AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT CLASSIFICATION

A. PRIMARY: Food production and nutrition AE10-0000-G662

B. SECONDARY: Agricultural economics--Indonesia

2. TITLE AND SUBTITLE

Southeast Asian corn commodity systems; the Indonesian corn commodity system

3. AUTHOR(S)

(100) Drilon, J. D. (101) SEARCA; Harvard Univ. Business School

4. DOCUMENT DATE: 1976

5. NUMBER OF PAGES: 261p.

6. ARC NUMBER: ARC ID338.17351.S272

7. REFERENCE ORGANIZATION NAME AND ADDRESS

Harvard

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*

(SEARCA-Harvard Project 928-B)

9. ABSTRACT

10. CONTROL NUMBER: PN-AAG-660

11. PRICE OF DOCUMENT

12. DESCRIPTORS

Maize
Agribusiness
Systems analysis
Production
Technological change
Marketing
Indonesia

13. PROJECT NUMBER: 931093600

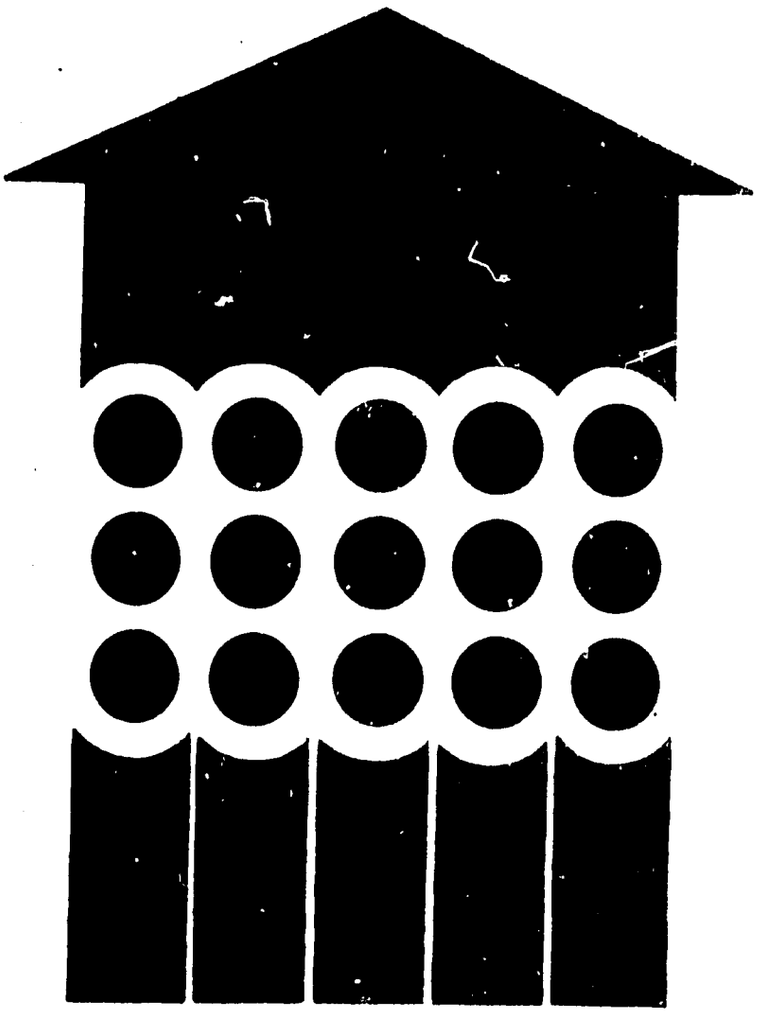
14. CONTRACT NUMBER: AID/csd-3153 GTS

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

ID
338.17351
S727

HARVARD-SEARCA Project 928-B
SOUTHEAST ASIAN CORN COMMODITY SYSTEMS



THE INDONESIAN CORN COMMODITY SYSTEM

SEARCA-HARVARD PROJECT 928-B
Southeast Asian Corn Commodity Systems

Project Director:

J. D. Drilon Jr.

Deputy Director:

Gil F. Saguiguit, Sr.

Chief, Executive Staff:

Geronimo M. Collado

Philippines	Thailand	Indonesia
G. M. Collado (Coordinator)	Sopin Tongpan (Coordinator)	Rusli Hakim (Coordinator)
Manuel M. Arreola	Phaitoon Hathamart	Hidajat Natadmadja
Luis C. Ranit	Somsak Priebprom	A. Soeharjo
Donato Antiporta	Winich Werayangkool	Sjariffudin Baharsjah
Gil C. Saguiguit, Jr.	Sutat Sriwatanapongse	
Domingo E. Cigaral		
Myrna S. Corpus		
Corazon M. Felismino		

Counterpart Agribusiness Team
(Project 928-B, Harvard Business School)

Ray A. Goldberg
Project Director

James E. Austin
Richard McGinity
Richard Gartrell
Leonard Wilson
David Cole
Ernette Au

TABLE OF CONTENTS

Chapter		Page
I.	A Socio-Economic Profile of Indonesia	1 - 23
II.	Agricultural Inputs	24 - 36
III.	Production and Technology	37 - 72
IV.	Assembly, Storage and Transport	73 - 127
V.	Marketing and Distribution	128 - 183
VI.	Consumption, Utilization and Nutritional Dimension	184 - 215
VII.	Facilitative and Developmental Coordination: The Government Programs	216 - 237
VIII.	The Education and Research Dimensions	238 - 254
IX.	Bibliography	255 - 257

CHAPTER I. A SOCIO-ECONOMIC PROFILE OF INDONESIA

Geography

Indonesia is potentially a big maritime country consisting of thousands of islands spread between the continental South Asia and the Northern tip of Australia. The five biggest islands are Java, Sumatra, Kalimantan, Sulawesi and Irian Jaya. Two major groups of islands are distinguished, the Maluku and Nusa Tenggara.

The islands are within the tropical belt, the majority of which belongs to the tropical rain-forest area. At the eastern part of Java rainfall decreases slightly, and in the eastern parts of the Nusa Tenggara is an arid climate, characteristic of savannah vegetation.

The Latosol and Podsolic soils predominate, with alluvial and peat soils spread in the low coastal area of the bigger islands.

The country is composed of 26 provinces including the Capital City of Jakarta. These provinces are autonomous, each having an independent regional People's Representative (DPRD) or the regional Parliament. Each province is then sub-divided into several autonomous districts (Kabupaten).

Each Kabupaten is sub-divided into several sub-districts or "kecamatans". The smallest administrative unit is the "desa".

In rural areas, desa officials do not receive salary from the government, but they receive some incentives from local sources. Most of Java's desa official receive an ex-officio rice field called bengkok. One desa may consist of a cluster of villages or hamlets, the population ranging from about 3,000 to 15,000.

Demography and Land Resources

Java is the most fertile and densely populated area of the country where 60% of the people live in about 7% of the total land area. It is also the seat of the central government, trade and industrial centers and leading universities. The yearly influx of people to Java could exceed the number of out-migrating people sponsored by the government to equilibrate the highly inequitable population distribution.

Table 1 shows the population distribution by islands or island groups in Indonesia.

Although land is abundant in the other islands, the cultivated land area is highest in Java. Table 1 presents the aggregate cultivated land area in Indonesia.

Table 2 shows the average size farm in various regions of the country.

Land is a scarce resource in Java, while labor is abundant. Irrigation and other infrastructural facilities are better in Java as a result of the early colonial policy of concentrating socio-economic activities here.

Table 1

Population Growth and Distribution in Indonesia, 1971

Region*	AREA		CENSUS 1930			CENSUS 1961			CENSUS 1971		
	Sq. Km.	%	Population (thousand)	%	Density per sq. km.	Population (thousand)	%	Density per sq. km.	Population (thousand)	%	Density per sq. km.
1. Jakarta	577	0.0	533	0.9	924	2,907	3.0	5,038	4,576	3.86	7,931
2. West Java	46,300	2.4	10,864	17.9	235	17,615	18.1	380	21,633	18.26	467
3. Central Java	34,206	1.8	13,706	22.5	401	18,407	19.0	538	21,877	18.47	640
4. Yogyakarta	3,169	0.2	1,559	2.6	492	2,241	2.3	707	2,490	2.10	786
5. East Java	47,922	2.5	15,059	24.8	314	21,823	22.5	455	25,527	21.55	533
Java Madura	132,174	6.9	41,718	68.7	316	62,993	64.9	477	76,103	64.24	576
6. Sumatra	473,606	24.9	8,255	13.6	17	15,739	16.2	33	20,813	17.57	44
7. Kalimantan	539,460	28.3	2,169	3.6	4	4,102	4.3	8	5,152	4.35	10
8. Sulawesi	189,035	9.9	4,232	7.0	22	7,079	7.3	37	8,535	7.21	45
9. Other Islands	570,070	30.0	4,353	7.1	8	7,106	7.3	12	7,857	6.63	14
Outside Java	1,772,171	93.1	19,009	31.3	11	34,026	35.1	19	42,357	35.76	24
INDONESIA	1,904,345	100.0	60,727	100.0	32	97,019	100.0	51	118,460	100.00	62

*Excluding about 800,000 inland popualtion of Irian Jaya.

Source: C.B.S. "Ulasan Singkat Census Penduduk 1971"

Table 2

Population and Smallholders Cultivated Land
by Island, 1971 (Food Crop Area Only)

Island(s)	Population (Million)	Arable Land (Ha)			Arable Land Per Population (Ha/Head)
		Lowland	Upland	Total	
1. Java	76,103	3,419,966	4,898,180	8,318,146	0.109
2. Sumatra	20,813	1,205,405	1,035,589	2,241,094	0.107
3. Kalimantan	5,152	527,990	603,897	1,131,887	0.219
4. Sulawesi	8,535	551,044	273,578	824,622	0.096
5. Other Islands	7,857	302,664	542,392	845,556	0.107
Indonesia	118,460	6,007,069	7,354,237	13,361,306	1,127,917

Sources: For arable land: Department of Agriculture, 1969

For population : CBS, 1971

Note that arable land per population is about the same in all regions, showing the limit of labor capacity in the sparsely populated areas outside Java.

Table 3

Average Farm Size in Indonesia, 1973

Region	Average Farm Size (Ha)
1. DKI	0.63
2. West Java	0.69
3. Central Java	0.69
4. DI Yogyakarta	0.58
5. East Java	0.76
6. South Sumatra	2.63
7. Riau	3.05
8. Jambi	2.69
9. West Sumatra	0.85
10. North Sumatra	1.23
11. DI Aceh	1.47
12. West Kalimantan	2.54
13. Central Kalimantan	5.19
14. South Kalimantan	1.05
15. East Kalimantan	1.98
16. North and Central Sulawesi	1.85
17. South and Southeast Sulawesi	0.97
18. Bali	0.95
19. West Nusa Tenggara	1.38
20. East Nusa Tenggara	1.70

Source: CBS, Agricultural Census, 1963

Table 4 shows the distribution of irrigation facilities in the islands.

Most of the people live in the rural areas and are employed in agriculture. Table 5 shows the nature of employment of the labor force.

National Income

Per capita income has increased steadily, particularly since 1969. The average growth of per capita income has been about 4-5% per year. In the meantime, the price index has been increasing as shown in Table 6.

Income sources and their contribution to GDP can be seen in Table 7. It is obvious that most of the income was derived from the agriculture sector. Yet it is in the non-agricultural sector that the economy has been primarily expanding in terms of government support.

Agricultural Production and Growth

Table 8 shows production records for various crops from 1968 to 1972. In the food crops sector, an encouraging increase was observed in rice production and, to some extent, soybean production. Rice production increased steadily except in 1972 when a long and severe drought occurred. Rice import soared to the highest peak of 1.22 million tons in that year. But rice production in 1973 and 1974 was encouraging.

Table 4

Irrigation Facilities in Indonesia, 1969

Island	Irrigated Area by Types of Irrigation (Ha)				
	Technically Irrigated	Half Tech. Irrigated	Rural Irrigation	Rainfed and Other	Total
Java	758,183	412,660	1,335,313	886,810	3,419,966
Sumatra	84,087	257,596	333,400	530,220	1,205,405
Kalimantan	-	71,500	80,910	375,580	527,990
Sulawesi	116,329	50,791	158,416	225,508	551,044
Other Islands	85,180	97,395	75,384	44,705	302,664
Total	1,070,779	889,942	1,983,425	2,062,923	6,007,069

Source: Department of Agriculture, 1969

Table 5

Percentages of Labor Force by Types of Employment in Indonesia (10 years and above), 1971

Employment	Java	Sumatra	Kalimantan	Sulawesi	Other Islands	Indonesia
1. Agriculture, forestry, fishery	58.65	72.77	72.70	64.47	75.30	63.18
2. Mining	0.12	0.81	0.19	0.04	0.02	0.23
3. Processing Industry	8.87	2.69	2.47	10.15	6.80	7.48
4. Electricity, gas and water	0.10	0.07	0.15	0.05	0.12	0.10
5. Construction	1.99	1.61	1.52	1.61	1.99	1.88
6. Commerce (wholesale and retail), hotel and restaurants	12.72	6.79	5.69	6.85	4.62	10.49
7. Transportation, storage and communication	2.48	1.95	2.78	3.41	0.75	2.34
8. Finance, insurance, and real estate	0.28	0.20	0.12	0.22	0.10	0.24
9. Social service	10.92	8.40	7.93	9.85	6.79	10.00
10. Miscellaneous	3.87	4.71	6.45	3.35	3.51	4.06

Source: CBS, 1971

Table 6

Per capital income (gross domestic product) in terms of current prices and base year price and the corollary price index in Indonesia, 1969

Year	Income per Capita (Current Price) Rp./Cap.	Price Index (1960 = 100)	Income per Capita (Based on 1960 Prices) Rp./Cap.
1969	23,929	512,580	4,673
1970	28,745	579,249	4,913
1971	31,940	612,124	5,125
1972	37,329	682,843	5,352

The face value of rupiah was devalued by one thousand in 1966.

Source: Central Bureau of Statistics

Table 7

Income Sources, their Contributions and Growth in Indonesia
Based on Prices in 1960

Income Source	Gross Domestic Product in Billion of Rupiahs			
	1968	1969	1970	1971
1. Agriculture, forestry, fishery	255.2	260.1	270.7	280.5
a) Food crops	169.5	170.2	175.7	181.5
b) Smallholders commercial crops	35.4	35.5	36.1	36.5
c) Estate crops	11.6	13.0	13.7	13.9
d) Animal husbandry	20.2	21.1	22.2	23.3
e) Forestry	6.8	8.0	10.3	12.5
f) Fishery	11.7	12.3	12.7	12.8
2. Mining and quarrying	22.8	27.7	32.2	34.0
3. Manufacturing	40.8	46.6	51.1	56.4
a) Large & medium establishment	26.7	32.0	36.0	40.9
b) Small establishment	14.1	14.6	15.1	15.5
4. Construction	9.2	12.1	15.2	17.1
5. Electricity, gas and water	2.3	2.6	3.0	3.3
6. Transportation and communication	15.9	16.5	17.4	19.7
a) Railway	0.6	0.6	0.6	0.7
b) Air transport	0.7	0.9	1.2	1.8
c) Communication	0.3	0.4	0.4	0.4
d) Other transportation	14.3	14.6	15.2	16.8
7. Wholesale and retail business	78.8	88.8	100.2	108.5
8. Banking and financial institution	4.0	6.6	8.6	11.3
a) Banking	2.9	5.5	7.5	10.2
b) Insurance	1.0	1.0	1.0	1.0
c) Others	0.1	0.1	0.1	0.1
9. Housing	9.7	10.4	11.2	11.9
10. Public Administration and Defense	28.8	29.3	30.4	31.8
11. Services	29.4	30.1	30.9	31.7
Total	496.9	530.8	570.9	606.2

Source: CBS, Monthly Statistical Bulletin, April 1973

Table 8

Agricultural Production in Indonesia
1968-1972 (thousand tons)

Commodity	1968	1969	1970	1971	1972
Food					
Rice	10,166	10,642	12,169	12,711	12,337
Corn	3,165	2,292	2,825	2,632	2,269
Cassava	11,356	11,034	10,478	10,685	10,099
Sweet potatoes	2,364	3,021	2,175	2,154	1,944
Soybean	420	389	498	516	515
Peanut	287	267	281	280	273
Sea fishery	723	785	808	820	838
Inland fishery	437	427	421	424	429
Large Estate					
Rubber	204	224	231	234	249
Palm oil	181	189	217	242	270
Tea	43	40	43	48	46
Sugar	602	702	708	835	884
Coffee	14	13	15	18	18
Smallholders commercial crops					
Rubber	531	558	571	572	568
Tea	33	22	21	24	24
Sugar	203	220	196	211	210
Coffee	144	162	170	178	196
Tobacco	54	73	69	69	74
Coconut	1,131	1,220	1,198	1,147	1,216
Pepper	47	17	17	24	18
Capoc	22	29	30	29	14
Clove	17	11	15	14	18

Source: Department of Agriculture, Appendix to the Presidential Speech, August 17, 1973

The steady increase in rice production is due particularly to the government rice intensification program, the so called Bimas and Inmas. Similar programs were initiated in 1971 for other food crops, particularly for corn, soybean and peanut.

These food crops compete with rice for land area so that the increase in rice production may be a consequence of the decrease in production of other crops as discussed in Chapter II.

For small-scale commercial crops, a perceptible increase was observed for coffee and tobacco. No definite trend was observed in the other crops.

From these figures it is clear that the 4.1% increase in per capita income was not due to the distribution of the agricultural growth, but the contribution of the other sectors of the economy, such as mining, industrial and service sectors.

The export earnings of agricultural crops are presented in Table 9. For food and feed commodities, cassava leads in volume followed by corn and peanut. The trend is not encouraging. However, the stationary export performance is probably a reflection of the limited domestic production opportunities under the existing level of agricultural technology. These food crops are believed to be highly competitive with rice for land.

For estate crop export, encouraging figures are shown by tobacco and palm oil. Since 1974, copra production was absorbed totally by domestic consumption. These smallholder crops would

Table 9

Export Performances of Food Crops and Estate Crops in Indonesia, 1969-1972

Commodity	1969		1970		1971		1972	
	1000 Tons	Million US$	1000 Tons	Million US$	1000 Tons	Million US$	1000 Tons	Million US$
Food Crops								
1. Corn	155.0	-	254.0	-	213.0	-	78.1	-
2. Peanut	20.0.	-	22.0	-	21.0	-	13.4	-
3. Soybean	0.7	-	3.7		0.7	-	3.1	-
4. Cassava chips	304.0	-	312.0	-	452.0	-	333.3	-
5. Tapioca flour	1.6	-	1.0	-	1.3	-	1.1	-
Estate Crops								
1. Rubber	833.3	240.1	755.7	245.4	719.5	209.7	65.3	195.5
2. Palm oil	193.4	31.9	187.0	41.3	219.7	48.2	22.4	42.2
3. Tea	29.5	14.6	35.5	21.2	40.5	29.1	3.8	31.9
4. Coffee	120.9	58.5	94.3	64.3	65.9	50.3	15.1	72.2
5. Pepper	16.7	10.7	2.6	3.1	23.6	24.2	3.4	20.5
6. Copra	157.0	18.5	185.0	30.3	63.7	10.2	5.1	3.9
7. Tobacco	13.2	28.5	16.9	21.9	19.5	30.7	3.6	29.5

Source: Department of Agriculture, 1973

receive more government attention in the second phase of the Five Year Program (Pelita II).

For forestry, fishery, and animal husbandry, export figures are presented in Table 10. Encouraging figures are shown in log and shrimp export. and to some extent, cattle export.

On the other hand, imports of agricultural commodities are increasing steadily for dairy products, cotton, wheat and cloves, Table 11.

Industrial Performance and Overall Climate[1/]

The present government of Indonesia has a high national and international reputation in curbing inflation and boosting a previously stagnant economy. The membership of Indonesia in the IMF, the trust given by the IGGI countries, the stream of foreign investment and the perceptible growth of the economy are indicative of the potentials of the economy.

The government has also been able to maintain political stability which has never been achieved before.

Public Law No. 1, 1967 was effected to attract foreign investments. Similarly, Public Law No. 6, 1968 is meant to encourage domestic investment. In essence, these laws provide the needed incentives for investors to go into favored sectors. Tax

---

[1/] This section is a summary of the information to be found in Rencana Pembangunan Lima Tahun II, 1974/75 - 1978/79, Vol. I, Chapter 5 and 6, p. 141-179.

Table 9

Export Performances for Forestry, Animal Husbandry, and Fishery Products in Indonesia, 1969-1972

Commodity	1969		1970		1971		1972	
	1000 Tons	Million US$	1000 Tons	Million US$	1000 Tons	Million US$	1000 Tons	Million US$
Forestry								
1. Log	3,596*	26.8	7,412*	100.5	10,760*	168.5	13,520*	320.4
2. Others	-	1.7	-	3.8	-	2.9	-	7.6
Animal Product								
1. Cattle	56.8**	0.8	87.7**	2.0	75.6**	1.7	83.4**	3.5
2. Hide	-	4.0	-	5.0	-	5.2	-	7.6
3. Bone	-	-	-	0.2	-	0.2	-	0.2
Fisheries								
1. Shrimp	5.6	0.8	5.9	3.7	14.1	13.8	19.5	24.9
2. Fresh Fish	2.3	0.2	1.1	0.2	3.5	0.8	3.2	0.4
3. Frogs	-	-	0.6	0.3	0.5	0.3	0.8	0.6
4. Others	13.6	0.5	10.8	2.0	10.5	3.0	11.9	3.3

* Thousand of cu. m.

** Thousand of heads

Source: Department of Agriculture, 1973

Table 11

Imports of Agricultural Products In Indonesia, 1969-1972

Commodity	1969		1970		1971		1972	
	1000 Tons	Million US$	1000 Tons	Million US$	1000 Tons	Million US$	1000 Tons	Million US$
Dairy Product	-	8.5	-	11.3	-	12.9	-	12.2
Crop Product								
1. Sugar	10.3	-	14.2	-	7.1	-	0.1	-
2. Clove	7.0	-	20.7	-	30.6	-	24.1	-
3. Tobacco	7.6	-	2.1	-	3.2	-	2.8	-
4. Raw cotton	24.2	-	18.5	-	45.1	-	34.9	-
5. Rice	796.0	-	764.0	-	524.0	-	1,220	-
6. Grains*	347.0	-	504.0	-	316.0	-	340.0	-

* Equivalent in flour

Source: Department of Agriculture, 1973

holidays, tax exemption or reduction, exemption or lower duties for the importation of capital goods and raw materials, and promoting the supporting public facilities are invariably parts of the incentive package.

In 1973, the procedures for investment application were simplified. At the same time, the Technical Committee for Investment (Panitia Teknis Penanaman Modal, PTPM) was changed into the Investment Coordinative Body (Badan Koordinasi Penanaman Modal, BKPM) which has stronger coordinative powers.

Change has also been made in the tariff system by replacing the older Geneva tariff classification (1937) by the newer Brussel Tariff Nomenclature (BTN). This change has simplified the classification of capital goods.

The government provides investment credit for the first time at the beginning of Pelita I to rehabilitate and expand existing facilities.

In the food production sector, the government gives credit at 1% per month to farmers, particularly for rice production. This is not a subsidized credit and is subject to the same creditors governing industrial rates.

To support economically weak enterprises, two lending institutions have been founded, namely the Askrindo Ltd. and Bahana Ltd. to provide the minimum amount of capital required by the banking institutions to finance industrial investments. The

government has also enacted the Cooperative Credit Insurance Institute (Lembaga Jaminan Kredit Koperasi), which offers assistance for the development of cooperative enterprises.

To create a favorable climate for investment, several measures have been effected in the banking and financial institutions.

1. Merger of several private banks and insurance companies;
2. License for foreign banks to establish branches in Indonesia;
3. Enactment of new financial institutions such as the Indonesian Development Finance Company (IDFC) and the Private Development Finance Company of Indonesia (PDFCI);
4. Enactment of 9 monetary institutions as intermediaries for the release of securities and bonds in the newly established stock market in Jakarta.

An Outlook to the Future

Industrial development is expected to proceed faster than the expected shifts in sectoral importance can be seen in Tables 12 and 13.These tables show that the relative importance of the agricultural sector is diminishing. Nevertheless, the agricultural sector is expected to grow steadily.

Table 12

The Expected Shift in the Proportion of the Contribution of Several Economic Sectors to the National Product in the Pelita II

Sector	1973/74 (Estimated)	Rate of Growth in Pelita II	1978/79 (Projection)
1. Agriculture	40.1%	4.6%	35.0%
2. Mining	9.6%	10.1%	10.8%
3. Industry	9.8%	13.1%	12.6%
4. Construction	3.8%	9.2%	4.1%
5. Transportation and Communication	4.1%	10.0%	4.6%
6. Others	32.6%	7.7%	32.6%
Gross National Product	100.0%	7.5%	100.0%

Source: Pelita II, Vol. 1, Chapter 5, Table 6.1, p. 180.

Table 13

The Expected Shifts and Growth in Employment by Sectors

Sector	Estimated Employment 1973/1974 (in thousand)	Sectoral Distribution 1973/1974 (in percent)	Projected Increase in Employment Per Year (in percent)	Projected Change in Employment in Pelita II (in thousand)	Projected Employment in 1978/1979 (in thousand)	Sectoral Distribution 1978/1979 (in percent)
1. Agriculture	25,342	60.3	0.9	1,187	26,529	55.8
2. Mining	93	0.2	2.2	10	103	0.2
3. Industry	3,209	7.6	6.5	1,187	4,396	9.3
4. Electricity	39	0.1	3.0	6	45	0.1
5. Construction	1,032	2.5	5.5	318	1,350	2.8
6. Trade	5,236	12.5	4.2	1,196	6,432	13.5
7. Transportation and Communication	1,045	2.5	4.0	226	1,271	2.7
8. Banking and Finance	121	0.3	5.4	36	157	0.3
9. Services and Others	5,897	14.0	4.2	1,347	7,244	155.2
Total	42,014	100.0	2.5	5,513	47,527	100.0

Source: Pelita II, Volume I, Chapter VI, Table 2, p. 182

The amount of investment needed to support the projected income and employment growth of Indonesia can be seen in Table 14.

Table 14

Gross Domestic Product and the Planned Investment, 1974/75 - 1978/79
(in billion of rupiahs, current price)

Source or Item	1974/75	1975/76	1976/77	1977/78	1978/79	Pelita II
1. Gross National Product	7,565	8,785	10,200	11,840	13,745	-
2. Investment	1,445	1,900	2,280	2,640	3,150	11,415
a) Government	616	972	1,058	1,196	1,408	5,250
i. Saving	(402)	(780)	(850)	(976)	(1,184)	(4,194)
ii. Foreign Credit	(214)	(192)	(208)	(218)	(224)	(1,056)
b) Others	829	928	1,222	1,444	1,742	6,165
3. Investment as percentage of National Product	19.1%	21.6%	22.3%	22.3%	22.9%	

Source: Pelita II, Vol. I, Chapter 6, Table 6.2, p. 185

Table 15 shows that the proportion of foreign investment is expected to decrease gradually. Disaggregated by sectors, the planned investments by the Indonesian government are presented in Table 16.

Table 15

Expected Sources of Investments and the Relative Proportion to the Domestic Product 1974/75 - 1978/79

Source of Investment	1974/75	1975/76	1976/77	1977/78	1978/79	Pelita II
I. Domestic Saving	881 (11.1%)	1,322 (15.0%)	1,596 (15.6%)	1,931 (16.3%)	1,453 (17.8%)	8,183
1. Government Saving	402 (5.3%)	780 (8.9%)	850 (8.3%)	978 (8.3%)	1,184 (8.6%)	4,194 -
2. Private Saving	479 (6.3%)	542 (6.2%)	746 (7.3%)	953 (8.0%)	1,259 (9.2%)	3,989 -
II. Foreign Capital	564 (7.5%)	578 (6.6%)	684 (6.7%)	709 (6.0%)	697 (5.1%)	3,232 -
Total -	1,445 (19.1%)	1,900 (21.6%)	2,280 (22.3%)	2,640 (22.3%)	3,150 (22.9%)	11,415

Source: Pelita II, Vol. 1, Chapter 6, Tables 6.4 and 6.5, p. 194-195.

Table 16

Planned Investment by Sectors in the Pelita II
(Billion of Rupiahs)

	Sector	1974/75	Pelita II
1.	Agriculture and irrigation	120.9	1,001.6
2.	Industry and mining	12.8	185.8
3.	Electric power	55.7	387.8
4.	Communication and tourism	111.4	831.7
5.	Trade and cooperative	4.2	37.9
6.	Manpower and transmigration	6.6	69.4
7.	Regional development	127.7	930.6
8.	Religion	1.6	15.0
9.	Education, culture, and youth guidance	55.7	525.8
10.	Health, family planning and social welfare	23.4	192.1
11.	People housing and drink water	6.6	101.6
12.	Law and public guidance	2.0	30.0
13.	Defense and national security	18.0	126.0
14.	Information service and communication	2.1	26.7
15.	Development of science, technology, statistics and research	11.1	101.3
16.	Administration apparatus	20.5	123.0
17.	Government investment	35.3	562.9
	Total -	615.7	5,249.2

Source: Pelita II, Volume 1, Chapter 6, Table 6.21, p. 201.

CHAPTER II. AGRICULTURAL INPUTS

A. Systematic Linkages

The increase in agricultural productivity in Indonesia is mainly attributed to the influx of new technology, increase in water resource use and expansion of cultivated area. However, production goals cannot be attained unless better seeds, more fertilizers, better plant protection services and more credit facilities and made available to the farmers.

Indonesian corn production and other agricultural crops are dependent on several primary systemic linkage industries for agricultural inputs. These linkage sectors include the fertilizer industry, pesticide industry, research and seed production, farm machinery industry, natural resource sector and agricultural credit.

B. Agricultural Credit and Financing

There are five state banks operating in the agricultural sector. The three most important state banks are Bank Rakyat Indonesia (BRI), Bank Pembangunan Indonesia (BAPINDO) and Bank Bumidaya. Each bank institution specializes on the following credit requirements of the country.

Bank Rakyat Indonesia (BRI)	-	Rural Credits
BAPINDO	-	Industrial development, financing commercial production, estates and agro-industries

Bank Bumidaya	- Specializes in financing the estates sector (rubber, tea, coffee, palm oil)

Foreign and local private commercial banks are not as active as these sectors. Interest rates have been progressively reduced as the inflation rate in the country declined and primarily explain the non-active participation of these local and foreign commercial banks in agricultural production.

Except for some foreign loans for private estates, almost all development loans for agro-industries, state owned estates and seasonal loans for rural credit have an annual interest rate of 12% for the past three years. The rest, including marketing loans, charge 24% to 36% interest rate. Institutional rates for loans outside of agriculture can be as high as 36%. For this reason, there is a selective participation of state owned, private and foreign banking institutions in providing agricultural credit.

Small farmers obtain production credit from several sources. However, the supply and accessibility of credit funds to farmers is limited. Apart from Bank Rakyat Indonesia (BRI), credit sources include fertilizer distributors, tobacco and sugar estates, village and paddy banks, cooperatives, pawnshops and provincial development banks. Although privat money lending is illegal, it remains an important source of rural credit. However, interest rates from private sources are reportedly very high.

BRI is thereby considered the largest institutional credit source which operates profitably as a commercial bank with full banking services. About one-third of its loan operations is in agriculture.

The rice intensification programs had an important impact on rural credit. The original BIMAS program (1966-1970) brought about the establishment of cooperatives from which farmers could get credit. These cooperatives failed due to lack of management expertise, lack of loan security, non-evaluation of farmer's loan repayment abilities, and malversation of funds.

Under the BIMAS Gotong Rojong program (1969-1970), credit was supplied and charged as a fixed package per hectare for every farmer in selected areas. A farmer was given credit whether or not he wanted, needed or could efficiently use it. The village headman received the total allocation for his village for distribution. Since no records were kept, farmers easily evaded repayment.

In 1970-1971, the old program was replaced by the Improved BIMAS program which is still implemented. Under this program, credit is supplied in cash and in kind to qualified farmers through village and mobile units of the Bank Rakyat Indonesia. In the modified set-up credit was extended to more than 10% of rice farmers. This has widened the distribution of institutional credit in the country which was negligible prior to 1966.

Since the establishment of the Improved BIMAS Program, credit operations were expanded not only for rice but also for corn (jagung), soybeans (dedele), peanuts (kacang tanah), sorghum and mungbeans (kacang ijo). As of mid-1974, BIMAS had a total target of 160,590 hectares with a credit appropriation of Rp 2.89 billion ($6.96 million) for the production of the following crops.

	Area (Ha)	Credit Appropriation Rupiah (000)	US$
Corn	89,640	1,407,438	3.39 million
Sorghum	1,400	17,220	0.04
Soybeans	39,550	545,790	1.31
Peanuts	26,700	878,430	2.11
Mungbeans	3,300	45,540	0.11
Total	160,590	2,894,328	6.96

$1.00 = Rp 415

In 1973, the total amount of loans appropriated for rural credit and production reached Rp 424.5 billion as compared to Rp 3.97 billion in 1966. The increase was attributed largely to rice intensification programs. However, less than one-tenth of this amount was in the form of medium-term loans. About 1.5 to 1.8 million Indonesian farmers availed of these credit extensions.

The major shortcomings of the current rural credit programs are in the lack of long-term laons and a very small amount of medium-term loans for the farmer. The rural sector needs medium-term loans (1-5 years) to acquire small pumps, draft animals and

small machineries and equipment. On the other hand, long-term loans (5-15 years) are required for smallholder farm replanting, farm improvements and larger agricultural machineries as threshers, shellers, dryers and even storage facilities.

Over the next decade, considerably more funds will be required for the agricultural sector to maintain its expansion. More funds would be needed and supplied mainly through the Bank Rakyat Indonesia which is a main and practical channel. However, to achieve these objectives, BRI will require more intensive staff training programs, explore ways to improve the performance of village and mobile units and establish a long-term development financing program.

Short-term funds of 6 to 1 year are available at commercial banks while limited long-term development funds may be obtained from government and some private sources. However, the government has prohibited bank loans of more than five years for private development purposes due to the inflation rate. Likewise, limited funds for medium-term agricultural development are available at the five state banks.

Bank of Indonesia has provided about one-fourth of total credits extended over the past five years. From a total of about $2.3 billion of foreign investments approved by the government from 1967 to 1972, 25% channeled to agriculture, forestry and fishery. The major investors were the Philippines, Japan, USA, South Korea and Malaysia with an Indonesian participation of about 7%.

The main deterrents to increased private investments are the interest rate structure, 5-year maximum term loans, a compulsory contribution of 25% from borrowers of any investment project, and the lack of working capital loans. Despite these problems, state banks have a large backlog of loan applications mainly due to its subsidized annual interest rate of 12%.

If the growing demands for agricultural credit must be met, the government must institute changes in the interest rates and credit system in order to attract more investors. Current agricultural interest rates for development are too low to provide incentives for investors and insufficient to provide for opportunity costs for capital invested.[1/]

B. Fertilizer Industry

Fertilizer consumption has grown from insignificant amounts prior to 1960 to an annual demand rate of more than 700,000 metric tons in 1973. The rate of consumption is expected to double before 1980 as intensified food production efforts gain momentum. Presently, the consumption level per unit of cultivated area is low by international standards especially for phosphate and potassium fertilizers.

Consumption by crops groups and by nutrients was estimated as follows.[2/]

1/ Excerpts from the Agricultural Sector Survey of Indonesia, Central Research Institute of Agriculture, IBRD, 1972, p. 40-43.

2/ Agricultural Sector Assessment of Indonesia, USAID Mission to Indonesia, October 1973, p. 34.

Crops	Percent Nutrient N	P_2O_5	K_2O	% NPK
Rice	60	38	3	46
Secondary (conr, soybeans, ground nuts, cassava)	15	15	10	14
Smallholder Cash Crops	8	12	15	10
Estate Crops (Rubber, Palm oil, coffee, tea)	17	35	72	30

A large percentage of fertilizers used is imported especially for potassium (K) and phosphate (P) fertilizers. Nitrogen production capacity is being expanded to 225,000 metric tons by 1974 to as much as 1.2 million by 1979. Tentative plans for the addition of new fertilizer plants indicate that Indonesia may be self-sufficient in nitrogen fertilizer by 1977 and could be exporting surplus by 1979. Foreign countries have encouraged Indonesia to produce more nitrogen fertilizer for export. Indonesia's capability to attain this lies in its vast oil and natural gas reserves which are still under development.

For the next two years up to 1977, about 50% of Indonesia's nitrogen requirements and all of its phosphate and potassium fertilizers will have to be imported.

In the past, practically all of the imported fertilizer was used in Java when the BIMAS program was introduced in the outer islands, primarily in Sumatra.

The fertilizer industry in Indonesia is a public enterprise which entails problems, particularly in distribution, characteristic

of the system. Regarding the pricing system, fertilizers for estate crops are priced at the free market level while fertilizers for food crops, particularly rice and corn, has been heavily subsidized since 1966. This has led to considerable misallocation and diversion of fertilizers. The price of fertilizers is uniform throughout Indoresia, so that the added cost of transportation in places that are far from major distribution centers is not included in the retail price. Because of expected losses, fertilizer distributors do not supply fertilizers in distant places.

In effort to correct these anomalies, the Fertilizer Management Board was formed in 1972 to, among other things, review the prices of the government on fertilizer distribution. Furthermore, a 50% increase in fertilizer price was instituted in September 1973. This was inevitable since the subsidy was becoming too heavy for the government and this policy is also expected to result in a more rational distribution policy.

C. Agricultural Machinery and Equipment Industry

In Indonesia, the land is tilled mostly by hand or with bullock power. Even among large Japanese commercial corn producers in Lampung, Sumatra, tractors and other heavy equipment are used mainly for land clearing and initial land preparation mainly because labor costs are low and human or animal cultivation is more practical and inexpensive.

Harvesting, threshing and shelling corn are done manually. With the abundance of labor and large scale unemployment, the Ministry of Agriculture was provided little incentive to promote farm mechanization.

Agricultural surveys have indicated a decreasing trend in the number of livestock used for agricultural cultivation during the last five years. This may mean that a growing proportion of the land tillage operations may be done by hand since machinery importations had remained insignificant. While there is a need to double the number of livestock for draft power, this alternative has proven to be impractical since there is a lack of feed for animal use.

Investments on the production of agricultural machineries such as hand tractors, dryers, threshers and shellers for corn remain untapped. As the intensified food production drives gain momentum, there will be an increasing need for machineries to efficiently process and prepare grain for distribution or storage.

D. Water Resources for Irrigation

Irrigated crop cultivation, particularly on rice, is a well established practice in Indonesia. The irrigation system of the country is based largely on gravity flow of water directed from streams with little or no storage for efficient irrigation. About 80% of the 3.5 million hectares of rice lands on Java and Bali and about 50% of the 2.3 million hectares of the outer islands are irrigated. Sugarcane is the only major irrigated crop which

is planted to about 60,000 hectares in East Java. Dry season crops such as corn and soybeans are often planted after the rice is harvested when the soil still has adequate moisture to sustain corn growth.

The irrigation facilities of Indonesia are administered by various branches and levels of government. Central and provincial public works agencies construct, operate and maintain irrigation systems up to tertiary canals. Below the tertiary level, irrigation development and operation depends on the village administration with the assistance of the Ministries of Agriculture and Home Affairs. However, village administrations have only very limited technical capability to manage village-level distribution systems and regulate irrigation practices.

The controlled delivery of water does not extend below the secondary canals whose outlets may serve about 100 hectares in each locality. Because irrigation water flows from one field to the next field, farmers at the inlet end of the chain have the greatest opportunity to control both the intake and discharge of water from their fields. Those at the lower ends of the chain have only limited control over the inflow and outflow of water from their fields. Farmers on the lower end of the irrigation channels suffer most in times of water deficit or water excess. Tertiary and quarternary canals may be constructed to control water flow.

