

IMPACTS OF AGRICULTURAL INCENTIVES POLICY ON THE RURAL ECONOMY OF INDONESIA*)

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ABSTRAK

Tujuan utama dari tulisan ini adalah untuk mempelajari berbagai dampak kebijakan insentif pertanian yang diambil pemerintah terhadap produksi, tenaga kerja, dan pendapatan masyarakat pedesaan dengan acuan khusus pada hasil penelitian Studi Dinamika Pedesaan. Keragaan yang cukup mengesankan dari sektor pertanian Indonesia selama sepuluh tahun terakhir terjadi karena kebijakan insentif pertanian yang dilaksanakan secara berdaya-guna baik ditinjau secara makro ekonomi maupun secara sektoral. Kebijakan insentif yang dicanangkan pemerintah dalam bidang pertanian telah mampu meningkatkan produktivitas dan pendapatan rumahtangga petani di pedesaan. Keadaan yang cukup menggembirakan dalam pendapatan rumahtangga pedesaan adalah kemampuannya mengurangi tingkat kemiskinan, dan mengubah struktur konsumsi pedesaan yang membuat bagian pengeluaran yang lebih banyak untuk jasa dan barang-barang tahan lama. Tenaga kerja bukan pertanian menjadi lebih penting sebagai perangsang utama untuk pertumbuhan pendapatan rumahtangga pedesaan khususnya rumahtangga berpendapatan rendah. Setelah pencapaian swa-sembedada beras, arah kebijakan ditekankan pada usaha diversifikasi pertanian pada tingkat regional maupun nasional. Tulisan ini menyajikan deskripsi beberapa elemen penyesuaian dalam strategi pengembangan pertanian untuk sepuluh tahun mendatang.

ABSTRACT

The main objective of the paper is to examine the impacts of Government agricultural incentives policies on production, employment, and income of rural people with special references to the results of Rural Dynamic Study. The impressive performance of the Indonesian agricultural sector in the last decades was made possible by an effectively implemented set of agricultural incentive policies both macroeconomic and sectoral. Government incentive policies in agriculture have increased productivity and income of the rural households. A remarkable increase in rural households income has reduced poverty incident, and changed rural consumption structure towards into more portion of expenditure to the consumer durable goods and services. Non-agriculture employment become more important as the major stimulant to the income growth of the rural households especially for those in low income brackets. After the achievement of rice self sufficiency, there is strong policy direction for diversification of agriculture at both national and regional levels. Several elements of adjustment in agricultural development strategies for the next decade were described.

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INTRODUCTION

The performance of the agricultural sector in Indonesia has been remarkable. Over the past decade agricultural output has grown by 4 percent per annum, almost twice the rate of population growth and exceeding that of most other developing countries (World Bank, 1987). Agriculture has been a major source of growth in the overall economic Indonesia and has made a significant contribution to employment and income. Indonesia has even succeeded in increasing agricultural exports. An important point is that the sector's contribution to job creation did not take place at the cost of productivity, as indicated by the higher rates of growth in output (4.1 percent per annum) than in employment (1.4 percent per annum).

This impressive performance was made possible by an effectively implemented set of policies, both macroeconomic and sectoral. A flexible exchange rate regime, which include major devaluations in 1983 and 1986, tight monetary and fiscal stances, and adequate control over inflation are examples of the favorable macro management. While trade policy has been adjusted more gradually, export taxation and procedures have been reduced and streamlining of import procedures introduced (World Bank, 1987). At the sectoral policy level, the government has promoted agriculture through an extensive set of incentives, especially subsidies for key inputs and rural infrastructure, as well as through market and pricing interventions (World Bank 1987). Rice, the most important foodstuff in Indonesian diet, has received particularly strong support as part of the drive for self sufficiency, following the severe shortages of the early 1970s. Much of the increase in production has come about as a result of higher yields attributable to greater use of fertilizers, pesticides and high-yielding varieties of crops, as well as a successful program to bring more land under cultivation. These policies together with infrastructure investment in rural areas has improved labor productivity, rural income and employment structure in rural areas.

In line with the agricultural incentives policy, the aim of this paper is to examine the impacts of the policy on production, employment and income of rural people with special reference to food crops. The next sections are devoted consecutively to describe the performance of Agriculture in general and food crops in particular, agricultural incentive measures in Indonesia and then to present the impacts of the measures on rural economy with special references to the results of Rural Dynamics Study.

PERFORMANCE OF AGRICULTURE

The role of Agriculture

A large part of the growth in the agricultural sector has been derived from the rapid expansion of rice production which accounts for around 30 percent of agricultural GDP and more than 40 percent of agricultural land use and employment. Rice output increased from 15.8 millions tons in 1976 to 26.5 million tons in 1985, and as a result, Indonesia has achieved the important national objective of rice self-sufficiency. Other agriculture subsectors, although overshadowed by rice, has also performed well. For example, three crops (e.g. rubber, palm oil), livestock and fisheries have all grown by more than 4 percent p.a. over the past decade. Indonesia has been exporting primarily non-cereal commodities, e.g. rubber, palm oil, coffee, tobacco, tea, palm kernel, pepper, copra cake and dried cassava (pellets).

While the role of agriculture sector has been diminishing in recent years, it is still very significant in the economy in terms of gross domestic product, trade (both exports and import substitution), employment and per capita income, and foreign exchange. Its share in gross domestic product (GDP) at current market prices has been around 25 percent since 1980, down from 45 percent in 1971. As the largest non-service sector, agriculture accounted for about 30 percent of non-oil GDP in 1985, a share that remained relatively stable during the 1978-85 period (Table 1).

In terms of shares in agricultural gross domestic product (GDP), the dominant subsector in Indonesian agriculture is food crops (63 percent of agriculture GDP in 1985), followed by tree crops (around 16 percent), livestock products (10 percent), fisheries (almost 7 percent), and forestry (under 5 percent). Within food crops, rice has been dominant, accounting for about 30 percent of agricultural GDP in 1985, followed by fruits and vegetables at 15 percent and corn and cassava at 4 percent each. Other food crops have a 2 percent share or less for each crops. As Table 2 shows, there have been significant changes in the relative positions of these groups over the years.

Food Crop Subsector

In aggregate term, output of the food crop subsector has increased at 2.7 percent annually in the last 5 years, where the GDP only grew at 2.2 percent during that period. Therefore agricultural sector and specifically food crop subsector has neutralized impact of economic recession of the country.

Most food crops have experienced an impressive increases in output, particularly rice and corn. The gains have been primarily due to increase in yield that in turn have been the result of the development and use of high-yielding varieties (particularly in the case of rice), and the greater use of fertilizers and pesticides with the expansion of cultivated areas and irrigation as secondary factors.

