
gating effect to the whole of Indonesia is not great
because the project cost is small relative to
Indonesia's GDP. Nevertheless, an increase in GDP
of about 4 billion Rp, produciton output of 10
billion Rp and an increase in employment of 11
thousand persons are expected. Furthermore,
considering that the latent social benefit of
consumer's surplus is large (EIRR is about 2% higher
than FIRR), the implementation of this project is
justified by the economic evaluation as well.

③ However, the increase in domestic demand brought
about by the execution of this project will be met,
not by domestic products, but by imported goods.
Thus, the task facing Indonesia in the future is to
transform its industrial structure, that is, to
attempt to increase domestic products by developing
manufacturing industries.