E. Seed Research and Production

There is no organized system of seed marketing in Indonesia. Improved seedstock is usually sold as part of the Improved Bimas and Bimas Palawija package. The Ministry of Agriculture has overall responsibility for the multiplication and distribution of improved seeds. The Central Research Institute of Agriculture (CRIA) at Bogor is responsible for the breeding of improved rice and corn varieties for foundation seed production. Corn foundation seed is distributed to the Provincial Agricultural Services for the production of seedstocks in their research farms. Good seed varieties are planted for multiplication on thousands of small private farms in Indonesia. Aside from corn, improved varieties of rice, groundnuts and soybeans are also multiplied for dispersion.

The flow of foundation seeds from CRIA to the Extension Seed Farms is inadequate. Supervision of production is poor at all levels and facilities for drying, grading, storage and distribution are non-existent.

A government and foreign fund supported project has been approved to upgrade the national seed production system. A national seed law had also been drafted. In addition, the National Seeds Corporation (NSC) had been formed which will manage a 2,450 hectare seed production farm at Sukamandi and in three other outlying districts.

NSC will be responsible for grading, storing and distributing certified seeds produced at Sukamandi and in the other farm production units. The project plans to modernize seed production, processing, storage, and distribution in the country.

The NSC will also train personnel for the development and operation of a system for seed certification and quality control. Although the current emphasis is on the production of corn, groundnuts, soybeans and other food crops has been scheduled. By 1978, the Sukamandi center will be producing an aggregate of 12,000 tons per year of certified seeds of rice, corn, groundnuts, soybeans and other crops while the other production units will produce 10,000 tons of seeds per year.[3/]

The bulk of the seed requirements of corn farmers are supplied from farm production. Farmers usually leave a portion of their good seed harvests to be used for the next cropping season. As a result, traditional varieties are mainly used.

F. Chemical, Insecticide and Pesticide Industry

Agricultural chemicals and pesticides in Indonesia are used mainly for rice production as part of the Improved Bimas technical and credit program. However, 80-90% of the rice farmers use minimal or no agricultural chemicals at all.

In the case of corn and other crops, no agricultural

3/ Agricultural Sector Assessment of Indonesia, op. cit., p. 32-33.

chemicals are used. The pesticide importations in the past was minimal. Despite the prevalence of diseases and insect vectors which significantly decrease crop yields in the country, farmers do not widely use chemicals due to its high costs and lack of technical knowledge regarding application.

Through the Bimas program many farmers were convinced to use more pesticides. However, the price of agricultural chemicals which are mostly imported is beyond most of the farmers. Poor distribution and the lack of adequate marketing outlets and distribution facilities has further hindered the use of agricultural chemicals. The introduction of the Bimas Palawija in mid-1974 may bring about further acceptance and orientation in the use of agricultural chemicals for corn, soybeans, peanuts and mungbeans.

The bulk of agricultural pesticides and chemicals for crop protection are basically oil based derivatives. With Indonesia's vast oil resources and gas reserves, the development of agricultural chemical plants in the country should also be given emphasis to provide the agricultural sector with more inexpensive insecticides. Inflow of technical knowhow on this field should be encouraged. More chemical firms with multi-based subsidiaries and foreign branches should be encouraged to develop the agricultural chemical industry in the country.

CHAPTER III. PRODUCTION AND TECHNOLOGY

A. Trends in Corn Production

Comparative data on yield per hectare of corn and other food crops are shown in Table 17-18. The tables show that corn yield has increased significantly (1.39% per year) for the past 22 years only in Java. Sulawesi, one of the main corn producers has decreased in yield per hectare (1.8% per year).

The area planted to corn has been increasing in all regions, with the aggregate increase for Indonesia totalling 40 thousand hectares per year or an increase of about 2% every year. The appreciable increase in yield per hectare in Java suggests the intensification of cropping systems probably due to better irrigation facilities. However, the increase in area was evident only up to 1966 after which corn area has been decreasing. This is particularly true for Java, Sulawesi, Kalimantan and for the whole Indonesia.

The fact that food-land per man ration is almost equal for widely different areas,there may be a need for farm machinery to increase effective crop area. In Java, this is primarily true in the so called gogorancah system with direct seeding in which all seeding operations must be carried out within a short period at the beginning of the rainy season.

Table 17 (continued)

II. Harvested area (ha)

a) Spearman correlation (r)

1. Java	0.148	0.331*	0.765**	0.702**	0.712	0.764**
2. Sumatra	0.984**	0.892**	0.859**	0.634**	0.016	0.898**
3. Sulawesi	0.899**	0.790**	0.879**	0.627**	0.856	0.791**
4. Kalimantan	0.627**	0.154	0.495**	0.723**	0.678**	0.618**
5. Outside Java (aggregate)	0.987**	0.840**	0.888**	0.845**	0.853**	0.915**
6. Indonesia	0.874**	0.535**	0.815**	0.425**	0.819**	0.845**

b) Simple regression Cofficient

$(b = \frac{vy}{vx}) \times 1000$

1. Java	5.45	18.06**	20.53**	0.68**	2.81**	7.78**
2. Sumatra	37.90**	4.76**	3.05**	1.09**	0.01	1.38**
3. Sulawesi	11.27**	14.23**	3.01**	0.98**	0.92**	0.38**
4. Kalimantan	10.48**	0.19	1.07**	0.21**	0.09**	0.07**
5. Outside Java (aggregate)	66.16**	22.50**	10.02**	4.86**	1.68**	3.96**
6. Indonesia	75.58**	40.57**	30.57**	5.74**	4.50**	11.62**

* Significant at the 0.05 level

** Significant at the 0.01 level

Table 17

Time Trend in Crop Yield (quintal/ha) and Harvested Area (Ha) by Islands, 1950-1972

Island	CROPS					
	Rice	Corn	Cassava	Sweet Potatoes	Peanut	Soybean
1	2	3	4	5	6	7
I. Yield (qt/ha)						
a) Spearman correlation (r)						
1. Java	0.874**	0.752**	0.0274**	-0.123	0.661**	0.561**
2. Sumatra	0.489**	0.180	-0.933**	-0.372**	0.522**	-0.374**
3. Sulawesi	0.734**	0.804**	-0.525**	-0.658**	0.179	0.218*
4. Kalimantan	0.005	-0.697**	-0.869**	-0.582**	-0.218*	0.488**
5. Outside Java (aggregate)	0.624**	-	-0.931**	-0.770**	-0.081	0.776**
6. Indonesia	0.878**	0.588**	-0.606**	-0.621**	0.547**	0.362*
b) Simple regression coefficient ($b = \frac{vy}{vx}$)						
1. Java	0.491**	0.135**	0.165*	-0.032	0.067**	0.040**
2. Sumatra	0.129**	0.046	-4.866**	-0.965**	0.124**	-0.054**
3. Sulawesi	0.338**	-0.177**	-1.568**	-2.041**	0.027	0.035*
4. Kalimantan	0.001	-0.255**	-2.676**	-0.713**	-0.036*	0.175**
5. Outside Java (aggregate)	0.164**	-	-4.170**	-1.297**	-0.013	-0.134**
6. Indonesia	0.401**	0.074**	-0.506**	-0.384**	-0.041**	0.0362*

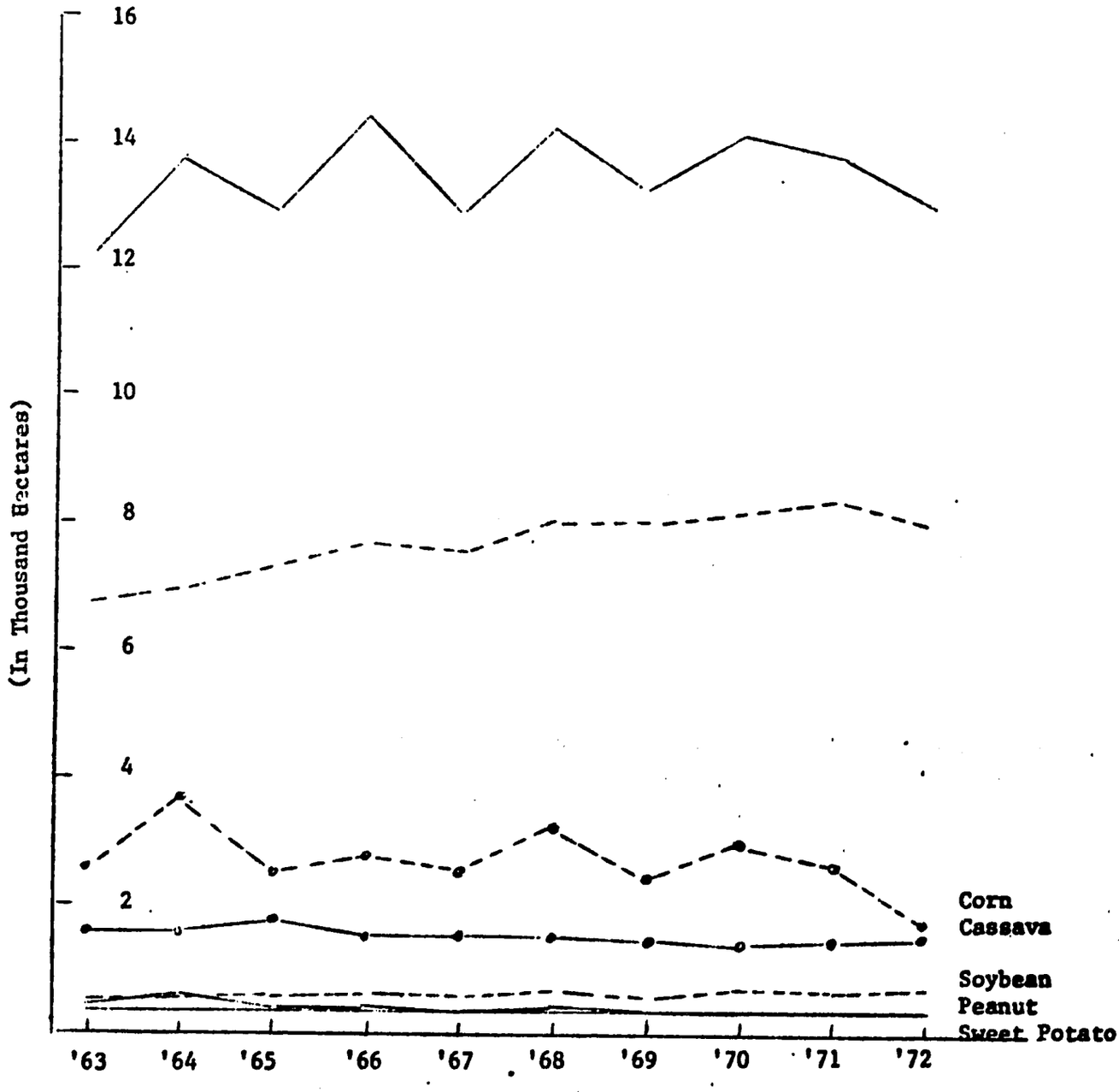
Table 18
Harvested Areas of Food Crops, Indonesia, 1963-1972

Year	RICE Lowland	RICE Upland	RICE Total	Corn	Cassava	Sweet Potato	Soybean	Peanut	Total	% Rice	% Corn
1963	5,329	1,402	6,731	2,559	1,598	484	539	352	12,263	54	21
1964	5,484	1,496	6,9[illegible]	3,646	1,579	620	571	373	13,769	51	26
1965	5,875	1,452	7,327	2,507	1,754	416	584	351	12,939	56	19
1966	6,011	1,680	7,691	2,778	1,514	402	605	388	14,378	55	26
1967	5,995	1,521	7,516	2,547	1,524	360	589	351	12,887	58	20
1968	6,354	1,659	8,013	3,220	1,503	404	677	394	14,218	56	22
1969	6,543	1,470	8,013	2,435	1,467	369	554	372	13,211	61	18
1970	6,679	1,456	8,135	2,939	1,398	358	695	380	14,085	59	21
1971	6,893	1,432	8,325	2,616	1,406	357	680	375	13,768	60	19
1972	6,691	1,296	7,987	2,160	1,468	338	698	354	13,004	61	16
Total	61,854	14,864	76,718	28,417	15,211	4,108	6,192	3,690	134,520	571	208
Average	6,185	1,486	7,672	2,842	1,521	411	619	369	13,452	57	21
Percent	46	11	57	21	11	3	5	3	100		

Source: Central Bureau of Statistics

Figure A

Area (in hectares) Planted to Food Crops
in Indonesia



Farm machinery might compete with human labor and thereby will cause unemployment in the rural areas. Farm machinery, applied properly, may in fact boost employment in the rural area due to the effective increase in cropped area.

B. Corn Productivity and Technology Level

Indonesian corn yield is still among the lowest in the world. National average yield from 1963 to 1972 ranged from 0.92 to 1.04 tons per hectare, Table 19 and Figures B.1 to B.3.

The low yield is attributed to the following reasons.

1. The farmers are still observing traditional practices
2. Poor soil condition in upland areas
3. Inadequate irrigation facilities
4. Very little amount of fertilizer usage
5. Prevalence of corn downy mildew disease

Most of the farmers are still using local varieties which mature in less than 95 days while the recommended varieties mature in 110 to 115 days. The main reason for this is that local varieties fit the traditional cropping pattern.

Although corn may be planted any time during the year the biggest crop is planted in October or November which is the beginning of the wet season. Using early maturing varieties, the farmers could harvest corn in December or January, which generally coincides with lean months of rice supply.

Table 19

Harvested Areas, Production, and Yield of Corn, Indonesia, 1963-1972

Year	Harvested Areas (000 Ha)	Production (000 tons)	Yield Kg/Ha
1963	2,559	2,358	921
1964	3,646	3,769	1,033
1965	2,507	2,364	943
1966	3,778	3,717	983
1967	2,547	2,369	930
1963/1967 Average	3,007	2,913	969
1968	3,220	3,166	983
1969	2,435	2,293	942
1970	2,939	2,825	961
1971	2,616	2,606	996
1972	2,160	2,255	1,044
1968/1972 Average	2,674	2,628	983
1973		2,912	

Source: Central Bureau of Statistics

Figure B.1

Total Area Planted to Corn in Hectares in Indonesia, 1963-1972

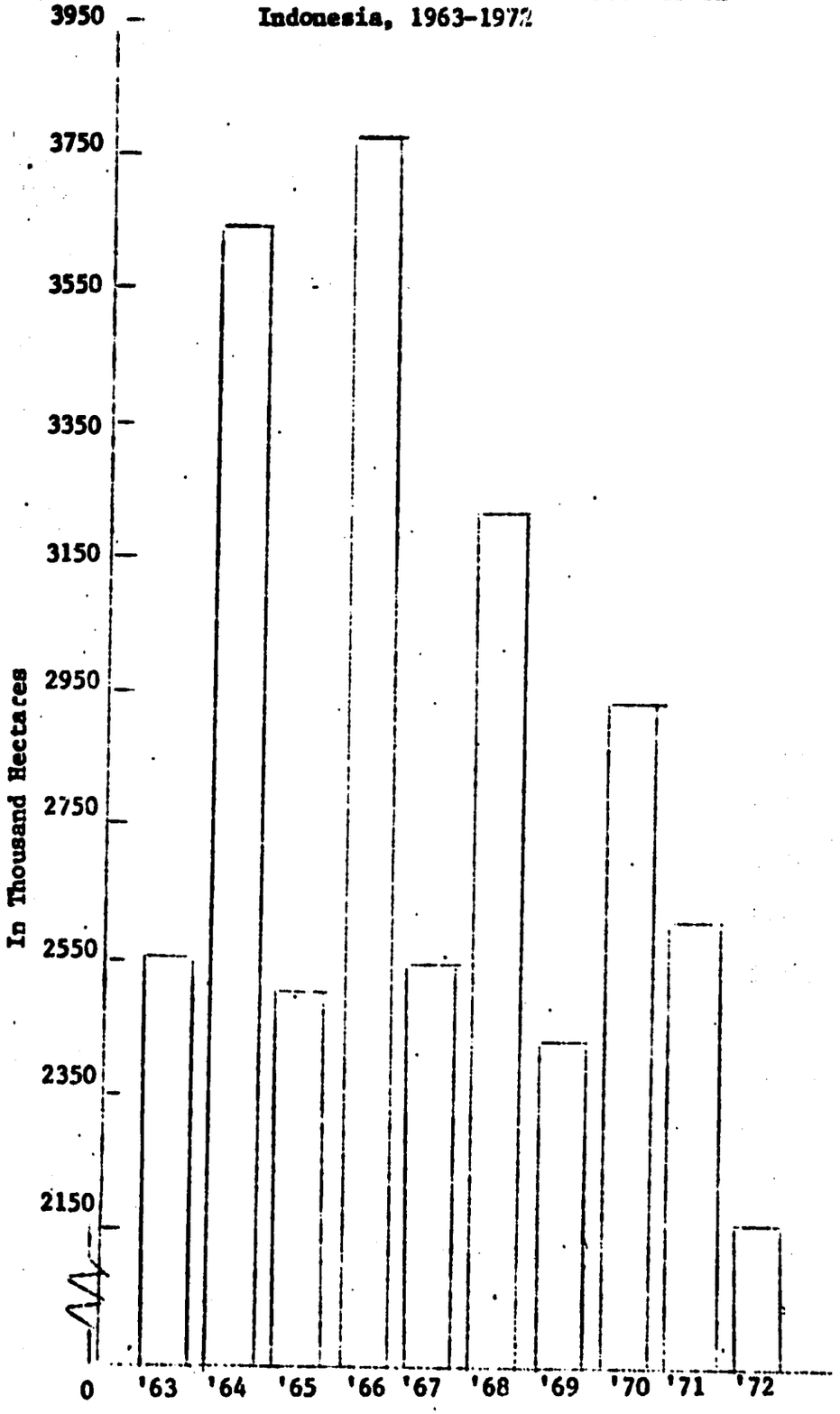


Figure B.2

Corn Production of Indonesia, 1963-1973

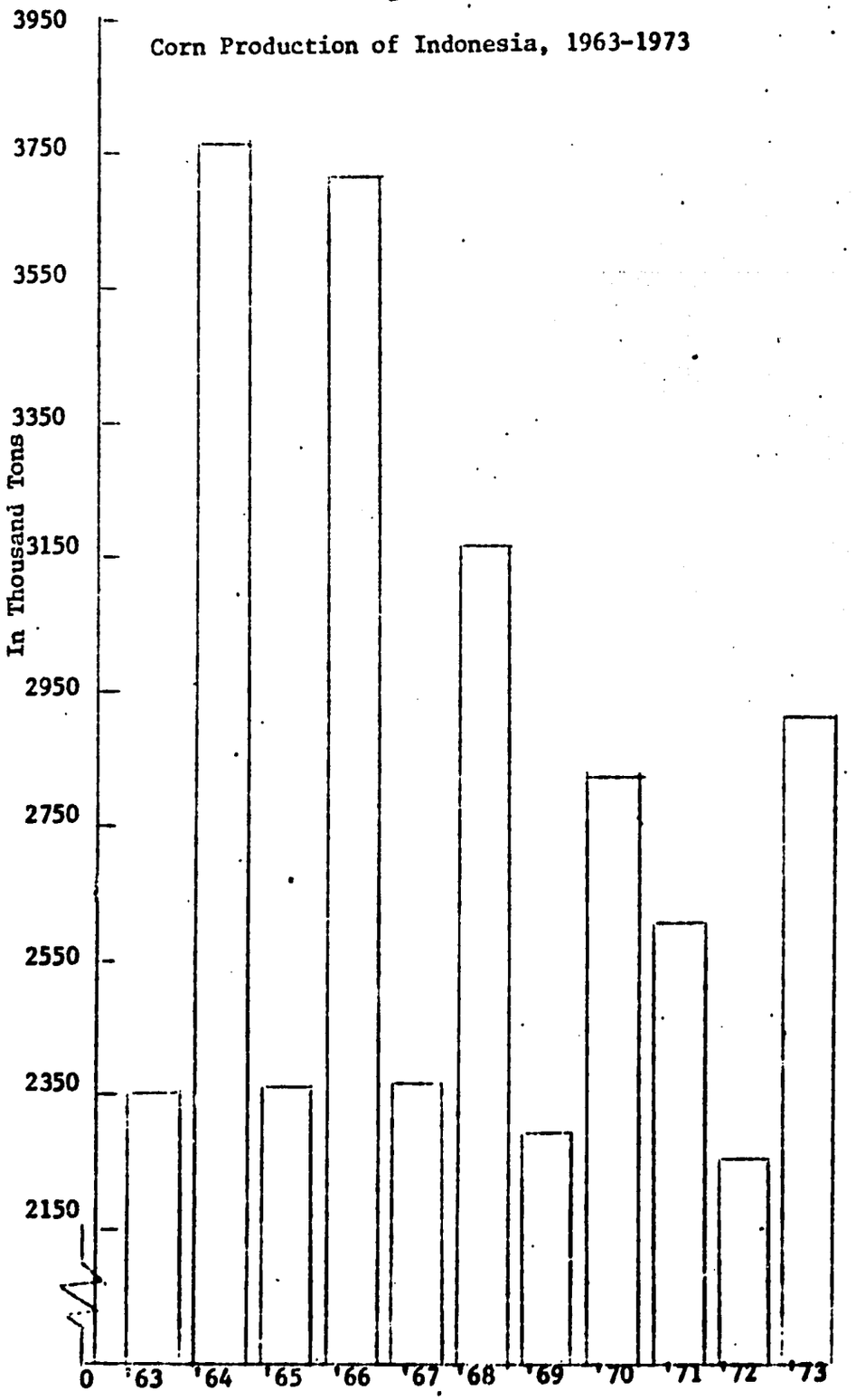


Figure B.3

Corn Yield in Kilogram Per Hectare in Indonesia 1963-1972

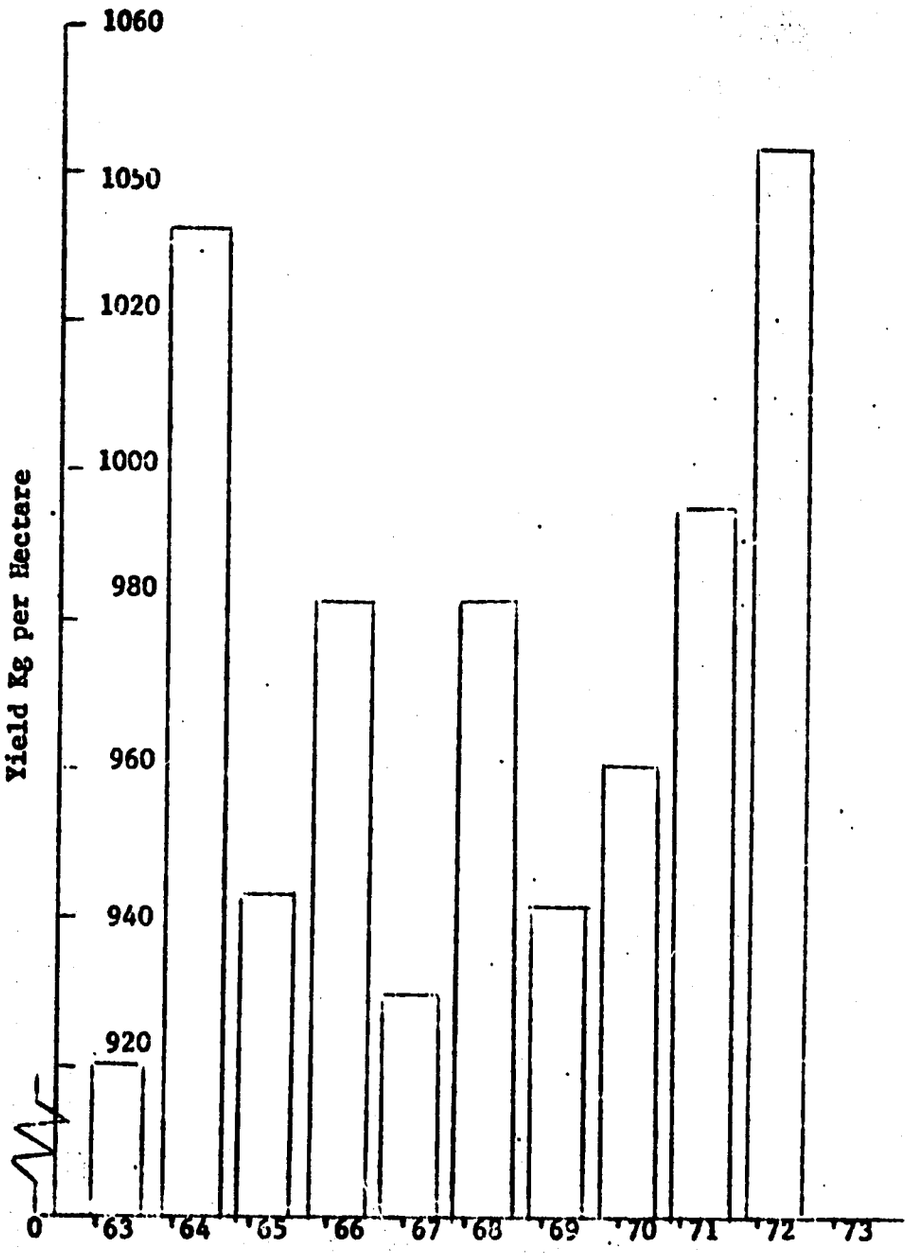


Table 20

Projected Corn Harvested Area and Production in Indonesia, 1973-1980

Year	Harvested Area (Hectares)	Production (Metric tons)
1973	2216.16	2110.19
1974	2273.78	2171.26
1975	2332.90	2233.93
1976	2393.55	2298.22
1977	2455.78	2364.19
1978	2519.63	2431.87
1979	2585.14	2501.31
1980	2652.35	2572.55

Formula used:

$$\hat{y} = a + b\hat{x}$$

$$a = \bar{y} - b\bar{x}$$

$$b = \frac{\sum (x - \bar{x})(y - y)}{\sum (x - \bar{x})^2}$$

Where:

$\hat{y}$ = Estimated Production

$\hat{x}$ = Projected Area Harvested

$\bar{y}$ = Average Production

$\bar{x}$ = Average Area Harvested

x = Actual Area Harvested

Note: The average rate of increase of area harvested which was found to be 2.6% was used as basis for making projections for harvested area.

In Bondowoso, East Java, most farmers plant the first crop of corn at the beginning of the rainy season followed by soybean and a second crop of corn at the end of the rainy season. Varieties that mature in more than 100 days would not fit the cropping pattern.

In the northern part of Central Java covering an area of 300,000 hectares the farmers can grow corn using the residual moisture of the previous rice crop. The local varieties are more adaptable to drought conditions than the recommended high-yielding varieties.

Most corn harvests coincide with the incidence of highest rainfall from December to February. This presents problems in drying and storing. Local varieties are of the flinty type which is more resistant to weevil infestation. The recommended varieties are semi-flint or semi-dent types which are more susceptible to weevil damage.

Downy mildew is a serious problem in Indonesia. The local varieties exhibit some resistance to this disease, whereas the recommended varieties are susceptible.

About 35% of the corn planted by farmers is of the white varieties while all of the recommended varieties are yellow.

Taste is another important factor. Farmers claim that the recommended varieties do not conform with their taste. This is a major factor since about 85% of the corn produce is eaten as a rice substitute.

Regarding cultural practices most farmers do not have enough cash to buy fertilizers and pesticides. Any yield increase realized by applying new technology does not offer enough incentives to the farmers because the marketing facilities are obsolete and inadequate. Furthermore, price is usually low during harvest time.

It is fair to assume that the farmers need food security for the family. Thus, in terms of priority, farmers prefer to plant rice. However, since rice requires intensive irrigation, corn is usually planted.

C. Production Centers

The average production figures in 1963-1972 show that Java produced 74% of the Indonesian corn production, Table 21. Most of the production of Java was concentrated in East Java which accounted for 52% of the national corn production. Central Java produced 26% and West Java produced 6%.

Comparing the national average production of 1963 to 1967 with that of 1968 to 1972, a reduction of 285 thousand tons was observed in the latter period. A major reason for this was that the rehabilitation of irrigation facilities caused a shift in cropping pattern from corn to rice. This was most evident in the island of Java.

Sulawesi is the second biggest corn producer in Indonesia. It accounted for 13% of the national production. Like in Java, corn production has been observed to be decreasing in Sulawesi.

Table 21

Average Corn Area by Regions, Indonesia, 1963-1973

Regions	Area (000 Ha)	Percentage	1963/67 Products (1000 tons)	1968/72 Products (1000 tons)
East Java	1,135	42	1,187	1,082
Central Java	740	26	780	703
West Java	165	6	195	134
Java	2,040	74	2,162	1,916
Sumatra	115	4	98	133
Sulawesi	374	13	424	323
Nusa Tenggara	217	8	204	230
Others	25	1	25	23
Outside Java	731	26	751	709
INDONESIA	2,771	100	2,913	2,628

Source: Central Bureau of Statistics

The 1968 to 1972 average production was only 323 thousand tons, compared to 424 thousand tons for 1963 to 1967. One reason for the decrease in the production of Sulawesi might be the inadequacy of sea transport facilities from the farm to the consumption centers in other islands.

Sumatra and Nusa Tenggara contribute a 12% share of the national production. Both regions have shown an increase in production. In 1969 to 1972 the average production was 133 tons in Sumatra and 230 tons in Nusa Tenggara, compared to 98 and 204 thousand tons, respectively during 1963 to 1967. The reason for the increase of production in Sumatra was the introduction of commercial corn planting by Japanese multinationals in Lampung for export. On the other hand, Nusa Tenggara has limited facilities for rice irrigation, so that there was a shift in food production from rice to corn.

D. Corn Production and the Unique Climatology

Higher corn production has been obtained in even years than in odd years, Table 19. Consistently, higher production in even years and lower production in odd years has been due to the unique climatological fact that the rainy season in Java consistently started early in even years. In even years the rain started late in September or the first week of October, and because the farmers planted varieties that mature in 75 to 90 days at the start of the

rainy season the September or October planting can be harvested in the same year. On the other hand, during the odd years the rainy season started usually in the latter part of October. The corn would then be harvested in January or February of the next year which is even.

The overall trend in corn production from 1963 to 1972 indicated that in odd years the production remained static between 2.3 to 2.6 million tons. In even years, production continuously decreased from 3.8 million tons in 1964 to 2.2 million tons in 1972. The preliminary figure for 1973 indicated an increase in production from 2.6 million in 1971 to 2.9 million tons. One reason was that the government encouraged farmers to plant more food crops in 1973 to prevent food shortage after the long drought in 1972.

E. The Farm Inputs

E.1 Varieties

The present recommended varieties developed by the Central Research Institute for Agriculture are Harapan, Metro and Bogor Composite 2. All yellow varieties, their yield potential range from 4.5 to 5.5 tons as shown by the results of 36 multilocational trials conducted in the main corn growing areas in the country. These varieties mature in 100-110 days in the eastern part of the country and 110 to 120 days in the western part because of rainfall

variability. All of these varieties are relatively tall and susceptible to lodging and downy mildew. They are semi-flint and susceptible to weevil.

E.2 Fertilizer

Fertilization studies on corn conducted in Indonesia indicated that at 90 kg nitrogen, a yield of 3.72 tons per hectare can be realized compared to 1.15 tons per hectare without fertilizer. At 135 kg of nitrogen, the yield was 2.91 tons.

Local varieties do not respond as well to nitrogen. At 60 kg of nitrogen, the average yield was 1.5 tons per hectare compared to 0.9 ton without fertilizer. At 120 kg per hectare the yield was only 1.8 tons.

Response to phosphorus was observed only in certain types of soils like Grumusols, Latosols and Red Yellow Podsolic Soils. Response to phosphorus ranged from 7 to 10 kg of corn per kg phosphate (P_2O_5) applied. Potassium usually does not give any appreciable contribution to yield.

The present recommended fertilizer dosage is 90 kg nitrogen and 30 kg P_2O_5. When there is potassium deficiency in the soil, 30 kg of the K_2O is recommended. One third of the nitrogen and all of the P_2O_5 or K_2O should be applied at planting, with the rest of the nitrogen applied one month after planting.

For better results, fertilizer must be banded 10 cm from the seed and 7 1/2 cm deep.

E.3 Herbicides and Insecticides

Linuron, a direct post-emergence spray and atrazine effectively control weeds under experimental conditions.

For controlling insects, especially the rice seedling fly (Atherigona Exigua), the following insecticides may be applied.

1. Diazinon 60 EC, 15-20 cc per 10 liter water
2. Dieldrin 50% WP, 20-25 gm per 10 liter water
3. Forferno 5-10 cc per liter water.

The volume needed per hectare ranges from 200 to 250 liters up to the third week and 500 liters at flowering time.

E.4 Water Requirements and Climate

About 71% of corn is planted under upland conditions. There are two planting seasons per year. The first crop is grown at the beginning of the rainy season called "Labuhan". The second crop is planted at the end of the rainy season called "Marengan".

The other 29% of corn production is planted after the rice has been harvested in the dry season from June to August.

Lampung, in southern part of Sumatra, has an evenly distributed rainfall during the year and it can grow three crops of corn a year. But the wide occurrence of downy mildew in late 1973 has prevented the expansion of corn hectarage.

See Appendix 1 for the state of the arts in corn production Technology for Indonesia.

F. Cost Structure in Corn Production

The following data on costs and returns are based on a survey conducted in January 1971 by the Central Bureau of Statistics throughout Indonesia, except West Kalimantan, Maluku and West Irian.

The survey reported that the average harvested area per corn farmer in Java was 0.72 hectare compared to 0.76 hectare outside Java (Table 22). For the whole Indonesia, the average was 0.73 hectare.

The yield in Java was 1000 kg/ha which was 135 kg higher than the average in the other islands. The national average yield was 962 kg per hectare.

The highest production costs per hectare and per kilogram was reported in Java. The total cost per hectare was Rp 5,253, equivalent to Rp 5.25 per kilogram. Outside Java the production cost per hectare was Rp 1,597. Although lower yield was recorded outside Java the cost of production per kg was lower, Rp 2.26. For the whole country, the production cost per hectare and per kilogram was Rp 4,334 and Rp 4.50, respectively.

The average cost of production, as a percentage of sales, was 34% in Java and about 17% outside Java. The national average was 30%.

Hired labor and rental cost of animals were the two biggest cash expenses in Java, namely Rp 1,665 and Rp 988 per hectare, respectively, which came to 51% of the total cost. On the other

Table 22 (continued)

Cost of production/kg (Rp)	5.25	2.26	4.50
Price received by farmers/kg	15.38	13.09	14.81
Net farm income from lowland rice (Rp)	46,598	56,173	50,322
Net farm income from upland rice (Rp)	26,556	25,960	26,120
Net farm income from cassava (Rp)	35,006	76,972	43,178

Source: Agriculture Survey, January-February 1971, Central Bureau of Statistics

Table 22

Production and Cost Per Hectare of Corn Cultivation, Indonesia, 1970

	Java & Madura	Outside Java	Indonesia
Number of corn farmers	2,933,836	1,066,072	3,999,908
Harvested area (Ha)	2,101,648	812,513	2,914,161
Harvested area/farmer (Ha)	.72	.76	.73
Yield per hectare (Kg)	1,000	865	962
Production cost per Ha (Rp)	15,332	11,321	14,250
Value of production (Rp)	5,253 (34%)	1,957 (17%)	4,334 (30%)
Total Cost (Rp)			
1. Seed	528	377	486
2. Fertilizer			
Chemical	841	5	608
Manure	399	5	289
3. Insecticide	11	17	13
4. Rental cost of animal	988	433	833
5. Wages/Salaries			
Planting	1,194	267	936
Others	471	66	358
6. Other costs			
Tax	305	241	287
Maintenance	168	168	168
Others	347	378	356
Net farm income	10,129	9,364	9,916

hand, outside Java, the highest cash expense was incurred for the cost of animal rentals.

Net farm income per hectare was higher in Java than in the outer islands, Rp 10.1 and Rp 9.4 thousands per hectare,respectively. For the whole Indonesia, the net farm income was Rp 9.9 thousand.

Relative to the net farm income from rice and cassava, the survey indicated that rice and cassava were more profitable than corn. For lowland rice, upland rice and cassava, the net farm income per hectare was 50.26 and 43 thousand rupiahs, respectively.

G. The Future Outlook on Production and Technology

G.1 Government Policies on Agriculture for Pelita II (Second Five Year Development Program)

Agriculture is the most important sector in the Indonesian economy. It plays the major role as the provider of foods, raw materials for industry, and foreign exchange. The farmers and their families are the biggest consumers of the products of the local industrial sector also.

In the Repelita I (1969-1974), agriculture was the first priority. In Pelita II (1974-1979) agriculture is still given with the following goals, (1) increasing farmers' income, (2) equalizing distribution of income and (3) creating more job opportunities.

Rice production during Pelita II increased from 12.3 to 14.5 million metric tons. The increase was due to the rice intensification program (BIMAS) by expanding rice areas and increasing

yield per hectare. Production target for 1978 is 18.2 million tons of rice compared to 14.5 million tons obtained in 1973.

Production of corn, tuber crops and legumes also plays an important role in increasing farmers income, especially where irrigation is not available. During Pelita II, however, the production of secondary crops should be intensified.

Increasing secondary crop production, especially corn, sorghum, tuber crop and legumes, will be done through such intensification programs as the BIMAS (with credit) and INMAS (without credit). The BIMAS program includes: (1) soft loan, (2) HYV seeds, (3) intensifying research effort, and (4) extension.

To improve marketing facilities, attention will also be given to the rehabilitation and development of drying, processing and storage facilities.

During Repelita II the corn intensification program in 1974 aims to cover 290 thousand hectares which will be expanded to 1.4 million hectares in 1978 , see Table 23. Intensification program will also be carried out in sorghum, cassava, soybean, peanut and mungbean.

It is expected that from these intensification programs during Pelita II, the yield will increase as follows:

1) corn from 2.6 to 4.15 million tons
2) sorghum from 55 to 240 thousand tons
3) cassava from 9.90 to 12.75 million tons

4) soybean from 495 to 670 thousand tons

5) peanut from 275 to 355 thousand tons, and

6) mungbean from 65 to 90 thousand tons

G.2 The Impact of the Global Fertilizer Shortage

In 1970, only an average of 30 kilograms of fertilizer was used in Java. The recommended rate is 200 kg of urea and 50 kg of T.S.P., see Table 24. Less than one kg per hectare was applied outside Java. The average was 22 kg per hectare for the whole country.

According to the National Fertilizer Study, the factors affecting fertilizer use were, (1) non-availability of fertilizer at the right time, (2) lack of credit, and (3) relatively high price for fertilizer. Furthermore, it was shown earlier that net profit from corn was lower than that from rice or cassava. This has served to discourage farmers from using fertilizers in corn.

In 1974, the estimated need for fertilizer for food crops was 1,041 million tons of urea and 342 thousand tons of T.S.P. The expected national production was only 189 thousand tons of urea and none for T.S.P. The government is trying to bridge the gap through importation. The present world shortage in fertilizer might cause some dislocations in food production in Indonesia. However, it might be more pronounced in rice than in corn production, Tables 25 and 26.