Table 1. Gross domestic product of Indonesia by industrial origin at constant 1983 market price (New Series), 1978-1985.

	1978	1981	1983	1984	1985	1978	1981	1983	1984	1985
	(Rp. billion)					Percentage				
1. Agriculture	14,381.2	17,187.0	17,696.2	18,431.1	19,209.0	24.7	24.0	24.0	23.6	24.0
Farm Food Crops	8,399.8	10,639.1	11,057.4	11,598.7	11,894.6	14.4	14.8	15.0	14.9	14.9
Farm non-food crops	1,442.5	2,010.0	2,059.5	2,349.3	2,575.7	2.5	2.8	2.8	3.0	3.2
Estate Crops	437.6	517.6	610.7	445.5	510.8	0.8	0.7	0.8	0.6	0.6
Livestock Products	1,247.6	1,620.6	1,754.3	1,890.1	2,036.5	2.1	2.3	2.4	2.3	2.5
Forestry	1,871.2	1,260.6	994.2	894.4	850.7	3.2	1.8	1.3	1.2	1.1
Fishery	982.5	1,139.1	1,220.1	1,253.1	1,340.7	1.7	1.6	1.7	1.6	1.7
2. Mining and Quarrying	16,363.8	16,340.1	13,967.9	14,788.7	13,980.5	28.1	22.8	18.6	18.9	17.5
Oil & Natural Gas	15,923.0	15,767.2	13,346.4	14,203.4	13,368.7	27.4	22.0	18.1	18.1	16.8
Other	440.8	572.9	621.7	585.3	611.8	0.7	0.8	0.5	0.8	0.7
3. Industry	5,107.5	7,878.4	8,211.3	9,770.3	10,579.1	8.8	11.0	11.1	12.4	13.2
Refinery oil	147.8	169.8	129.4	386.5	659.9	0.3	0.2	0.2	0.5	0.8
LNG	725.1	1,711.6	1,871.2	2,790.2	2,918.5	1.2	2.4	2.5	3.5	3.6
Manufacturing	4,234.6	5,997.0	6,210.7	6,593.6	7,000.7	7.3	8.4	8.4	8.4	8.8
4. Electricity, gas and water	243.7	360.8	524.3	550.3	594.9	0.4	0.5	0.7	0.7	0.7
5. Construction	2,904.1	4,367.9	4,597.2	4,393.8	4,508.0	5.0	6.1	6.2	5.6	5.6
6. Trade	8,231.6	10,949.5	12,009.4	12,159.7	12,363.0	14.2	15.3	16.3	15.5	15.5
Retail & wholesale trade	6,887.3	9,417.5	10,411.7	10,451.5	10,619.8	11.8	13.1	14.1	13.4	13.3
Hotel & restaurants	1,344.3	1,532.0	1,597.7	1,708.2	1,743.2	2.4	2.2	2.2	2.1	2.2
7. Transport & communications	2,505.8	3,309.3	3,978.0	4,442.4	4,481.8	4.3	4.6	5.4	5.7	5.7
Transport	2,366.3	3,083.1	3,693.7	4,008.1	4,031.8	4.0	4.3	5.0	5.1	5.0
Communications	139.5	226.2	284.3	434.3	450.0	0.3	0.3	0.4	0.6	0.7
8. Banking, etc.	1,121.5	1,940.7	2,039.2	2,422.3	2,430.6	1.9	2.7	2.8	3.1	3.0
9. Ownership of wellings	1,461.7	1,822.7	1,961.8	2,072.3	2,145.2	2.5	2.5	2.7	2.6	2.7
10. Public administration & defence	3,385.2	4,664.6	5,711.5	5,996.7	6,438.5	5.8	6.5	7.7	7.7	8.1
11. Other services	2,483.8	2,792.1	3,000.8	3,116.8	3,180.2	4.3	4.0	4.5	4.2	4.0
12. Gross Domestic Product	58,189.9	71,613.1	73,697.6	78,144.4	79,910.8	100	100	100	100	100

Source: World Bank (1987) and Central Bureau of Statistic, Economic Indicators, October 1987. CBS. Jakarta.

The major food crops (rice, corn, soybean and cassava) are highly concentrated geographically, with over 80 percent of total production occurring in Java and Sumatera. Java accounts for over 60 percent of the rice production and over 70 percent of corn and soybean production. About 87 percent the area under rice is irrigated, with Java accounting for 57 percent of the total irrigated area in Indonesia (see Rosegrant, *et al.* 1987).

Rice. Rice output has grown steadily and strongly, averaging 5.0 percent over 1969-85 and a particularly impressive 6.8 percent per annum during 1977-85

Table 2. Composition of agricultural GDP.

	1978	1981	1985
Farm food crops a)	58.4	61.9	63.0
Farm nonfood crops b)	10.0	11.7	13.2
Estate crops c)	3.0	3.0	2.5
Livestock products	8.7	9.4	10.0
Forestry	13.0	7.3	4.5
Fisheries	6.8	6.6	6.8
Total	100	100	100

a) Including fruit and vegetables.

b) Smallholder tree crops.

c) Large estate tree crops.

Source: World Bank (1987).

Table 3. Growth rates in regional area, yield, and production of rice, Indonesia, 1969-85¹⁾.

Region	Area			Yield			Production		
	1969-77	1977-85	1969-85	1969-77	1977-85	1969-85	1969-77	1977-85	1969-85
	----- % -----								
East Java	1.47	2.14	1.77	2.10	5.05	4.04	3.60	7.30	5.87
Central Java	0.00	1.76	0.86	1.49	7.17	4.13	1.49	9.06	5.02
West Java	0.54	1.79	0.80	2.47	5.38	3.84	3.02	7.27	4.67
N. Sumatera	-0.70	1.63	0.69	0.65	3.45	1.48	-0.06	5.14	2.18
OT. Sumatera	0.01	2.70	1.43	3.99	3.63	3.54	4.00	6.43	5.02
S. Sulawesi	0.30	1.14	1.87	3.24	5.20	4.14	3.55	6.39	6.08
OT. Sulawesi	1.68	0.67	1.27	3.42	5.95	3.54	5.16	6.66	4.86
OT. Indonesia	1.83	0.11	1.28	5.11	3.09	4.14	7.03	4.20	5.47
Total Indonesia	0.62	1.67	1.20	2.67	5.04	3.77	3.30	6.80	5.02

¹⁾ OT. Sumatera is "other Sumatera", excluding N. Sumatera; OT. Sulawesi is "other Sulawesi", excluding S. Sulawesi; OT. Indonesia is "other Indonesia", excluding Java, Sumatera, and Sulawesi.

Source: Rosegrant *et al.* (1987).

(Table 3). Rice is the key food crop in which the government has made a national effort to raise yields through intensification measures, and this crop has benefited tremendously from research and extension services. As a result, Indonesia achieved rapid import substitution over the period, leading to self-sufficiency in rice in 1985.

Corn. Corn is the major foodgrain after rice. Most corn (55 percent) is used for human consumption with the balance going for feed (30 percent) for the livestock and poultry, food industries (10 percent) and losses (5 percent). Both white and yellow corn is produced, the former is for noodle industry. Although yields of corn have been increasing at an average of 4.4 percent per year, production has shown fluctuations over time because of changes in the area harvested and because corn is a rain-fed crop subject to variable weather conditions (Table 4). Another problem with the rainfed corn is that the harvest time coincides with rainy season, so that the grain has a very high moisture content that makes storage difficult (Timmer, 1987).

The large fluctuations in supply and hence in prices over time have been harmful to the growing poultry industry and have caused Indonesia to alternate between being a net exporter and importer of corn, although it has always imported certain types of corn. The swings in exports, for example, is the shift from 160,000 tons in 1984 to 3,000 tons in 1985. The lack of a steady supply, therefore, is not conducive to boosting sales abroad.

Recently, the government has been paying more attention to overcome supply problem and the lack of integrated market for both yellow and white corn, in part because the grain is a key element in the development of poultry industry.

Soybean. Because of a high protein content, there has been relatively strong and growing demand for soybean for human consumption as *tofu* and *tempe*. There is also a substantial market for soybean meal as a livestock feed. At present, demand exceeds the domestic supply, and Indonesia has been importing significant quantities. Soybean import has increased from 107,000 mt in 1979 to 343,000 mt in 1986 and soybean meal import has increased from 170,000 mt in 1981 to 290,000 mt in 1986. This situation led the government to initiate an intensification program and targeting of areas for soybean cultivation in recent years.

Cassava. Cassava is consumed mainly by the poor in rural areas. However, a growing source of demand is agro-industry, consisting mainly of processing the tuber into food pellets for livestock or into starch as a food additive and for textile and plywood industries. Indonesia has also exported some cassava in the form of pellets for livestock to the EEC but, in fact, it has never met its quota in the market. Although cassava production has the advantage of requiring little labor, the area devoted to it has been falling. However, production has still risen slowly as a result of improving yields (Table 4).

Table 4. Area harvested, production and yield of major food crops in Indonesia, 1975-1985 (area in thousands ha, production in thousands tons).

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Growth rates ¹⁾
Paddy												
Area Harvested	8,495.1	8,368.8	8,359.6	8,929.2	8,803.6	9,005.1	9,381.8	8,988.5	9,162.5	9,763.6	9,381.5	1.3
Production	22,339.3	23,300.9	23,347.1	25,771.6	26,282.7	29,651.9	32,774.2	33,583.7	35,303.1	38,136.4	39,025.2	6.3
Yield per ha (100 kg/ha)	26.3	27.8	27.9	28.9	29.9	32.9	34.9	37.4	38.5	39.1	39.7	4.7
Corn												
Area Harvested	2,444.9	2,095.1	2,566.5	3,024.6	2,593.6	2,734.9	2,955.0	2,061.3	3,002.2	3,086.2	2,325.7	1.0
Production	2,902.9	2,572.1	3,142.7	4,029.2	3,605.5	3,990.9	4,509.3	3,234.8	5,086.8	5,287.8	4,099.0	5.4
Yield per ha (100 kg/ha)	11.9	12.3	12.2	13.3	13.9	14.6	14.3	15.7	16.9	17.1	17.6	4.4
Cassava												
Area Harvested	1,410.0	1,353.3	1,363.6	1,382.9	1,439.3	1,412.5	1,387.5	1,323.7	1,220.8	1,350.5	1,254.6	-1.0
Production	12,545.5	12,190.7	12,487.7	12,902.0	13,750.8	13,773.8	13,300.9	12,987.9	12,102.7	14,167.1	13,762.4	0.9
Yield per ha (100 kg/ha)	89.0	90.0	92.0	93.0	96.0	98.0	96.0	98.0	99.0	105.0	110.0	1.8
Soybeans												
Area Harvested	751.7	646.3	646.1	733.1	784.5	732.3	809.9	607.8	639.9	858.9	835.4	1.2
Production	589.8	512.8	522.8	616.6	679.8	652.7	703.8	521.4	536.1	769.4	817.5	2.8
Yield per ha (100 kg/ha)	7.8	8.1	8.1	8.4	8.7	8.9	8.7	8.6	8.4	8.9	9.8	1.7

¹⁾ Trend growth rates estimated from Log-Linear functions.

Source: World Bank (1987).

Estate crops

Performance of estate crops can be seen in Table 5. The growth patterns for estate crops are completely different from food crops. In contrary to food crops, the main source of production growth for estate crops is planted area. The yield growth rates are negative for most of the crops. The best performance is shown by cocoa and tea. For these two crops, both productivity and planted area increase rapidly. It should also be mentioned that the yield figures shown in Table 5 are not the yield on harvested area. Hence, the increase in the area of immature crops reduces the computed productivity. In the next five years as the mature area increase crops yield will increase significantly.

The vast increase in planted area of estate crops is due to the government supported programs for estate crops. The programs are intended initially to reduce country dependency on oil petroleum export, to improve technology and to increase farm income. The program initiated in 1977. The government were able to spend large amount of money to this rather slow yielding investment because of its vast revenue during the oil boom.

With oil palm and tea exceptions, most of estate crops are owned by small holders. The smallholders mostly use traditional varieties and inputs. Farm management ability is also low. This may be the reason why estate crop productivities are very slow.

The government main policy for smallholders development is the nucleus estate system in which a mutual cooperation between smallholders and a large estate company is expected to exist in order to induce and to speed up technological transfers from big plantation to smallholders. The large estate company helps the smallholders on technical and marketing skills and supply farm inputs and credit. The smallholders, on the other hand, supply raw produce at reasonable price to the large private estate company.

Another government major policy to increase smallholders productivity is called project implementation unit. This is similar to rice intensification program. In this program, the government guides a group of smallholders in one area and provides modern inputs, extension service, financing and helps them in marketing.

AGRICULTURAL INCENTIVES

Intensification Program

Indonesia has utilized intensification program since 1950's as a part of its rice production strategy. Since then many reforms to improve the program have been made. After 1970, a central coordinating committee was established with direct

Table 5. Estate crops harvested area, production and yield in Indonesia, 1975-1985.