Table 23

Expected Area to be Covered by Secondary Crop Intensification Programs (1974-1978)(1000 Ha)

Year	Size of Intensification Area					
	Corn	Sorghum	Cassava	Soybean	Peanut	Mungbean
1974	290	10	1	75	22	3
1975	370	30	10	150	44	6
1976	1,600	60	50	200	70	10
1977	950	80	100	240	94	16
1978	1,400	100	200	270	110	20

Figure C

Expected Area to be Covered by Secondary Crop Intensification Programs, 1974-78

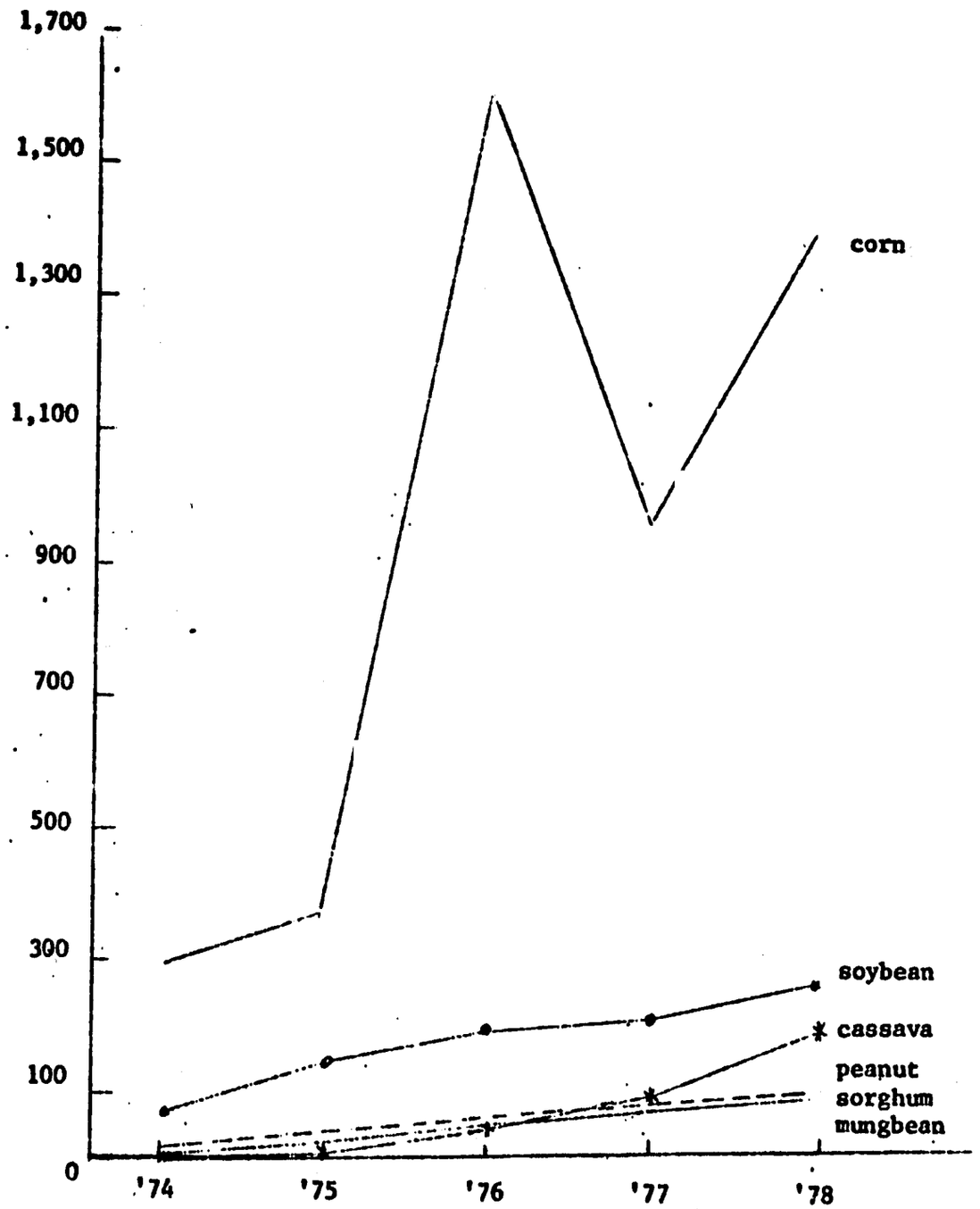


Table 24

Fertilizer Usage Levels in Kg/Ha, Indonesia, 1970

	Java & Madura	Outside Java	Indonesia
Rice	95	14	58
Corn	30	x	22
Cassava	6	-	5

Source: Central Bureau of Statistics

Table 25

Estimated Fertilizer Need During Pelita II 1974-1978
(Thousand Tons)

Kinds of Fertilizer	1974	1975	1976	1977	1978
1. Urea 1/	1,104 (1,041)	1,386 (1,306)	1,554 (1,467)	1,794 (1,677)	1,975 (1,834)
2. T.S.P. 1/	376 (342)	432 (394)	494 (450)	549 (501)	579 (526)
3. Potassium Chloride 2/	16.7 (3)	27.2 (6)	44.7 (15)	65.3 (25)	111 (27)
4. Ammonium Sulphate	169	176	187	197	205
5. Compound (NP-NPK)	57.4	73.3	95.8	125.3	161.9
6. Others	110.5	121.2	134.1	146.6	154.4

1/ In brackets: for rice and secondary crops

2/ In brackets: for upland rice

Source: Pelita II

Table 26

Estimated Area Fertilized by Major Smallholder Crops, 1969

Region	Crop	Harvested Area in 1969 (1000 Ha)	Nitrogen Applied (Ton)	Area Fertilizer 1000 Ha	Area Fertilizer % of Total
Java	Rice	4,326	72,913	1,247	29
	Corn	1,599	19,298	482	30
	Vegetables	504	8,271	138	27
	Tobacco	132	5,514	85	64
Other Islands	Rice	3,883	13,814	331	9
	Corn	836	347	9	1
	Vegetables	77	867	14	19
	Tobacco	25	-	-	-
Indonesia	Rice	8,210	86,727	1,578	19
	Corn	2,435	18,622	491	20
	Vegetables	581	9,311	152	26
	Tobacco	156	4,656	85	54

Source: National Fertilizer Study, 1972. Annex II, p. 93

To overcome the fertilizer shortage in the future, the government plans to expand the present fertilizer production facilities in the country. By the end of Pelita II, the country will hopefully be self-sufficient in fertilizer.

Expected fertilizer supply and demand are given in Table 27.

Table 27

Expected National Fertilizer Production, 1974/1975-1978/1979 (Ton)

Year	Total N	From A.S.	Volume A.S.	From Urea	Volume Urea	P_2O_5	Volume TSP
1974/1975	110,000	23,100	110,000	86,900	188,913		
1975/1976	307,100	23,100	110,000	184,000	400,000	-	-
1976/1977	400,300	23,100	110,000	377,200	820,000	24,000	52,000
1977/1978	584,200	23,100	110,000	561,100	1,272,000	77,000	167,000
1978/1979	981,100	23,100	110,000	958,000	2,084,000	177,000	254,000

Urea: 46% N

A.S.: 21% N

TSP: 46% P_2O_5

Source: Pelita II

Appendix 1

State of the Arts in Corn Production

a) Commonly Used Varieties: Genjah Kodok, Kapur, Genjah Warangan

Average Yield: 900 kg/ha

b) Recommended Varieties : Harapan, Metro, Bogor Composite 2

Potential Yield: 4,000 kg/ha

c) Cultural Management Practices

1. Land preparation

(1.a) Current practices

Land preparation is done using mainly human labor or animal power. The field is plowed once and harrowed once.

(1.b) Recommended practices

2 weeks before planting. First plowing 25 cm deep followed by first harrowing to break big clods to smaller sizes. It must be done at the right soil moisture condition.

One week before planting. Second plowing and harrowing.

2. Planting

(2.a) Current practice

Distance of planting. Variable distance between rows from 0.6 to 0.8 meter, within

rows 0.4 to 0.8 meters at 3 to 6 seeds per hill. Amount of seed needed per hectare is 15 to 20 kg.

(2.b) Recommended

Distance between rows is 75 cm and within rows is 25 cm at 3 seeds per hill.

3. Basal Fertilization

(3.a) Current practice

Not being done.

(3.b) Recommended

Time and rate of application. Basal application 30 kg of nitrogen, 30 kg of P_2O_5 and if necessary 30 kg K_2O per hectare. Band fertilizer 7 cm from the seed, 7 1/2 cm deep and cover with soil.

4. Weeding

(4.a) Current practice

Occasional

(4.b) Recommended

Two weeks after planting the first weeding should be done.

The second weeding will be done 4 weeks after planting.

5. Pest and disease control

(5.a) Current practice

Not being done.

(5.b) Recommended

Two or three days after emergence spray with Dieldren 50% WP 20-25 gm/10 liters to control rice seedling fly. Any other recommended insecticide available can be used. The amount needed ranges between 200 to 250 liters per hectare. When other insects occur it is recommended to repeat the spraying.

6. Second fertilization

(6.a) Current practice

Not being done.

(6.b) Recommended

One month after planting 60 kg nitrogen per hectare should be banded 10 cm from the rows.

7. Harvesting and drying

(7.a) Current practice

The ears are harvested when all the leaves are dried. Ears are detached and usually put in bundles of ten and placed above the kitchen.

(7.b) Recommended

Harvest 110-115 days after planting when the leaves are dried. Husk and sun-dry for 3 to

4 days. Shell and dry grains to about 15% moisture content.

8. Production Cost of Corn Per Hectare as per Recommended Practices

1. Activities

Land preparation (135 man-days)	Rp 27,000
Making furrows and hole (25 man-days)	RP 5,000
First fertilizer application (a0 man-days)	Rp 2,000
Planting (10 man-days)	Rp 2,000
First weeding (40 man-days)	Rp 8,000
Side dressing (10 man-days)	Rp 2,000
Hilling (35 man-days)	Rp 7,000
Thinning (4 man-days)	Rp 800
Spraying (2 man-days)	Rp 400
Supervising. (2 man-days)	Rp 400
Harvesting (35 man-days)	Rp 7,000
Processing (35 man-days)	Rp 7,000
Total labor costs -	Rp 41,600

2. Materials

Seed (20 kg at Rp 75/kg)	Rp 1,500
Fertilizer	
Urea 200 kg	Rp 8,000
TSP 100 kg	Rp 4,000

Insecticides (2 liters)	Rp 1,000
Sacks (55 sacks at Rp 50)	Rp 2,750
Diesel oil (137.5 liters at Rp 15)	Rp 2,062.5
Total material costs -	Rp 19,312.5
3. Miscellaneous	Rp 4,396
Total cost of production per hectare -	Rp 92,308.50

Average yield = 2,750 kg/hectare

Price/ton	Rp 50,000
Gross Sale	Rp 137,500
Total production Costs	Rp 92,308.5

Net profit per hectare before marketing - Rp 44,191.5

CHAPTER IV. ASSEMBLY, STORAGE AND TRANSPORT

A. Assembly Lines

The assembly line and functional linkages of institutions involved in the industry is presented in Figure D. This figure tries to illucidate in a more detailed manner the aggregate linkages for Indonesia as a whole.

B. Corn Processing and Storage

Husking and shelling corn is usually done manually. Most of the corn produced in East Java is sold in the form of grain, but some farmers prefer to sell corn on the cob, so that husking and shelling are done by traders.

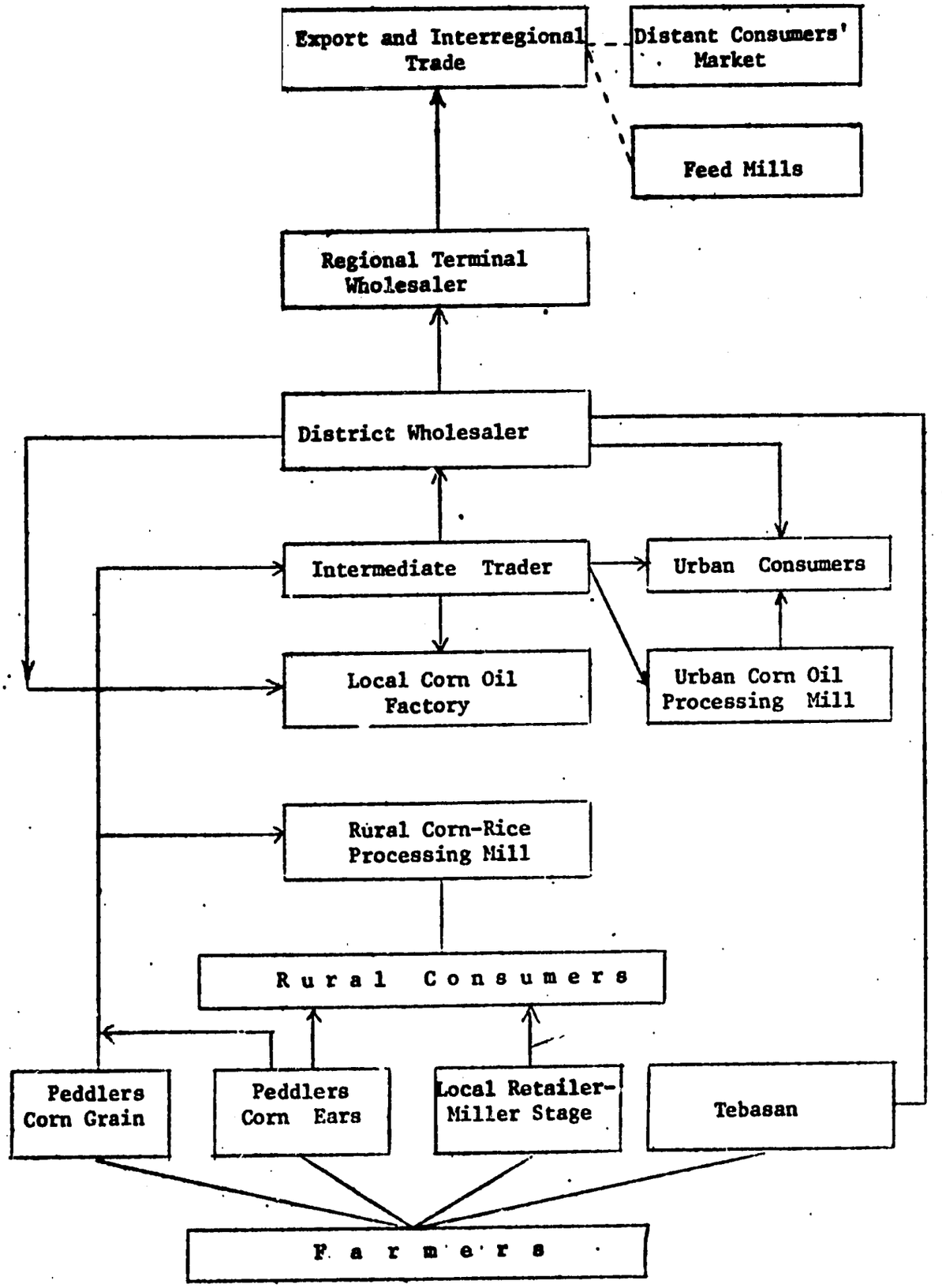
In case farmers prefer to store corn unshelled, the drying process is simply carried out by hanging corn ears above the stove. This is usually regarded as the best way to minimize cost and damage during storage especially for small quantities. For large quantities, they resort to sundrying and store it in grain form.

In the sample study area, one intermediate trader had a mechanical dryer. Cost estimates of such dryer has been presented in Chapter III.

Rice-corn mill technology was introduced in Indonesia in the early 1960. At that time, the government was trying to persuade consumers to switch from rice to corn consumption due to

Figure D

Corn Assembly Line, East Java



the rice shortage and the difficulty of maintaining adequate quantities from import.

These rice-corn mills are usually household industries or a supplementary activity of feed mills. Usually their activity is based on custom milling in which they accept small quantities from individual consumers and retailers.

Investment and operation costs for these rice-corn mills are similar to those of the feed industry.

Usually, small-scale exporters of corn are not equipped with special drying and storage facilities to maintain international standard requirements. Only large-scale exporters such as Mitsugoro and and the East Java Corn Project has adequate drying and storage facilities.

With regards to mechanical dryers, there is a tendency to view mechanical drying as a substitute for sundrying, and the installation of mechanical dryers as the solution to Indonesia's rice and corn drying problems.[1/] This is especially obvious in arguments against mechanical drying. It is easy to argue that sundrying is less expensive than mechanical drying. There is little disagreement on this point when expenses are measured in terms of out-of-pocket costs. One cannot automatically conclude, however, that because sundrying is less expensive, it is also "more efficient" or "more economical." Such a generalization certainly does not apply if there are not enough sunny days to adequately dry the available grains during

1/ USAID, Weitz-Hettelsater Engineer, Rice Storage, Handling and Marketing, 1972, p. 160-161.

part of the harvest season. In this situation, mechanical drying may be the only feasible alternative and the grains saved may be worth far more than the cost of drying. Similarly, it is sometimes argued that sundrying is labor intensive in contrast to mechanical drying which is capital intensive. There is little disagreement about this classification. However, it does not automatically follow that in a surplus labor situation which exists in Java, the introduction of mechanical drying represents a substitution of capital for labor and, is in some sense, uneconomical from a social point of view. However, mechanical dryers substitute for sundrying on rainy days or when there is shortage of space for rice and corn drying.

Viewing mechanical drying as a substitute for sundrying over simplifies the arguments for and against the introduction of mechanical drying. It is much more realistic to consider mechanical drying to be complementary to sundrying. Rice and corn are better dried through a combination of both methods for cost savings and practicality.

Even the simplest type of warm air mechanical dryers are often too complicated and too expensive to be used on the farm by the average farmer. Batch type warm air mechanical dryers are most likely to prove useful at the village or small mill level. Continuous flow mechanical dryers are expensive and best suited to large rice mill operation especially those with bulk storage capacity for grains.

In the same study, the average size of the warehouses owned by Bulog has a 1,486 ton capacity. The other warehouses which rent space have an average 2,207 tons of storage capacity. The average size of Bulog warehouses in Jakarta is somewhat larger than in other areas. Its own warehouses in Jakarta average 6,500 tons in size and its rented warehouses average 4,375 tons in capacity. Bulog also owns two warehouses in North Sumatra with an average size of 8,750 tons for milled rice.

Private rice mills frequently store rice in two different ways. Milled rice and gabah is usually stored in sacks and piled in godowns. Stalk paddy is stored unthreshed in piles on concrete drying pads until it is processed. A few of the larger mills in Java have a storage capacity of 1,000 to 3,000 tons, some are stored on open air concrete drying pads and some in godowns. Most of the mills in other place have much smaller storage capacity with an average of about 50 tons of stalk paddy. The hullers may have a storage capacity from 10 to 30 tons of stalk paddy.

Private warehouse operators and retail rice merchants also have some rice storage capacity but, on the basis of data available, it is impossible to make a rough estimate of the capacity. Much of this storage capacity is undoubtedly very flexible in the sense that if it is not being used to store rice it can be used to store other goods.

There are numerous village godowns throughout the country. These godowns frequently have a storage capacity of from 5 to 10

tons of gabah or stalk paddy. The size and number of godowns in a village depend on the size of the village. In the case of the smaller villages it is probably more appropriate to classify the village godowns as on-farm storage facilities than to include them as part of the storage capacity used for the marketed surplus of rice. Regardless of how it is classified, the amount of rice storage capacity in the village godown is substantial. Unfortunately, there are no authoritative estimates on the total storage capacity of these godowns.

Recently, the GOI began to experiment with a modern version of village godowns. The purpose of the new village godown is to provide a facility where the farmer could store his grain as a part of the commercial transaction and be able to obtain up to 70% of its value the modern godown would store his proceed until seasonal price increases. The loan rates, storage charges, and the features are given in detail in Appendix 2.[2/]

The Bank Rakyat Indonesia (BRI) will finance the building and equipment, the ownership of which will be transferred to a local cooperative or other agency. There will be a godown foreman at each village, perhaps a BRI man, who may be able to administer six godowns by visiting each facility once a week.[3/]

2/ This project was developed by M. A. Tournier, a FAO expert in Jakarta.

3/ BRI Village Godown (V-6), Program-undated.

The godowns visit were built of local material and labor at a cost of approximately Rp 1.5 million each. They have a capacity of 200 metric tons with provisions for expansion.

The godowns consist of individual wooden bins about 2 meters x 3 meters x 3 meters high each without cover and open up to the tile roof above the top of the bins. They were designed by local architects and not by storage experts. The gabah (grain) is stored in bags with information on its original identity. While it requires considerable labor to load and unload the bags, this poses no problem as labor is abundant. Six godowns constitute one administrative unit. A BRI representative visits one godown each day of the week for inspection and necessary administrative work.

It is of interest that the godowns could be equipped with warm air ducts under a perforated metal floor thereby creating and in-bin drying unit on a small scale as described earlier in this chapter.

For an overview of the existing storage facilities for rice (grain), data on storage warehouses and capacity are presented in Table 28.

C. Land and Water Transport[4/]

Transportation is one of the most troublesome bottlenecks in

4/ The following section is reproduced from the Rice Storage, Handling and Marketing Study, Chapter VI. For price and cost updating, multiplication of Rupiah value by about 1.50 to 2.00 would be desired.

Table 28

Existing Warehouse and Godown Storage, By Province, Indonesia, 1971
(In Thousand Tons)

Province	Warehouse As Reported by Bulog, July 1971: Owned by Bulog Qty.	Owned by Bulog Cap.	Owned by Other Qty.	Owned by Other Cap.	Total Qty.	Total Cap.	Rice Mill Storage (a)	Huller Storage (b)	Godown and Retail Storage	Total	Total Existing Storage, 1971
Aceh	4	2.4	7	3.9	11	6.3	7.8	3.6	9.1	20.5	26.8
North Sumatra	2	13.1	9	15.0	11	28.1	0.8	18.1	26.3	45.2	73.3
West Sumatra	-	-	15	9.3	15	9.3	3.2	10.5	11.2	24.9	34.2
Riau	-	-	10	11.7	10	11.7	0.2	0.5	6.2	6.9	18.6
Jambi	-	-	6	5.3	6	5.3	0.2	2.5	4.1	6.8	12.1
South Sumatra	-	-	26	26.2	26	26.2	3.6	14.9	13.8	32.3	58.5
Lampung	4	3.9	1	2.6	5	6.5	8.5	5.[illegible]	8.4	22.8	29.3
Jakarta	2	9.7	44	144.4	46	154.1	0.1	0.2	67.2	67.5	221.6
West Java	1	0.5	75	106.5	76	107.0	197.1	12.9	71.1	281.1	388.1
Central Java	5	6.4	42	75.9	47	82.3	32.1	5.1	53.2	90.4	172.7
Yogyakarta	-	-	4	6.4	4	6.4	1.3	1.7	5.3	8.3	14.7
East Java	1	4.2	38	109.1	39	113.3	35.4	15.3	62.0	112.7	226.0
West Kalimantan	-	-	12	11.9	12	11.9	0.3	3.2	7.8	11.3	23.2
Central Kalimantan	-	-	-	-	-	-	-	2.1	3.1	5.2	5.2
East Kalimantan	1	0.4	13	10.6	14	11.0	-	1.1	2.8	3.9	14.9
South Kalimantan	-	-	18	8.1	18	8.1	2.4	5.6	7.2	15.5	23.6
South Sulawesi	60	47.6	3	7.1	63	54.7	4.9	10.4	13.8	29.1	83.6
Bali	-	-	4	2.3	4	2.3	-	1.1	6.4	7.5	9.8
West Nusa Tenggara	2	1.0	6	1.4	8	2.4	1.6	-	6.7	8.3	10.7
Other Province	4	6.6	52	79.6	56	90.2	-	2.0	19.8	21.8	108.0
INDONESIA	86	95.8	385	637.3	471	733.1	299.5	117.0	405.5	822.0	1,555.1

(a) Estimated storage capacity of 100 tons at each rice milk
(b) Estimated storage capacity of 20 tons at each huller
(c) Based on the assumption that the storage not reported is approximately equal to the percent of grain marketed (25%) to supply one month's consumption, multiplied by 1.5 to convert rice to gabah.

Source: Rice Storage, handling, and Marketing, op. cit., p. 170

Indonesia's marketing system. The roads, ports, and railways must be repaired and modernized. The lack of public investments in improving the transportation system results in higher costs for merchants and higher prices for consumers. Extensive studies of the transportation system have been made in recent years by public agencies and private consulting companies. The result of several studies are summarized in this section.

C.1 Condition of Existing Roads

The government's largest problem on transportation is the need to rehabilitate and upgrade the country's existing road system. Following inter-island shipping, the road system offers the greatest potential communication link in the country. Much of the system is based on conditions in 1939 and, even if repaired, would be inadequate for present day needs and motor vehicles. Most sections need repairs, and many sections have become unpassable

There were 84, 269 kilometers of highways in Indonesia as of 1966. Only 10,139 kilometers of these kilometers were classified as national highways, Maintenance responsibility for the remaining 88% of the highways was under provincial, country or municipal jurisdiction. The location of the main roads are shown in Figures E.1 to E.4. A list of the national, provincial, country and municipal roads by province is presented in Table 29.

Figure E.1

REPUBLIC OF INDONESIA

Main Roads

WEST JAVA

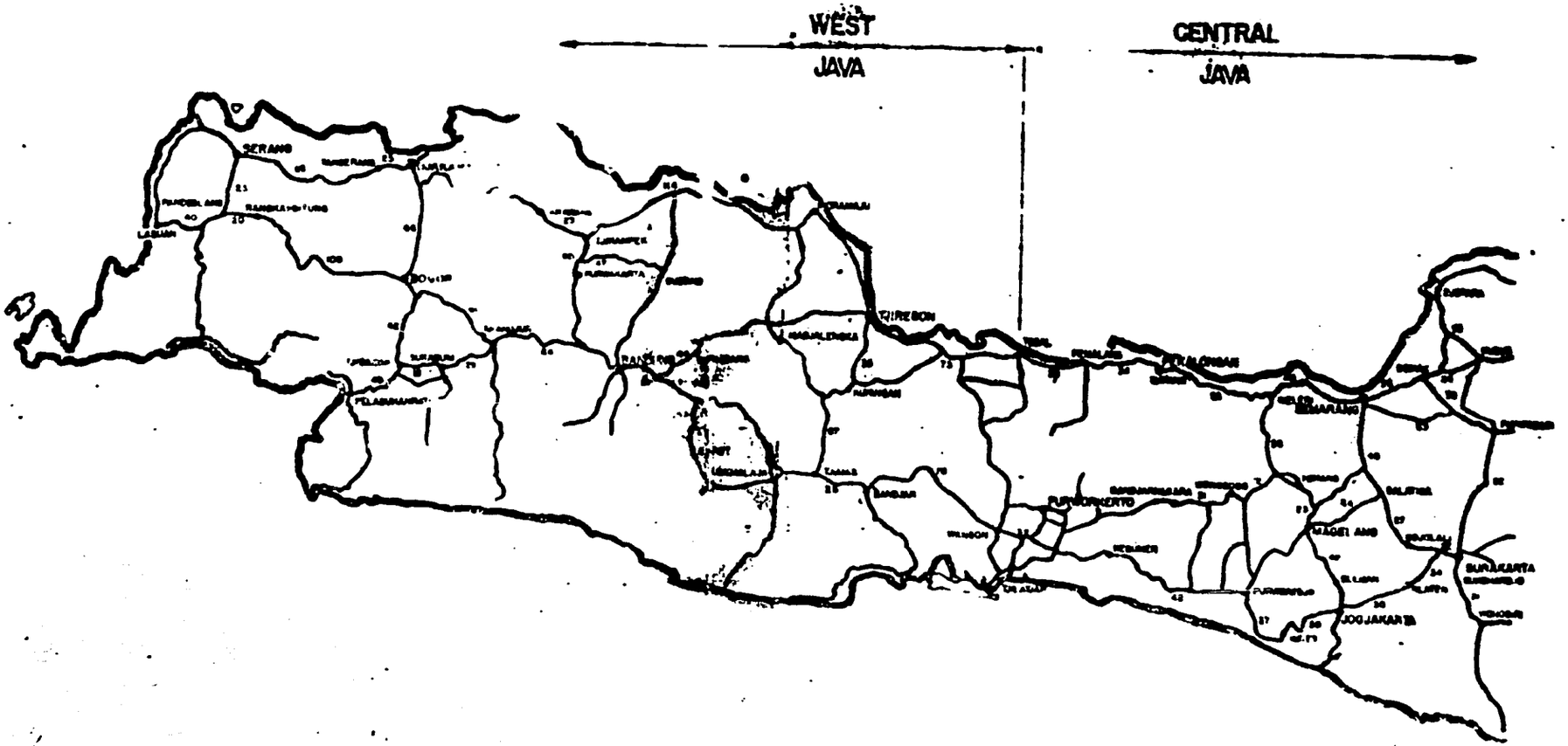


Figure E.2

REPUBLIC OF INDONESIA

Main Roads

EAST JAVA and BALI

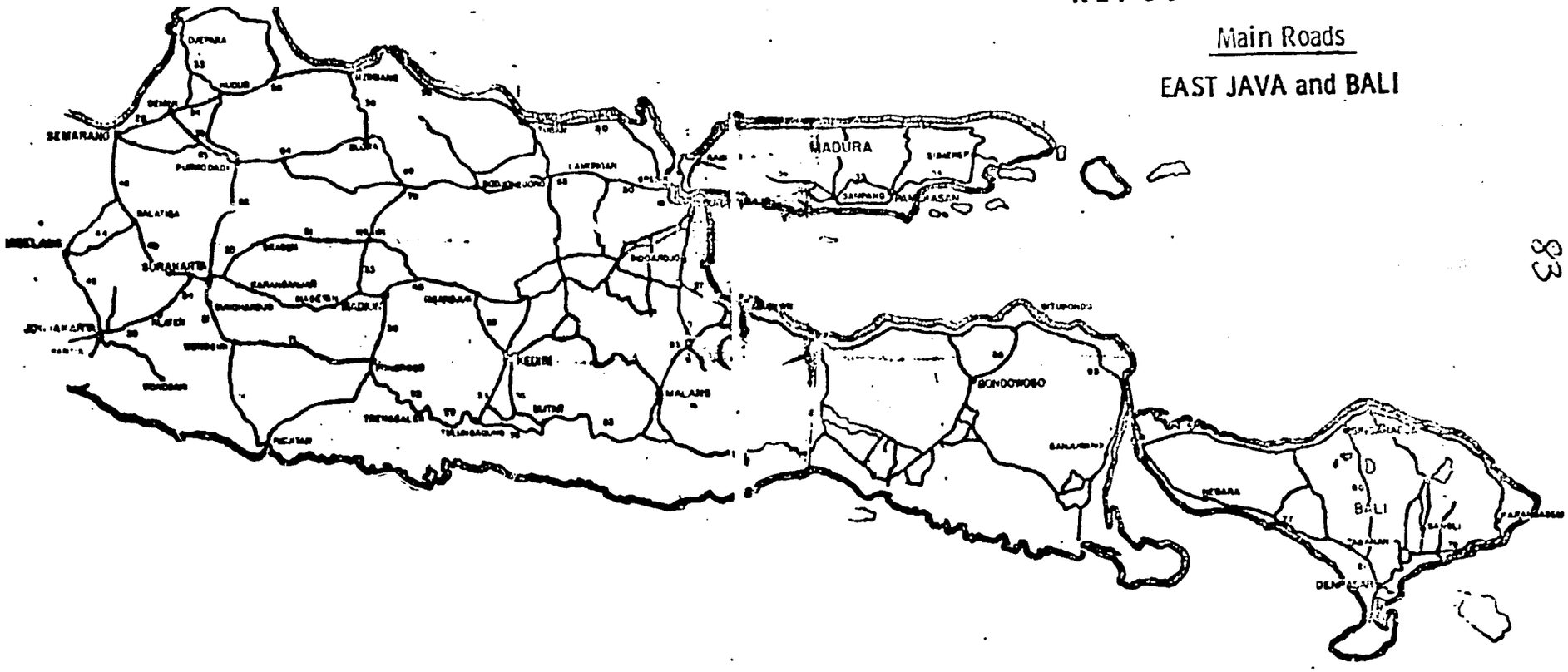
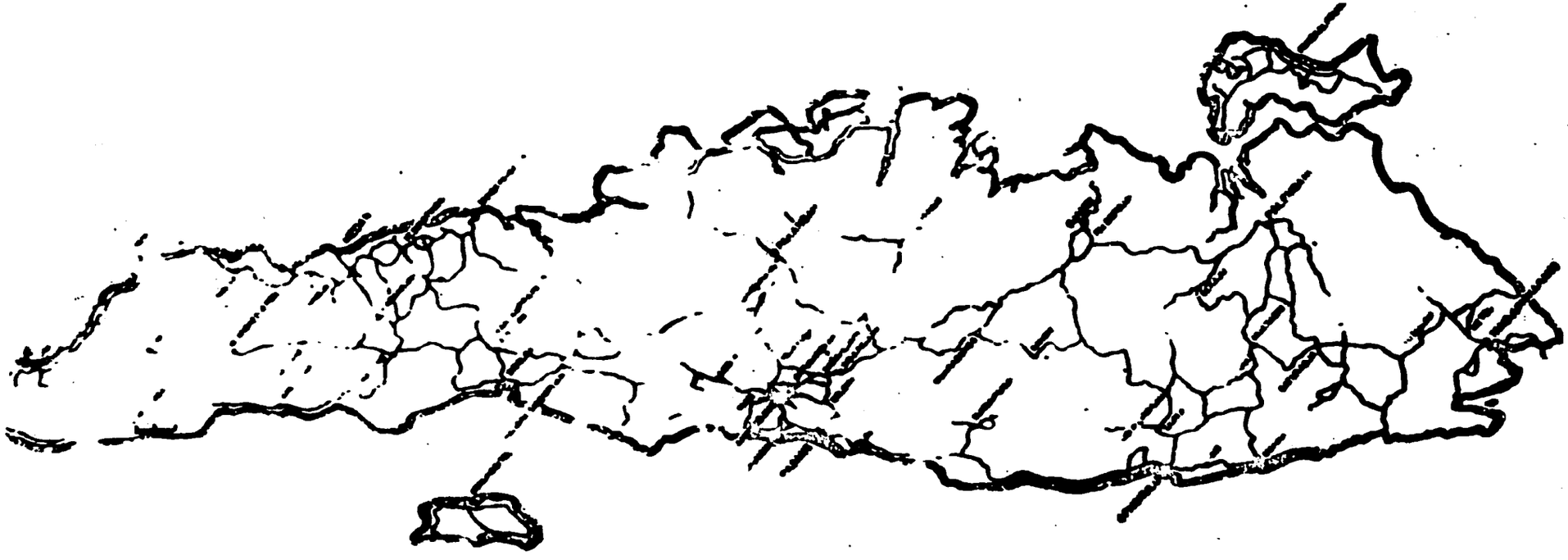


Figure E 3

REPUBLIC OF INDONESIA

MAIN ROADS

SUMATRA



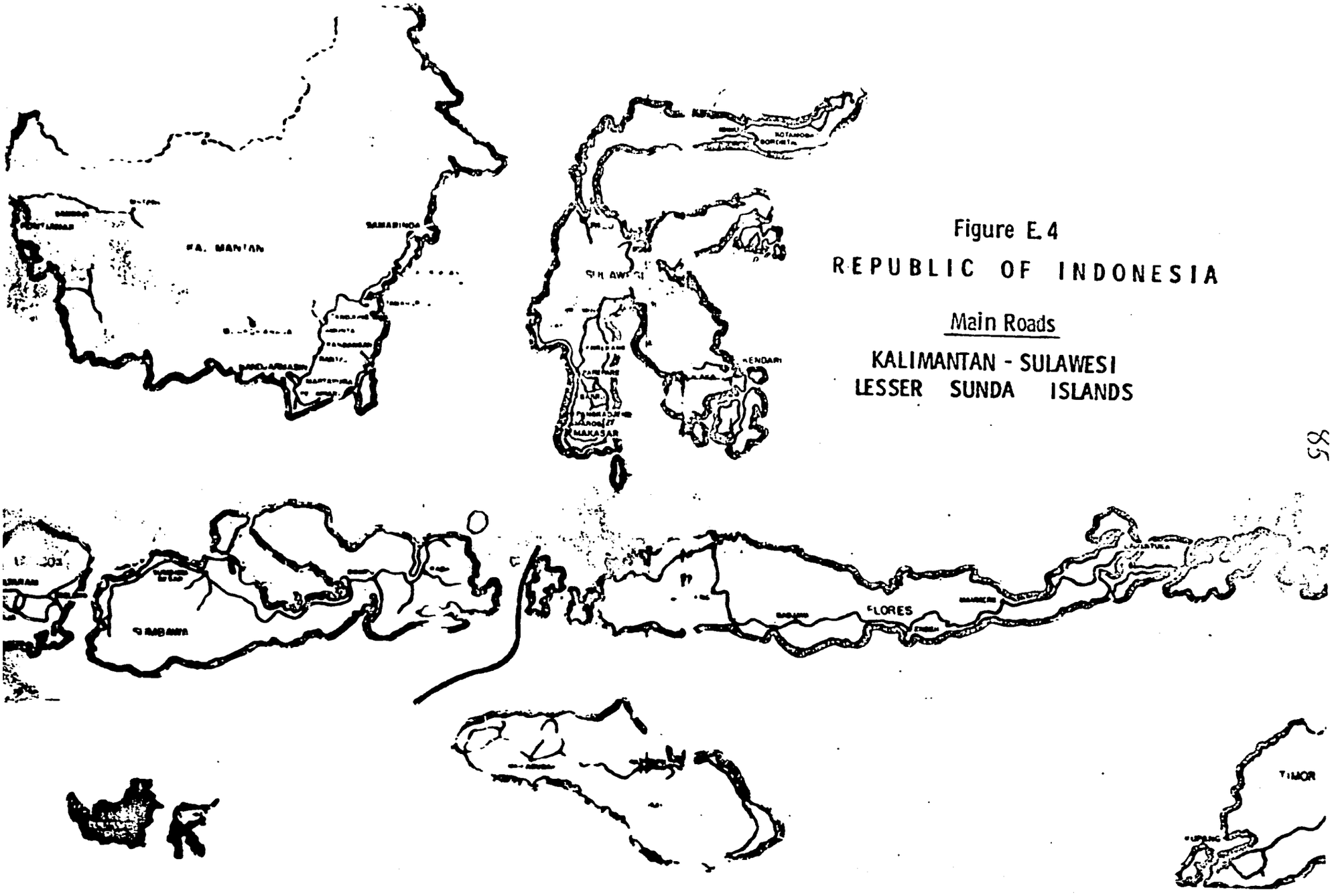


Figure E.4

REPUBLIC OF INDONESIA

Main Roads

KALIMANTAN - SULAWESI
LESSER SUNDA ISLANDS

In 1968, only 18% of the roads were paved. Nearly 40% of all roads were dirt roads. Only 5% was considered to be in good condition while 85% was in need of repair. Only 2% of the road network could handle axle loads of over 5 metric tons and 75.6% is limited to 2 tons or less.[5/]

Table 29

Road and Highways in Indonesia, 1966

Type	Kilometer	1971
National (state) Highways	10,139	10,628
Provincial Highways	22,682	24,466
Country Highways	49,134	51,170
Municipal Highway	2,314	3,114
Total	84,269	89,378

Source: KAMPSAX/BERGER, Indonesia 1968-1970 Highway Services, Interim Report, dated May 1969; 1971-1973 BPS, Statistik Kendaraan Bermotor Dan Panjang Jalan,

The condition of the road system is of considerable concern to the government of Indonesia. Government officials are aware of the state of road repairs and the implications of poor roads for rice marketing. In a recent government meeting, for example, it was reported that 80% of the government and provincial roads in South

5/ John W. Henderson, Area Handbook for Indonesia, DA Pam 550-39, (Washington, D.C. 20402: Superintendent of Documents, U.S. Government Printing Office, p. 439.

Sulawesi were damaged. Only 60% of the trucks were in operation. As a result truck transportation was very expensive, costing as much as Rp 4,500 per ton of rice transported in a distance of 155 kilometers.[6/] Although the truck transportation cost reported in this case may be somewhat higher than typical, it indicates that the published truck transportation charges may tend to understate the actual charges. The truck transportation charges and distances between important cities in several of the main provinces are given in Table 30 through optimum rice shipment patterns discussed in Chapter VII. Truck transportation charges reported by the Department of Communications for West Java, as an example, average Rp 10 per ton kilometer. The reported truck charges for shipping rice between Makassar and Pare-Pare in South Sulawesi, distance of 155 kilometers, is Rp 2,325 per ton. The actual charges probably vary during the year depending on the roads and the availability of trucks.