	1975	1976	1977	1979	1980	1981	1982	1983	1984	1985	Growth rates
Rubber											
Planted area ('000 ha)	2,292.8	2,265.5	2,324.2	2,383.9	2,382.5	2,444.2	2,465.7	2,564.2	2,578.4	2,657.5	1.5
Production ('000 ha)	786.6	857.0	386.7	963.9	989.4	693.2	887.4	982.1	993.6	1,044.0	2.9
Yield per ha (100 kg/ha)	34.3	37.8	36.0	40.4	41.5	39.4	36.0	38.3	38.5	39.0	1.4
Tea											
Planted area ('000 ha)	94.4	95.0	103.7	107.9	112.7	106.5	112.4	107.6	108.6	118.8	2.3
Production ('000 ha)	69.4	73.0	76.7	97.2	106.2	108.8	90.1	111.6	127.5	128.8	6.4
Yield per ha (100 kg/ha)	73.5	76.8	74.0	90.1	94.2	102.2	80.2	103.7	117.4	108.4	4.0
Coffee											
Planted area ('000 ha)	398.8	439.4	493.4	262.2	689.4	792.0	802.0	808.5	825.6	879.0	8.2
Production ('000 ha)	170.7	193.2	198.5	268.3	299.0	314.9	281.7	304.0	322.0	325.3	6.7
Yield per ha (100 kg/ha)	4.3	4.4	4.0	4.3	4.3	4.0	3.5	3.8	3.9	3.7	-1.4
Palm Oil											
Planted area ('000 ha)	170.9	179.9	181.7	260.9	294.6	318.9	365.8	368.8	411.4	469.1	10.6
Production ('000 ha)	411.4	433.9	479.4	559.9	721.1	753.3	836.8	894.9	1,083.1	1,215.9	11.4
Yield per ha (100 kg/ha)	240.7	241.2	273.7	214.6	244.8	236.2	228.8	242.7	263.3	259.2	0.7
Coconut											
Planted area ('000 ha)	2,210.6	2,304.8	2,386.7	2,578.8	2,680.4	2,752.4	2,809.0	2,890.7	2,954.2	3,001.5	3.1
Production ('000 ha)	1,391.4	1,526.6	1,512.5	1,622.1	1,666.1	1,764.6	1,587.2	1,590.2	1,593.6	1,791.4	2.6
Yield per ha (100 kg/ha)	62.9	66.2	63.4	62.9	62.2	64.1	56.5	55.0	53.9	59.7	-0.5
Cocoa											
Planted area ('000 ha)	17.4	17.8	18.8	35.7	35.1	35.8	42.4	52.5	58.0	78.4	16.2
Production ('000 ha)	4.0	3.8	4.6	9.1	10.3	12.8	17.1	19.0	28.9	32.3	28.2
Yield per ha (100 kg/ha)	23.0	21.3	24.5	25.5	29.2	35.8	40.2	36.2	49.8	41.2	6.0
Sugarcane											
Planted area ('000 ha)	268.0	207.7	240.3	343.5	316.1	346.2	363.3	384.3	381.2	385.4	3.7
Production ('000 ha)	1,251.2	1,322.4	1,453.0	1,828.9	1,442.6	2,107.6	2,981.7	2,820.6	2,886.9	1,389.2	1.1
Yield per ha (100 kg/ha)	466.9	636.7	604.7	532.4	456.4	608.8	820.7	734.0	757.3	360.5	-2.6

Source: World Bank (1987).

links to the provincial Agricultural Extension Service, which was made responsible for extension activities under BIMAS intensification program. Banking Services were more fully integrated with the program, with Bank Rakyat Indonesia in particular, providing specially trained staff for the program. In addition, private fertilizer distributors, farmers' cooperative (KUD) were permitted to participate in the program, improving competition in the distribution of fertilizer to the villages. BULOG, a Government Logistic Agency, was given responsibility to implement price support and stabilization programs. The BULOG purchases rice through farmers cooperative, its also monopolize import and export of food commodities (i.e. rice, corn, soybeans, wheat and sugar).

These reforms, combined with improvement in irrigation, and development of modern rice varieties, led to rapid growth in the Bimas program. Other intensification programs have also contributed to production growth: INMAS which was begun in 1968 provides modern inputs on the private market at the same subsidized prices extended to Bimas farmers; INSUS, begun in 1980, organizes farmers in better-irrigated areas into 50-hectare production groups; OPSUS, also begun in 1980, provides free inputs for a limited period of time to farmers settling in frontier regions. These institutional innovations were aimed to better organize the farmers in attempting to capture scale economies in production.

The growth rate in intensified area was impressive, 8.2 percent per annum for 1969-1985 period. The rate of growth was somewhat higher in 1969-1977, primarily because the program was just underway, so the base area was very low. After 1977, the growth rate remained strong in all regions. Java accounts for around 66 percent of total area under intensification. Java not only accounts for most of the intensification area, but also has the highest proportion of rice area under intensification. Greater use of modern varieties, better irrigation and higher fertilizer use in intensification area have resulted in higher yield (a yield increment of 1.11 mt/ha) in intensification area.

Irrigation Development

Investment in the expansion and improvement of irrigation has been another major contributor to the growth in rice production since 1969. Area irrigated in Indonesia has grown at the rate of 1.6 percent per year over the 1969-1985 period. In Java, 94 percent of rice area was irrigated in 1981-1985, up from 92 percent in 1969-1974. South Sulawesi was 96 percent irrigated in 1981-1985, while Sumatera had 80 percent of rice area harvested in irrigation. Further expansion of irrigation on Java is constrained to a large extent by the diminishing area available for new irrigation. Despite the lower growth rates in irrigated area on Java, Java still accounts for 57 percent of total area irrigated in Indonesia. For Indonesia as a

whole, 87 percent of rice area was irrigated. The farmers only paid water charger 12.0 percent of over all investment and maintenance cost of irrigation facilities (World Bank, 1987).

Agricultural Research and Technology Development

Government breeding programs and extension services (primarily through the intensification program described above) have assisted in the rapid spread of modern, high yielding, pest resistant varieties of rice in the 1970's. Indonesia has a long history of breeding work, with particular priority going to rice with the establishment of the Rice Institute in 1956, focusing mainly on breeding and agronomy.

In 1963 the research program was reorganized to include rice, maize and sorghum breeding and agronomy research, and was renamed the Cereals Institute. Since then, additional crops and research disciplines have been added, and in 1971 the institute was rename the Central Research Institute for Food Crops (CRIFC). The institute has branches in Sukamandi (West Java), Padang (West Sumatera), Maros (South Sulawesi), Malang (East Java) and Banjarmasin (South Kalimantan). The reorganization has strengthened the food crops program of CRIFC by forming a multidisciplinary team of scientists, including breeders, agronomists, entomologists, plant physiologists, and economists. CRIFC has collaborated closely with IRRI in the development, screening, and release of modern rice varieties adopted to Indonesia condition.

The CRIFC along with the other agricultural research centers for horticulture, estate crops, industrial crops, livestock, fishery, soil and agroecconomics in 1976 were reorganized and put under the Agency for Agricultural Research and Development (AARD), Ministry of Agriculture.

Area under Modern rice variety in Indonesia increased at an annual rate of 17.8 percent over 1969-1985 period. The growth curve follows the usual pattern for diffusion of new technology, with a period of rapid growth, followed by a slowing rate as the level of adoption increases. In 1969-1974 more than 90 percent of modern variety area in Indonesia was on Java, but this has declined to about 65 percent in 1981-1985 because other regions have had higher growth from a low initial area. Sumatera accounted for about 15 percent of modern variety area in 1981-1985 and Sulawesi about 8 percent. Modern varieties were used on about three fourth of rice area for Indonesia as a whole in 1981-1985, up from just 49 percent in 1969-1974. On Java for 1981-1985, the average area under modern varieties was nearly 94 percent of the total rice area, and in East Java the figure was 99 percent. After Java, the regions with the highest percentages of modern varieties were South Sulawesi with 74 percent and North Sumatera with 60 percent.

Price Support and Input Subsidies

Initially, fertilizer and pesticides subsidy was only applied for BIMAS mass guidance farmers for rice production. In the last decade, however, the subsidy has been extended to other crops and credit subsidies are also extended to other crops include export crops (rubber, palm oil, coffee, coconut, sugar cane and tea). The objective of the subsidies are to induce the adoption of modern technological packages, to increase export earning, to increase farm income and stabilize consumer prices. The main tool the government employed is subsidies for inputs including irrigation and credit, and implementation of floor price to producer and ceiling price to consumer especially for rice.

Fertilizer subsidy has increased from Rp 125 billions in 1980 to Rp 477 billions in 1986 (Table 6). In term of total government development expenditures on agriculture and irrigation the share of fertilizer subsidy on the expenditures has increased from 25 percent of the development expenditures in 1980 to 42 percent in 1986.

Table 6. Development expenditures a) and input subsidies (Rp. billions).

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Agriculture & irrigation	508.0	929.0	954.0	931.0	913.0	1,699.1	1,137.5	1,180.7
(of which Fertilizer subsidy) b)	125.0	283.6	371.4	420.1	324.2	731.6	477.1	467.2
Fertilizer subsidy as percent of total expenditures for agriculture & irrigation	25	31	39	45	36	43	42	39.6
Percent change over previous year expenditure c)								
Agriculture & Irrigation (excl. subsidy)	57 (88)	69 (89)	-10 (-12)	-12 (-13)	15 (14)	64 (55)	-32 (-25)	8.0 (2.6)
Fertilizer subsidy	51 (78)	127 (165)	31 (37)	13 (14)	-23 (-22)	126 (108)	-35 (-27)	-2.1 (-12)

a) Includes GOI budget and external loans.

b) Fertilizer Subsidy also includes subsidies on pesticides and seeds, and the administration costs of BIMAS.

c) In parentheses, percent change in 1983 prices is indicated. GDP deflators used are 0.65, 0.77, 0.84, 0.93, 1.04, 1.6, 1.29, 1.43 (weighted average of 2 calendar years used to estimate the corresponding fiscal year deflator). Inflation rates for 1986 and 1987 are projected at 12 and 10% respectively.

Source: World Bank (1987).

In relation to rice production, the government has encouraged fertilizer use by maintaining a highly favorable rice price to fertilizer price ratio. The floor price of rice at farm level is set annually, taking into account a number of factors, including cost of rice production, farm income, potential inflationary effects and the costs to the government in supporting the floor price. The floor price is implemented by BULOG rice procurement in major rice producing regions, including all provinces in Java, Lampung, South Sumatera, West Sumatera, North Sumatera, South Sulawesi and South Kalimantan.

The price of fertilizer and pesticides have been highly subsidized as an incentive to increase food production. During the last five years, the average implicit tariffs adjusted at the farmers level ranged from -40 percent to -65 percent for urea and TSP fertilizers. Although time series data on pesticide prices are not available, computations for 1983 indicates an implicit tariff of -75.5 percent for liquid pesticides (Rosegrant *et al.* 1987). The key purchased inputs are thus highly subsidized.

Table 7 shows the floor price of rice, price of urea and the rice urea price ratio in 1974-1986. In the first six years of this period the ratio averaged 1.04, and then increased to an average of 1.72 in 1980-1984. Even in the first time period, the paddy/urea ratio in Indonesia was about double the ratio in the Philippines and Thailand, and in the second period was as much triple the price ratios in these countries. The paddy-fertilizer price ratio thus has provided a strong incentive for fertilizer use in Indonesia. As a result, the growth rate of fertilizer consumption for all food crops was about 16.1 percent per year since 1969.

Table 7. Paddy/Urea price ratio, Indonesia, 1974-1985.

	Price of dried paddy*) (Rp/kg*)	Price of Urea (Rp/kg)	Paddy/Urea Price ratio
1974	41.80	40.00	1.05
1975	58.50	60.00	0.98
1976	68.50	80.00	0.86
1977	71.00	70.00	1.01
1978	75.00	70.00	1.07
1979	85.00/95.00	70.00	1.21/1.36
1980	105.00	70.00	1.50
1981	120.00	70.00	1.71
1982	135.00	70.00	1.93
1983	145.00	90.00	1.61
1984	165.00	90.00	1.83
1985	175.00	100.00	1.75
1986	175.00	125.00	1.40

*) Price of paddy at KUD (cooperative) level (14.00% moisture content).

Source: Rosegrant *et al.* (1987).

Subsidized Credit

Public credit outstanding for agriculture in 1985 was 1.6 trillion rupiahs, excluding that was provided to BULOG. The interest rate for most loan was 12 percent a year, versus commercial rates of 17-24 percent. The subsidized credit for nucleus estate crops (rubber, palm oil, coffee, etc.) and agricultural machinery (tractors, threshers, etc.) even charged lower interest rate, 10.5 percent per year. In recent years, however there has been a move away toward more general credit program at market interest rate (e.g. KUPEDES). There has also been a shift from annual crops (short-term credit) toward tree and estate crops which require longer term investments.