In Sumatra, the national highways, composed principally of the north to south highway from Banda Aceh to Telukbetung, varies considerably in standard and condition. Good bituminous surfaces are found in North Sumatra, West Sumatra and Lampung. The highway foundation and base are generally in good condition but the wearing course is usually of poor quality and durability.

6/ From the transportation of the Ministry of Agriculture's NRRP Second Technical Meeting April 3-5, 1971, Ciawi-Bogor: "Beberapa implikasi dari masalah surplus dan pemasaran beras Sulawesi selatan serta perkembangan harga beras dunia bagi kabijaksanaan intensifikasi pertanian national oleh Zainul Jasni," p. 3.

Table 30

National, Provincial, Country and Municipal Roads in Indonesia, 1966

Province	1971	Total	1971	National Roads	1971	Provincial Roads	1971	Country Roads	1971	Municipal Roads
					(Kilometers)					
East Java	10,717	10,733	549	521	2,714	2,689	6,363	6,932	597	591 a/
Central Java	9,297	9,296	409	490	1,801	1,801	6,582	6,682	405	404 a/
West Java	7,188	7,878	624	623	1,828	1,855	4,309	4,973	427	427 a/
Yogyakarta	1,096	990	32	32	113	113	346	740	105	105
Jakarta b/	1,072	478	145	-	213	150	-	-	714	-
JAVA MADURA c/	29,370	29,375	1,759	1,585	6,669	6,908	18,700	19,327	2,241	1,527
South Sumatra	5,910	6,976	662	663	2,617	3,467	2,547	2,762	84	84
Lampung	2,057	3,010	245	244	637	513	1,089	2,251	86	-
Bengkulu	2,027	d/	84	c/	634	c/	1,309	c/	-	c/
West Sumatra	3,566	3,568	631	567	1,015	1,081	1,889	1,889	31	31
Jambi	1,621	1,621	433	433	574	574	614	614	-	d/
Riau	1,895	1,692	95	95	964	656	836	841	-	d/
North Sumatra	7,113	7,404	794	786	2,384	2,388	3,535	3,835	395	395
Aceh	5,406	6,117	489	489	1,331	1,942	3,544	3,544	42	42
SUMATRA	29,593	28,988	3,433	6,277	6,669	9,723	15,363	15,436	638	552
West Kalimantan	1,956	4,930	452	449	932	985	572	496	-	d/
East Kalimantan	834	664	335	202	322	222	72	72	105	105
South Kalimantan	2,638	2,661	285	285	543	486	1,797	1,797	33	33
Central Kalimantan	306	271	115	80	76	76	55	55	60	60
KALIMANTAN	-	5,493	1,187	1,016	1,873	1,769	2,496	2,420	198	198
North Sulawesi	3,312	1,178	723	717	415	377	2,174	84	-	d/
Central Sulawesi	2,725	4,632	592	595	563	614	1,570	3,423	-	-
South Sulawesi	6,450	4,612	582	383	1,651	1,235	4,200	2,177	17	17
Southeast Sulawesi	1,031	2,047	173	189	239	238	1,619	1,620	-	-
SULAWESI	14,518	11,869	2,070	2,084	2,868	2,464	9,563	7,304	17	17
Bali	1,744	51	389	389	337	310	1,018	1,652	-	-
West Nusa Tenggara	1,852	2,265	486	486	395	68	971	1,761	-	-

Table 30 (continued)

East Nusa Tenggara	4,757	2,913	1,227	1,227	1,530	341	2,000	1,345	19	19
Moluccas	990	860	77	77	518	223	376	540	-	-
West Irian	798	879	-	-	115	879	683	-	-	-
BALI, TENGGARA MOLUCCAS AND WEST IRIAN	-	-	-	-	2,895	-	5,048	-	19	-
	10,141	8,668	2,179	2,179	-	1,821	-	4,648	-	19
INDONESIA	89,378	84,269	10,628	10,139	24,466	22,682	51,170	46,134	3,114	2,314

a/ Information recorded only in some municipalities
b/ Including the project of Asian Games Roads of 28 km, not specified
c/ Part of South Sumatra Province in 1966
d/ Information not yet received
e/ Preliminary

Source: Kampsax/Berger Interim Report, 1969, 1971: Biro Pusat Statistik and Stahthr Kendaraan, Panjang Jalan, 1973

In Java and Bali, majority of the national and provincial roads were asphalted at one time.[7/] In most cases, the surface type was either laid penetration macadam or surface sealing. In most cases these pavements would still continue to maintain the present traffic satisfactorily were it not for lack of maintenance and poor design characteristics. If resealing had been carried out, the surface would still be satisfactory.

The highways on the islands to the east of Java and Bali are generally in very poor condition. Few have had an asphalt surface at any time.

The existing highway network in Sulawesi consists of asphalt surfaced roads and gravel and earth roads most of which are in poor condition. No roads have been constructed since the end of World War II except a few steps leading to industrial areas which were not been built by the Public Works Department.

A few roads are under construction in South and Southeast Kalimantan. Part of the roads have been completed but they are not yet open to traffic because of expected maintenance problems. Many roads in these provinces are unpassable due to lack of maintenance

---

7/ This section draws heavily on Kampsax/Berger Interim Report, 1969, Kampmann, Kierulff and Sakild A/S, KAMPSAX, Consulting Engineers, Copenhagen, in association with Louis Berger, Inc., Architects-Engineers-Economists, USA. Indonesia 1968-1970, Highway Services (Interim Report), (A transportation coordination advisory service study under the auspices of IBRD for the Government of Indonesia.), KAMPSAX, May 1969.

and it is probable that additional lengths of road will cease to be passable in the future.

In West and South Kalimantan, flooding is a serious problem. In West Kalimantan, long spans of road have been closed because of floods. Roads of South Kalimantan are more developed, but flooding still causes serious road maintenance problems. Despite the flooding, trucks continue to use the roads as long as possible. The resulting potholes after floods are both dangerous and destructive to transportation vehicles. Roads in these provinces have been abandoned because of lack of maintenance for many years.

The deterioration of the present highway transport system has changed the distribution of transport demand between the various methods of transportation and has restricted the economic development of the country. The Government of Indonesia is taking action to correct this situation. Work is underway in Sumatra, Java Nusa Tenggara and South Sulawesi to rehabilitate roads and improve road maintenance procedures.

C.2 Road Vehicles

According to the Central Bureau of Statistics' figures, there were 298,686 cars, buses and trucks in Indonesia in 1967. The regional distribution of these vehicles is shown in Table 31. About 70% of the total vehicles were found on the island of Java.

Table 31

Regional Distributions of the Vehicle Fleet by Provinces and Islands Indonesia, 1967

Island Province	1973	1967 Cars	1973	1973 Bus	1973	1967 Trucks	1973	Total 1967
JAVA								
East Java	45,923	30,305	2,452	1,578	23,132	18,017	71,508	49,900
Central Java	26,800	18,914	2,774	1,215	15,445	10,096	45,019	30,225
West Java	39,780	25,914	2,544	1,678	18,931	12,177	61,255	39,766
Jakarta Raya	115,635	68,977	7,648	3,858	29,430	17,021	152,713	89,856
Total	228,138	144,407	15,418	8,329	86,938	57,311	330,49[illegible]	209,747
SUMATRA								
South Sumatra	14,586	8,490	4,498	2,9[illegible]9	12,037	8,183	31,121	19,622
West Sumatra	3,360	2,445	1,264	963	3,421	2,520	8,046	5,928
Jambi	1,293	912	361	150	1,574	1,144	3,228	2,206
Riau	3,922	1,694	350	176	4,617	2,069	8,889	3,939
North Sumatra	30,137	12,638	3,945	3,609	11,974	9,610	46,056	25,857
Aceh	2,099	1,330	719	450	2,665	1,920	5,483	3,700
Total	55,397	27,509	11,137	8,297	36,288	25,446	102,822	61,252
KALIMANTAN								
West Kalimantan	1,244	852	200	187	816	732	2,260	1,771
East Kalimantan	3,229	1,145	311	66	3,031	771	6,571	1,982
South Kalimantan	2,643	2,122	126	67	1,416	1,595	4,185	3,784
Middle Kalimantan	160	94	2	2	105	89	267	182
Total	7,276	4,210	639	322	5,368	3,187	13,283	7,719
SULAWESI								
North/Middle Sulawesi	2,873	965	532	464	2,162	974	5,567	2,403
South/Southeast Sulawesi	4,333	2,305	674	483	5,310	4,407	10,317	7,695
Total	7,206	3,770	1,206	947	7,472	5,381	15,884	10,098

Table 31 (continued)

OTHER ISLANDS								
Bali	2,774	1,629	966	528	2,718	1,643	6,458	3,800
West North Tenggara	831	717	244	205	1,032	662	2,107	1,584
East North Tenggara	749	519	10	82	928	426	1,687	1,027
Moluccas	600	370	268	78	664	450	1,532	898
West Irian	3,742	2,123	148	52	1,844	386	5,734	2,561
Total	8,696	5,358	1,636	945	7,186	3,567	17,518	9,870
INDONESIA	306,713	184,954	30,036	18,840	143,252	94,892	480,001	298,686

Note: These figures are exclusive of cehicles belonging to the armed forces.

Source: Indonesia, Central Bureau of Statistics (Biro Statistik), Kampsax/Berger Interim Report, 1969-1973: BPS, Statistik Kendaraan Bermotor dan Panjang Jalan, 1973

It is estimated that over 90% of all road transport vehicles are owned by the private sector. The limited data available on transportation vehicles suggest that between 20 and 40% is usually inoperative because of a lack of tires and spare parts. The intra-city bus system suffers from obsolescence and shortage of spare parts rendering as much as 50% of the vehicles inoperable.

Figures are unavailable for the pedicab fleet that services urban centres.

In theory, strict control of road transport vehicles is provided through operating license, rate controls, weight and dimension limitations, and analytical inspections. In actuality, most of these controls are not enforced. Trucks designed to carry loads heavier than road specifications are allowed to operate and overloading results in damage to both vehicles and roads.[8/]

C.3 Water Transport

Inter-island shipping is an essential part of Indonesia's transportation system. The principal products carried in the trade are rice, copra, cement, flour, fertilizer, coconut oil, cattle, salt, rubber, species, asphalt and lumber. The islands depend on one another for raw materials and consumer goods. Sugar, salt

8/ John W. Henderson, et. al., Area Handbook for Indonesia; DA Pam 550-39, (Washington, D.C. 20402: Superintendent of Documents, Government Printing Office, March 1970, pp.439-440.

and cement, for example, are shipped from Java to Sumatra. Oil products and fertilizer are shipped from South Sumatra to all areas of the archipelago. Rice is shipped from Surabaya to Kalimantan and Timor. Copra is shipped from Sulawesi to Jakarta. Cattle is shipped from the Eastern Nusa Tenggara Islands to Java, Singapore, and other islands.[9/]

Inland waterways are important links in the transport systems of some islands, especially in the case of Kalimantan and eastern Sumatra. The Hari River of Sumatra, for example, is navigable by steamship for 380 miles. Rivers also link several large inland ports on these islands to the sea. Inland waterways are of little importance in Java.[10/]

Java plays an especially important role in inter-island trade. It is the main entry point for foreign goods and the principal distributor of consumers and manufactured commodities. West Java usually carries a sizable export surplus with the other islands. About three-fifths of all exports in inter-island trade come from Java, most of these go to Sumatra which is the largest importer in inter-island trade. Sumatra's ability to import goods from Java is due to the fact that it is the largest foreign exchange earner.

9/ Transportation Coordination Advisory Services (BAPPENAS), September 1969.

10/ Ibid., John W. Henderson, et. al, p. 438.

Java's relative importance in export activities has declined in recent years. The export capacity of the outer islands has grown primarily through petroleum exports. Lumber and other tree products such as rubber, copra and coffee are also important sources of foreign exchange for the outer islands. Java's economy depends heavily on being able to obtain part of these foreign exchange earnings through tax receipts and payments for manufactured goods.

C.4 The Indonesia Fleet

Indonesia's commercial ships can be classified into the following four categories:

a) Ocean-Going Foreign Trade

These ships are employed in overseas trade. Some of the vessels provide shipping service around the world.

b) Inter-Insular

These vessels are employed mostly in inter-island trade. A few are given special permission to carry on "Samudera Dekat" or "Ocean Going Nearby" trade. These vessels trade with Bangkok, Penang, Hongkong and other nearby foreign ports. Singapore is included as part of the inter-island trade. A special body known as the Joint Operational Body for Inter-Island Shipping (BOPBERPAN) has been authorized by the Minister of Communications to organize these vessels and control their operations to an extent necessary to assure that they will serve established routes on a regular schedule.

c) Coastal Shipping

These vessels has a gross tonnage of under 175 tons and employed on routes not longer than 200 miles from their home port. If this definition was strictly adhered to in actual licensing and registration of ships, many of the privately owned ships now listed as Coastal Vessels probably would have to be transferred to the Inter-Insular list or change their present routes.

d) Sailing Vessels

These vessels range in deadweight tonnage (DWT) from 10 tons to 200 tons each and many carry cargoes for a distance well over 500 miles. This is an important category of ships both in number and in total tonnage. Very little, however, is known about the employment of these ships.

The number and total tonnage of the vessels in each of these categories is shown in Table 32. The total tonnage of commercial vessels in 1969 was 1,151,971. If ocean going vessels are excluded the total tonnage of commercial vessels engaged in inter-island shipping is 716,153. The government controlled companies (P.N. Jakarta Lloyd, P. N. Pelmi, and P.N. Bahtera Adhiguna) accounted for about 29% of the total tonnage of commercial vessels in 1969.

The number of tonnage of the non-commercial and military ships is also listed in Table 32. These figures are incomplete,

however, because data on the ships operated by the Navy, Air Force and National Police are not available.

The ships listed in Table 32 do not include 58 tankers which are owned and operated by P. N. Pertamina. These ships range from 700 to 42,000 deadweight tons in size and have a total tonnage of 523,705. This is a highly specialized fleet which does not exactly fit into any of the categories discussed previously. Additional tankers are reportedly being procured.

The physical condition of Indonesia's commercial fleet is poor. It has been estimated that 30% of the PELNI fleet and 20% of the private fleet were inoperable in 1968. Managerial efficiency of the larger companies was affected by the departure of Dutch personnel in 1957. Both public and private fleets were reportedly overstaffed.

C.5 Ship Operating Costs

The estimated operating costs for various size vessels is presented in Table 33. These costs are based on the assumptions that the ship is:

a) Making rated speed with clean bottom

b) Carrying a 30% load factor

c) 100 days at sea annually

d) 200 days in port annually working cargo, and

e) Down for repairs and/or survey for 65 days annually

The assumed 30% load factor is probably somewhat lower than average on smaller vessels and higher than average for the larger vessels engaged in inter-island trade.

The average vessel listed under Inter-Insular trade in Table 32 has a tonnage of 1,217. PELNI's ships average about 1,032 deadweight tons. These figures conceal considerable variation in the size of ships category. The estimated ship operating cost presented in Table 33 is nearly constant over the range from 1,000 to 2,345 deadweight tons. Thus, under the given assumptions, the average ship engaged in inter-island trade has an operating costs of approximately US$0.011 per ton mile.

Table 32

Ships of Indonesia, 1969

Type of Ships	Number	Tonnage
1. Ocean-Going Foreign Trade		
P. N. Jakarta Lloyd	23	219,972
Pricately Owned	28	215,846
2. Inter-Insular Trade		
P. N. Pelni	59	100,000
P. N. Bahtera Adhiguna	4	8,375
Privately Owned	170	175,395
	233	283,770
3. Coastal (Local Shipping) Pelnas		
Privately Owned	414	42,383
4. Sailing Vessels		
Bugainese Ships	2,000	140,000
Small Proas	15,000	250,000
	17,000	390,000
TOTAL COMMERCIAL TONNAGE		1,151,971

5. Non-Commercial Ships and Those Owned by Armed Forces

Army	7	9,700
Navy	Unknown	Unknown
Air Force	Unknown	Unknown
Directorate General Sea Communication	29	15,521
National Police	Unknown	Unknown
Department of Mining	8	27,624
National Salt Company	28	20,951
TOTAL NON-COMMERCIAL	72 (+)	73,796 (+)

Source: Transportation Coordination Advisory Services (BAPPENAS); September, 1969

Table 33

Ship Operating Costs, Indonesia

Ship	Annual Cost	Cost Per Ton Mile
(DWT)	(U.S. Dollars)	
4,950	$422,000	$0.0079
4,200	320,000	0.0082
3,100	242,000	0.0088
2,345	211,000	0.0105
2,230	212,000	0.0110
1,466	147,000	0.0109
1,000	151,921	0.0108
957	107,400	0.0148
720	83,000	0.0200
600	76,000	0.0195
575	77,000	0.0194

Notes: The annual costs are based on the following cost components: wages and allowances, food, lube oil, bunkers at sea, bunkers in port, fresh water, running repairs, return on capital investment and port charges. The exchange rate used was $1.00 + Rp. 380.

Source: Transportation Coordination Advisory Services (BAPPENAS), September, 1969

C.6 Indonesia's Ports

Indonesia has 299 ports 44 of which are open to ships operating in foreign trade both for imports and exports.[11/] Ninety-five of the ports are used primarily by ships operating in inter-insular trade. Ships engaged in foreign trade can enter 34 of these ports to load specified export cargoes.[12/] The export commodities allowed to be loaded directly from these smaller ports are palm oil, logs, petroleum products, bauxite, tin, rotan, nickel and cattle. The remaining 160 ports are used primarily by coastal vessels engaged in local shipping. Sailing ships ranging from 20 to 200 deadweight tons call on all of the ports in Indonesia.

The three major international ports in Indonesia are Belawan in North Sumatra, Tg. Priok in West Java and Surabaya in East Java. These ports each have approximately 2,000 ship calls per year.

Palembang, on the Musi River, in South Sumatra is an important inland port. It handles about 3,200 ship calls each year. An estimated 1,900 of these class are made by tankers picking up oil at the two refineries located across the river from Palembang.

11/ Based on Chart No. UT 10"/64, published by the Directorate General of Sea Communications, 1964.

12/ These ports were opened to foreign trade ships on this limited basis beginning June 18, 1969.

Other ports with facilities for receiving ships alongside a quay or pier are:

1. Padang in West Sumatra
2. Panjang in South Sumatra
3. Dumai in Riau
4. Pontianak in West Kalimantan
5. Cilacap in South Coast of Central Java
6. Banjarmasin and Sampit in Central Kalimantan
7. Balikpapan in East Kalimantan
8. Makassar in South Sulawesi
9. Bitung in North Sulawesi
10. Ternate in North Malukus
11. Ambon in South Malukus
12. Benoa in Bali
13. Bima in Sumbawa
14. Tenau in Timor, and
15. Some of the ports in West Irian

Hence, approximately 20 of the 300 ports in Indonesia provide facilities for large ships to handle cargo at the sides.

Improvement of ports has been given a high priority by the government of Indonesia. The task is a difficult one because the harbors and docking facilities are operated and controlled through a highly complicated organizational structure that results in considerable diffusion of both responsibility and authority.

The major problems faced by harbor authorities are:

a) the silting of harbors
b) the lack of port services
c) the lack of maintenance and repair of port facilities
d) the slowness of ship clearance procedures

The solution of these problems will require the close cooperation of private companies, labor groups and government agencies. The relative importance of the problems varies from port to port.

Silting is an especially serious problem for some ports. Harbor dredging was estimated to be about 45 million cubic meters behind schedule since 1968 with silt accumulating at an annual rate of 22 million cubic meters.[13/] In some ports, channel depths and turning restrictions limit the use of the port. Pontianal, which used to have a short 10 mile channel with enough water to allow 2,000 ton vessels to enter, now can be reached only by a 75-mile river route which is limited to vessels of 60 meter in length. This effectively limits the size of vessels using the port to about 700 tons.

In all ports, the service facilities as well as the infrastructure are in poor condition because of the lack of normal maintenance and repair. Water supply and bunkering services are inadequate even in the three major ports. Many of the out-ports are unable to provide any water or bunkering services.

The slowness of ship clearance procedures is due to a large number of factors. In some ports, a shortage of buoy tenders and spare parts has left so many channel markets inoperable that port arrivals and departures have to be restricted to daylight hours. The lack of good ship-to-shore communication system and highly irregular schedules make advance arrangements for docking, shipping and repair nearly impossible. The administrative procedures for the routine entry and clearance of ships and cargo

13/ Ibid, John W. Henderson, p. 437.

frequently cause vessels to be delayed in port longer than necessary.

Several aspects of these problems were carefully studied by NEDECO Ports and Dredging Team in 1970.[14/] Their study was made for the purpose of upgrading 10 of the major ports in Indonesia. These ports are:

Belawan (North Sumatra)	Semarang (Central Java)
Padang (West Sumatra)	Surabaya (East Java)
Palembang (South Sumatra)	Banjarmasin (Kalimantan)
Tanjung Priok (Jakarta)	Makassar (South Sulawesi)
Cirebon (West Java)	Bitung (North Sulawesi)

C.7 Tariffs for Inter-Island Shipping

On March 1, 1969, BOPBERPAN published a new tariff rate for handling cargoes in the ports of Indonesia and freight rates for the inter-insular trade.

C.7.1 Freight Rates

The cost per ton depends upon the cargo falls and the distance it is being transported. There are eight categories, classified as AA, BB and so on through HH. Category AA with the lowest

14/ Netherlands Engineering Consultants, Javastaat 48, The Hague, Holland.

freight rate (coefficient 0.8) consists of items considered most essential to the welfare of the people such as rice, sugar, corn, salt, cement, fertilizer, drugs manufactured locally, tea, coconut oil and others. The least essential cargoes with the highest freight rates are those in category HH, which consists of luxury goods, such as cosmetics, photographic materials, and foreign made rugs. As an example of the differences, one ton of cargo in group AA transported 1,550 miles by sea from Tg. Priok to Bitung would cost Rp 3280 while one ton of HH would cost Rp 18,456. This amounts to about Rp2 per ton-mile for AA items and Rp 12 for group HH items. Group DD rates are about Rp 4 per ton-mile, or approximately US$0.01.

The BULOG rates are computed on the basis of the freight rates set by the government with additional charges of 10% for the first 500 miles and 7.5% for mileage above 500 miles. BULOG's freight rates for shipping rice from Jakarta to Bitung, for example, are Rp 5,122 per ton.

C.7.2 Port Cargo Handling Charges

Port handling charges can be divided into three parts. the first part is for moving the cargo from ship to pier apron or lighters; the second, from pier apron to transit-shed; and

the third; from transit-shed into a connecting land carrier, usually a truck. Some dirty or cumbersome cargoes are not allowed into the first line godowns, and must be discharged directly into trucks from ship tackle.

The basic charges per ton for the above movements under free in and out terms (F.I.O.)[15/] are:

Ship to Pier Apron	=	Rp 198.00
Pier Apron to Godown	=	Rp 990.00
Godown to Truck	=	Rp 495.00
Total		Rp 1,683.00

In the inter-island trade, the shipper or consignee must pay the charge at both ends of the voyage, so the total port handling charges would be Rp 3,366 or US$8.85 per ton regardless of the distance the cargo is shipped. Penalty charges of 50 to 100% are added to the basic charges if the cargo units are bulky, very long, and/or excessively heavy. The consignees also must pay godown rental charges that cannot be avoided because it is impossible to process the delivery and release orders in a short time. There is no free time period for cargo in the godowns.

Actual port costs may differ from the BOPBERPAN rates from time to time due to adjustments made by local port authorities.

15/ It is reported that the freight tariffs, as of June, 1969, have been modified so that they are quoted as Berth Term rates. If so, the shipper does not pay for the ship to pier apron charges.

In general, the BOPBERPAN rate of Rp 3,366 per ton for loading and unloading probably can be thought of as an average rate.

A breakdown of the port handling costs paid by BULOG for grains shipments between two different locations is shown in Table 33. Although it is impossible to assign cost estimates to all of the items listed in the table, the data clearly shows that BULOG's port costs for handling rice depended heavily on local wage rates and port fees.

C.8 Railway Transportation

Railroads play only a moderate role in Indonesia's total transportation network. Java is the only island with an extensively developed rail system. Sumatra has four separate systems but no connecting railway links. The entire railroad system consists of 7,141 kilometers[16/] of trackage located as follows.

	Kilometers of Trackage
Java (main lines)	2,895
Java (secondary lines)	2,170
Madura	126
Java/Madura	5,191
South Sumatra	640
West Sumatra	260
North Sumatra	540
Aceh	510
Sumatra	1,950

16/ Indonesia State Railway (PNKA), February 1971, German Railway Advisory Group (DEC), February 1971. The trackage in Aceh is 0.750 meter gauge. All of the other systems are 1.067 meter gauge.

Table 33

Inter-Island Transport Handling Costs for Grain Shipments at Two Different Locations, Indonesia, 1971

I T E M	From East Java to Medan	From West Sumatra to Bengkulu
	(rupiahs per ton)	
COSTS AT THE LOADING POINT:		
From inland warehouse to shipping point:		
Weighing and loading at the inland warehouse	90.00	155.00
Clearing rice sweeping and rebagging	a/	51.00
Truck transportation from inland warehouse to shipping port (depending of the distance)	a/	a/
Discharging weighing and stacking in the port warehouse	90.00	155.00
At port warehouse:		
Warehouse rent (depending on the length of storage time)	a/	a/
Weighing at the port warehouse	50.00	30.00
Administrative charges	a/	12.00
From port warehouse to ship:		
Loading charges (OPP)	1,323.00	396.00
Clearing service fee for freight forwarder	a/	115.00
Commission (fee) for freight forwarder	a/	a/
Other:		
Regional fee		1,000.00
COSTS AT THE DISCHARGING POINT:		
From ship to port warehouse:		
Unloading cost (OPT)	1,665.00	396.00
Clearing service fee for freight forwarder) Fee for freight forwarder) Lighterage) Weighing and stacking at the port warehouse))	1,711.00	1,500.00

Table 32 (continued)

At port warehouse:	)
Warehouse rent	)
Weighing and loading at the port warehouse	)
	)
From the port warehouse to inland warehouses:	)
Truck transportation from port warehouse, to inland warehouse	)
Discharging, weighing and stacking at the inland warehouse	)
Administrative charges	)

a/ Data not available

Source: From data supplied by BULOG, April 1971

The railway lines connecting Java and Madura are shown in Figure F.1. The railway lines in South Sumatra, West Sumatra, and Aceh are shown in Figure F.2.

Passenger traffic railroads increased during the 1960s while freight traffic declined. The decline in freight traffic is a reflection of both the overall decline in economic activity during the 1960s and rising freight rates.

Railroads have suffered from lack of funds for maintenance in recent years. Most of the tracks, roadbeds, and bridges are in poor conditions. Sixty percent of both the rolling stock and the less than 1,000 locomotives in use in 1968 were over 40 years old. A large number of diesel and electric locomotives are not in service because of lack of spare parts. Speed restrictions are imposed because of the condition of system repair. Freight rolling stock was idle 90% of the time. The system was heavily staffed with approximately 20 men in 1966 to service every mile of track.[17/] The condition of the railroads, however, is somewhat better than most of the other transportation systems. Railroads have managed to continue operations and have generally met traffic demands.

In Sumatra, the railways are only of local importance. The railway tracks, linking Palembang with Lampung and the local mines near Lubuklingau have been rehabilitated recently and the rolling

17/ Ibid, John W. Henderson, p. 439

FIGURE F.1

REPUBLIC OF INDONESIA

RAILROADS

JAVA

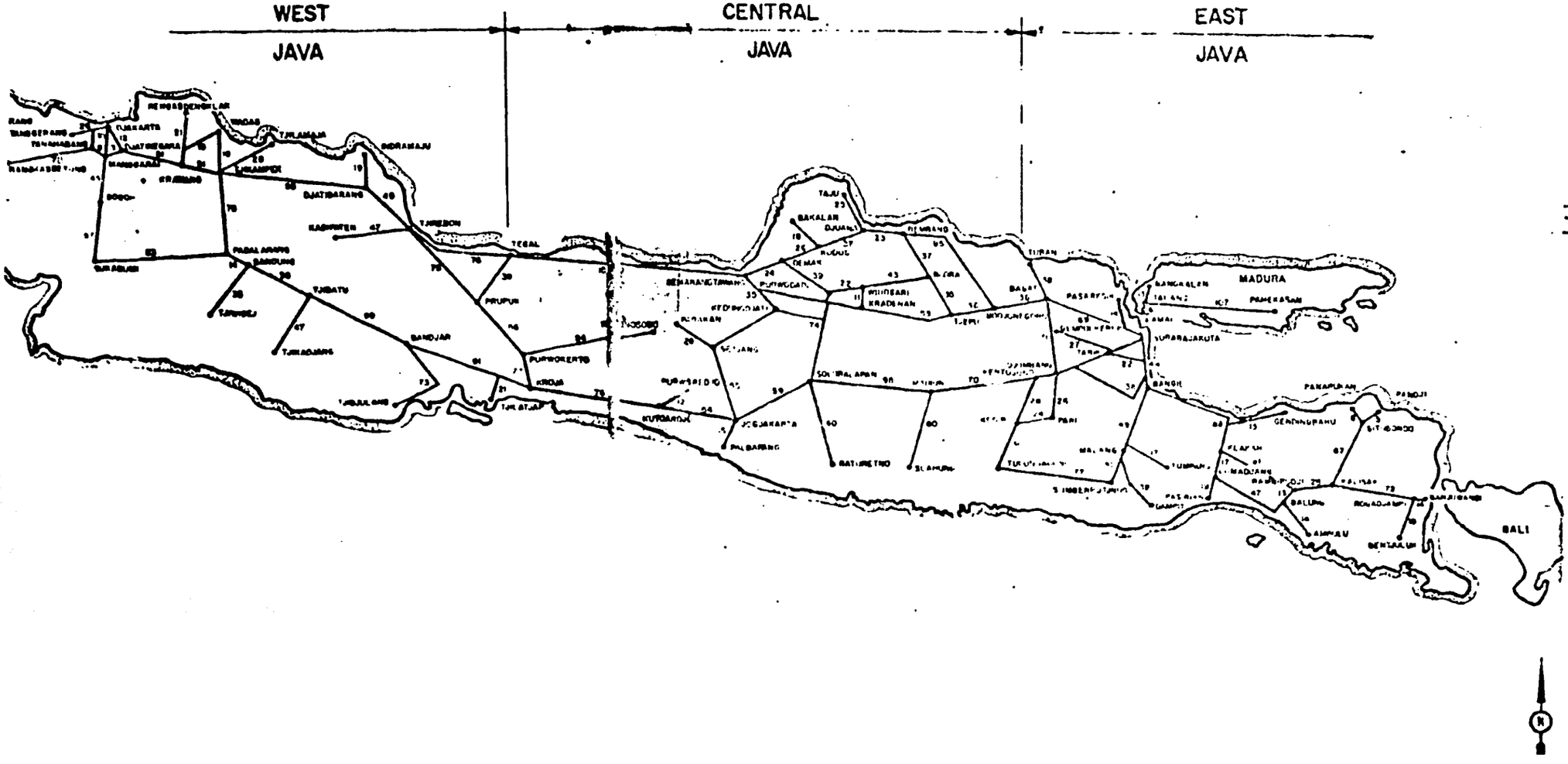
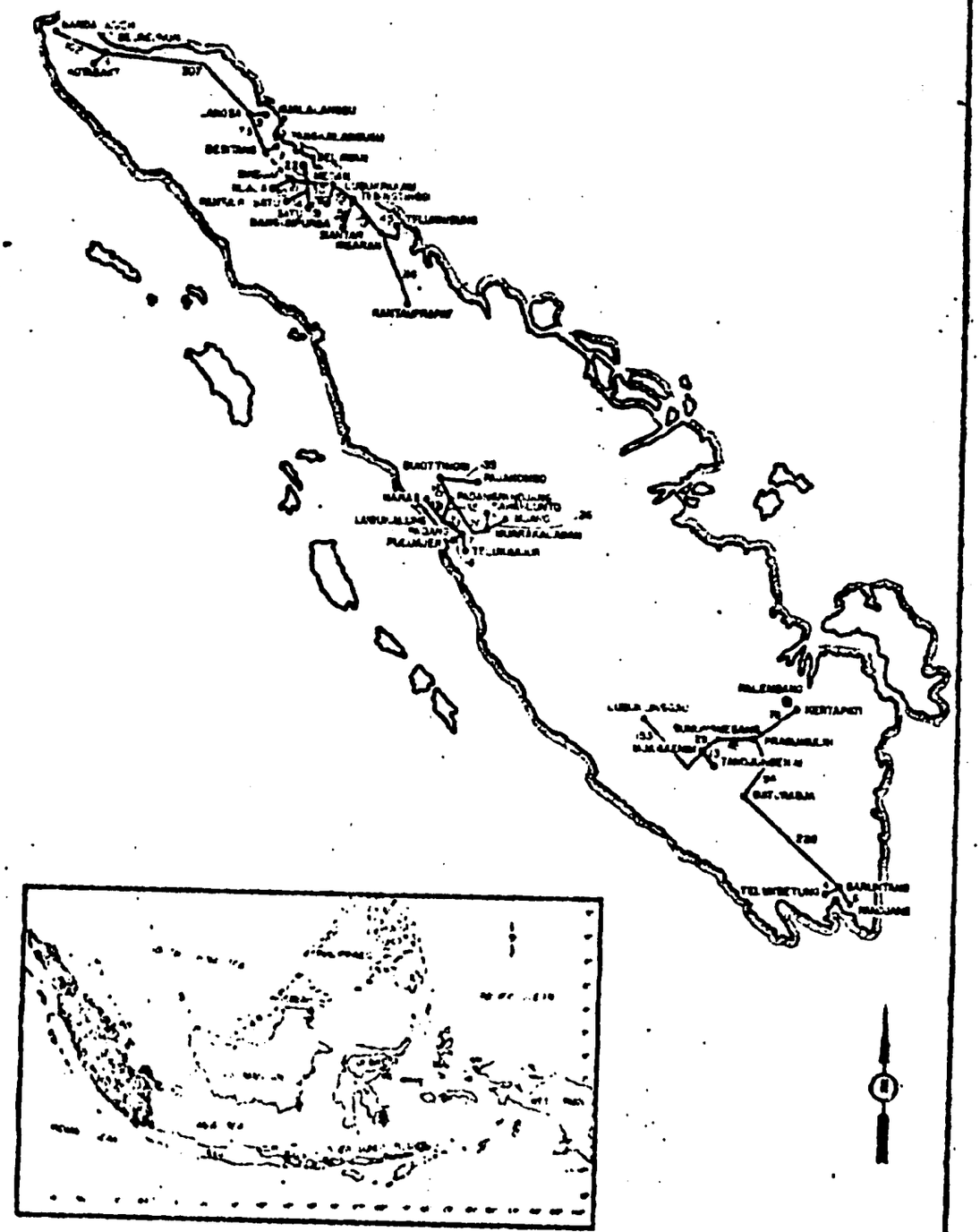


FIGURE F.2

REPUBLIC OF INDONESIA

RAILROADS

SUMATRA



SOURCE: PNBA MAP SA NUMBER 4918

stock is in fairly good condition and serves the local needs as a transport medium from producer areas to markets.

The PNKA charges Rp 470 to ship a ton of rice 100 kilometers. The rates for longer hauls are somewhat lower per ton kilometer. The charge to ship one ton of rice, 1,000 kilometers, for example, is approximately Rp 3,413 which is less than 10 times the 100 kilometer rate.

The freight rates for shipping rice by rail are considerably less than the rates for truck shipments. Less rice is being shipped by rail each year. However, because losses are higher than those for truck shipments, time in transit is longer for rail shipments, and the delivery dates of rail shipments are frequently unpredictable. In Java/Madura, the railroad carried 400,000 tons of rice in 1960 and only about 85,000 tons in 1968. Similarly, in North Sumatra, the railroad carried about 250,000 tons of rice in 1960 and only about 48,000 tons in 1969. In West Sumatra and Aceh, the tonnage of transported rice was very small throughout this period.

D. Future Outlook

Some up-dated information and future prospect in the transportation system are available in Chapter 15 of the Pelita

book.[18/] Part of the information as found in that book is translated below.

D.1 Road and Transportation by Roads

The existing road system includes approximately 85,000 km consisting of 9,900 km managed by the central government (subsequently called "national road"), 21,800 province road, and 53,000 kabupaten or district road.

In Table 34 the accomplishments achieved in Pelita I can be seen Improvements in road facilities are crucial to economic growth which is projected at 8.5% per year. To support this rate of economic development the corollary growth in the transportation system required is in the neighborhood of 10% per year.

Table 34

The Performance in the Pelita I

Items	Project	Performance in Pelita I
1. Roads	Maintenance	22,330 km*
	Rehabilitation	6,535 km
	Upgrading	3,785 km
	New construction	367 km
2. Bridges	Rehabilitation	19,800 m
	Upgrading/new construction	14,703 m
3. Others	Workshops	34 units
	Laboratories	37 units

*Average performance per year

18/ Rencana Pembangunan Lima Tahun Kedua, 1974-1975 to 1978-1979, Vol. II, Chapter 15, pp. 317-355.

The planned performances for the Pelita II can be seen in Table 35. To achieve the goal, domestic asphalt production will be increased. During Pelita I the total amount of asphalt required was about 330,000 tons, only 22% of which was domestically produced. Asphalt requirement in the Pelita II would be 518,000 tons, about 50% of which will be produced domestically.

Table 35

Planned Performance in Pelita II for National and Province Roads

Road Condition	By the End of Pelita I		By the End of Pelita II	
	Km	%	Km	%
1. In good consition	7,310	23	15,800	50
2. In fair condition	11,321	36	13,200	41
3. In bad or very bad condition	13,107	41	2,818	9
Total	31,738	100	31,818	100

Classified by components of the program, the planned performances can be seen in Table 36.

Table 36

Planned Performance in Pelita II for Roads and Bridges

	Estimated Performances 1974/75 (km)	Estimated Performances in Pelita II (km)
1. Rehabilitation	3,739	14,480.5
2. Upgrading	593	7,997
3. New construction	161	1,555
4. Maintenance	32,000*	32,000*

*Estimated yearly performances

Specified by province the planned performances can be seen in Table 37.

The expected increase in the number of freight and passengers during Pelita II is 8.5% per annum. It means that the estimated total of 434,873 cars in 1972 would become 652,300 by the end of Pelita II.

D.2 Railroad

The accomplishments achieved in Pelita I can be seen in Tables 38 and 39. We observe the decline in the number of passengers due to the shift of passengers to road transportation for close distance travels. This also reflects, to some extent, the improvement in land transportation system.

On the other hand, passengers for distant travelling increased steadily in Pelita I especially with the establishment of express train service between large cities in Java.