SOME CHANGES IN RURAL ECONOMY

Returns to Production Factors

Rice intensification program in Indonesia (Supported by extension in the use of modern input, input and credit subsidies, price support, and irrigation and other infrastructure development) has brought about a wide range of consequences in rural economy. The use of modern inputs in favorable environment, which has been the focus of the program, has increased production and, in turn, changed the returns to factors of production, income, and employment structure.

In the last seven years (1977-1984), total yield increased by 44.7 percent with average yield of rice has increased by 6 percent per year. From this amount, the distribution of benefit on a perhectare bases was 272 kg (9.4 percent) to additional wage bills, 330 kg (11.4 percent) to additional land value, and 213 kg (7.3 percent) to operator's surplus, while return to current inputs and capital (animal and tractor) nearly unchanged. (see Table 8). Therefore most of the benefit of the

Table 8. Changes in factor shares and value added in ten villages of Java, 1977-1984.

Items	1977	1984	Changes
Rice yield (kg/he)	2905	4202	1297
Absolute Shares (kg)			
Labor	1125	1397	272
Current inputs and capital	683	689	6
Land and Operator residual	925	1468	543
Value added	2222	3513	1291
Relative Shares (%)*			
Labor	38.7	33.2	-5.5
Land and Operator residual	31.8	34.9	3.1
Total value added	76.5	83.6	58.1

*) Relative factor shares in terms of rice yield per hectare.

development program with an emphasis on increasing land productivity and subsidizing the price of inputs and capital, reach only the land owning group in rural areas. Although absolute share of labor increased, its relative share declined. Wage rate in real term increased during that period due to the fact that labor use per harvested area nearly unchanged. The relatively small increase in absolute labor share, as compared with the increase in absolute land and operator's residual shares, was brought about by the negative effect of population pressure which was not offset by the expansion of non-agricultural employment (see also Hayami and Kikuchi, 1981).

Changes in Income and Employment

For the last decade, the government of Indonesia has implemented a set of incentive policies as mentioned above. These programs and policies are aimed to provide incentives to farmers and to improve labor productivity in the rural areas. These policies also has induced structural changes in rural employment and has increased real wage rates since 1980 (See Table 9 and 10). The rate of growth in real wage rate is higher in non agriculture sector than agriculture. This trend also reflect that rural labor market become more competitive.

In the early 1970's, technological changes in rice production has followed by the shift from "traditional" open harvest (*bawon*) to *tebasan* system. In *bawon* system, harvest is open to every farm laborers with harvest share ranging from 10 percent to 20 percent of paddy harvested. In *tebasan* system the standing crop is sold to an intermediary who brings in his own harvesting crew (Collier *et al.* 1974).

Table 9. Changes in rental and real wage rates in ten villages in the major rice producing areas of Java, 1976/77 to 1983/84.

	Wet season 1976/1977	Wet season 1983/1984	Percentage of change (%)
1. Manual labor (kg of gabah/hr)	0.98	1.36	38.8
2. Women labor for Weeding (kg of gabah/hr)	0.65	0.87	33.8
3. Animal rental Rate (kg of gabah/hr)	3.0	4.40	37.5
4. Tractor Rental Rate (kg of gabah/ha)	300.00	315.00	5.0
5. Harvester Share of Output (Bawon)			
a. Percentage	14.60	13.60	-7.0
b. Kg of gabah per ha	424.00	571.00	34.7
6. Rice Production (kg of gabah/ha)	2905.00	4202.00	44.6

Table 10. The structure of rural employment in Indonesia.

Sectors	Distribution by sector		Rural share in total	
	1971	1982	1971	1982
Total rural employment (000 s)	32,248 (100%)	47,101 (100%)	85.3	84.7
Agriculture	72.3%	65.3%	97.5%	99.3%
Mining	0.1	0.7	40.3	67.4
Manufacture	6.8	9.4	76.6	86.2
Construction	1.3	3.1	59.9	80.4
Transport	1.2	2.0	46.1	55.6
Commerce	8.0	11.4	66.4	69.8
Services	6.2	7.9	54.0	48.7
Unclassified	4.0	0.9	—	—

Subsequent evidence suggest this institutional change that restricted harvesting opportunities and sickle use is taking place independently of *tebasan* system (Papanek, 1985). A survey in West Java found *tebasan* to be declining but documented the increasing importance of an institution known as "*kedokan*", "*ceblokan*" and "*ngepak-ngedok*", in which workers who performed particular pre-harvest tasks are only paid in kind at harvest time (Wiradi, 1979). The effects of all these institutional and technological changes could be to lower the number of workers and the employer's wage bill, while the wage income of workers included in these arrangements could increase.

On Table 10 we present data on changes of rural employment structure from 1971 to 1982. Agricultural employment declined from 72 percent in 1971 to 65 percent in 1982. Manufactural and services sectors employment has increased significantly. Technological changes in rice production which increase rural income has induced employment in other sector of the economy in rural areas. In Table 11 we show income structure in East Java villages base on micro or farm level data, and in Table 12 we present imputed average hourly labor income. In general labor income for non agricultural employment was higher than agriculture. There is an indication that the degree of diversification of rural economy is influenced by rural resources endowment.

Data collected from 12 sample villages in Java and 3 sample villages in South Sulawesi depicted that more than 50 percents of rural household income in 50 percents of the sample villages was generated from non-agricultural sectors. Land ownership, however, remained important for rural people since average households income was significantly related to land ownership.

Table 11. Household income by source in East Java, 1984.

Source of Income	Villages		
	Wet land	Dry land	Lowland
Farm Income			
Food Crops	42,5	36,5	57,9
Perennial Crops	3,4	15,3	0
Farm Labor	7,9	7,5	0,4
Animal Husbandry:			
— Poultry	3,7	1,0	0
— Livestock	2,9	13,1	0,2
Total	60,4	73,4	58,1
Off-Farm Income			
Home Industry	1,4	1,0	6,8
Trade	11,2	4,6	12,9
White Collar Jobs	17,2	10,9	12,4
Other Services	1,5	1,4	2,3
Collecting Free Goods	1,9	2,1	0,7
Total	39,6	26,6	41,9
Total 1 + 2	100	100	100
Average (rupiah)	344.815	323.005	497.897
Gini Index	0,70	0,72	0,69

Source: Yusuf, Abrar S. (1987).