Table 37

Planned Performances by Province, 1974/75-1978/79

Province	New Construction	Up Grading	Rehabi-litation	Main-tenance
1. Aceh	-	700	650	1,709
2. North Sumatra	103	700	1,268	2,925
3. West Sumatra	225	460	840	1,666
4. Riau	60	150	200	962
5. Jambi	60	500	500	1,212
6. South Sumatra	-	500	600	2,790
7. Bengkulu	-	126	400	784
8. Lampung	150	200	400	672
9. DKI Jakarta	150	186	-	p.m.
10. West Java	270	575	1,250	2,656
11. Central Java	45	600	900	2,271

12. Yogyakarta	-	48	108	186
13. East Java	175	700	1,200	3,000
14. West Kalimantan	50	130	500	1,278
15. South Kalimantan	-	280	400	686
16. Central Kalimantan	-	100	100	394
17. East Kalimantan	100	140	200	461
18. North Sumatra	150	240	250	897
19. Central Sulawesi	-	200	600	1,104
20. South Sulawesi	-	500	1,400	1,900
21. Southeast Sulawesi	-	160	260	432
22. Bali	17	302	330	765
23. West Nusa Tenggara	-	100	400	822
24. East Nusa Tenggara	-	200	1,347	1,787
25. Maluku	-	100	200	329
26. Irian Jaya	-	-	129	129
Total	1,555	7,997	14,480	32,000

Table 38

The Performance in Pelita I

Project	Performance in Pelita I
1. Railroad rehabilitation	950 km
2. Railroad reconstruction	575.5 km
3. Purchased rail cushions	1,305,195 price
4. Locomotive	
Addition	29 unit
Replacement	104 unit
5. Passenger wagon	
Addition	228 unit
6. Wagon	
Addition	185 unit
Replacement	937 unit

Table 39

Passenger and Receipt in Million of Rupiah, 1968-73

Year	Passenger		Freight			Total Receipt (million rupiah) **
	Passenger Per Km	Total Receipt (million rupiah) *	Ton (Mill)	Ton/ Km	Total Receipt (million rupiah)	
1968	4,053	3,661	3.3	737	3,140	7,177
1969	3,370	4,665	3.9	843	4,595	9,838
1970	3,549	4,908	4.0	855	4,742	10,364
1971	3,601	5,436	4.2	949	4,941	11,418
1972	3,352	5,892	4.6	1,038	5,851	13,219
1973	2,878	7,877	4.7	1,051	6,463	-

*Estimate as of December, 1973
**Ferry transport included

Planned performances during the next Pelita II are presented in Tables 40 and 41.

Table 41

Planned Performances for 1974-1978

Year	Passenger (km)	Ton Million	Ton-Kilometer Million
1973	2,880	4.7	1,100
1974	2,970	4.9	1,170
1975	3,060	5.2	1,240
1976	3,150	5.5	1,310
1977	3,250	5.8	1,390
1978	3,350	6.1	1,470

Table 41

Rehabilitation Project for 1974-1978

Project and Location	1974/1975	1974-1975/1978-1979
1. Cirebon-Semarang-Surabaya		
- Railroad (km)	110	179
- Bridges (tons)	-	4,283
2. Other Project		
- Cirebon-Yogya-Surabaya	40	200
- Bandung-Kroya	55	248
- Jakarta-Merak	49	157
- Kalisat-Banyuwangi:		
- Railroad	-	86
- Bridges (tons)	-	450
- Malang-Blitar	-	73
- South Sumatra	40	110
- North Sumatra	46	332

D.3 Sea Transportation

The Indonesian merchant fleet is classified into:

a) Ocean fleet serving international trade and transportation

b) Inter-island fleet serving inter-island trade and transportation

c) Local fleet serving short distance or within island travels

d) Special fleet consisting of tankers, ships for log transportation, etc.

e) Artisan fleet, consisting of traditional sail-boats, used also for inter-island trade

In 1972 ocean fleets consisted of 84% cargo ships and 16% passenger ships; 43% of the ships has a capacity below 10,000 DWT and 56% above 10,000 DWT.

The inter-island fleet consists of 85% of cargo ships and 15% of passenger/cargo ships; 63% has a capacity up to 1,000 DWT, 16% has a capacity between 1,000 to 2,500 DWT and 11% above 2,500 DWT.

Local fleets consist of 20% of the 175 BRT capacity, and 80% below 175 BRT. Artisan fleet belong to the class above 30 BRT.

The special fleet consist of 21% tankers, 6% log ships, and 29% hawlers and 54% others. Seventy-seven percent is below 1,500 DWT and 23% above 1,500 DWT.

From the age composition of the fleet and the capacity, it is felt that the growth in the fleet capacity could not meet the estimated increase in freight which is estimated to increase by 8 to 10 per year as shown in Table 42.

Table 42

Estimated Cargo by Types of Fleet in Pelita II
(thousand tons)

Type	1974-1975	1978-1979
I. Domestic Cargo:		
. Oil Tanker	12,966	16,753
. General Cargo	6,790	9,942
a) Inter-island fleet	2,784	4,971
b) Local fleet	1,765	2,486
c) Artisan fleet	1,019	1,491
d) Foreign fleet	1,222	994
Total Inter-Island Cargo	19,756	26,695

II. International Cargo (Import and Export)

1. Japan	1,562	2,125
2. Australia	334	450
3. United States	1,548	2,106
4. Europe	1,896	2,580
Total International Cargo	5,340	7,261

Docking capacity is still below the existing needs. The existing facility for ship construction is limited to a capacity of 1,000 DWT and below.

D.4 Planned Program in Fleet Development

In the Pelita II the efficiency and capacity of the fleet will be increased. The present efficiency of 12 ton DWT/year will be increased to 18 ton DWT/year by the end of Pelita II.

Rehabilitation of 60,000 DWT will be made, in addition to replacement and new purchase and construction of 138,000 DWT. It means that the capacity of the inter-island fleet would become 262,000 DWT by the end of Pelita II. With the planned efficiency of 18 ton DWT/year, it is expected that about 50% of the total inter-island cargo can be transported by the inter-island fleet. The planned increase in capacity is presented in Table 43.

D.5 Docking

Priority for the new construction of docking facilities will be placed in Jakarta, Surabaya, Ambon, and other important harbors. Domestic docking and ship-building capacity will be improved

from a mere 650,000 DWT in 1974 to 1975 to 1,850,000 DWT in 1978 to 1979, for ships up to 30,000 DWT. Ship building capacity will be increased from 15,750 DWT in 1974 to 1975 to 45,000 DWT in 1978 to 1979.

Table 43

Planned Increase in Fleet Capacity in the Pelita II

Type of Fleet	Year 1974-1975	Year 1978-1979
I. Domestic Fleet		
1. Inter-island fleet	220,000	262,000
2. Local fleet	103,500	118,900
3. Artisan fleet	36,000	45,200
4. Special fleet	385,557	521,900
Sub-total	745,057	948,000
II. International Fleet		
1. Cargo ships	278,276	541,409
2. Log ships	142,000	414,000
3. Oil Tankers	186,000	903,000
4. Bulk Cargo Ships	-	141,000
Sub-total	606,276	1,999,409
Total	1,351,333	2,947,409

Even if the docking and ship reparation capacity can be increased as planned, it can only serve about 45% of the present needs. New construction facilities will serve only 7% for replacement and new addition.

D.6 Supporting Sea Transport Facilities

In Indonesia there are about 600 ports with the total wharf length of about 29,667 meter. Storage facilities consist of 583,646 square meters closed storage and 233,000 square meters open storage.

About 22 ports receive routine dredging. Silting is one of the major problem for many ports, such as Surabaya, Palembang, Pontianak, Sampit, Banjarmasin, Belawan, and Jambi, amounting to the estimated total of 170,400 cubic meters of silt.

Dredging fleet needed additional capacity. The present capacity of 45,000-48,000 cubic meters of silt per year is inadequate. inadequate.

Appendix 2

Suggestions for General Procedures for Operating the BRI Village Godowns 1/

Farmers who bring rice to the BRI warehouse in the form of stock padi will be offered two alternatives in converting their stock padi into gabah; 1) utilize the pedal thresher at the BRI warehouse free of charge or 2) turn the stock padi over to BRI warehousemen who will thresh the stock padi and charge the farmer Rp 3.50 per quintal of threshed screened gabah. All incoming gabah will be screened by the use of scalper, before determining weight to be stored or valued as security for a commodity loan.

A moisture test will then be run on the clean gabah. All incoming gabah will be weighed as it comes into the warehouse. After scalping, the clean gabah and the screenings will each be weighed again separately and recorded on the warehouse receiving card and farmers receipt. The screening may be returned to the farmers. Farmers should be encouraged to stay and observe the moisture testing, weighing and scalping process.

Each farmer will have a lot number assigned to him. Each farmer will have a separate receiving card kept at the BRI warehouse. This card will show all information and transaction regarding each lot of gabah and farmers brings into the warehouse. A separate card will be

---

1/ Bank Rakyat Indonesia, as presented in the Rice Shortage Handling, and Marketing Study.

kept for each quantity of seed brought into the warehouse. An A-B-C, etc., code will proceed the lot number to indicate variety (example, A-106 would mean A = PB.8 - 106 + Suhardi's seed).

A receipt book with the same information that appears on side "A" of the receiving card would be necessary. The grower would receive a copy, the warehouse would keep a copy, and a copy would be sent to each of the BRI bank units involved (branch, provincial and national). Each receipt would carry a receipt number. The receipt number would appear on the gabah receiving card in the warehouse. To encourage farmers to use the BRI warehouse and credit scheme it is suggested that a warehouse loan of 90% of the floor price of the gabah be given on a 16% moisture equivalent. If the gabah moisture is higher than 16% the moisture percentage relation would be used in calculating floor price for loan payment. This schedule would encourage farmers to dry their grain prior to delivery to the warehouse for storage and loan application.

Appendix Table 2.1

Gabah Price Calculation for Storage Loans Based Upon the Floor Price of Rps. 19.60 for One Kilogram of Gabah at 16% of Moisture[a]

Moisture in Gabah (Percent)	Price (Rp Per Kilogram)
16 and lower	19.60
17	18.37
18	17.15
19	15.92
20	14.70
21	13.47
22	12.25
23	11.02

24	9.80
25	8.57
26	7.35

a/ Present floor price for gabah is Rps. 40.0 per kilogram (1974). It means that the price estimate should be twice as high as presented above or elsewhere in the text.

Warehouse Charges:

1. Storage charges for gabah in the 100 kilogram sack at 16% or less moisture will be at the rate of Rps. 0.5 per kilogram per month.

2. Handling charges will be Rps. 20 per 200 kilogram sack per month for the duration of the storage period.

3. Interest rate of the money borrowed against the stored commodity will be at 1% per month for the duration of the loan plus an additional 1% for handling and administering the loan.

4. Sacks for bagging the gabah will be sold to the grower at the regular market price or leased to him 1/3 the market value of the bag per season. In the latter case, the bags rented by the BRI units should be bought with permanent easily visible markings.

5. Outside drying charges done by the BRI warehousemen will be at the rate of Rps. 50 per quintal.

6. Threshing to gabah if done by the warehousemen will be charged at Rps. 50 per quintal of threshed screened gabah.

7. All clients storage contracts with BRI V-6 storage units shall have a clause stating that the client will have no complaints against the BRI Village Godown for gabah shrinkage rates of up to 1/8 of one percent per week while in storage in the godown based upon the weight recorded when placed in storage. Any claim for shrinkage in excess of that standard rate will be compensated by the BRI Godown at the Bank loan price established for the 16% moistures content of gabah for the season during which the gabah was placed in storage plus 1/3 of 1% for each full two week period that the gabah involved are to be charged to the client and will be based upon the weight of gabah of 16 % moisture content or less as recorded when first placed in storage.

Each lot received into storage shall be of the same variety of gabah and the minimum size of any lot received by the village godown unit shall be no less than one full weight quintal (100 kg). The minimum lot may need to be increased in size according to later experience.

Note: Farmers are encouraged to thresh and dry their own stock padi and deliver it as gabah to the BRI warehouse. It is expected, however, that in many areas, in the first year of operation, the warehouse organization must be in a position to dry, thresh, and scalp the commodity brought in by the farmer.

CHAPTER V. MARKETING AND DISTRIBUTION

1. Marketing at the Farm Level

A. Harvesting, Storage and Processing at the Farm Level

A.1 East Java

Corn is usually harvested at the ripe stage. A negligible quantity is harvested at the milk stage, usually for home consumption. About half of the total production is sold.

There are two ways of storing corn.

1. Tongkolan or Ombyokan

Tongkolans are unhusked ears of corn which are dried in the sun for 1 to 7 days before it is stored. The unhusked ears are called ombyokan. Tongkolans are stored in bags, cans or baskets. Ombyokans are bound into bushels and stored hanging on poles that are usually stacked under a shed. About 8% of the total production is stored in this manner.

2. Pipilan

Pipilan is a shelled tongkolan or ombyokan which is further dried in the sun. Pipilans are stored for as long as 3 months in gunny-bags, cans, baskets or wooden boxes.

Other forms in which corn may be stored by farmers over short periods of time, usually before consumption, are: beras jagung (corn rice) and tepung jagung (corn flour). The quantities stored in these forms are quite small.

Processing of corn into pipilans is usually done by hand, after corn is dried in the sun in the form of tongkolans or ombyolans. Farmers prefer to dry corn in these forms because they are easy to handle. It is also easy to inspect for quality. After shelling, pipilans are dried in the sun for another 1 or 2 days after which the moisture content is around 18%.

Dry pipilans may further be processed by the farmer into corn rice and corn flour. Processing is done by pounding or by milling with yield recoveries of 60% good quality corn rice, 20% inferior quality corn rice and 20% flour. Corn flour is processed from corn rice, again by pounding or milling and sieving. The usual yield is 75% flour.

A.2 South Sulawesi

In South Sulawesi, corn is usually harvested at the ripe stage. Part of it is harvested at the milk stage for home consumption. Corn harvested at the milk stage may give a slightly higher price than mature corn. In 1970, corn at the milk stage was sold in the market at Rp 2.50 per ear while pipilans were sold at Rp 1.50 per year. In spite of this,

farmers prefer to harvest at the ripe stage to meet their needs in the paceklik seasons. Furthermore, the demand for corn at the milk stage is obviously quite limited. A large increase in its supply would lower its price considerably.

The harvesting of corn requires more labor than what the farmer's family can usually supply. The additional labor is hired and paid in kind according to the 1:5 bawon system, wherein a hired laborer is paid one-fifth of the total harvest he produces. Corn is transported from the field to the farmer's house in bags carried by man or by hired horses. Transportation cost is paid in kind varying from one-tenth to one-fifth of the total load. For distances in excess of 5 kilometers, transportation cost may amount to one-fifth of the total load.

Immediately after harvest, corn is unhusked without entirely peeling off the husk from the ear. The resulting ombyokans are then dried in the sun for up to seven days. After sundrying, corn is stored in bushels piled up under the roof or hung on the walls or along poles placed under the kitchen roof. Corn is also stored in the pipilan form, in cans or bags. When shelling is done by hired labor, payment may be given in kind, amounting to about one-tenth of the total shelled corn.

A.3 Lampung

Almost all corn is harvested at the ripe stage for grain. After harvesting, the ombyokans are dried in the sun, in the

farmers' yards with or without mats for up to seven days, depending on the dryness and quality desired. Ombyokans are usually stored by hanging the bushels under the kitchen rrof, or piled up separately on a low bench or in wooden boxes.

Shelling is done after the sundried ears are freed of their remaining husks. Shelling is done by means of a tool called the kokrokan or gosroka which is made of wood with a nail driven at an angle at the middle. Using this tool, a man can shell an average of 25 kilograms of shelled corn per hour.

Pipilans are stored in gunny-bags, cans, baskets and wooden boxes.

B. The Quality of Corn Marketed at the Farm Level

B.1 East Java

The following varieties of corn are produced and sold by farmers:

1. Goser - reddish yellow, round kernels, 83 days
2. Selli - reddish yellow, small kernels, soft when boiled, 83 days
3. Kretek - yellow, small kernels, small ears, 83 days
4. Petra - shiny yellow, flat kernels, soft when boiled full ears, 101 days

5. Metro - yellowish red, large, hard kernels packed closely 114 days
6. Harapan - reddish yellow, large kernels, closely packed kernels do not break easily, 101 days

Varieties Petra, Metro and Harapan are improved, high yielding varieties. Farmers prefer Harapan because of its yellow color and large grains which do not break easily.

The quality of corn is usually determined by inspection. Tongkolans are classified according to size. Pipilans are inspected for ripeness, moisture content, color, shape and weight of the grains by sight. Corn is differentiated by the size of the kernels, dryness and color.

B.2 South Sulawesi

The varieties that are grown in South Sulawesi include Pakilo, Baddo, Dadi, Baku-baku and Metro. Except for Metro which is an improved high yielding variety, the others are local white corn varieties with a lifespan of 90 days. The choice of a variety to grow is influenced by its taste, resistance to pests and yield. The yellow corn Metro produces "corn rice" which is considered of inferior quality.

B.3 Lampung

The most common variety grown in Lampung is a local, yellow corn variety known as Local Metro. It is believed that

it was brought over by transmigrants from Java. Some seeds were distributed by the Resettlement Service to newly arrived transmigrants. The Local Metro is harvested after 90 to 105 days. More recently PT MITSUGORO distributed an improved yellow corn variety developed by their breeding program.

There are three qualities of corn marketed by farmers: the asalan basah, asalan magel and asalan kering. All three are pipilans differing in their moisture content.. The moisture content of the asalan basah ranges from 19% to 24%; the moisture content of the asalan magel is around 18% and the moisture content of the asalan kering ranges from 14% to 19%.

The quality of corn is usually determined by qualitative checks such as biting a sample of the grains, inspecting the sample and feeling for moisture content.

C. The Quantity of Corn Marketed by Farmers

C.1 Home Consumption

Beside rice, corn is an important staple food to farmers in East Java and Lampung. Three patterns of corn consumption as staple food were reported:

1. Corn is consumed as main staple only during particular months. As the price of rice begins to drop, the importance of corn as staple food decreases and more rice is consumed;

2. Corn is mixed with rice as staple food all year round;

3. Corn is the only staple food throughout the year.

East Java recorded the highest consumption of corn per capita. In 1967, corn consumption in East Java amounted to a total of 0.4949 kilograms per capita per week. Most of it (0.4328 kg) was consumed in the form of grain. In the same period, corn consumption in West Java was 0.0178 kilograms per capita per week and 0.3297 kilograms per capita per week for Central Java.

Consumption of corn in the rural areas is higher than in the urban areas. Corn consumption in rural East Java is as high as 0.5525 kilograms per capita per week, while in urban East Java, corn consumption amounted only to 0.1267 kilograms per capita per week.

Staple food consumption in three villages in East Java is shown in Table 44.

From the previous table, it can be seen that corn constitutes an important staple food item in either mixed or unmixed forms. In some regions, corn is not the only other staple food item beside rice. This is true, for example, in Lampung where the local staple food consists of rice, corn and cassava chips or gaplek. The common combination is rice and corn, or rice

Table 44

Staple Food Consumption by Farmers' Families in Three Villages in East Java, 1971*

	Percentage of Families in Village with the Staple Food Consumption Pattern		
	Randuagung	Menang	Jatiblimbing
Rice throughout the year	10.14	6.37	8.01
Corn, mixed	61.95	71.51	57.06
Corn only	27.91	22.12	34.93

* Sortaman Sinaga, Jumlah Jagung Yang Tersedia Untuk Dijual Dan Beberapa Faktor Yang Mempehgaruhi Produksi Konsumsi Dan Jumlah Jagung Yang Dijual Oleh Petani Pemilik Penggarap, Departemen Sosial Ekonomi, IPB, 1973.

and gaplek. In these combinations, corn and gaplek are usually the dominant ingredients. Unmixed rice or unmixed corn is only consumed during rice and corn harvest seasons, respectively.

Staple food consumption patterns in four villages in Lampung are reported in Table 45.

Table 45 shows that rich farmers consumed less corn and gaplek than poor farmer families. The amount of corn consumed as staple food depends also on the season. During the paceklik, less rice and corn is consumed and consumption of gaplek increases as shown in Table 46.

Table 45

Staple Food Consumption Pattern in Four Villages in Lampung, 1971*

Village	Category	Consumption/capita/year in quintals			Income per Capita per Year in Rupiahs
		Corn	Rice	Gaplek	
Bandung Baru	Rich	0.411	0.913	0.830	13,824
	Poor	0.716	0.721	0.877	8,925
Simpang Agung	Rich	0.639	0.795	0.756	12,178
	Poor	0.802	0.492	1.512	6,962
Campur Asri	Rich	0.486	1.209	0.604	17,068
	Poor	0.691	0.597	1.220	9,332
Sri Bhawono	Rich	0.513	1.227	0.402	20,048
	Poor	0.966	0.657	0.830	10,328

* Isang Gonarsyah, Pengaruch adanya fasilitas pengeringan di daerah produsen terhadap kwantitas dan kwalitas jagung yang dijual oleh petani, Fakultas Pertanian Institut Pertanian Bogor, 1973.

Table 46

Seasonal Consumption of Staple Food by Farmers' Families in Four Villages in Lampung, 1971*, in Kilograms Per Capita Per Month

Village	Paceklik Season			Harvest Season		
	Corn	Rice	Gaplek	Corn	Rice	Gaplek
Bandung Baru	4.14	5.27	9.57	6.76	8.86	5.70
Simpang Agung	5.05	4.55	10.20	8.49	6.57	7.20
Campur Asri	4.11	5.28	10.22	6.91	8.86	7.30
Sri Bhawono	6.09	5.41	7.93	10.25	9.08	5.26

* Isang Gonarsyah, 1973

C.2 The Quantity of Corn Marketed by Farmers

The quantity of corn marketed by farmers depends on the quantity produced and the needs of the farmer's family for its own consumption for seed and animal feed.

The corn consumption of the farmers' household, seed and feed usage, and marketed surplus in South Sulawesi are shown in Table 47.

Table 47

Corn Utilization in Four Kabupatens in South Sulawesi, 1967, in Percentage of Total Production*

Kabupaten	Own Consumption	Seed and Feed	Marketed
Bone	24.0%	3.6%	72.4%
Soppeng	36.5%	1.0%	62.5%
Wadjo	21.5%	2.0%	76.5%
Bulukumba	29.0%	2.0%	69.0%
Sinjai	46.0%	5.0%	49.0%

* Abdul Kadir Hamid, et. al., Survey Jagung Propinsi Sulawesi Selatan, UNHAS, 1968.

The percentage of total production which is marketed by farmers is less in East Java where corn is an important staple food, as shown in Table 48.

Table 48

The Quantity of Corn Marketed by Farmers in Three Villages in East Java, 1971, in Percentages of Total Production*

Village	Marketed Surplus
Randuagung	36.52%
Menang	33.31%
Jatiblimbing	15.87%

* Sortaman Sinaga, 1973

However, when the marketable surplus is computed, namely, the difference between the total production and quantity which the family needs for its own consumption and other uses, the resulting quantities are different, in one case it was even negative as shown in Table 49.

Table 49

The Quantities of Corn Produced, Consumed, Used for Seed and Feed, and the Marketable Supplies of Farmers in Four Villages in East Java, 1971*

Village	Production in Quintals	Own Consumption in Quintals	Seed and Feed in Quintals	Quantity Required Per Year Quintals	Marketable Surplus %
Randuagung	207.40	120.61	5.19	125.80	39.34
Menang	203.35	159.56	4.42	164.28	20.68
Jatiblimbing	119.70	206.39	1.77	208.16	73.90

* Sortaman Sinaga, 1973

The difference between the quantity marketed and the marketable surplus indicates that the farmer's need for corn does not determine the quantity of corn that the farmer retains or sells. Even when the need is greater than that which the farmer produced, as indicated by the negative marketable surplus, some corn is still sold.

The difference between the quantity marketed and the marketable surplus in Lampung is also reported as shown in Table 50.

Table 50

The Quantity of Corn Marketed and the Marketable Surplus of Farmers in Four Villages in Lampung, 1971 in Percentage of Total Production

Village	Quantity Marketed	Marketable Supply
Bandung Baru	53.4	61.2
Simpang Agung	43.1	1.4
Campur Asri	68.0	36.8
Sri Bhawono	79.4	64.8

* Isang Gonarsyah, 1973

D. Marketing Channels

Looking only at the grain trade, three ultimate markets for corn may be distinguished: (1) the local market, (2) the inter-insular domestic market, and (3) the export market.

Between the producers and the consumers, a number of marketing institutions perform various marketing functions. The channels differ in name from region to region. However, they may be generally classified into the following:

1. Tenkulak Kebun, Tengkulak bakul (East Java), tengkulak desa (South Sulawesi), pedagang desa, warung (Lampung). These are the village traders who purchase corn directly from the farmers. Some of them such as the tengkulak desa in South Sulawesi, the pedagang desa in Lampung and the tengkulak kebun in East Java by corn from visiting the farmers. Others such as warung in Lampung, tengkulak desa in South Sulawesi and tengkulak bakul in East Java operate in the village markets.
2. Pedagang pengumpul (East Java and South Sulawesi), pedagang kecamatan (Lampung). These are collectors who operate in the sub-district (kecamatan) market.
3. Pedagang perantara. The shippers who purchase corn from collectors and ship them to wholesalers.
4. Pedagang besar. The wholesaler
5. Eksportir. The exporters
6. Pengecer, The retailers
7. Agen, makelar, cenkau. The commission agents.

The following activities are performed by the different market channels.

1. Packaging - tengkulak bakul, tengkulak kebun, pedagang desa, warung, pedagang besar, exportir, pengecer;
2. Transportation - tengkulak kebun, pedagang pengumpul, pedagang perantara;
3. Storage - warung, pedagang pengumpul, pedagang besar, eksportir;
4. Grading - pedagang pengumpul, pedagang besar, eksportir;
5. Processing - pedagang pengumpul, eksportir.

E. Local Marketing Practices

1. In East Java about 15% corn is sold directly by the farmers to the consumers. The remaining 85% is marketed through the following channels according to the following proportions:

   15%: farmers ⟶ village traders ⟶ consumers

   35%: farmers ⟶ collectors at the sub-district level ⟶ shippers ⟶ wholesalers ⟶ exporters

   35%: farmers ⟶ village traders ⟶ collectors at the sub-district level ⟶ shippers ⟶ wholesalers ⟶ exporters

2. In South Sulawesi, the marketing channel which serves the inter-insular domestic market is as follows:

   farmers ⟶ village traders ⟶ collectors at the sub-district level ⟶ shippers ⟶ wholesalers ⟶ retailers ⟶ consumers

3. The marketing channel serving the export market is:

   farmers ⟶ the exporters' commission agents at the village and sub-district levels ⟶ exporters

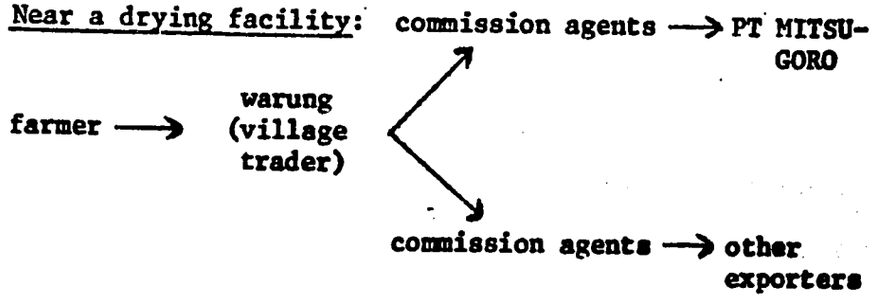
4. Corn from the above-mentioned four villages in Lampung is marketed as follows:

   Bandung Baru: farmers ⟶ village traders ⟶ commission agents ⟶ collectors at the sub-district level commission agents working for the exporters ⟶ exporters;

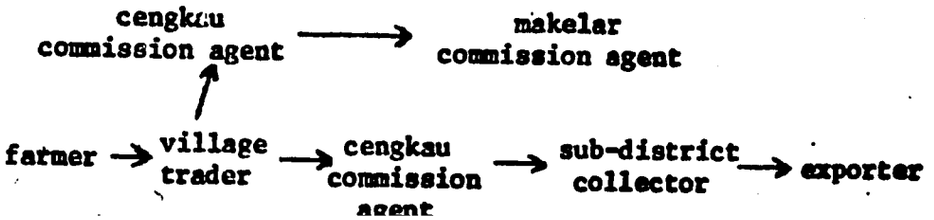
   Simpang Agung: farmers ⟶ village traders ⟶ commission agents working for the exporters ⟶ exporters.

   The same channel as that of Simpang Agung is used in Campur Asri. For Sri Bhawono, the type of marketing channel depends on whether or not the farmers' houses are located near or far from a drying facility.

5.1 Near a drying facility:



5.2 Far from any drying facility:



F. Price Levels, Marketing Costs and Marketing Margins

A breakdown of the costs related to corn marketing in four villages in Lampung is given in Table 51.

Table 51

Marketing Costs for Corn from Four Villages in Lampung to Teluk Betung, 1972, in Rupiahs per Kilogram*

Village	Marketing Costs				
	Transportation	Processing	Packaging	Tax	Total
Bandung Baru	1.35	0.35	0.25	0.15	2.10
Simpang Agung	1.50	0.40	0.25	0.20	2.35
Campur Asri	3.00	0.40	0.25	0.30	3.95
Sri Bhawono	3.00	0.40	0.35	0.30	4.05

* Isang Gonarsyah, 1973

Table 51 shows that the largest cost item is transportation which constitute 64.29% to 74.07% of the total marketing costs. The modes of transportation from the four villages are: bicycles and oxcarts (from the village to the kecamatan market), and trucks (from Sri Bhawono to the kecamatan market, and from the kecamatan markets to Teluk Betung).

Processing costs consist of costs for drying, cleaning, weight reduction and losses. Packaging costs include bagging and loading.

Another breakdown showing the prices received by the farmers and the profit margins of the marketing agencies is given in Table 52.

Table 52

Profit Margins Received by Marketing Institutions Involved in Corn from Four Villages in Lampung, 1972, in Rupiah per Kilogram*

Village	Market Price Teluk Betung	Producer Receipt	Marketing Costs	Profit Margin (Total)
Bandung Baru	15.00	10.00	1.95	3.05
Simpang Agung	15.00	10.50	2.20	2.30
Campur Asri	15.00	8.00	3.80	3.20
Sri Bhawono	15.00	9.25	3.90	1.85

* Isang Gonarsyah, 1973

2. The Marketing Channel

Due to the increase in spread of production activities among farmers marketing activities have also expanded. Marketing of agricultural products is also carried out by numerous peddlers who buy various farm products and at the same time they are also farm operators managing a small portion of land. Some large farmers also act as merchants who sell farm produce in their localities.

Retailers in corn producing regions are usually served by local traders. Local traders and retailers are the main channels connecting corn production centers to distant consumers although local traders

and retailers can earn more by handling a much larger volume of transaction and gain more from economies of size and continuity of supply.

Part of the produce of neighboring villages is channeled to newly established corn oil factory in East Java. However, for continuity of supply, the factory largely depends on district corn traders.

The marketing channels of corn are shown in
However, it is difficult to give reliable estimates on the actual percentage volume of corn handled by each channel.

The figures shown in Figure G were derived from the estimates in Chapter II from the Indonesia aggregate. Therefore, it would not correspond to the real flow from any particular producing region. In the case of East Java, one of the major producing corn region, the percentages would deviate from the distribution flow figures presented in Figure F.

An illustration of the percentage of corn marketed by farmers is presented in Table 53. The figures in the table were derived from the case studies conducted in East Java and South Sulawesi.

In one of the villages in East Java, it was noted that corn farmers purchased additional quantities of corn for home consumption. It was also noted that in East Java the marketed surplus was less than the estimated aggregate of 47%, while in South Sulawesi it was much higher.

Table 53

Percentages of Corn Consumed and Marketed by Farmers

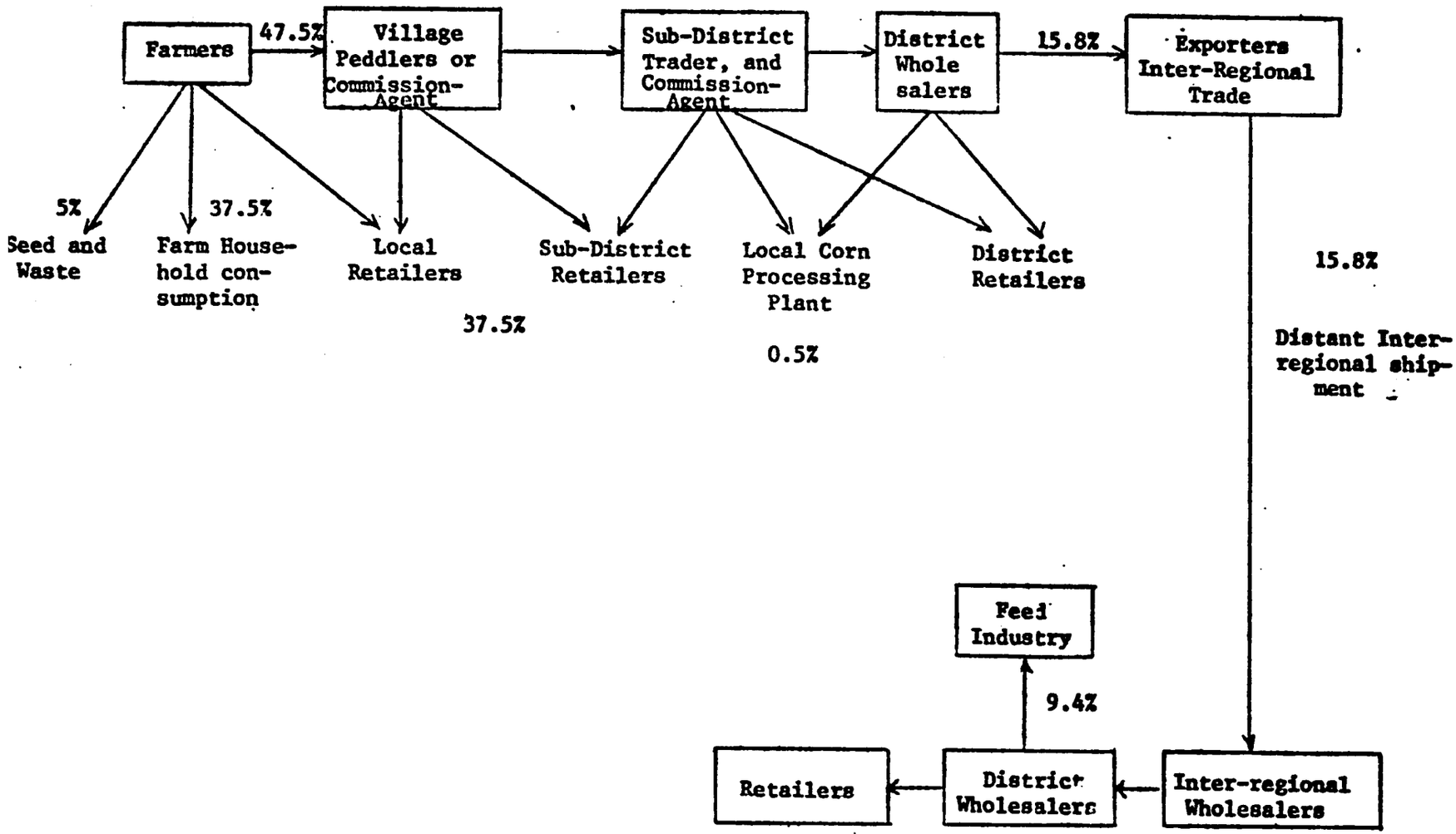
Province and District or Village	Home Consumption (%)	Seed and Feed (%)	Marketed (%)
South Sulawesi[1/]			
1. Bone	24.0	3.6	72.4
2. Soppeng	36.5	1.0	62.5
3. Wajo	21.5	2.0	76.5
4. Bulukumba	29.0	2.0	69.0
5. Sinjai	46.0	5.0	49.0
East Java[2/]			
1. Randuagung	58.1	2.6	39.3
2. Menang	78.5	0.8	20.7
3. Jatiblimbing	172.4	41.5	-73.9

[1/] Abdul Kadir Hamid, et al., "Survey Jagung Provinsi Sulawesi Selatan", Unhas, 1968.

[2/] Sortaman Sinaga, Institute Pertanian Bogor, 1973.

Figure G

Corn Flow Chart



Farmers in South Sulawesi have relatively more abundant quantity of rice for home consumption. Corn production in South Sulawesi is also more commercially oriented. Hence, it is expected that production is more susceptible to price changes.

The large number of intermediate marketing linkages reflects the spread of activities, which also implies a relatively higher marketing cost. Probably, it is also for this reason that quality control is difficult to maintain. This creates difficulties in maintaining standard export quality.

Total marketing margin and its components in Lampung are presented in Tables 54 and 55.

Table 54

Marketing Costs in Four Villages in Lampung with the Terminal Market at Teluk Betung (Rupiah per kilogram)

Village	Marketing Cost				
	Transportation	Processing	Packaging	Tax	Total
Bandung Baru	1.35	0.35	0.25	0.15	2.10
Simpang Agung	1.50	0.40	0.25	0.20	2.35
Campur Asri	3.00	0.40	0.25	0.30	3.95
Sri Bhawono	3.00	0.40	0.35	0.30	4.05

Source: Isang Gonarsyah, IPB, 1973.

The profit margin ranged from 17 up to 38% of the producer's price compared to the average retail price in Jakarta, Table 54. The price of corn is really very low.

Table 55

Profit Margin in Corn Marketing in Lampung, 1972
(Rupiah Per Kilogram)

Village	Terminal Market Price	Producer's Price	Marketing Costs	Profit Margin
Bandung Baru	15.00	10.00	2.10	2.90
Simpang Agung	15.00	10.50	2.35	2.15
Sampur Asri	15.00	8.00	3.90	3.10
Sri Bhawono	15.00	9.25	4.05	1.60

Source: Isang Gonarsyah, IPB, 1973.

To account for this high marketing margin there should be allowance for the decrease in weight due to decreasing moisture content, and grain damaged incurred in post-harvest handling. Assuming this to be in the range of 5%, the estimated marketing margin above is still high.

The quality of corn is partly determined by the type of varieties grown. In Randuagung, East Java, where the case study was conducted the majority of farmers grow improved varieties of the yellow flint type, Table 56.

Practically all the corn is harvested at the dry or ripe stage.

Table 56

Corn Varieties Produced in Randuagung, East Java, 1974

Variety	Improved Local	Yellow White	Percentage of Total Production
Perta	improved	-	80
Metro	improved	-	10
Harapan	improved	-	3.3
Songko	local	-	3.3
PS	local	-	3.3

Throughout the marketing system five corn products are marketed, such as:

1) glondongan : corn ears, unhusked
2) pipilan : shelled corn grains
3) beras jagung : corn rice
4) empok : by-product in the processing of corn rice
5) tumpi : by-product in the processing of corn rice

At the village gate, two forms of corn products are purchased by the village traders: glondongang and pipilan. In the first season, the quantities of each product sold by the farmers are almost equal. In the second season, the quantity of pipilan,

(shelled corn grain) increase slightly to about 60% of the total corn purchased by the village traders.

The purchase price of glondongan (corn ears) paid by the village traders is lower than that paid for an equal amount of pipilan (corn grains), as shown in Table 57.

Table 57

Purchase Prices of 100 kg Pipilan when Purchased in the Pipilan and Glondongan form, Paid by Village Traders in Randuagung, East Java, August, 1974

Form	Conversion Factor	Processing Costs Paid			Purchase Price	Equivalent Purchase Price
		Tebas	Drying	Shelling		
Pipilan	100	-	-	-	4000	4000
Glondongan	57.5	230	60	100	1800	3522

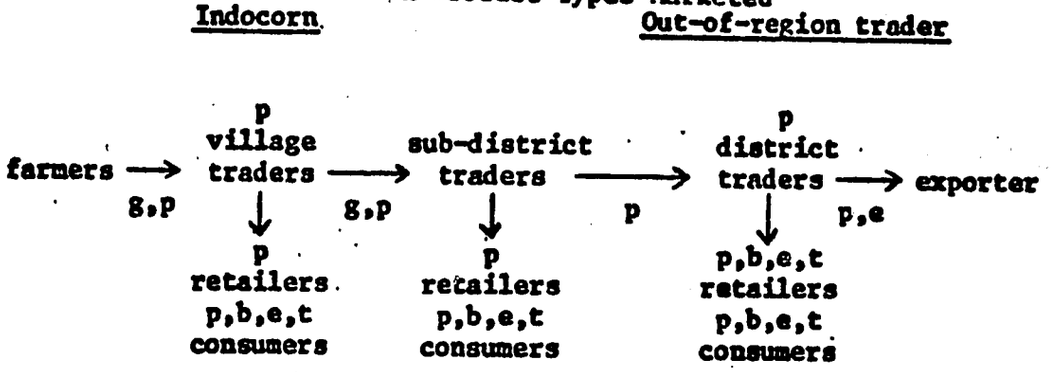
Almost all glondongan corn (corn ears) is processed into pipilan (corn grains) by the village traders. After this stage only a small amount equivalent to less than 10% is marketed in the glondongan form. These are finally processed into pipilan by the district traders.

Corn rice appears in the marketing system when pipilan corn is processed by the district traders and the local retailers. With corn-rice, empok and tumpi also appear in the market.

A diagram showing the corn products marketed throughout the system is shown in Figure E.

Figure E

Corn Product Types Marketed



: g = glondongan

p = pipilan

b = corn rice

e = by-product of corn rice processing, empok

t = by-product of corn rice processing, tumpi

In processing pipilan into corn rice, the yields obtained by the district trader are slightly higher than those obtained by the village retailer. However, due to a higher purchase price of the pipilan paid by the district trader, his processing profits are lower than those gained by the village retailer, as shown in Table 58.

Table 58

Processing Profits Gained by the Village Retailer and the District Trader, Randuagung and Malang, East Java, 1974

Trader	Buying Price	Processing Costs +	Conversion Factors			Total Sale	
			Rice	Empok	Tumpi	Value Rupiah	Profit Rupiah
Village retailer	4000	100	.70	.18	.03	4770	670
District trader	4720	100	.76	.19	.03	5232	412

* Rupiah per 100 kg pipilan + Grinding and cleaning

Buying and selling practices

The buying and selling practices observed in various marketing institutions are shown in Table 59.

Table 59

Buying Practices in the Marketing of Corn in East Java, 1974 in Percentage of Total Transactions

Buyer	Delivery		Method of Payment				
	Franco	Loco	Cash	Before Delivery	Contract	Tebas	After Delivery
Village trader	43	57	45	22	-	22	11
Sub-district trader	100	-	50	50	-	-	-
District trader	80	20	43	57	-	-	-
Exporter	100	-	60	30	10	-	-

Except for the village trader, most traders have their corn delivered to their establishment when purchases are made. In these cases, the sellers have to pay for transportation costs incurred. In the case of the village traders, in more than half of the cases observed during the study, corn is purchased in the farmers' fields or houses. Transportation costs from these points to the village traders' storage facilities are to be paid by the purchasers. Cikars or oxcarts are the most commonly used forms of transportation in this

stage. Other means of transportation includes tricycles. Along shorter distances, corn is simply carried on poles.

Under the tebasa system, harvesting and transportation costs are paid by the purchaser. Harvesting costs cover mainly wages paid to men and women laborers needed.

About half of the corn marketed at all levels of the marketing system is sold on a cash and carry basis. At the village traders level, distinction should be made between tebasan and purchases with advance payments. Tebasan refers to transactions wherein harvesting costs are paid by the purchasers either in cash or in advance. Some purchases made by village traders often involve payments after the corn is delivered.

Contract buying is observed at the exporters level. Contract buying differs from advance payment buying in that under contract buying a contract is drawn in which the volume, quality, price and time of delivery are explicitly specified. Such specification are not mentioned in advance purchases. Relationship between the exporter and the Kabupaten traders in the latter case are more informal. Finally, all exports are made under formal agreements with foreign importers.

Processing and storage

As mentioned earlier, two corn products are marketed by the farmers and four product types are finally bought by the end users

served by the marketing system. Table 60 presents the types of corn products sold by the farmers and users in the marketing of corn from Randuagung.

Table 60

Corn products Sold or Purchased by the Farmers and Users in the Marketing of Corn from Randuagung, East Java, 1974

Seller/Buyer	Corn Product Sold/Purchased
Farmers	Glondongan (corn ears) Pipilan (shelled grains)
Local consumers	Pipilan (shelled grains) Beras Jagung (corn rice) Empok (corn rice by-product) Tumpi (corn rice by-product)
Out-of-region Consumers	Pipilan (shelled grains)
Exporter	Pipilan (shelled grains) Empok (corn rice by-product)
Industry (Indocorn)	Pipilan (shelled grains)

Two steps of processing occur in the system, namely (1) the processing of glondongan into pipilans and (2) the processing of pipilan into corn rice, empok and tumpi as by-products.

Glondongan is processed into pipilan mostly by the village traders. It includes the activities and costs incurred as shown in Table 61.

Table 61.

Costs Incurred in the Processing of Glondongans into Pipilans by the Village Traders in Randuagung, East Java, 1974

Activity	Cost Per 100 Kg Pipilan
Drying of glondongan	Rp 32.00
Shelling	Rp 100.00
Drying of shelled grain	Rp 60.00
Weighing, bagging	Rp 15.00
Total	Rp 207.00

The cost of processing glondongans into pipilans as given in Table 61. includes the costs incurred for weighing and bagging. These costs are not entered into the computations when the processing costs are used to compare the purchase price of glondongan and pipilans which the village traders pay the farmers. On the other hand, harvesting costs and transportation costs are entered into the computation when glondongan corn is purchased under the tebasan system.

Glondongan is dried in the sun for a period of one to two days. Pipilans are also dried in the sun by the village traders before weighing and bagging. Pipilans are dried for three to seven days, depending on the weather.

Pipilan at the village traders' level has a moisture content varying from 16% to 18%. It is further dried by the sub-district and district trader. In some case, drying is done by the sub-district trader using a gasoline powered dryer owned by a cooperative at the sub-

district level. The dryer has a capacity of 30 quintals per day and requires the employment of one operator assisted by several laborers. The operating costs for drying 30 quintals of pipilan are as follows:

Operator	Rp	300.00
Fuel: gasoline (8 liters)	Rp	400.00
kerosene (13.5 liters)	Rp	270.00
Labor	Rp	300.00
Weight loss at 2% and Rp 4,150.00	Rp	2,460.00
Per quintal	Rp	1,845.00
Total costs for 30 quintals	Rp	3,730.00
Total costs per 1 quintal	Rp	124.30

The operating costs per quintal is slightly higher than the cost incurred in sundrying. These costs are:

Labor	Rp	35.00
Weight loss at 2% and Rp 2,150.00 per quintal Rp 4,150.00	Rp	83.00
Total drying costs per quintal	Rp	118.00

The use of a machine dryer is justified despite its slightly higher costs as it is independent of weather conditions. In poor weather conditions, sun drying may take as long as seven instead of three days. While there are no additional costs for labor, the longer time required for sun drying compels the traders to operate at less than the desired volumes.

After drying at the sub-district level the moisture content of the pipilan corn is about 15%.

Pipilan is processed into corn rice at the district trader level and at the local retail levels. It has been observed that the district trader is a more efficient corn rice processor compared to the village retailer. However, due to the higher purchase price of pipilan which the district trader has to pay, he has less processing profit.

At all stages of the marketing system, pipilan corn is the most commonly stored product. At the village and sub-district levels, glondongan corn is almost immediately processed into pipilan after drying for one or two days. At the district or local retailer levels, pipilan corn is processed into corn rice only when there is a demand for corn rice. Corn rice inventory is kept low to prevent damage.

Most village traders prefer to keep their pipilan corn for not more than one week. Storage facilities at the village trader level are limited, consisting mainly of covered godowns with a capacity of 10 tons to 50 tons. No village trader rent storage facilities. In this godowns, pipilan corn is stored in gunny sacks. The weight loss during the storage is estimated at about 2%.

The storage facilities owned by the sub-district trader are also limited. During the period of the case study only one case at the sub-district at the cooperative level had a capacity of 200 tons. In this particular case, corn was stored as pipilan for up to four weeks, during which

time losses were estimated at 2%. Other traders at the sub-district level have smaller storage facilities and also store their pipilan corn for periods of one to two weeks.

The district traders own larger storage facilities ranging from 100 to 500 ton capacity. These are covered godowns, located mostly in the offices of district traders. In godowns, corn is stored as pipilan in gunny sacks. Storage time at this level is somewhat longer ranging from one to six weeks. Weight loss is estimated at 1.5%.

Unlike the other traders, exporters prefer to rent larger storage facilities for their operation. While most storage facilities at the early stages of the marketing system are owned by the traders, 58% of the total storage facilities used by the exporters are not owned but rented at Rp 4 per ton per day. These facilities are mostly covered godowns near the Tanjung Perak harbor. The other 42% of the total storage facilities are owned by the exporters and located near their main offices. Pipilan corn and empok are stored in these facilities in gunny sacks for periods between two weeks and a month. The loss of weight at this stage is estimated at 1%. Fumigation is only observed at the exporters' level at Rp 900 per ton.

Transportation

Randuagung is situated at about 3 kilometers from the sub-district capital. The village is accessible, but agricultural products are mainly transported by non-motorized vehicles.

Table 62

Transportation Means Available in Randuagung, East Java, 1971

Type	Number
Trucks	1
Motorcycles	2
Cikars (oxcarts)	56
Delmans (horse carts)	62
Bicycles	40

Source: Sortaman Sinaga, Jumlah Yang Tersedia Untuk Dijual dan Beberapa Faktor Yang Mempengaruhi Produksi Konsumsi Dan Jumlah Jagung Yang Dijual oleh Petani Pemilik Penggarap, IPB, 1973.

At the village level, cikars constitute the principal means for transporting corn. These are cow driven carts which can lead up to two tons of corn. Most of these corn is transported along a distance of 4 to 5 kilometers at the rate of Rp 50 per quintal for a distance of about 4 kilometers and Rp 75 per quintal for distances of 5 or more kilometers. In addition bicycles are also used to transport corn at about the same costs as when cikars are rented.

Outside the village the main means for transporting corn are trucks.

At attempt was made to review the present state of knowledge regarding supply and demand for corn in Indonesia. This was not based

on specific corn information alone, but also on the influence of the major staple food in Southeast Asia, namely rice. Information concerning supply and demand determination of rice is more complete and well known compared to corn, and it can provide some valuable comparative correlates.

Supply Determination

Supply is determined by:

a) Existing production possibility as determined by the available arable area, irrigation, labor force, and infrastructural facilities.

b) Level of technology available and adopted by farmers such as cropping system, high-yielding varieties, fertilizer, and pesticide use.

c) Price and demand for agricultural products.

Based on Table 63, percentage increase in yield and in harvested area by regions is shown in Tables 64 to 65. In Table 65 the total percentage increases are shown which are approximately equal to the percentage increases in crop production.

For rice, the increase in yield is highest in Java, probably due to the intensive Bimas program. But the harvested area for Java is almost stationary. Outside Java, the increase in yield is very low, except in Sulawesi. But the increase in harvested area is high, due probably to the favorable man-land ration. For Indonesia as a whole, the increase in rice production just about balances the increase in

Table 63

The Trend of Crop Yield (Qt/Ha) in the Periods 1950-72 by Regions

Region	Rice*			Corn			Cassava			Sweet Potato			Peanut			Soybean		
	a	b	%	a	b	%	a	b	%	a	b	%	a	b	%	a	b	%
Java	0.491	24.57	2.0	0.135	9.30	1.4	0.165	72	0.2	-0.03	56	-0.0	0.07	6.89	1.0	0.04	6.88	0.6
Sumatra	0.129	31.23	0.4	0.046	9.84	0.4	-4.87	130	-3.7	-0.97	83	-1.2	0.12	7.79	1.5	-0.05	7.30	-0.7
Sulawesi	0.338	25.28	1.3	-0.177	9.88	-1.8	-1.57	91	-1.7	-2.04	67	-3.0	0.03	5.67	0.5	0.04	6.46	0.6
Kalimantan	0.001	18.46	0.0	-0.255	8.74	-2.9	-2.68	105	-2.6	-0.71	59	-1.2	-0.04	7.67	-0.5	0.18	6.91	2.6
Outside Java	0.164	27.54	0.6	-	9.83	-	-4.17	109	-3.8	-1.30	79	-1.6	-0.01	7.70	-0.1	-0.13	7.06	-1.8
Indonesia	0.401	25.51	1.6	0.074	9.35	0.8	-0.51	78	-0.6	-0.38	65	-0.6	-0.04	6.97	-0.6	0.04	6.87	0.6

a = Yield increase in qt/ha/year

b = Average yield in qt/ha

% = Percentage increase in yield per year

* = Lowland rice only

Table 64

The Trend of Harvested Crop Area in the Period 1950-72 by Regions

Region	Rice*			Corn			Cassava			Sweet Potato			Peanut			Soybean		
	a	b	%	a	b	%	a	b	%	a	b	%	a	b	%	a	b	%
Java	5.45	3,794	0.1	18.06	1,884	1.0	20.53	1,057	1.9	0.68	230	0.3	2.81	280	1.0	7.78	490	1.6
Sumatra	37.90	924	4.1	4.76	76	6.2	3.05	75	4.1	1.09	39	2.8	0.01	18	0.0	1.38	20	6.9
Sulawesi	11.27	441	2.6	14.23	317	4.5	3.01	66	4.6	0.98	28	3.5	0.92	20	4.6	0.33	4.7	8.1
Kalimantan	10.48	351	3.0	0.19	16	1.2	1.07	32	3.3	0.21	4.1	5.1	0.09	1.7	5.3	0.07	1.2	5.8
Outside Java	66.16	2,017	3.3	22.50	661	3.4	10.02	268	3.7	4.86	146	3.3	1.68	64	2.6	3.96	73	5.5
Indonesia	75.58	5,811	1.3	40.57	2,545	1.6	30.57	1,325	2.3	5.74	376	1.5	4.50	344	1.3	11.62	563	2.1

a = Harvested area increased in 1,000 hectares per year

b = Average harvested area in 1,000 hectares

% = Percentage area increase

* = Lowland rice only

The Trend of Production Derived from Tables 63 and 64, in the period 1950-72

Region	Rice			Corn			Cassava			Sweet Potato			Peanut			Soybean		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
Java	2.0	0.1	2.1	1.4	1.0	2.4	0.2	1.9	2.1	0.0	0.3	0.3	1.0	1.0	2.0	0.6	1.6	2.2
Sumatra	0.4	4.1	4.5	0.4	6.2	6.6	-3.7	4.1	0.4	-1.2	2.8	1.6	1.5	0.0	1.5	-0.7	6.9	6.2
Sulawesi	1.3	2.6	3.9	-1.8	4.5	2.7	-1.7	4.6	2.9	-3.0	3.5	0.5	0.5	4.6	5.1	0.6	8.1	8.7
Kalimantan	0.0	3.0	3.0	-2.9	1.2	-1.7	-2.6	3.3	0.7	-1.2	5.1	3.9	-0.5	5.3	4.8	2.6	5.8	8.4
Outside Java	0.6	3.3	3.9	-	3.4	3.4	-3.8	3.7	-0.1	-1.6	3.3	1.7	-0.1	2.6	2.6	-1.8	5.5	3.7
Indonesia	1.6	1.3	2.9	0.8	1.6	2.4	-0.6	2.3	1.7	-0.6	1.5	0.9	-0.6	1.3	0.7	0.6	2.1	2.7

a = Percentage increase in harvested area (from Table 64)

b = Percentage increase in yield (from Table 63)

c = a + b

* = Lowland rice only

demand due to the increase in population (± 2.5%) and the increase in income. No thrust towards an agricultural revolution is yet discernable from the figures.

For corn, the increase in yield is very low except Java. In Sulawesi and Kalimantan, yield was decreased substantially. Crop acreage also increased for Sumatra and Sulawesi. For Indonesia as a whole, the increase in production is approximately equal to the increase in population.

Farm Technology as the Determinant of Supply

Chapter II discussed the level of technological innovation at the farm level. Due to little improvement in the level of farm technology, it is not surprising to see the almost static production performance. Production has been geared simply for subsistence needs in conjunction with the increase in population and labor force.

The effect of government policies in rice production is perceptible only in Java and, to some extent, in Sulawesi. However, the increase in rice yield due to intensification is lower compared to the increase in population. This is also true for Java where the rice intensification program was carried out with relative intensity.

For corn, intensification programs have been effected to a much lesser extent compared to rice. Yet, some perceptible increases in corn yield have been observed especially in Java. Nonetheless, the overall outlook on corn productivity is unsatisfactory.

In general, it is still possible to increase food crop production by encouraging farmers to use better technological practices.

The direct implication of these observations, especially for Java, is obviously that of impoverization since the increase in crop production is much lower than the increase in population. The growth of the agricultural sector of the economy can alleviate this widening gap only through increased production.

Price as the Determinant of Supply

Many agricultural economists believed that traditional farmers are responsive to price. Crop production will increase in response to the increase in price.

In Indonesia an attempt was made by Mubyarto to prove this statement for rice, but the result appeared to be inconclusive.[3/] He noted instead the significant increase in production over time.

From various studies, Mubyarto collected some supply response estimates as presented in Table 66.

Mubyarto's analysis for rice acreage response in Java was inconclusive although he observed a positive yield response to price of the magnitude of 0.06 for the dry season and 0.20 for the wet season.

[3/] Mubyarto, and Lehman B. Fletcher, Marketable Surplus Beras di Indonesia, Fakultas Ekonomi Gajah Mada, 1970, p. 49.

Table 66

Comparison of Some Price Elasticity of Crop Acreage in Various Countries (Mubyarto and Fletcher,1970)

Region	Price Elasticity	Period
India (Punjab)		
Rice	0.31	1914-45
Wheat (irrigated)	0.08	1914-43
Corn	0.23	1914-43
Pakistan		
Rice (Aus and Aman)	0.05	1948-63
Rice (Aus)	0.12	1948-63
Wheat (irrigated)	0.20	
United States		
Wheat	0.48	1909-32
Corn	0.10	1909-32

In developing countries where an increase in production is approximately equal to an increase in population, there must be a considerable constraint factor faced by farmers. And this constraint could not be that of price. This statement is based on the assumption that traditional farmers will at least export a part of the production in proportion to the increase in population. For this case, the increase in population and the increase in income over time are ignored.

Even if farmers are responsive to price, there is a ceiling to their output. This production constraint is the level of technology available at the farm level.

The response to price would depend largely on:

a) Perceived production opportunities

b) The level of technology available at the farm level, especially on farm mechanization.

Farm mechanization is considered a major ingredient in developing traditional agriculture. Many social scientists are very cautious in stating their views on the mechanization of traditional agriculture because of concern on probable displacement of manual labor.

Without using a proper level of mechanization, the increase in yield would be constrained by the power of muscle. This only means that the increase in crop area would be at most equal to the increase in population.

It is further noted that an increase in cultivated land area may mean the extension of agricultural area to marginal lands. It means that in using manual labor a lesser proportion of land can be cultivated as compared to the increase in labor force. Likewise, the effectiveness of an improved agricultural technology depends on the level of mechanization. Using a hand sprayer is probably less effective than using power sprayers collectively.

One crucial aspect of consideration to achieve timely tillage of land in conjunction with the availability of water and rainfall is through the effective use of farm machineries.

By selecting the need for farm machineries based on regional priorities, farm machinery would favorably affect not only the magnitude of income, but also income distribution even for densely populated areas as Java.

Although the limiting constraint is technological in nature, adequate price incentive should be regarded as an indispensable correlate. The same would also be true with various government programs such as credit extensions under the Bimas program.

Demand as the Determinant of Supply

Assuming that there is no shift in consumption pattern, traditional agriculture is supposed to have the intermediate goal of achieving the same level of supply as demanded by the increase in population. Table 66 shows that this assumption did not materialize for Java. This means that the traditional farmers are facing a considerable constraint in trying to increase production proportional to the minimum requirement of the traditional Indonesian diet.

The nature of demand and the associated shifts in demand over time is difficult to measure. To be sure, it could, at most, be measured only in isolation from a large portion of its factor correlates.

Based on the cross-sectional consumption data, Mubyarto came to the conclusion that for the Yogyakarta area, the "expenditure-elasticity" of consumption for cereals ranged between 0.5 to about 1.0.[4/]

[4/] Mubyarto op. cit., p. 53.

Based on the assumption, the price elasticity for rice would be between 0.10 to 0.50. For comparison he presented some estimates in various countries as presented in Table 67.

Table 67

Income Elasticity of Demand for Rice in Several Asian Countries and the Far East

Country	Income Elasticity
India	0.81 a
Ceylon	0.81 a
Japan	0.60 a
Philippines	0.76 b
Burma	0.79 a
Cina (Thailand)	0.60 a

Source: Mubyarto, op. cit., p. 54

a = Hont Hakker

b = Mangahas

Hidaja[5/] obtained a time trend increase in price of about 1% per year after due regard to increased production. Noting that this increase might be associated to the increase in per capita

[5/] Hidajat Nataatmadja, "Masalah Harga Beras dan Inflasi", Agro Economic Survey, 1973.

income of about 2% annually in the period covered by the study (1952-1969), the increase of 1% of demand would be associated with an income elasticity of about 0.5. With the present increase in income of about 4%, the increase in demand would be in the neighborhood of 2% per year.

What is interesting to note from the study cited above, is that the change in price appeared to be significantly determined by the change of the "inflationary acceleration". Price elasticity of consumption is 1.14 which is not considered significant.

If it is true that the price of rice is determined primarily by the "inflationary acceleration", then the increase in price did not accrue to the benefit of the farmers. Instead, it would accrue to the distribution and marketing channel of the economy.

Provisional corn specific analysis is presented in Table for the Harvard-SEARCA corn study. In this analysis, corn available for human consumption in the market is estimated for the period 1960-1972.

Expressed in per capita, this variable is then regressed with the price of corn, income, and rice available per capita. Because of the difficulty in obtaining the price level in the rural areas, the wholesale price at Jakarta is used, with the assumption that it would be highly correlated with the retail price for the Indonesian aggregate. Large differences in price between and within the region is believed to be high.

The results of the analysis and the associated data matrix are presented in Tables 68 and 69.

Table 68

Regression Coefficient

Parameter	Variable			
	X_1	X_2	X_3	X_4
Regression Coefficient	7.2163**	1.8736	-8.4634**	0.0264
Standards Error	2.1234	1.8566	1.1373	0.1270
R^2		0.7258		

-** Significant at the 0.1 probability level.

Table 69

Regression Data Matrix

Year	Corn per Capita (Y)	Dummy (X_1)	Corn Price (X_2)	Income Per Capita (1 x 3)	Rice Per Capita (X_4)
1960	23.93	1	3.70	3.61	97.83
1961	21.56	0	4.79	3.37	92.45
1962	30.25	1	5.45	3.73	96.19
1963	22.48	0	4.98	3.55	86.12
1964	33.78	1	4.56	3.59	88.23
1965	20.31	0	4.65	3.55	81.99
1966	31.05	1	3.58	3.56	85.77
1967	17.99	0	3.77	3.52	81.63
1968	25.09	1	3.78	3.57	91.50

1969	16.32	0	3.93	4.07	99.55
1970	18.99	1	3.38	4.28	110.01
1971	17.25	0	3.34	4.47	110.01
1972	15.03	1	4.01	4.67	110.01

Based on the regression analysis, income elsticity of corn is high and negative, which contradicts the results of Mubyarto's study on cereal consumption in Yogyakarta.

One cannot rely too much on the result of the analysis above, but it is assuring that corn consumption is decreasing. It may also be noted that the price index for corn has been slightly decreasing, which reflects to some extent the decrease in demand for corn home consumption. Even though the relation between rice supply and corn consumption in the model is weak, there is a good reason to assume that the decrease in demand is due partly to the increase in rice supply available in the market. In this analysis, data on rice supply and rice imports are included.

It is only plausible to assume that the decrease in corn production since 1968 is due to the decreasing demand and the corollary decrease in corn price. The increasing rice supply may function as a direct causal factor in the decreasing corn prices.

Inter-regional Trade and Export

Unfortunately no reliable statistical data are available concerning inter-island trade of corn. But in general, it can be said

that there are four major production centers namely East Java, Central Java, Lampung (Southern tip of Sumatra), and South Sulawesi.

For export, no inter-island trade is necessary. For the above-mentioned production region, corn export can be carried out through the main ports in the respective area, namely: Surabaya in East Java, Semarang in Central Java, Cheribon in West Java, Tanjung Karang in Lampung, and Ujung Pandang (Makassar) in South Sulawesi.

The estimated figures on the extent of surplus in these producing areas are presented in Table 70 which are based on the production figures in 1972, population in 1971 and consumption estimates in 1967 (see consumption estimated in Chapter VI). Note that the estimated consumption outside Java is not segregated by province.

Qualitatively, the deficit of corn in Sumatra is questionable, and actually there is no record available for possible corn inflow into this island.

The other deficit area, Kalimantan, obtains its corn mostly from South Sulawesi. Transportation of corn from Nusa Tenggara, another producing center to the eastern part of the archipelago, is difficult. Thus, this potential producing area could not be considered as an important source of corn. The climatical condition in this area, particularly rainfall, is not favorable to crop production. From time to time shortages in food production occur. For food stabilization purposes, it is desirable to restrict the outflow of food

from this area, unless a better communication network is established and better farm management conditions to stabilize food production are pursued.

Export performances are discussed in Table 71. The low figure for corn export in 1972 is due to the restriction placed by the government due to food shortages in that particular year. The usual export performances range between 150 to 250 thousand tons per year.

In terms of quantity and export value, corn is second to cassava chips as a food export commodity. Corn exports earned about $11 million dollars in 1971 (See Table 71). It comprises about 2.5% of the export earnings from the agricultural sector, excluding fishery and forestry. When fishery and forestry are included, it comprises about 1.7% of the total earnings.

To have some idea of the Indonesian corn international trade, the corn volume, countries of destination and port of origins are presented in Tables 71 to 72.

From Table 72 it appears that Sumatra as a whole is the main exporting region even though Lampung exports a sizable quantity of corn. It only means that the estimated deficit of 180 thousand tons of corn for this island is highly questionable. It is either due to the under-estimation of regional production, the over-estimation of regional consumption or both.

Table 70

Corn Production, Consumption and Surplus by Region, 1972

Region	Production (000 tons)	Population (thousand)	Consumption Per Capita Per Year (kg)	Total Consumption (000 tons)	Surplus (000 tons)
Jakarta	-	4,576	0.5408	2.4	- 2.4
West Java	104	21,633	0.9256	20.0	84.0
Central Java	576	24,367	17.1444	417.8	158.2
East Java	969	25,527	25.7348	656.9	312.1
Sumatra	150	20,813	16.2240	337.7	-187.7
Kalimantan	10	5,152	16.2240	83.6	- 73.6
Sulawesi	224	8,535	16.2240	138.5	85.5
Other Islands	221	7,857	16.2240	127.5	93.5
Total	2,254	118,460		1,784.4	469.6

Based on the estimated requirement for seed, feed, and waste in Chapter II, we arrived at the net surplus available for export of about 145,000 tons.

Table 71

Country of Destination and the Volume of Corn Export, 1970 and 1971

Country of Destination	Volume of Export (thousand tons)	
	1970	1971
Japan	68.4	46.3
Hongkong	48.6	35.8
Singapore	146.7	113.2
Malaysia (Penang)	15.2	21.7
Sarawak, Brunei and Sabah	2.6	-
Zanzibar	-	0.1
Netherlands	0.3	-
Total	281.8	217.1

Source: Central Bureau of Statistics, "Export by Commodity Country of Destination, and Part of Export, 1970-1971, p. 34.

Table 72

Ports of Origin for Corn Export and Volume, 1970 and 1971

Port of Origin	Province or Island	Volume of Export (000 tons)	
		1970	1971
Lho' Seumawe	Aceh (Sumatra)	*	-
Belawan	North Sumatra	5.1	12.5
Tg. Balai Asahan	North Sumatra	0.6	0.1
Bengkulu	Sumatra	0.1	0.1
Panjang	Lampung	52.6	68.1
Tg. Priok	Jakarta	*	*
Cirebon	West Java	1.5	0.1
Tegal	Central Java	0.5	1.0
Semarang	Central Java	8.1	3.8
Tuban	East Java	*	*
Surabaya	East Java	148.5	95.0
Panarukan	East Java	10.4	9.5
Pacitan	East Java	-	0.1
Banyuwangi	East Java	29.5	18.9
Ampenan	Nusa Tenggara	-	1.7
Sumbawa	Nusa Tenggara	-	*
Kupang	Nusa Tenggara	-	0.2
Pare-pare	South Sulawesi	2.3	0.2
Ujung Pandang	South Sulawesi	21.5	5.1
Total	-	281.7	216.4

Source: BPS, Export ... 1970, 1971, op. cit., p. 35.

* = Smaller than 50 tons

Price Determination and Policy Goal

In this Chapter price differential and its determination were discussed. In this section, analysis is not provided but it will try to present a better view of the price problem in relation to the desired government policy to increase food production.

Fortunately, data on price are available from some areas in several marketing levels from the farmers up to the terminal consumer markets. On the time estimates presently available, these are regarded sufficient for the present study purpose. These figures are presented in Table 73.

As noted in Chapter II price differential depends heavily on the harvesting season which may differ from region to region. Note the low record of farm-gate price in Table 73 . The low farm price must have corresponded to the harvest time for that area. It means that the farm-gate price may be less than 50% of the prices from the intermediate kabupaten market. In Table 74 similar figures are presented and expressed in percentages of the terminal market price at Jakarta.

From Table 74 there is some indication that the kabupaten markets for West and Central Java play the role of an intermediate market between the producer's and the terminal's market. On the other hand in East Java, the province market seem to be directly served by the regional markets below the kabupaten level, so that little price

differential is observed between the kabupaten and surabaya markets. Note also the relatively high producer's price in East Java. Based on these scarcity point estimations, caution must be exercised in generalizing results.

The producer's price, which is very low as indicated by the case in Central Java, suggests the need to improve the corn marketing system. Up to the present, the government price stabilization program refers singularly to rice. Even for rice, the maintenance of the floor price policy is not very effective because the floor price level appears to be too low.

Domestic demand for corn is limited. The growth of the corn industry is expected to increase by 7.5% per year. However, this is not adequate to meet the level of demand for the next 10 years. The newly established corn oil processing industry can absorb at present only an insignificant amount of 10,000 tons of corn per year. Lack of corn processing facilities is probably one reason why corn production has been declining since 1967.

If one of the intermediate goals of Indonesia is to increase corn production, then export promotion is necessary for the short term programs. Internally, Indonesia should also strive to improve its domestic marketing of corn to give proper incentives to producers.

Table 73

Price Formation from Farm Gate up to the Terminal Market in Several Regions, April 15, 1974, for Yellow Corn

Region	Terminal Market		Province Market		Kabupaten Market		Producer's Market	
	Location	Price (Rp/Kg)	Location	Price (Rp/Kg)	Location*	Price (Rp/Kg)	Location	Price (Rp/Kg)
West Java	Jakarta	63.30	Bandung	60.00	Average	52.30	Cheribon*	40.00
Lampung	-	-	Tg. Karang	45.00	Average	40.00	No record	-
South Sumatra	-	-	Palembang	60.00	Average	61.65	Kota Agung	65.00**
Central Java	-	-	Semarang	60.00	Average	55.00	Plumbon	26.05
East Java	-	-	Surabaya	50.00	Average	49.45	Karanganyar	43.40
South Sulawesi	-	-	Ujung-pandang	no record	Average	39.45	Enrekang	38.75

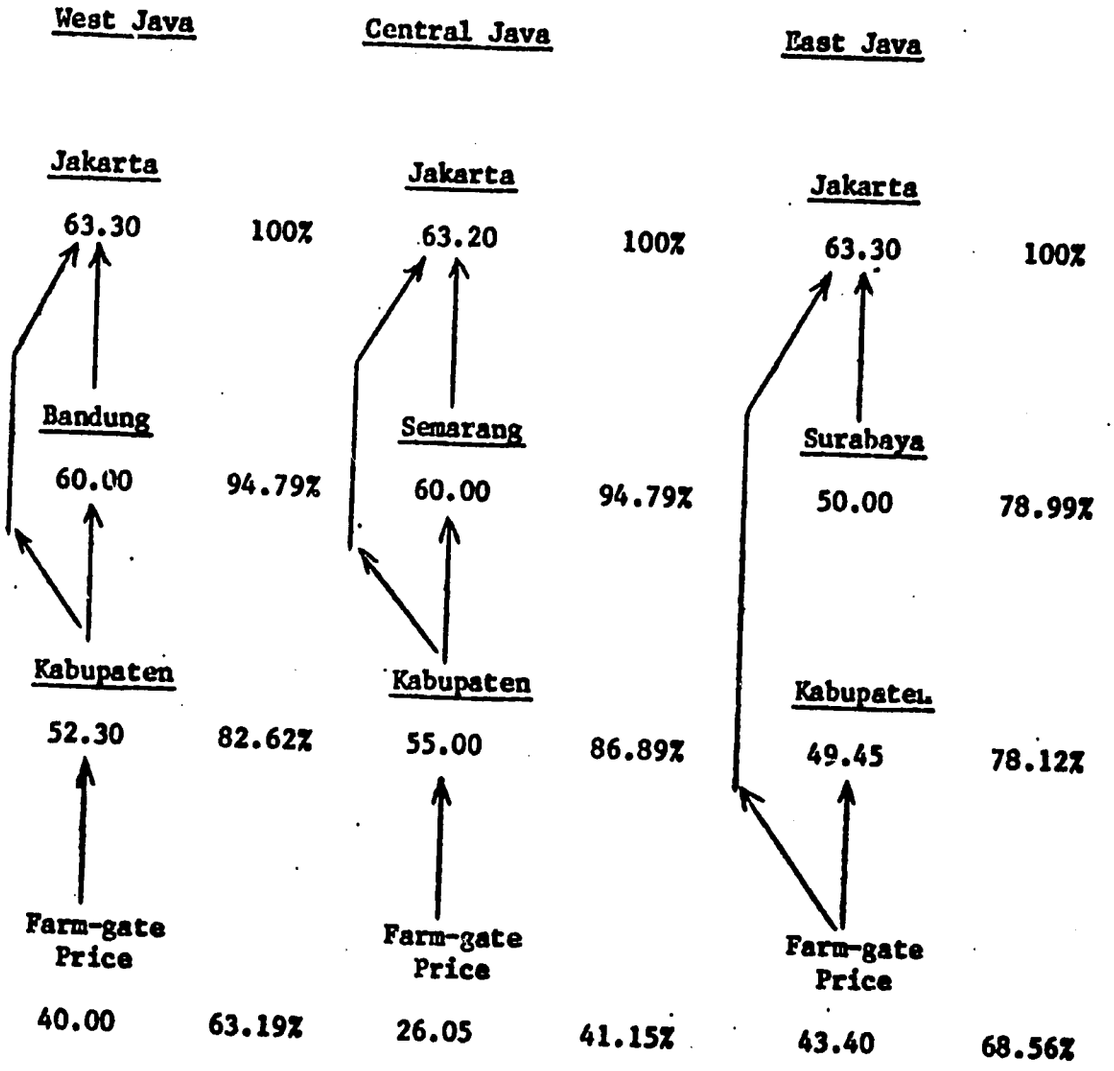
Source: Directorat Ekonomi, Ditjentan, "Catatan Harga Palawija .....", 1974.
For Jakarta price: Central Bureau of Statistics

* = Average for all Kabupaten markets available

** = Note that this area is probably a deficit area, so that corn was supplied from the terminal market at Palembang.

Table 74

Price Formation of Corn in Java
April 15, 1974



CHAPTER VI. CONSUMPTION, UTILIZATION AND NUTRITIONAL DIMENSION

A. Human Consumption

Corn is consumed as a secondary staple food in Indonesia. In a few areas, corn is a major staple food, such as in the rural areas of Madura. Most Indonesians eat rice as their major staple food. For a West Javanese, corn is merely a food supplement.

Corn consumption increases from West to East Java, but the major staple food in Java is still rice. The same is true for most islands outside Java, except the people in the island of Irian Jaya and in some of the islands of Maluku and Nusa Tenggara. In these latter islands, some people depend heavily on sago palm for their staple food.

Table 75 shows the regional differences in corn consumption based on the results of two consumption surveys conducted in October-December 1969 and February-April 1970. In general, rural Indonesians consume larger amounts of corn than their urban counterparts.

Table 76 presents regional variations in corn consumption for Java based on the consumption surveys of 1967. The 1969/1970 consumption figures show that consumption was about two times larger than the 1967 data. It is obvious that no such change was possible because corn production increased only slightly. The consumption figures for 1969/1970 are therefore biased upward.

Table 75

Weekly Per Capita Consumption of Corn in Indonesia, October 1969-April 1970

Region	Expenditure Class (Rp per Month per Family)											
	Up to 300	301 500	501 750	751 1000	1001 1250	1251 1500	1501 2000	2001 2500	2501 3000	3001 and Over	Average per Year	Per Year (Kg/Capita)
1	2	3	4	5	6	7	8	9	10	11	12	13
OUTSIDE JAVA												
Urban + Rural												
a. Fresh	.388	.232	.223	.136	.094	.072	.066	.076	.050	.061	.101	5.252
b. Grain	.477	.476	.341	.235	.210	.159	.132	.165	.116	.135	.197	10.244
c. Flour	.001	.033	.021	.020	.018	.012	.011	.012	.007	.009	.014	.728
Total -	.866	.741	.585	.391	.322	.243	.209	.253	.173	.205	.312	17.224
URBAN -												
a. Fresh	-	.026	.001	.016	.047	.005	.011	.042	.002	.007	.017	.884
b. Grain	-	.208	.165	.180	.154	.093	.023	.042	.028	.034	.074	3.848
c. Flour	-	.001	.009	.040	.019	.012	.004	.006	.009	.005	.011	.572
Total -	-	.235	.175	.236	.220	.110	.038	.090	.035	.046	.102	4.294
RURAL -												
a. Fresh	.396	.241	.241	.143	.100	.082	.076	.077	.063	.073	.113	5.976
b. Grain	.487	.487	.355	.241	.227	.167	.152	.187	.140	.159	.216	11.232
c. Flour	.001	.034	.022	.018	.018	.012	.012	.013	.006	.010	.015	.780
Total -	.884	.762	.018	.402	.355	.261	.240	.277	.219	.242	.344	17.888

1	2	3	4	5	6	7	8	9	10	11	12	13
JAVA-MADURA (R + U)												
a. Fresh	.038	.038	.033	.029	.025	.037	.033	.019	.025	.039	.036	1.872
b. Grain	.666	.895	.735	.557	.454	.406	.383	.317	.217	.271	.543	28.236
c. Flour	.039	.041	.042	.029	.029	.032	.02[illegible]	.019	.010	.034	.032	1.664
Total -	.742	.974	.810	.615	.508	.475	.440	.355	.252	.344	.611	31.772
URBAN -												
a. Fresh	-	.002	.009	.003	.007	.005	.006	.008	.004	.008	.006	.312
b. Grain	.085	.293	.103	.068	.055	.013	.058	.031	.009	.040	.056	2.912
c. Flour	-	.037	.034	.017	.027	.010	.001	.005	.009	.005	.014	.728
Total -	.085	.332	.146	.088	.089	.028	.065	.044	.022	.053	.076	3.952
RURAL -												
a. Fresh	.040	.040	.035	.033	.028	.046	.043	.025	.041	.069	.036	1.872
b. Grain	.697	.925	.796	.615	.533	.507	.494	.454	.372	.503	.641	33.332
c. Flour	.041	.041	.043	.030	.029	.038	.032	.026	.010	.065	.035	1.820
Total -	.778	1.006	.874	.678	.590	.591	.569	.505	.423	.637	.712	37.024
INDONESIA (R + U)												
a. Fresh	.103	.073	.067	.056	.047	.052	.048	.047	.039	.052	.056	2.912
b. Grain	.631	.819	.664	.476	.377	.307	.268	.237	.160	.187	.423	21.996
c. Flour	.031	.040	.038	.026	.025	.024	.018	.015	.008	.019	.026	1.352
Total -	.765	.932	.769	.558	.449	.383	.334	.299	.207	.258	.505	26.260

Source: Computed from the CBS data.