A partial census carried out in the 15 sample villages in Java and South Sulawesi in 1971 and in 1981 revealed that the rate of landlessness considerably increased during that period. Meanwhile, the average size of land per land owner increased in some sample villages and the percentages of land owners having less than 0.50 hectares was also declining. Although landlessness was increasing, tenancy rate (leaseholding and sharecropping) for landless villagers did not increase. Modern technology even tended to induce landowners to seek additional land under tenancy arrangement (Wiradi and Makali, 1984). Therefore, it was not surprising that, as shown by data gathered from 16 sample villages, tenants' bargaining power in tenurial arrangement was influenced by the distribution of land ownership along with (implicit) land rent (Kasryno, 1981). In this relation, land rent was considered as a proxy variable of land productivity which was not only affected by the use of modern inputs but also by irrigation improvement. The increase in explicit land rents varied from 22 to 82 percents across 12 sample villages in Java (Wiradi and Makali, 1984).

Table 12. Average income per hour (Rp/hour) by source in East Java, 1984.

Source of income	Villages		
	Wet land	Dry land	Lowland
Farm income			
Food crops	362,2	256,9	506
Perennial crops	649,6	1096,4	0
Farm labor	99,8	77,0	23
Animal husbandry:			
— Poultry	107,2	46,2	0
— Livestock	24,2	30,8	20
Average	248,6	301,5	101,8
Off-Farm income			
Home industry	192,8	128,8	48,7
Trade	173,9	162,9	128,9
White collar Jobs	557,4	358,7	905,1
Other services	416,9	734,1	217,4
Collecting free goods	76,4	98,1	124,8
Non agricultural labor	79,8	105,3	124,0
Average	249,5	264,6	258,2

Source: Yusuf, Abrar S. (1987).

Since landlessness is increasing and class stratification is in process, non-agricultural employment becomes very important for rural people. Data from 10 sample villages in Java revealed that the higher the agricultural population density the lower the percentage of rural people employed in agriculture (Table 13). In other words, while agricultural land was not able to provide sufficient employment, rural people responded to the challenge to some extent (Soentoro, 1984).

Across the sample villages, the contribution of non-agriculture to total rural households income varied from about 40 to 70 percents while the percentages of workers involved in non-agriculture varied from 19 to 66 percents and the percentages of those who purely worked in non-agriculture varied from 9 to 52 percents. Employment and income structures of the rural households were influenced by resources endowment, accessibility, and government policies.

On the average, the wage rate per hour either in agricultural industry or in non-agricultural industry was 50 percents higher than farm laborer's wage rate. Workers who worked in transportation and trained workers earned higher wage rates, i.e. respectively 75 and 90 percents, higher than on-farm wage rates. Income per hour for traders such as peddlers was 175 percents higher than agricultural wage rates (Table 14). Therefore labor productivity was most likely affected by individual assets and accessibility to employment.

Table 13. Agricultural density, landlessness, percentage of households under poverty line, percentage of income and working hours by sectors in 10 sample villages of Java.

Villages	Agricultural density (men/ha)	Landless ness (%)	Households under poverty line (%)	Percentages of income from		Percentage of working hours		
				Agriculture (%)	Non agriculture (%)	Purely agriculture (%)	Combination (%)	Non agriculture (%)
Wanarata	4.1	28	54	46	54	74	9	17
Mariuk	7.0	70	44	67	33	81	10	9
Sentul	9.0	30	75	33	67	61	13	26
Balida	10.0	59	44	63	37	64	17	19
Geneng	14.5	60	22	55	45	54	19	26
Kebangan	14.8	58	46	41	59	45	17	38
Jatisari	15.0	32	40	52	48	62	17	22
Sukosari	16.6	50	25	45	55	44	23	33
Rowosari	18.9	64	49	31	69	39	18	43
Janti	30.5	56	13	37	63	34	14	52

Source: Soentoro in Kasryno (1985).

Table 14. Average labor's income per hour (Rp) in agriculture and non-agriculture in 10 sample villages of Java, 1981.

Villages	Farm laborers	Labors in agricultural industry	Labors in non-agricultural industry	Labors in transportation	Skilled labors	Peddlers
Balida	125	138	109	238	166	267
Jatisari	105	123	150	203	232	360
Sentul	100	—	130	181	234	249
Mariuk	137	202	119	123	257	251
Rowosari	104	108	219	119	226	199
Wanarata	80	—	151	216	166	286
Kabanggan	82	120	150	—	166	178
Janti	103	225	—	—	140	—
Sukosari	122	155	203	179	159	—

Source: Soentoro in Kasryno (1985).

Since wage rate of farm laborers was the lowest, both working hours and income of rural people generated from working as farm laborers decreased by about 10 to 11 percents from 1976 to 1983 (Table 15). Table 15 also shows that although working hours spent in non-agriculture increased by only 13 percents, income from non-agriculture increased by about 44 percents.

Working hours of rural people as a whole increased by 16 percents in the time period of 1976-1983, while their income increased by 30 percents and per capita income increased by about 40 percents (Table 15 and 16).

In spite of the shift of households from one income group to the others, the percentages of households in each income group did not change considerably. The increase in income per capita of the lowest 20 percent income group (1976) increases by 279 percents from 1976 to 1983 due to the low level of their income in

Table 15. Changes of household income and hours-worked by major sector in rural areas in West Java, 1976-1983.

Items	1976	1983	Change (%)
Income (Rp 000/year)			
Farming	222 (47.9)	299 (49.6)	34.5
Farm labour	31 (17.4)	71 (11.9)	-11.4
Non-agriculture	161 (34.6)	232 (38.6)	44.2
All sectors	464 (100)	602 (100)	30.0
Hours-worked (hrs/year)			
Farming	535 (28.0)	772 (34.8)	44.3
Farm labour	461 (24.2)	414 (18.7)	-10.2
Non-agriculture	913 (47.8)	1030 (46.5)	12.8
All sectors	1909 (100)	2216 (100)	16.0

Source: Saefudin and Kasryno (1986).

Table 16. Change of income per capita in rural area West Java 1976-1983 (constante 1983 prices).

Items	1976	1983	Change (%)
1. Income per capita (Rp 000)	125	174	39.7
2. Income distribution (%)			
Bottom 20 percent	5.1	5.1	—
Bottom 40 percent	14.3	14.4	—
Middle 40-80 percent	33.0	34.1	—
Top 20 percent	52.7	51.5	—
Top 10 percent	38.4	35.3	—
3. Bottom 20 percent (1976) Income per capita (Rp 000)	29.7	112.5	279
4. Top percent (1976) Income per capita (Rp 000)	373.0	327.0	-12.3

Source: Saefudin and Kasryno (1986).