Table 76

Weekly per Capita Corn Consumption by Provinces in Java, 1967

Region	Corn: Fresh	Corn: Grains	Corn: Flour	Corn: Total	1969-1970 Java	Outside Java 1969-1970	Estimated Indonesia Aggregate Yearly Consumption'74
URBAN AND RURAL:							
1. West Java	.0086	.0079	.0013	.0178			
2. Central Java	.0157	.3106	.0034	.3297			
3. D I Y	.0036	.0030	-	.0066			
4. East Java	.0204	.4326	.0417	.4949			
5. Java + Madura	.0141	.2415	.0153	.2709	.611	.312	.288/cap/week 14,976 kg/cap/ year or equivalent to 1,812,000 ton/year (Population 121,000,000)
URBAN:							
1. West Java	-	.0077	.0075	.0152			
2. Central Java	.0029	.0347	-	.0376			
3. D I Y	.0011	.0089	-	.0100			
4. D K I	.0003	.0097	.0004	.0104			
5. East Java	.0057	.1100	.0110	.1267			
6. Java + Madura	.0045	.0410	.0046	.0501	.076	.102	
RURAL:							
1. West Java	.0097	.0080	.0004	.0181			
2. Central Java	.0173	.2437	.0038	.3648			
3. D I Y	.0035	.0019	-	.0054			
4. East Java	.0227	.4833	.0465	.5525			
5. Java + Madura	.0165	.2821	.0175	.3161	.712	.344	

For this reason, no time series trend could be derived. The 1967 consumption figures are, therefore, made as the basis of the succeeding analyses in this chapter.

B. Corn As Animal Feed

Corn is the major feed component for poultry. It is also used for hogs, milk cows and beef cows. It is difficult to estimate how much corn is consumed by hogs and cows because current feeding practices differ widely. At present corn is primarily used for hybrid chicken which is raised in or near the major urban centres. Corn is not fed in the traditional practices of chicken raising.

Poultry Feed Industry

Based on the data available in the College of Animal Husbandry (IPB, Bogor) the composition of feed-mix for poultry is as follows.

Corn	30-40%
Rice bran	20-30%
Peanut meal	10%
Coconut meal	15%
Mungbean	5%
Soybean	5-10%
Fish meal	10-20%

One of the largest feed mills in Jakarta uses approximately the following feed formulas.

Corn	55%
Soybean	15%
Rice bran	15%
Fish meal	10%
Coconut meal	5%

In general, high quality feed contain proportionally higher amount of corn. For the best premixed feed, the price is about Rp 110 per kg, while for the lower quality, the price is only Rp 80 per kg.

Poultry feed mills are concentrated near urban centers, particularly Jakarta, Bandung, Surabaya, Yogyakarta and Medan. Many of them are small-scale feed mills producing between 1-20 tons of feed per month.

From a survey conducted in 1973, the following figures were obtained for Jakarta.[1/]

Range of Capacity	No. of Mills	Average Capacity
1 - 20 tons/month	11	9.7 tons/month
21 - 41 tons/month	6	27.1 tons/month
41 and larger	11	188.0 tons/month
Total -	28	86.0 tons/month

1/ "Survey perusahaan-perusahaan ternak", Direktorat Pengembangan Produksi Peternakan, 1973.

These mills can also be classified by form of organization and based on the degree of integration as follows.

1. Types of Feed Mill/Feed Shop by Organization Type -	No. of Feed Mills
a) Household industry	18
b) Business enterprise	8
c) Cooperative	1
d) Joint venture with foreigners	1
	28

2. Feed mills Classified by degree of integration	Number
a) A	4
b) A, B	10
c) A, B, D	4
d) A, B, C	1
e) A, C	5
f) C	1
g) A, B, D	4
h) A, B, C, D	2
	31

Where:

A = Feed processing and retail

B = Feed processing for self-managed poultry farm

C = Marketing only

D = Having regional retail outlets

Hybrid chicken husbandry rapidly developed up to 1972, but it slowed down in 1973 and 1974 due partly to the slow increase in demand for eggs in the domestic market.

The hybrid poultry population in 1972 was estimated to be 3 million. The estimated demand for corn is calculated based on the assumed 50% laying hens with 100 gm feed requirement per day, and 50% young others with 60 gm feed requirement per day.

Although the increase in egg production from hybrid chicken reached a record of 66% in 1972 as shown in Table 77 , the long run growth would probably be limited to the increase in demand for eggs in the domestic market. If per capita income grows by 5% per year and population increases by 2.5% per year, the estimated increase in the demand for eggs would be limited to about 7.5% per year, assuming an income elasticity of unity.

Dairy Cows and Hogs

Dairy cows and hogs appear to have grown appreciably between 1969-1972 as indicated in Table 78.

Table 79 shows an estimated demand for corn by dairy cows.

Regional report presented in Table 79 is believed to be less reliable. When figures for West Java are compared (a and b) it is reasonable to assume that the regional report is an under-estimation, probably 3 times lower in 1972.

Table 77

Egg Production in Indonesia, 1969-1972 (million)

Type of Eggs	1969	1970	1971	1972
Chicken:				
a) local	882.2	894.6	947.5	1,010.4
b) hybrid	69.5	71.2	181.5	302.6
Duck	311.3	315.6	334.3	356.5
Others	37.1	37.6	39.8	42.4

Source: Department of Agriculture, Annex to the Presidential Speech, 1973

Table 78

Poultry and Livestock Population, 1969-1972
(thousand of heads)

Livestock	1969	1970	1971	1972
Dairy cows	52	59	66	79
Hogs	2,878	3,169	3,382	4,605
Hybrid chicken	688	706	1,799	3,000

Source: Department of Agriculture, 1973

Table 79

Estimated Corn Consumption of Dairy Cows in Java
(Thousand Tons)

Region		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Jakarta	a)	0.14	0.16	0.14	0.14	0.12	0.14	0.12	0.12	0.11	0.11	0.10
West Java	a)	0.53	0.62	0.66	0.77	0.70	0.70	0.78	0.81	0.85	0.88	0.91
	b)	(0.53)	(0.62)	(0.95)	(1.34)	(1.79)	(1.83)	(2.22)	(2.52)	(2.81)	(3.11)	(3.40)
Central Java	c)	-	-	-	-	-	-	-	-	-	-	-
East Java		0.78	0.88	1.15	1.35	1.60	1.75	1.96	2.17	2.37	2.57	2.78
Total	-	1.45	1.66	1.95	2.26	2.42	2.59	2.86	3.10	3.33	3.56	3.79
		(1.45)	(1.66)	(2.24)	(2.83)	(3.52)	(3.72)	(4.30)	(4.81)	(5.29)	(5.79)	(6.28)

a) Regional Report

b) Survey 1967 and "Ekutas" 1971

c) No corn was used in feeding.

Source: "Potensi Produksi Ternak di Indonesia", 1971, Fakultas Peternakan, Bogor.

Estimating the corn consumption of hogs is quite difficult. Most of these animals are traditionally raised using local breeds that thrive on non-commercial feedstuff. Nevertheless, Table 81 shows some estimates. These estimates by the IPB in Bogor assume that 5% of the rice bran requirement is provided by corn, so that the estimated corn consumption for hogs in 1972 would be about 167 thousand tons.

It has been estimated that the demand for livestock products would increase by about 7.5% per year. The domestic demand for dairy products has been higher than domestic production, and importation of dairy products is expected to increase further (see Table 80).

Table 80

Export and Import Value of Livestock Products, 1968-1972
(thousand US$)

Year	Export Value				Import Value
	Cattle	Hide	Bone	Total	
1968	952	4,569	80	5,601	6,631
1969	847	3,983	52	4,882	8,540
1970	2,031	5,008	172	7,211	11,281
1971	1,693	5,176	156	7,025	12,913
1972	3,526	7,625	157	11,308	12,201*

* As of October 1972.

Source: Department of Agriculture, 1973.

Table 81

Estimated Feed Consumption by Hogs, Including Projections

Year	Hogs Population (thousand) b)	Feed Component (thousand tons)			
		Rice Bran + corn a)	Sweet Potatoes + Cassava or its By Products	Soybean Meal, Copra Meal, or Peanut Meal	Fish Meal
1973	3,778	3.487	2.206	.897	.275
1974	4,109	3.546	2.400	.930	.300
1975	4,440	3.605	2.543	.969	.324
1976	4,771	3.665	2.786	1.002	.348
1977	5,101	3.784	2.979	1.036	.372
1978	5,432	3.979	3.172	1.069	.369

a) For the estimation of hog feed for 1972 cited in the text, the time tend is subtracted and it is assumed that the proportion of corn in the bran-corn mature is 5%.

b) These estimates differ from those presented in Table

Sources: 1. College of Animal Husbandry, Bogor University of Agriculture

2. Department of Agronomy, Bogor University of Agriculture

Most of the import items are dairy products, and it is obvious that there is enough room to accommodate any increase in domestic dairy production. Up to the present, the domestic dairy industry produces only enough fresh milk for urban consumers. Canned milk products and cheese have always been imported.

In this respect, the problem is in the breeding of dairy cows adjusted to tropical conditions. At present it seems domestic production cannot compete with imported products in terms of cost, quality and price. Without ample government support, it is difficult for domestic entrepreneurs to compete with the current exporting countries. It is expected that the demand for imported dairy products would grow by about 7.5% per year in real terms.

The Nutritional Attributes of Corn

Corn would probably remain as the major feed component, amounting to about 40-50% of the feed mixture.

Chemical analyses of some cereals and beans are presented in Table 82.

Based on total protein content, the nutritional content of corn is somewhat better compared to rice and it is almost equal to sorghum.

Compared to beans, corn protein content is much lower, but then, its price is about 1/3 to 1/4 of that of soybean and mungbean. Corn can be substituted with sorghum, but the minimum corn content in feed should not be lower than 20%.

Table 82

Nutritional Content of Some Cereals and Beans

Commodity	Nutritional Content in Percentage of Weight					
	Water	Protein	Non-Nitrogenous Extract	Fiber	Fat	Ash
Rice:						
a) With husk	10.5	7.5	62.0	10.0	2.25	7.5
b) With bran layer	9.8	8.9	77.2	1.0	2.0	1.1
Corn	13.5	9.4	68.8	2.7	4.2	1.4
Sorghum	11.2	9.8	71.6	2.3	3.3	1.8
Soybean	9.8	36.9	26.3	4.5	17.2	5.3
Mungbean	12.4	23.0	53.2	7.2	1.2	4.0

Source: Bogor University of Agriculture

As human food, corn is also nutritionally important in the diet of Indonesians. The complete nutritional composition of the US corn is shown in Table 83 and Table 84. For the Indonesian corn, the figures are supposed to be about the same, but the protein content appears to be somewhat higher.

C. Corn Utilization Dynamics

Corn became an export commodity only in 1963. Export figures are presented in Table 85, together with other agricultural exports. Corn export has been increasing appreciably except

Table 83

Nutrient Composition of Feedstuffs (air-dried basis)

Feedstuffs	Protein %	Metabolizable Energy Kcal/lb.	Metabolizable Energy Kcal/kg.	Fat %	Crude Fiber	Calcium %	Total %	Available %	Sodium %	Potassium %	Chlorine %	MN	ZM
Corn, Dent, No. 2 Yellow	8.7	1560	3430	3.9	2	.02	0.3	0.1	0.01	0.28	0.04	5	10
Fish Meals	60	1350	2970	8	1	5.5	2.8	2.8	0.3	0.7	1.2	36	150
Rice Bran	13	740	1630	13	12	0.12	1.5	0.21	0.07	1.7	0.07	200	30
Soybeans, unextracted	38	1600	3510	18	5	0.25	0.6	0.25	0.02	1.5	0.03	30	20
Coconut Oil Meal (copra meal)	21	700	1540	1.6	15	0.2	0.6	0.2	0.04	1.1	0.03	55	-

Source: Leslie E. Cards et al., Poultry Production, 1972.

Table 84

Nutrient Composition of Feedstuffs, Amino Acids

Feedstuffs	Protein	Arginine	Cystine	Glycine	Hiti-dine	Isoleu-cine	Leucine	Lycine	Methio-nine	Phenyl Alanine	Thro-nine	Tryp-tophan	Tyro sine	Valin
Corn, Dent, No. 2, Yellow	8.7	0.5	0.18	0.5	0.2	0.4	1.1	0.2	0.18	0.5	0.4	0.1	-	0.4
Fish Meals	60	3.8	0.94	4.4	1.4	3.6	5.0	5.0	1.8	2.7	2.6	0.3	2.0	3.4
Rice Bran	13	1.4	0.4	0.8	0.56	0.61	1.2	0.27	0.29	0.76	0.62	0.1	0.68	0.91
Soybeans, Un-extracted	38	2.8	0.64	2.0	0.89	2.0	2.8	2.4	0.51	1.8	1.5	0.55	1.2	1.8
Coconut Oil Meal (Copra Meal)	21	2.7	0.3	1.0	0.56	0.66	1.49	0.64	0.29	0.9	0.65	0.2	0.56	0.98

Source: Leslie E. Cards et al., Poultry Production, 1972

Table 85

Export Volume of Agricultural Commodities, 1963-1973 (thousand tons)

	Commodity	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973*
1.	Corn	358	-	5,200	86,265	158,760	65,946	156,264	285,833	218,904	78,647	177,572
2.	Cassava chips	52,967	-	84,210	144,894	110,597	152,582	298,752	334,227	458,963	343,402)	73,492
3.	Cassava meal	43,124	-	74,704	37,372	30,312	7.796	6,895	5,615	871	1,111)	
4.	Tapioca	6,571	-	493	345	980	665	1,591	1,048	1,[illegible]	1,143	1,063
5.	Tapioca meal	6,892	3,192	54,043	32,520	7,326	857	7,975	12,016	14,064	12,429	-
6.	Peanut pods	3,261	789	1,496	1,311	2,762	2,619	1,755	2,154	995	1,303)	21,707
7.	Peanut	550	667	4,534	9,085	6,867	19,747	19,684	22,659	20,184	12,069)	
8.	Peanut nil	47	42	974	1,901	354	264	322	331	63	396	2,277
9.	Peanut meal	..	..	211	3,960	1,373	1,446	616	12	66	-	-
10.	Soybean	311	-	290	27,446	6,860	8,316	749	3,955	732	3,055	35,021
11.	Mungbean	17	-	852	2,922	4,869	4,548	78	5	4,629	2,284	71
12.	Orange	544	-	-	-	10	345	-	-	-	3	-
13.	Mangoes	-	-	-	-	24	13	103	213	382	482	-
14.	Potatoes	2,088	20	-	-	37	19	59	553	1,261	2,781	3,653
15.	Cabbage	19,234	-	-	-	3,216	3,522	7,633	3,639	7,888	7,426	-
16.	Onion	460	5	-	783	2,949	6	3,345	2,805	213	3,519	-
17.	Dried chili	1,726	733	1,332	3,209	3,610	1,492	4,461	4,993	5,640	5,765	-
18.	Sesamum	3,277	3,757	3,794	6,239	6,286	7,956	3,138	9,126	5,295	1,516	-

NOTE: * - provisional figures .. - less than 500 Source: Central Bureau of Statistics

in 1972 when the government prohibited corn export due to the low domestic food production in the exceptionally dry year of 1972.

Industrial processing of corn is almost unknown in Indonesia. Recently, corn oil factories with an aggregate capacity of about 10,000 tons per year have been established. With the advent of the poultry feed industry, some corn has been diverted to the feed factories.

For human consumption, no particular processing has been done on corn. It is simply boiled or steamed as whole grain.

The bulk of corn production goes to human consumption. This corn is not marketed but is directly consumed by the farmers' household. As shown in Table 75 and Table 76, the rural sectors consume about 5 times more corn than the urban sectors per capita. About 70% of the Indonesians live in rural areas.

With these estimates and assumptions, the production flow for corn is shown in Table 86 and Figure H.

D. The Malnutrition Problem

The main nutrition problem in Indonesia stems from a low intake of protein and calories. Estimates showed the average daily shortage per person was 400 calories and 20 grams of protein. Various investigators have reported that many of the children under five years of age suffer from some degree of protein-calories malnutrition (PCM). While surveys in the poor urban areas have

Table 86

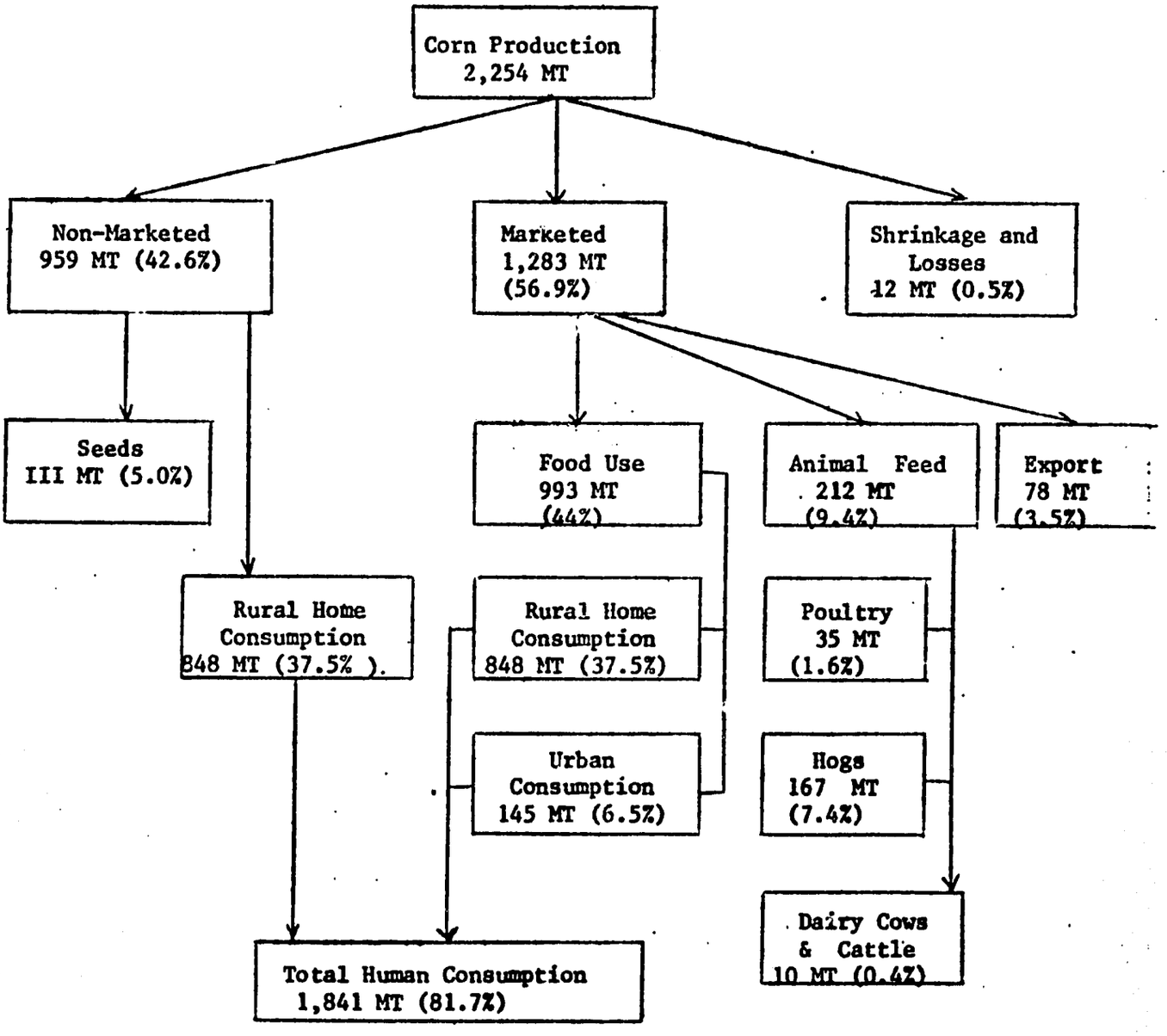
Corn Utilization Flow in Indonesia, 1972

Production Flow	Metric Tons	%
1. Production, 1972	2,254	100
2. Seed and waste, estimated at 5%	111	4.9
3. Human consumption based on per capita consumption of 1967	1,841	81.7
4. Feed		
a) Poultry	35	1.6
b) Hogs, assumed 5% of total corn + rice bran requirement	167	7.4
c) Dairy cows	10	0.4
5. Export	78	3.5
6. Unaccounted for	12	0.5
Total -	2,254	100.0

indicated that 46% of the children suffer from some degree of malnutrition, the incidence in the rural areas tends to be higher. An estimate of 50% of the total child population is usually taken as the average percentage suffering from some degree of PCM. Protein-calories malnutrition in young children is the most important nutritional problem faced by the developing countries. Other nutrition problems in Indonesia, which call for immediate action, are the almost absence of vitamin A and the very low fat intake.

Figure H

The Indonesian Corn Flow Chart
1972
(In Thousand MT)



Source: Central Research Institute in Agriculture
Central Bureau of Statistics, Jakarta

The nutritional problems of Indonesia result from economic, social and cultural factors, Figure I . The deficiencies in food production invariably result from imbalances in the man-land ratio, the land-use pattern, the inadequacy of agricultural inputs and poor transportation and distribution system, and other related factors. Inadequate nutrition, on the other hand, is a result of the social environment, such as lack of nutritional knowledge, low unstable income of the family, food beliefs and habits. The income of the average Indonesian is quite low. The government is obliged to increase his buying capacity by giving subsidies in the form of rice imports and setting up a ceiling price.

It has become increasingly evident to the food system planners and policy-makers that adequate food production does not always mean adequate nutrition. The effective utilization of food depends on its distribution to the consumers, and that prices within the reach of the people. But the food problem is not a problem to the consumer alone. With abundant food supply and increased buying capacity of the consumer, market demand for food will create a new problem to the producer.

A food workshop held in Jakarta in 1968 estimated the dietary allowances recommended for use in Indonesia, Tables 87 and 88.

The recommendation took into consideration the specific nutritional problems, local food beliefs and taste preferences. Although it was known that a menu based on a variety of food was better than one based on staples, the workshop had to contend with

Figure I

Determinants of Malnutrition

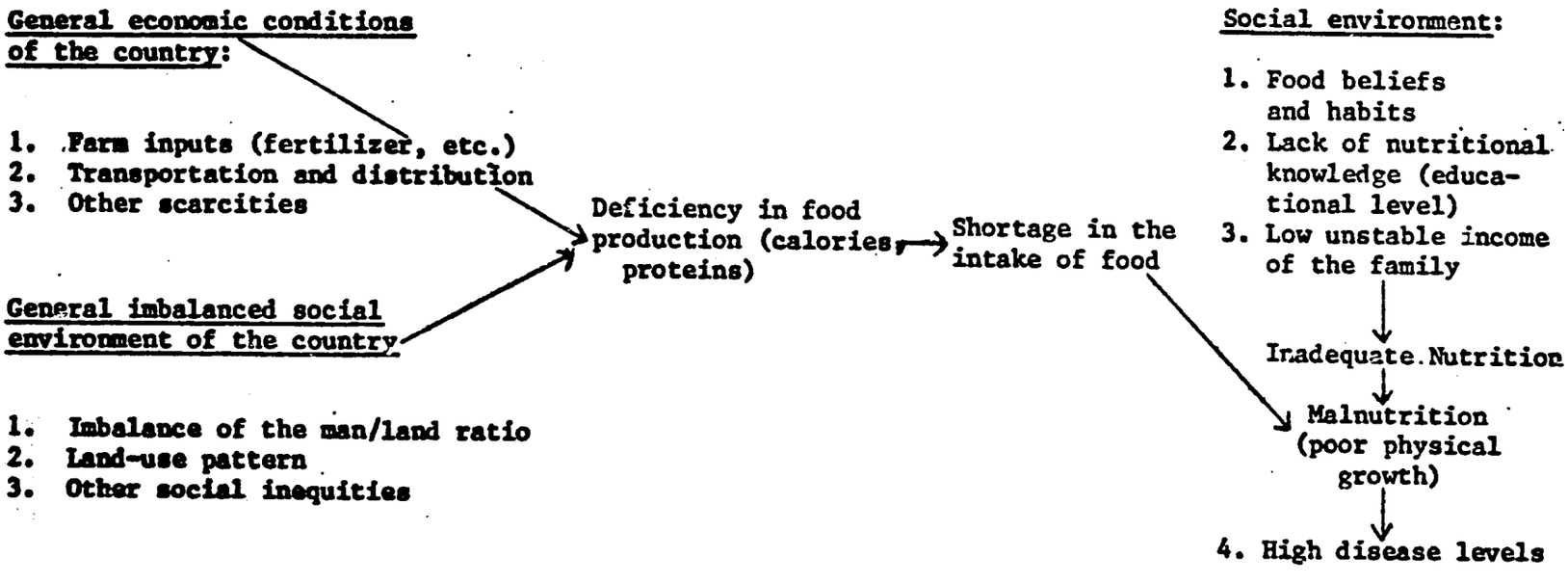


Table 87

Average Daily Per Capita Food Intake Compared to Recommended Intake in Some Areas of Indonesia

Foodstuffs	Recommended (gram/day/capita)	Actual Intake (gram/day/capita)			
		1	2	3	4
Cereals					
Rice	300	260	309	322	188
Other cereals	50	49	16	3	16
Roots and tubers	150	212	56	13	321
Legumes and pulses	40	-	42	39	32
Meat and poultry (bones not included)	20	37	6	3	0
Fish	60	11	35	20	14
Egg	5	1	1	4	0
Milk	5	2	1	-	0
Fruits and vegetables	200	11	95	71	70
Sugar	25	28	10	4	8
Fats and oils	20	9	9	10	10

Sources:
1. Central Bureau of Statistics Food Consumption Survey, 1964.
2. Figure for Bogor, 1958, NAS-LIPI workshop on Food, Jakarta, 1963.
3. Figure for the village of Bendungan, Bogor, 1969. Balai Penelitian Gizi Unit Semboja, Departemen Kesehatan, R.I., jilid 2, 1972.
4. Belitung - Martapura, South Sumatra, 1958 NAS-LIPI workshop of Food, Jakarta, 1968.

Table 88

Average Daily Per Capita Nutrient Intake of Various Groups in Certain Areas of Indonesia

Nutrient	Children*		Adults**	
	1-3 years of age	4-6 years of age	Pregnant Women	Non-pregnant Women
Calories	667	905	1346	1434
Protein (gram)	18.8	25.8	37.5	29.7
Fats (gram)	5.3	8.1	9.1	9.4
Calcium (m. gram)	103	144	206	246
Iron (m. gram)	5.50	7.97	8.6	9.8
Vitamin A, I.S.	1295	1520	2916	2244
Vitamin B_1	396	464	780	874
Vitamin C (m. gram)	10.9	12.8	20	21

Sources: * Balai Penelitian Gizi Unit Semboja, Departemen Kesehatan R.I., 1971, p. 29.

** Balai Penelitian Gizi Unit Semboja, Departemen Kesehatan R.I., 1972, p. 13.

Note: The report indicated a deficit of 44.6% for calories and 25.0% for proteins for the 1-3 years of age groups. The figures for the 4-6 years of age group are 43.2% and 14.0%, respectively. The report also indicates an estimated average shortage of 20.0% for calories and 39.0% for proteins for pregnant women. The figures for non-pregnant women are 14.0% and 39.0%, respectively.

the fact that Indonesians eat a lot of rice. At this stage, the combination of the protein-rich food, fat and green leafy vegetables in the Indonesian diet was considered as a good system for the maintenance of good health.

The success of the 1968 workshop on food was not only in the development of dietary recommendations, but it also tackled broader view of the nutrition situation in Indonesia. It was agreed that the existence of nutritional problems was a result of several factors. Therefore, the solution could be realized only by treating all the causes simultaneously. The chain of problems looking for solutions could be summarized in the following steps:

Step 1. Determine the desired level of health of the Indonesian people

Step 2. Find out the amount and quality of food which is needed to obtain or maintain the desired level of health

Step 3. Translate the daily nutrient allowances back to foodstuffs

Step 4. Outline the program of food production support needed

E. The Indonesian Food and Nutrition Program

The staple food of Indonesia is rice. In few places, people use a mixture of rice and corn or corn only. Many surveys indicate that 70 to 80% of the total calories and the total proteins are supplied by the staple food. Another reason is that people are reluctant to substitute rice with other foods. It is very

fortunate that rice has a relatively high quality of protein. Therefore, it is justified that food discussion centers on the problems of rice supply.

Fish, consumed as fresh or commonly consumed as dried-salted fish, very often constitutes the single animal food protein source in the diet. Legumes and pulses, the second vegetable source of protein after rice, are usually consumed as fermented soybean, soybean curd, or fermented peanut cake.

The recommended dietary intake forms the basis in the planning of food production. Ten groups of food constitute the Indonesian diet, four of which call for special attention, namely, rice and other cereals, legumes and pulses, fish, meat and poultry production.

Various short-run and long-run policies have been pursued to increase rice production in Indonesia. This included improving farm practices and expanding cultivated land areas. Attention has also been given to fertilizer experimentation, new varieties adaptable to Indonesian condition, and education and extension service. The government has, for instance, established "paddy centers" which provided improved seeds, fertilizer, pesticides and cash to be repaid in kind at harvest time. Another policy was pursued in 1959-1961 based on a mass-scale agricultural demonstration. Finally, in mid-1974, a new approach in extension work was tried under the name of "BIMAS". This approach was used during the first Five Year Development Plan (1969-1974) in the production

of rice and will be conducted again in the Second Five Year Development Plan (1974-1979).

The Bimas program in rice production has been pursued to increase production of other cereals, poultry production, and some commercial crops. Priority is being given to fisheries as a good source of protein, both marine as well as inland fisheries. As regard to legumes, soybeans, peanuts and coconuts, efforts have been made to stimulate production.

F. The Role of Corn in Indonesian Nutrition

A major significance of corn in nutrition is in protein complementation (Table 89). It is based on the well-known fact that it is possible to supplement the missing amino acids in plant proteins by combining different plant foods.

The Applied Nutrition Program (ANP) in Indonesia is essentially an effort in nutrition education. One of the shortcomings of ANP during the First Five Year Development Plan (1969-1974) was that ANP did not play a part in the overall framework of a community development. Moreover, social organizations at the village level and social consciousness have not yet been developed in the community.

A more integrated nutrition project will be established in the Second Five-Year Development Plan. One of the activities is strengthening nutritional supplementation program emphasizing local

food combinations of high protein value. Corn and other vegetables may easily be grown in home garden for home consumption.

Table 89

Illustration of Protein Complementation

	Usable Protein Available to the Body		
	Eaten Separately	Eaten Together	Percent Increase
1) Greengram + rice (100 grams of rice and 50 grams of greengrams)	11.25 grams	16.07 grams	32
2) Beans + corn (100 grams of corn and 50 grams of red kidneybeans)	2.102*	3.202*	50
3) Beans + sorghum (100 grams of sorghum and 50 grams of red kidneybeans)	13.00	19.02	46
4) Soybeans + sorghum (100 grams of sorghum and 50 grams of soybeans)	19.60	23.08	21

* The usable protein equivalent to that of beef.

Source: Proposal for an Integrated Nutrition Project, CARE-Indonesia

An estimate of per capita consumption and supply analysis for corn and other crop is shown in Table 90. Appendix A shows the Indonesian food policy program.

Table 90

Food Supply Analysis, 1971 Population: 118.5 Millions
(1000 tons)

Cereals	Output	Gross Import	Supply	Gross Export	Domestic Utilization						Per Capita Consumption (kg./year)
					Total	Feed	Seed	Food Manu-facture	Waste	Food	
1. Paddy (dry stalk)	18786	-	18786	-	18786	376	345	17314	751	-	-
2. Rice	11774	537	12311	-	12311	-	-	-	246	12065	101.81
3. Wheatfour	-	348	348	-	348	-	-	-	-	348	294
4. Corn	2632	-	2632	213	2419	53	69	-	53	2244	33.94
5. Roots and tubers	-	-	-	-	-	-	-	-	-	-	-
6. Cassava	10042	-	10042	113	9929	201	-	-	1004	8724	73.62
7. Sweet Potatoes	2154	-	2154	-	2154	-	-	-	215	1939	16.36

Source: Directorate General of Agriculture, Ministry of Agriculture

Note: Feed used = 2% of production

Seed used = paddy 40 kg/hectare
corn 25 kg/hectare

Wastage: Paddy = 4% of production
Rice = 2% of supply
Corn = 2% of production

Appendix A

Food Policy of Indonesia

Problem of Nutrition in Indonesia

Three Main Deficiencies:

1. Protein-calorie malnutrition (PCM)
   a. kwashiorkor (older than one year of age)
   b. marasmus (less than one year of age)
   c. Retarded growth and development
   d. infectious disease
2. Nutritional anemia (Predominant type is iron deficiency or anemia)
3. Vitamin deficiencies (particularly Xerophtalmia from avitaminosis A and rickets). Beri-beri is no longer a problem.

Note: Xeropht lmia is usually associated with PCM in children under 2 years of age.

Ultimate Goals of the Nutrition Effort

1. Adequately feed the Indonesian population and improved the nutritional condition of the Indonesian people.
2. Improve the eating habits of the Indonesians.

Methods and Strategies to Solve the Nutrition Problem

A. Operational Strategy

1. Determine the desired level of health.
2. Find out the amount and quality of food which is needed by an individual (Nutrients instead of foodstuffs).
3. Translate the daily nutrient allowances back to foodstuffs. Rice is the source of calories and fish is the source of protein. This should not be too different with the present dietary pattern.
4. Outline the program of food production (Food Policy).

B. Action Programs

1. Education
   - training programs pamphlets, mobile nutrition outfits to move from village to village.
   - educate grade school, intermediate, college students on correct eating habits and food planning.
2. Production
   - intensification of Bimas program
   - improve commercial livestock production, especially poultry and cattle
   - provide credit appropriation for programs on food production
   - encourage foreign investment for long-term agricultural projects.

Appendix A (continued)

C. Family Planning

- applied program on family planning and control
- education of housewives and the people on the importance of family planning to provide a better future for their children

Appendix A (continued)

Agencies To Be Involved in Nutrition Program

CARE nutrition program in I donesia feels the need for broad-based action programs involving nutrition supplementation, food production and nutrition education. The proposed integrated nutrition project will be coordinated with current and planned nutrition programs of the Government of Indonesia such as the Applied Nutrition Program (ANP) and the Family Nutrition Improvement Program (FNIP). The following is a list of possible participants for the project proposed:

1. Ministry of Health

   Directorate of Nutrition, Jakarta
   Nutrition Research Institute, Bogor

2. Ministry of Agriculture

   Directorate for Food Development
   Directorate of Plantations & Plantation Groups

3. Ministry of Education

   Bogor Agricultural University
   Division of Family Life Education

4. Provincial Government

   Provincial Health, Agricultural Health, Education Services
   Provincial Applied Nutrition Board

5. The National Planning Board

6. Inter-Ministerial Committee for the Improvement of Nutrition

7. CARE

Source: Proposal for An Integrated Nutrition Project, CARE-Indonesia

CHAPTER VII. FACILITATIVE AND DEVELOPMENTAL COORDINATION: THE GOVERNMENT PROGRAMS

A. The Role of the Agricultural Sector in the Indonesian National Development

Agriculture plays a predominant role in Indonesia's economy. The 1971 population census indicated that 82% of the 118 million population stay in the rural areas and 62% of the total labor force is employed in agriculture.[1/] Agricultural products accounted for 44% of the national income in 1971 and supplied 54% of export earnings.[2/]

Realizing the importance of agriculture, the Indonesian government has launched the First and the Second Five-Year Development (PELITA II) with agriculture as the first priority in both plans.

B. The Government Development Priorities

B.1 Results of Agricultural Program during PELITA I

Increasing food and export crop production is aimed at food self-sufficiency, providing raw materials for industries, and generate foreign exchange. In implementing the program, the following objectives are established.

1/ 1971 Population Census, CBS.

2/ Statistical Pocketbook of Indonesia, 1970 and 1971, CBS

1. Increasing farmers' income
2. Equalizing income distribution
3. Providing job opportunities

In PELITA I, perhaps, rice production from 1968 to 1973 increased on the average 4.4% 3/ per year which was at least higher than the population growth. In other words, the rice consumption per capita in 1973 was higher than in 1968.

As shown in Table 90 , the increase in rice production was due mainly to increased hectarage. This was the result of the BIMAS and INMAS rice intensification programs. However, the 1973 production of "palawija crops" such as corn, tuber crops, and legumes was lower than in 1968 because of the decrease in areas cultivated to these crops. The rice intensification program made it more profitable for the farmers to plant rice instead of other secondary crops.

The production of "smallholders industrial crops" was generally increasing, except tea and sugar. The production in 1973 of coffee increased by 35%, and tobacco by 20% over 1968. Coconut and clove production remained the same while the production of pepper and kapok decreased. For estate crops, the production of rubber was increased by 22%, palm oil by 65%, tea by 16% and sugar by 64%.

3/ See: PELITA II.

Livestock and fishery showed the same general trend in production. The production of meat was increased by 20%, milk by 36% and eggs by 70%. The average yearly increase for ocean fishery was 4%. However, there was no increase in the production of inland fishery. In Kalimantan, the decrease in fish production was attributed to a switch of labor from inland fishery to the more attractive logging industry. In Java, inland fish production was limited because of the widespread use of insecticides.

A spectacular increase was observed in lumber production. In 1968, the production was 8 million cubic meters. At the end of PELITA I (1973), the total production was more than double because of the entry of local and foreign investors in forestry.

B.2 Export of Agricultural Products

Total volume and value of agricultural exports are indicated in Table 91 . In general, during PELITA I the total volume and value increased. Significant increases are indicated in fishery and forestry in which the 1973 value is more than 10 times the value in 1969. This increase in value of export is due to the increase in production and the higher price in the international market.

B.3 Development Priorities

PELITA II is still the first priority in the total development program. Opportunities still exist in increasing food production to increase farm income and food self-sufficiency.

See Table 91.2 and Figure J for aggregate exports by sector.

Table 91.1

Export of Agricultural Products

Item	Unit (1,000)	1968	1969	1970	1971	1972	1973**
Corn	ton	91.0	155.0	254.0	213.0	78.0	54.4
Gaplek	ton	162.0	304.0	312.0	452.0	333.3	28.2
Rubber	ton	770.9	833.3	755.7	719.5	740.6	669.9
Copra	ton	217.0	157.0	185.0	63.7	42.0	65.0
Tobacco	ton	8.2	13.2	16.9	19.5	30.1	30.7
Coffee	ton	84.7	120.9	94.3	65.9	89.4	73.4
Oil Palm	ton	52.4	193.4	187.0	219.7	275.1	191.1
Pepper	ton	24.6	16.7	2.6	23.6	24.4	18.7
Tea	ton	20.2	29.5	35.5	40.5	39.3	34.4
Buffaloes	head	18.0	18.7	34.3	24.3	19.4	23.3
Cattle	head	34.5	38.3	53.0	51.4	52.4	57.0
Shrimps	ton	2.9	5.6	5.9	14.1	21.6	25.3
Fish	ton	3.4	2.3	1.2	3.5	3.7	4.3
Logs	m^3	1,239.5	3,595.8	7,412.0	10,760.5	13,520.0	13,315.0

*Preliminary figures

**For industrial crop and lumbers up to September. All estimated figures.

Source: PELITA II, Volume II, p. 27.

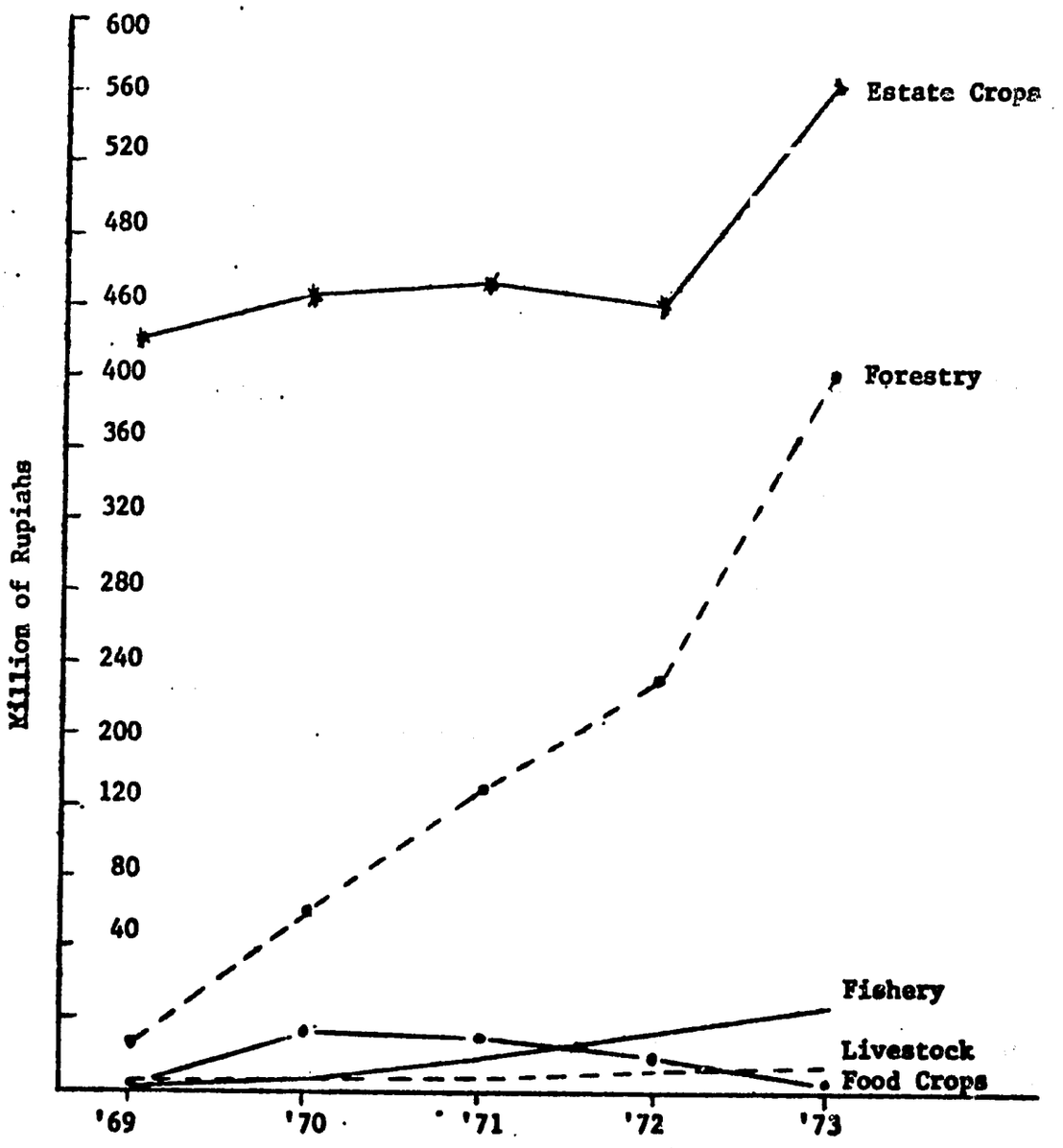
Table 91.2

Value of Agricultural Exports in Indonesia, 1969-1973
(Million US$)

	1969	1970	1971	1972	1973
Food crops	2.5	32.9	29.7	18.4	5.1
Estate crops	421	446.9	453.0	443.3	567.7
Livestock	4.0	7.2	7.0	12.0	13.5
Fishery	2.4	7.0	19.0	33.2	48.6
Forestry	26.8	100.5	168.5	230.4	400.3

Figure J

Value of Agricultural Exports
1969-1973



In the case of palawija, the objectives are increased food production, development of livestock industry and increased exports.

The level of protein consumption among Indonesians is lower than the recommended level. To overcome this situation, attention will be given to promote the livestock and fishery industries. Ninety-eight percent of the fishermen still use primitive equipment due to lack of capital for investments and operations. Marketing of the produce poses another problem.

To increase the estate production of industrial crops, emphasis will be given on increasing yield per hectare. Small industrial crop farmers will be encouraged to replant the old rubber trees and coconuts. As with other crops, marketing is still inefficient and disorganized.

In forestry, the cutting and marketing of lumber still need improvement. The development of industries using lumber as raw materials will be encouraged. The expansion of lumber production should go hand in hand with the conservation of natural resources and reforestation. Coordination between forestry and irrigation will be strenthened to make efficient use of available water.

C. Specific Agricultural Improvement Programs

C.1 Food Crops

Increased food crop production is hoped to increase farmers income, supply enough food for the population, provide raw materials for industry, and create more job opportunities. The food production

programs would be implemented through the production and distribution of high-yielding varieties, facilitating credit, improvement of the availability and distribution of agricultural inputs, and providing the necessary facilities for increasing production.

C.1.a Rice

Demonstration of the use of high-yielding varieties will be continued. Every year during PELITA II, a total of 12,500 hectares throughout Indonesia will be planted with high-yielding varieties for demonstration purposes. In areas where there are many progressive farmers, private growers will be encouraged to engage in seed production ventures. In other areas the seed farms of extension service agencies operating in the provinces will be used for seed production. Seed quality will be controlled through seed certification by the Seed Certification Division of the Directorate of Production.

Regarding the availability and distribution of fertilizer the projected need of fertilizer during PELITA II is given in Table 92. During PELITA I, the supply and distribution of fertilizer are two major problems. The projected fertilizer supply during PELITA II is given in Table 93. The table indicates that although the existing fertilizer plants would be expanded, Indonesia would still rely on the importation of fertilizers to satisfy the needs of the agricultural development program.

The number of retail shops would be increased to improve fertilizer distribution. Also, the capacity of village unit banks to supply credit to buy fertilizer should be intensified.

Table 92

Projected Fertilizer Need for Food Crops During PELITA II, 1974-1978 (10^3 tons)

Year	Urea*	T.S.P.*	Potassium Sulfate**
1974	1,041	342	3
1975	1,036	394	6
1976	1,467	450	15
1977	1,677	501	25
1978	1,834	526	27

Source: PELITA II, Volume II, p. 39

* For rice and secondary crops

** For upland rice

Table 93

Projected National Fertilizer Production During PELITA II (ton)

Year	Urea	T.S.P.
1974	188,913	-
1975	400,000	-
1976	820,000	52,000
1977	1,292,000	167,000
1978	2,084,000	254,000

Table 94 shows that the intensification program is not limited to irrigated rice during PELITA II. Upland rice, "gogo rancah", "pasang surut", and "lebank" rice are also supported in the intensification program.

Table 94

Rice Intensification Program (10^3 Ha)

Year	New Intensification	Usual Intensification	Upland	Total Intensification	Intensification + Non-intensification
1974	3,306	1,000	20	4,326	8,464
1975	3,666	950	50	4,666	8,530
1976	4,095	900	100	5,095	8,599
1977	4,444	900	200	5,544	8,736
1978	4,832	900	350	6,082	8,982

In 1974, about 4.3 million of the targeted area of 8.58 million hectares is expected to be covered by the intensification program for rice.

Expansion of rice areas depends on the availability of irrigation. Table 95 indicates that in 1974, 69,000 hectares of irrigated rice fields would be established and by the end of PELITA II, 950 thousand hectares more would be irrigated.

Table 95

Area of Irrigation Development in PELITA II (Ha)

Program	1974/1975	PELITA II
Improvement of irrigation	233,210	834,698
Expansion of irrigation	69,000	950,000

During PELITA II, foreign investors will be encouraged to engage in commercial rice production in the so-called "rice estates." Investments include the cost of irrigation, road and other facilities. The government will give incentives in terms of taxation, facilities, and the right to use the land in line with existing regulations of the government. They are allowed to engage in the production of other food crops. It should be pointed out that commercial rice production would not compete with the small farmers. The rice estate will be placed in areas with low population density, and in areas with some potential for irrigation. They would also conform with existing programs of regional development and transmigration. Table 96 shows the actual and expected production during Pelita I and II.

C.1.b Other Crops

Production of secondary crops plays an important role as a source of farmers' income, especially when irrigation facilities are not available. However, during PELITA I, production and consumption of the secondary crops decreased. In line with increasing

Table 96
Actual and Expected Rice Production in Indonesia, PELITA I and PELITA II

Year	Production		Increase in Production Through Intensification				Total Production	Increase in Production	
			New		Total				
	New	Total	Ton	%	Ton	%		Ton	%
1968	-	-	-	-	-	-	11,666	-	-
1969	1,153	3,783	-	-	-	-	12,249	583	5.0
1970	1,803	4,312	650	56.4	529	14.0	13,140	891	7.3
1971	2,656	5,817	853	47.3	1,505	34.9	13,724	584	4.4
1972	3,571	7,170	915	34.5	1,353	23.3	13,305	-419	-3.1
1973	5,839	9,382	2,268	63.5	2,212	30.9	14,455	1,150	8.6
Average	3,004	6,092	1,172	39.0	1,400	23.0	13,089	557	4.3
1973	5,839	9,382	-	-	-	-	14,455	-	-
1974	8,531	10,466	2,692	46.1	1,084	11.6	15,032	577	4.0
1975	9,530	11,431	999	11.7	965	9.2	15,633	601	4.0
1976	10,765	12,653	1,235	13.0	1,222	10.7	16,383	750	4.8
1977	11,813	13,844	1,048	9.7	1,191	9.4	17,235	852	5.2
1978	12,984	15,027	1,171	9.9	1,183	8.5	18,183	948	5.5
Average	9,910	12,131	1,429	14.4	1,129	9.3	16,154	746	4.6

production, the use of corn, sorghum, tuber crops and legumes are encouraged.

The implementation of the palawija program would be similar to rice, namely, through BIMAS (with credit) and INMAS (without credit) programs. The intensification program includes an extension program and the supply of fertilizer and pesticides. For farmers who want to join the program, credit in the form of soft loans are provided. The use of HYV is promoted and research technology at the farm level is given high priority.

The intensification program for secondary crops in PELITA II is indicated in Table 97.

Table 97

Targeted Areas for Intensification of Secondary Crops, 1974-1978 (1000 ha)

Year	Corn	Sorghum	Cassava	Soybean	Peanut	Mungbean
1974	290	10	1	75	22	3
1975	370	30	10	150	44	6
1976	100	60	50	200	70	10
1977	950	80	100	240	94	16
1978	1,400	100	200	270	110	20

As a result of the intensification program during PELITA II, corn production is expected to increase from 2.6 million tons in 1971 to 4.15 million tons in 1978. Sorghum production is hoped to increase from 55 to 240 thousand tons; cassava, from 9.9 to 12.75

million tons; soybean, from 495 to 670 thousand tons; peanut, from 275 to 355 thousand tons; and mungbean, from 65 to 90 thousand tons. Tables 98 and 99 show the intensification program area coverage and estimated production.

C.2 Estate Crops

During PELITA,II different approaches will be used to increase production for smallholder estate crops, private estate plantation, and government estate plantation.

For smallholder estate crops the following programs will be carried out.

1) Increase extension activities
2) Facilitate credit
3) Pest and disease control
4) Crop diversification and
5) Increase facilities for processing

The government estate crop plantation will aim at the following:

1) Increase yield per hectare at less lost
2) Develop and increase efficiency in processing and
3) Expand foreign market.

C.2.a Rubber

Rubber is produced by government and private plantations and small farmers. The target production for 1974 is 855 thousand tons compared to 829.3 thousand tons in 1973.

Table 98

Secondary Crop Intensification Program in Indonesia
(In Hectares)

Crops	Bimas (Has)	Inmas (Has)	Total (Has)
MT. 1974			
1. Corn	87,653	18,200	103,855
2. Sorghum	1,200	2,700	3,900
3. Cassava	-	-	-
4. Soybeans	37,950	14,490	52,440
5. Peanut	19,700	4,200	23,900
6. Mungbean	1,900	700	2,600
Total -	148,405 (78.6%)	40,290 (21.4%)	188,695 (100%)
MT. 1974/1975			
1. Corn	176,535	9,525	186,060
2. Sorghum	3,400	2,700	6,100
3. Cassava	6,500	400	6,900
4. Soybean	16,055	6,505	22,560
5. Peanut	15,285	-	15,285
6. Mungbean	300	100	400
Total -	218,075 (91.9%)	19,230 (8.1%)	237,305 (100%)
MT. 1975/76			
1. Corn	264,190	27,723	291,915
2. Sorghum	4,600	3,400	10,000
3. Cassava	6,500	400	6,900
4. Soybean	54,005	20,995	75,000
5. Peanut	34,985	4,200	39,185
6. Mungbean	2,200	800	3,000
Total -	366,480 (86%)	59,520 (14%)	426,000 (100%)

Table 99

Expected Production of Secondary Crops in Indonesia, PELITA II

Year	Production			Increase in Production					
	Corn & Sorghum	Tubers	Legumes	Corn & Sorghum		Tubers		Legumes	
				Ha.	%	Ha.	%	Ha.	%
Intensification Program									
1974	569	13	113	-	-	-	-	-	-
1975	765	138	231	196	34.4	125	961.5	118	104.4
1976	1,282	710	327	517	67.6	572	414.5	96	41.6
1977	2,022	1,450	417	740	57.7	740	104.2	90	27.5
1978	3,006	3,000	484	984	48.7	1,550	106.9	67	16.1
Average	1,529	1,062	314	609	39.8	747	70.3	93	29.6
Intensification + Non-Intensification									
1974	2,669	12,006	839	-	-	-	-	-	-
1975	2,574	12,585	917	111-95	-3.6	579	4.8	78	9.3
1976	3,240	13,245	991	666	25.9	660	5.2	74	8.1
1977	3,420	14,115	1,048	180	5.6	870	6.6	57	5.8
1978	4,390	15,150	1,118	970	28.4	1,035	7.3	70	6.7
Average	3,259	13,420	983	430	13.2	786	5.9	70	7.1

The program for rubber involves replanting of old and non-productive rubber trees and improvement in processing. Since the yield of small rubber farmers is very low, special emphasis will be given on better cultural practices together with credit facilities.

C.2.b Oil Palm

At present, oil palm is produced by government as well as by private estates. During PELITA II, increased production is hoped for through replanting and yield improvements. The present yield of private palm oil estates is far below the yield obtained by government estate.

By 1978, it is expected that the total productive oil palm areas will increase from 82.2 thousand hectares in 1974 to 113.3 thousand hectares in 1978, with a yield of 2.98 and 3.29 tons per hectare, respectively.

C.2.c Tea

Tea is produced by government, private, and smallholder plantations. During PELITA II, the production is expected to increase at 2.1% per year. This would be achieved by increasing yield per hectare and expanding land area of 8.1 thousand hectares.

C.2.d Sugar

In 1973, Indonesia imported 162 thousand tons of sugar to meet domestic demand. With increasing population and income, the

total sugar consumption is expected to increase. The production plan for sugar during PELITA II is given in Table 100.

Table 100

Projected Yield of Sugar, 1974-1978

Year	Production (10^3 ton)	Yield (ton/ha)
1974	1,089	11.3
1975	1,194	11.6
1976	1,236	11.9
1977	1,319	12.2
1978	1,356	12.5

The strategy for sugar includes improving productivity, expanding sugarcane area, development of sugarcane planting outside Java, intensification and promoting "ratoon systems", increasing refinery efficiency, and rehabilitating and establishing new refineries.

C.2.e Coffee

Coffee production in 1971 was 196 thousand tons. From this amount, 90% was produced by smallholders and the rest was from estates. The expected production increase per year is 3%.

C.2.f Coconut

About 99% of the total 1.85 million hectares coconut area is cultivated by small farmers. The rest, comprising about 15

thousand hectares, is maintained by coconut estates. In 1972, the total production was 1,216 thousand tons of copra.

To increase the production by a project of 2% a year, better cultural practices such as controlling pest and diseases and fertilizer application have to be carried out. Furthermore, replanting of young coconut will be encouraged through extension, credit, and distribution of planting materials.

C.2.g Cotton

During PELITA II, cotton production will be encouraged. The area is expected to expand from nine thousand hectares in 1974 to 70,000 hectares in 1978. Currently, almost all the cotton supply of Indonesia is imported.

C.2.h Other Crops

The production of other crops, like tobacco, pepper, clove, nutmeg, rosella, cacao, cassiavera and kapok will also be encouraged to increase the income of the farmers. See Table 101 for expected estate crop production from 1973-1978.

C.3 Livestock

Present production of meat, eggs, and milk is not enough to meet domestic requirements. It is the government's policy to increase the yield of meat, eggs, and milk by 5%, 7% and 11% per year, respectively.

Table 101

Expected Production of Estate Crops in Indonesia
1973, 1974-78 (ton)

Crops	1973	1974	1978
Rubber	829,300	855,000	935,000
Palm oil	300,150	342,000	518,000
Copra	1,270,000	1,244,000	1,320,000
Coffee	210,300	215,000	248,800
Tea	54,400	79,200	87,300
Cloves	15,400	19,200	27,600
Pepper	28,000	27,300	32,000
Cotton	3,000	4,600	30,000
Tobacco	68,150	75,800	85,300
Pala	9,600	11,800	13,800
Cinnamon	6,380	8,800	10,400
Kapok	26,000	29,000	37,000
Cacao	2,000	2,130	2,400
Sugar	991,600	1,089,000	2,356,000
Fiber (Rosella/Kenaf)	9,900	15,200	20,700

The program for meat production covers areas with low population density such as Aceh, Sumbawa, East Nusa Tenggara and South Sulawesi. In these regions, farmers will be encouraged to establish ranches. The native herd will be upgraded through artificial insemination. Recommended grasses will be multiplied and distributed. Marketing system will be improved. In areas with high population density, emphasis will be given on improving poultry production.

To increase poultry and egg production in urban areas, the emphasis will be in promoting the use of high-yielding layers and broilers. Extension education will be provided by the government. In support of the program, aid will be also given to feed mills, hatcheries, and chemical distributors. In the rural areas, the introduction of hybrid males will be used to upgrade the local stocks. Veterinary services will be improved.

To improve milk production, the government will promote the use of superior breeding stock. Artificial insemination will be intensified. The use of high-yielding grasses for feed will be encouraged.

C.4 Fishery

It is expected that during PELITA II, fish production will increase by 4% a year and fish export will increase by 25% through the rehabilitation and development of existing infrastructure and improvement of the marketing system.

Development of the inland fishing ponds will be undertaken in Java, South Sumatra, and Kalimantan. Motorized fishing will be increased. To facilitate marketing, auction markets will be established and storage facilities provided.

C.5 Forestry

By the end of PELITA II, timber production is expected to be 27 million cubic meters. Export is expected to increase to 20 million cubic meters. Foreign technicians are expected to be phased out gradually during this period.

CHAPTER VIII. THE EDUCATION AND RESEARCH DIMENSIONS

A. Trends in General Education

One of the most serious problems Indonesia faced when independence was proclaimed in 1945 was the reconstruction of educational system. Education and vocational training had been neglected by the Dutch colonizers. In 1945, it was estimated that there were less than one thousand college graduates all over the country and the literacy rate was less than 10%.

Remarkable achievement has been made in the efforts of Indonesia to improve its educational system. Literacy has been raised to nearly 60% today. Enrolment in primary schools has increased fourfold from 1950 to 1960 while the secondary school attendance has expanded fifteen fold during the same period. University education has similarly expanded so that in 1960 almost one out of hundred persons of college age was pursuing a degree.

The government's budget for education has been increased substantially. The 1961 budget for education, stated in the Eight-Year Plan, was only about 4% of the total government expenditures. The most dramatic expansion in allocations of the government budget for education was embodied in the Second Five-Year Development Plan which was in 1969 wherein the government spent about 6.4% of total development expenditures for education. The second plan contemplates an allocation of about 10%. This represents

Table 102

School Attendance by Level of Education, Indonesia, 1950-1970

	1950	1960	1970
Literacy Rate (percent)	10	55.0	59.5
Primary school enrolment (percent of primary school age attended school)	20	49.0	63.3
Secondary school enrolment (percent of the 12-17 years group attended school)	0.3	4.0	12.8
College enrolment (percent of the college age group attended college)	0.4	0.8	1.9

Source: Central Bureau of Statistics

the largest increase of all sectors in the plan. Of this planned expenditure in education, 38% is allocated to primary education, 29% to junior and senior high school, and 12 percent for higher education. The rest is to be devoted to vocational training as well as youth development programs.

The educational objectives in Indonesia are clearly stated in the Five-Year Development Plan, namely:

1. To satisfy the manpower needs of the community
2. To link the educational sector with the needs of other sectors, such as agriculture, small and light industry, tourism, and
3. To make the school an integral part in the life of the community

Facilities for higher education were first offered in 1920 when the College of Engineering at Bandung was established. Between

1920 to 1971, six institutions of higher learning were established, all located in the densely populated island of Java as follows.

1. College of Engineering in Bandung (1920)
2. College of Law in Jakarta (1924)
3. College of Medicine in Jakarta (1927)
4. College of Arts in Jakarta (1940)
5. The first class in Agricultural Higher Education, attached to the College of Medicine in Jakarta (1941)

Only a small percentage of Indonesians was permitted to study in college. After independence, demand for higher education increased. The first university established after independence was the University of Gadjah Mada in Jogjakarta (1949), followed by the University of Indonesia (1950) in Jakarta. Up till 1965, 28 universities and some institutions of Teachers Training were established. In addition, other private institutions of higher education were established. In the beginning, some forms of academic activities were under the control of several ministries, such as the Department of Public Works, Department of Health, and the Department of Internal Affairs.

Admittedly, the quality of education suffered in the process of proliferation. Many schools were poorly equipped, and staff members were inadequately trained. Thus, some faculty members of higher academic institutions have been assigned by the government to upgrade the faculties of other schools in the same disciplines. A further step was the grouping of these feeder faculties into five

Table 103

Schools and School Enrolment in Indonesia, 1950-1970

Education	1950/51	1959/60	1970*
Elementary Schools			
Number	24,775	37,336	64,040
Enrolment	4,977,304	8,552,476	13,395,000
Secondary Schools			
Number	953	7,007	9,599
Enrolment	139,353	1,071,341	1,910,380
Higher Education Institutions			
Number	77	278	58**
Enrolment	1,164	49,773	236,892

*Beginning 1967, academic calendar started in January.

**Not included are private higher education institutions and Ministerial Academics. The figures of both for 1967 were respectively 124 and 92.

different consortia. One of them is the Consortium for Agricultural Sciences. An Advisory Council on Higher Education was also set up to advise the Minister on general policy matters. Finally, a Board was established dealing exclusively with matters relating to private universities.

B. Agricultural Education

Many of the institutions serving agriculture in Indonesia were established before World War II. The first senior agricultural high school was opened in Bogor in 1906. This was the highest

agricultural institute for over 40 years. After World War II, the number of such schools increased and spread throughout the country. Eleven schools were placed under the Department of Agriculture and the others were placed under the provincial governments. These schools provided three years of agricultural training after junior high school.

In addition to these agricultural high schools, similar schools specializing in forestry, animal husbandry and fisheries were set up. A new concept is now being adopted to change the curriculum. Efforts are now being made to make only one agricultural high school curriculum without any major field or specialization. This concept is now being carried out as a pilot project. In the future there will be specialized extension service personnel for animal husbandry, food crops, veterinary affairs, and inland fisheries.

Higher education in agriculture started in 1940. During this time hundreds of agriculturists who graduated from institutions abroad were recruited, including about ten Indonesians. In the first year of the agriculture curriculum, which was attached to the College of Medicine in Jakarta, the following courses were offered: Botany, Zoology, Mathematics, Chemistry, Meteorology, Climatology, Minerology, and General Economics.

The number of agricultural faculties has rapidly increased since 1950. By 1970, the number of agricultural faculties was

as follows.

Agriculture	22	Forestry	5
Veterinary Medicine	2	Technology & Mechanization	2
Animal Husbandry	13	Fisheries	5

Two institutions of higher agricultural education, the Bogor Agricultural University and the University of Gadjah Mada, were considered as feeder institutions. They were supposed to provide technical assistance to the other agricultural faculties. The existing system of education with a 5-year curriculum has been adopted since the establishment of the first agricultural higher education. A four-year program is now being carried out as a pilot project.

The main function of these agricultural faculties is education. Therefore, research is one only for teaching purposes and not related to the national effort. However, in some provinces, many agricultural faculties cooperate with the provincial government in the area of research and planning for the regional development. Quite often, agricultural faculties in the provinces are ragarded as research institutions. This is true especially when the agricultural research institutions are poorly equipped or under-staffed.

C. Agricultural Research and Extension Education

Agricultural research in Indonesia has been carried out by research institutions of the Ministry of Agriculture independent of the

research operation of institutions of higher education. The research institutions were established long before institutions of higher agricultural education were founded. For a long time there was no coordination in the exchange of information between research institutes and institutions of higher education. There were other institutions outside the Ministry of Agriculture, such as the Central Bureau of Statistics, and the Indonesian Scientific Council which also conducted research in agriculture.

The Five-Year Development Plan gives high priority to the development of the agricultural sector. The improvement of farm family income level of living and increased production will free large amounts of foreign exchange spent for food imports and which could be used for the development of other sectors. Realizing that the present agricultural research is not sufficient to meet the present and future needs, research programs are now being coordinated with programs in education and extension since the three activities are mutually interdependent.

The Directorate General of Agriculture has the largest extension personnel and the most widespread system extended down to the village level. The extension services of the other Directorate Generals usually do not research below the regency level.

The history of extension service in Indonesia dated long before World War II. Remarkable achievements have been made in the extension services. The 1973-1974 classification of activities

were as follows.

Number of demonstration plot	5,682
Number of demonstration farms	636
Frequency of agricultural courses held for the farmers	1,500
Frequency of courses held for the extension workers	233

Table 104

Enrolment Distribution by Levels and Sectors in Indonesia
1969-1970

	Percentage of Total Enrolment			
	1969		1970	
	Public	Private	Public	Private
Basic Education				
Kindergarten	0.53	99.47	10.30	89.70
Elementary School	84.84	15.16	82.82	17.18
General Education				
Junior High School	30.44	69.56	30.09	69.91
Senior High School	42.91	57.09	35.77	64.23
Teacher Education	64.52	35.48	55.92	44.08
Technological Education	81.31	18.69	64.48	35.52
Other Vocational Education				
Junior Level	70.40	29.60	56.38	43.62
Senior Level	56.78	43.22	41.65	58.35
Higher Education	n.a.	n.a.	57.78	42.21*

*Including Ministerial Staff Academics

Source: Central Bureau of Statistics, 1970 and 1971, p. 65 and 78

B.1 Minimum Curricula for the Faculty of Agriculture

For purposes of uniformity in the curriculum of agricultural higher education, ministerial decrees have been issued about minimum curricula. These minimum curricula were designed by the consortium of agricultural science. The minimum curriculum for the faculty of agriculture is shown below.

Field	Preparatory Study		Undergraduate Graduate		Total Units
Mental/Physical					12
Language/Social Economics	English	0-2	Rural Sociology	2-2	
	Economics	3-0	Agric. Economics	2-1	8-5
			Agric. Ext.	1-0	
Biology/Zoology	Anatomy/ Morphology		Plant Physiology	2-2	
			Agric. Micro-biology	2-2	11-10
	Taxonomy	2-2	Ecology/Plant Geography	1-2	
	Zoology/ Biology	2-2	Genetics	2-0	
Physics/Chemistry	Physics	3-3	Agric. Meteo-rology	2-1	
	Inorganic Chemistry	3-3			11-8
	Organic Chemistry/ Biochem.	3-1			
Mathematics	Mathematics	3-0	Statistics	2-2	7-4
			Exp. Design	2-2	
Special Field	Introduction to Agric.	2-0	Agronomy	6-4	Major 6 units
			Agric. Tools	2-1	Minor 3 units
			Entomology/ Phytopathology	3-2	Seminar 6 units
			Plant Breeding	2-2	Labwork 20 units
			Soil Fertilization	4-4	Thesis 12 units
			Irrigation	2-1	

Note: The remaining 60 units can be filled by elective courses justified by local needs, resources and conditions.

C. Agricultural Research and Extension

In Indonesian agriculture, corn, sorghum, soybean, peanuts and cassava are grown by farmers in mixed culture with one another and are called "palawija" or upland crops. A research center for palawija would be located in a site near Bedali, East Java. The selection is based on the importance of upland crops in that area and the availability of irrigation water. The area also represents a transition where palawija crops are grown in rotation with rice and with each other. Furthermore, the place is very accessible to other parts of Indonesia by air, rail and road. Linkages with Brawijaya University and at Pandaan in Bedali are existent and would be strengthened. This center would be a part of the Central Research Institute of Agriculture (CRIA) which would have primary responsibility for nationwide research on upland crops.

Table 105 shows the research and extension centers for upland crops.

Table 105

Research and Extension Centers

CRIA Centers		Extension Centers for Adaptive Trials and Seed Multiplication	
1. Muneng	East Java	1. Bedali (Pandaan)	East Java
2. Mojesari	East Java	2. Three additional Centers	East Java
3. Genteng	East Java	3. Pamekasan	Madura
4. Djakenan	Central Java	4. Tegal	Central Java
5. Cikeumenh	West Java	5. Pati	Central Java
6. Sukamandi	West Java	6. Soropadan	Central Java

7. Bontobili	South Sulawesi	7. Wonogiri	Central Java
8. Taman Bogo	Lampung Sumatra	8. Bandjarnegoro	Central Java
9. Bandar Buat	West Sumatra	9. Kebumen	Central Java
10. Rambatan Tanah Datar	North Sumatra	10. Klumbon	West Java
11. Kampar	Central Sumatra	11. Bulukumba	South Sulawesi
		12. Balitang	South Sumatra
		13. Tegineneng	Lampung
		14. Tanjung Morawa	North Sumatra
		15. Peninjauan	Bali

The function(s) of the different centers are as follows.

Center	Functions
Main Center	1. Leadership in commodity oriented research and multiple cropping 2. Coordination of research trials conducted throughout the country. 3. Information and training center for research and principal extension staff
Research centers	1. Conduct of coordinated research trials organized by research staff at the main center after annual or semi-annual meetings of research staff
Extension centers	1. Adaptive trials of a few promising crop varieties identified in coordinated trials 2. Seed multiplication center for new palawija crops varieties 3. Organize on-farm trials for palawija crops 4. Organize pilot palawija BIMAS programs with new varieties and practices

The development of a research base with competent staff and well planned research programs on a commodity basis is also recognized. In addition, an active group of stations, experimental farms, seed multiplication program, and an integrated and an extension program which can quickly deliver the new technology to the farmers would be established.

Table 106 shows the total staff requirements of the center. There will also be a 5-year staff development program consisting of graduate and short-term training programs.

Table 106
Category and Grouping: Professional, Technical, Clerical/Field

Category and Grouping	Professional	Technical	Clerical/Field
A. Administration:			
Director	1 + 1*	1	-
Associate Director	1	1	-
Research Coordinator	1	1	-
Secretary General	1	1	-
Farm Superintendent	1 + 1**	3	50
Farm Service Center	-	8	-
Accountant	-	2	-
Clerical	-	8	9
Photography) Artist)	-	2	-
Library-Information	1	4	1
Extension Specialist	3	-	-
Statistician-Economist	1	2	-
Economist-Farm management	1	2	-
Cafeteria	-	2	5
	11	37	65
B. Crop Improvement:			
Breeder, Maize	1 + 1*	6	4
Breeder, Sorghum	1 + 1*	6	4
Breeder, Grain Legumes	1 + 1***	6	4
Breeder, Tubers	1	3	2
Pathologist	2 + 1*	6	4
Entomologist	2 + 1*	6	4
Chemist	1	4	-
Physiologist	1	4	2
	10	41	24
C. Production:			
Agronomist, Cereals	1 + 1*	4	4
Agronomist, Grain Legumes	1	4	4
Agronomist, Tubercrops	1	4	4
Agronomist, Multiple Cropping	1 + 1***	4	4

Agronomist, Weed Specialist	1	-	-
Agronomist, Seed Production	1	6	1
Soil Chemist	1	2	2
Water Scientist	1	2	2
Farm Machinery Specialist	1	4	4

*Foreign scientists who would provide leadership to the project as co-director and as team leaders in the research programs together with the Indonesian counterparts.

**Consultant in experiment station operations for initial development to work with farm-superintendent.

***Foreign scientists with multiple cropping presently with IRRI/contract who could provide expatriate leadership.

Researches to be conducted on corn, sorghum and soybean would be of the commodity or crop research approach. However, since this research approach alone would be inadequate, it would include cropping systems as well. The research staff would function as a team with a research leader. The team would concentrate on breeding crop varieties suited to the conditions existing on the fields. Attention would be given to yield, maturity, grain type, disease and insect resistance. Promising selection would be multiplied at the main center for trials at the affiliated centers. At the same time, the agronomist would evaluate fertilizer response, crop management and how they fit into the cropping system - crop sequence, mono or mixed culture. The entomologists and pathologists of the team would develop screening programs which would eliminate high levels of susceptibility to pests and diseases.

With this project, it is hoped that there will be improvement in research capability as a result of the training effort. The

improvement in professional competence from training programs and degree training abroad is a factor which would have immediate application as well as a long terms impact on research capability. The research findings is expected to create a base for a much more effective extension program. Without this base and without a continuing research productivity, extension is relatively ineffective. With the development of new varieties,a potential is laid for the development of a seed industry. Until seeds of high economic return become available, the potential of a seed industry will continue to be limited.

Furthermore, it is anticipated that with the problem oriented research approach, farmers will find direct benefits from efforts. It is hoped that the program would be able to identify the factors which link extension activity closely with research and the ways by which research findings reach the farmers at the shortest possible time. Increase in production is also expected. Based on estimates of increases in production by 1980, increases in upland crop production could be 3.0 million tons for corn and sorghum, 0.4 million tons for soybean and 0.14 million tons for peanuts. This increase in production would be possible through high yielding and downy mildew resistant varieties. Nutrition would also be improved with the consumption of high lysine corn and sorghum. The export of these crops is also expected to increase provided the necessary infrastructures are present.

D. Corn Breeding Status

In breeding corn, the traits that are given priority are resistance to downy mildew, early maturity and improvement of protein quality. Downy mildew is a major problem in corn farming. Yearly losses due to downy mildew is estimated to be about Rp 1.4 billion or US$3.5 million. Early maturing varieties are preferred by 75% of the farmers while increasing the protein quality will improve the nutritive value of corn consuming people.

Breeding experiments indicated only a small prospect of improving "Harapan" variety for downy mildew resistance. In breeding for resistance to downy mildew, the information regarding the mode of inheritance is very essential. Experimental results of crossing ten local varieties having less than 10% infection with Metro, Harapan and Bogor Composite 2 showed that the gene action for downy mildew resistance is purely additive in nature and that the mode of inheritance followed the pattern of a quantitative character. The International Downy Mildew Nursery found out that Pop Corn Gromy Yellow had 30% infection compared with 40% for Bogor Synthetic 2 and 74% for Harapan. On the other hand, the Inter-Asian Downy Mildew Yield Trials found out that Philippine DMR 5 and 3 had 14 and 24% infection, respectively.

It has been observed that varieties that are resistant to downy mildew are early maturing while the susceptible ones are late maturing. Breeding experiments conducted indicate that the mode of inheritance for maturity follows the same pattern as

resistance to downy mildew like the gene action is additive in nature and quantitatively inherited. Maturity was also found to be correlated with yield. Results of the experiment showed that early maturing varieties had relatively low yield. However, there is still a possibility of decreasing the period of maturity without lowering yield level. This is indicated by the 6% higher yield of the Harapan-Puti Nusa cross than Harapan. The hybrid matures 7 days earlier than Harapan.

Results of crossing S_1 lines derived from Bogor Composite Opaque-2 (with high lysine content) showed that Opaque-2 had lower yield than "normal" corn. On the average, Opaque-2 yielded 3840 kgm per hectare or 75% of the yield that of normal corn which is 5097 kgm per hectare.

The yield of Bogor Composite 2 was 11% higher than that of Metro and 5% higher than that of Harapan. It also had a higher adaptibility and resistance to downy mildew than the other two varieties. Bogor Composite 2 was also found to have sufficient genetic variability that is additive in nature. Using the S_1 selection as a base to test for intra-population improvement, it was found that the highest yield increase of 13.3% over that of the base population can be obtained at 16% selection intensity.

Regional yield trials to test the adaptibility of 14 promising maturing varieties have shown that on the average, none of the varieties

has outyielded Harapan significantly. However, the uniformity tests in Indonesia conducted by the Inter-Asian Corn Uniformity Trials found that UPCA Var 1 and D_1 had the highest yield of 2697 and 2754 kg per hectare, respectively. Of the 50 high yielding varieties used in the International Maize Adaptation Nursery, it was discovered that 10 varieties has significantly higher yield than Harapan.

CHAPTER I

CBS, Monthly Statistical Bulletin, April 1973.

CBS, Statistical Pocketbook of Indonesia, 1970-1971.

Pelita II, Volume 1.

Rencana Pembangunan Lima Tahun II, 1974/75 - 1978/79, Volume 1.

CHAPTER II

Agricultural Sector Survey of Indonesia, Central Research Institute of Agriculture, IBRD, 1972.

Agricultural Sector Assessment of Indonesia, USAID Mission to Indonesia, October 1973.

CHAPTER III

Central Bureau of Statistics.

Pelita II.

CHAPTER IV

Henderson, John W., Area Handbook for Indonesia, DA Pam 550-39, (Washington, D.C. 20402: Superintendent of Documents, U. S. Government Printing Office).

Kampsax/Berger Interim Report, 1969. Kampmann, Kieruff and Sakild A/S, Kampsax, Consulting Engineers, Copenhagen, in association with Louis Berger, Inc., Architects-Engineers-Economists, USA.

USAID, Weitz-Hettelsater Engineer , Rice Storage, Handling and Marketing, 1972.

CHAPTER V

Abdul Kadir Hamid, et al. Survey Jagung Propinsi Sulawesi Selatan, UNHAS, 1968.

Hidajat Nataatmadja, "Masalah Harga Beras dan Inflasi," Agro Economic Survey, 1973.

Isang Gonarsyah, 1973.

Mubyarto, and Fletcher, Marketable Surplus Beras di Indonesia, Fakultas Ekonomi Gajah Mada, 1970.

Sortaman Sinaga, Jumlah Jagung Yang Tersedia Untuk Dijual Dan Beberapa Faktor Yang Mempehgaruhi Produksi Konsumsi Dan Jumlah Jagung Yang Dijual Oleh Petani Pemilik Penggarap, Departemen Sosial Ekonomi, IPB, 1973.

CHAPTER VI

Cards, Leslie E., et al., Poultry Production, 1972.

Belitung-Martapura, South Sumatra, 1958 NAS-LIPI workshop of Food, Jakarta, 1968.

Central Bureau of Statistics Food Consumption Survey, 1964.

Figure for Bogor, 1958, NAS-LIPI workshop on Food, Jakarta, 1968.

Figure for the village of Bendungan, Bogor, 1969, Balai Penedítian Gizi Unit Semboja, Departemen Kasehatan R.I. Jilid 2, 1972.

"Potensi Produksi Ternak di Indonesia," 1971, Fakultas Peternakan, Bogor.

Proposal for an Integrated Nutrition Project, Care-Indonesia

"Survey perusahaan-perusahaan ternak," Direktorat Pengembangan Produksi Peternakan, 1973.

CHAPTER VII

Pelita II, Volume II.

1971 Population Census, CBS.

Statistical Pocketbook of Indonesia, 1970 and 1971, CBS.

CHAPTER VIII

Central Bureau of Statistics, 1970 and 1971.