1976. Despite the decrease in per capita income of the top 20 percent income group (1976) by 12 percents, overall per capita income had been improving in the time period. The percentage of households below poverty line, defined as all households earning below 360 kg milled rice/cap/year, decreased from 50 percents in 1976 to 30 percents in 1983 (Saefudin, 1985).

There have been a significant improvement in overall per capita income of rural households in the seven years period 1976-1983. The incident of poverty declined substantially despite a relatively stable distribution of income. Change in household income is clearly the major factor contributing to the change in per capita income (Saefudin, and Kasryno, 1986).

There is a considerable diversity in the structural changes of individual household income within the group, partly related to the initial per capita income level. Initially poorer households on average do very much better than those with higher income in 1976 which record a slight decline in average per capita income. We note, however, over a half of the households being at the low income group in 1976 were still in the same position in 1983. Similarly, around one-fifth of households initially under poverty line were not benefited yet from the on going development process.

The pattern of change of household income by income group shows that, in general, income growth for the low income households is entirely due to the longer working hour. For medium income group it is derived from productivity gains, while for high income group from both new employment and productivity gains. Changes in returns per working hour appeared to have been the major factor behind the contrasting performances between low income group and the better-off ones.

With respect to sectoral changes of income, the major stimulus to income growth of low income households came from non-agricultural sector. This is also true for the other groups, but which subsectors contributing to the gain of income varied from place to place. Wage labor activity accounted for a very substantial share to non-agricultural income gain for the low income group, trade activity for the high income group, and from both activities for the medium income group. This is related to the accessibility of each group with respect to new employment opportunities in non-agricultural sectors. These structural changes in rural income and employment were primarily induced by technological and income improvement in agricultural sector of the economy.

Pattern of income and asset distribution remain important but increase access to productive urban and rural off-farm job opportunities reduced the relative dominance of these issues in rural welfare consideration. As can be seen on Tables 15 and 16, much of the increase in income of rural households come

from non-agricultural employment. A study by Kasryno (1985) reveal that the level of wage rate in rural areas determined by accessibility to industrial employment, expansion of rural non-farm activities and distribution of land ownership while the role of rice price is not significant.

On the consumption aspect, rising percapita income and the increased availability of manufacture goods and services accompanying overall economic expansion led to a decline in the relative share of rural household income spent on rice from 33.2 percent in 1976 to 22.0 percent in 1984 and total food expenditures declined from 78.0 percent in 1980 to 70.0 percent in 1984. Expenditures on consumer durables, health and education, transport and communication, and housing have increased (see Table 17). The data on this table also indicate that real percapita income increase at a rate of growth 3.0 percent annually from 1976 to 1980 and at 4.0 percent per year from 1980 to 1984.

It can be concluded that the technological changes in the food crop subsector especially rice did not have direct employment linkage. Relatively small indirect employment linkage exist through inducing trade on modern farm inputs and output trade and processing. The induce employment linkage seemed to be large.

Table 17. Structural changes in rural consumption expenditures of Indonesia 1976-1984.

Items	1976	1980	1984
	Expenditures (%)		
1. Cereal	33.2	27.8	22.0
2. Tubers	3.4	2.2	1.8
3. Fish	6.5	7.0	6.6
4. Meat	3.0	3.0	3.3
5. Eggs and milk	1.2	1.9	2.3
6. Vegetables & Fruits	10.7	11.5	11.0
7. Fully and partially prepared foods	13.8	15.0	11.5
8. Other foods	5.7	5.2	11.4
Total food	(77.5)	(73.7)	(69.9)
9. Housing	7.6	9.6	14.8
10. Clothing and footwear	5.1	5.1	4.4
11. Durable goods	2.7	3.9	3.5
12. Other goods and services	4.2	4.5	6.4
13. Other non-food	2.9	3.2	2.0
Total non-food	(22.5)	(26.3)	(31.1)
Total annual Expenditures percapita Rp.	46,920	86,544	179,330
Expenditure at 1976 price Rp.	46,920	52,770	62,050

Source: C.B.S. Consumption Expenditures Survey 1976, 1980, and 1984.

Increasing rural household income as a result of technological improvement has induced the development of trade, services, construction and transportation business in the rural areas.

Agricultural Mechanization

Although macro data shows that labor force in agricultural sector increases by 1.2 percent per year, in some areas with better irrigation facilities there is a tendency of labor shortage in rice subsector, especially during land preparation and harvesting activities. This indicates that labor force does not reflect the potential labor supply for specific farm activities.

Some factors creating labor shortage are (a) better education level of young villages coupled with drudgery of farm works (especially hoeing) cause most of young people in rural areas are no longer interested in working in agricultural sector, (b) on the other hand, the number and productivity of older workers have been declining, (c) high rate of migration for farm works in 1970's has declined sharply due to the increase in employment resulting from agricultural development in their places of origin and the shift of some migrants to non-agricultural sector, (d) non-agricultural development induces migration from agriculture to non-agriculture, and (e) technological changes in agriculture lead to increase labor demand. Meanwhile, the number of draft animal is also declining due to (a) the decrease in grazing land area resulting from high competition in utilizing land for food crops, (b) high increase in meat consumption which can not be offset by livestock population, and (c) the limitation in which draft animal is not allowed to grass along irrigation canal or roads in some areas.

Since wage rate and its growth rate in non-agriculture, as shown in Table 18, are higher than those in agriculture, this difference creates labor shortage in agriculture and push agricultural wage rate up. In respond to the increase in wage rate, farmers tend to minimize labor costs by reducing hired labor use or increasing family labor use or using tractor for land preparation. When transaction costs (the costs for recruitment, selection and supervision) are taken into account, manual labor appears to be the highest and then followed by the cost of animal power (Kasryno, 1981 and Soentoro, *et al.*, 1981).

Another factor causing labor shortage is the increase in cropping intensity brought about by the development and improvement of irrigation infrastructure since the beginning of five year development plan (1969) both in Java and off-Java. As shown in Table 19, rice intensity index (defined as the ratio of harvested area to wet land area) in West Java, West Sumatera and South Sulawesi, respectively increased by 1.5, 1.2 and 0.2 percent per year. In areas having better irrigation, the increase in both harvested area and rice intensity are even higher. For

Table 18. Change in real wages of hoeing, planting, and carpenter assistant in 7 sample villages, West Java.

Season*)	Hoeing (Rp/day)	Planting (Rp/day)	Carpenter assistant (Rp/day)
DS 1977	231	124	374
WS 1977/78	227	120	379
DS 1978	243	154	371
WS 1978/79	217	132	394
DS 1979	216	130	438
WS 1979/80	202	132	492
DS 1980	229	138	473
WS 1980/81	235	133	421
DS 1981	252	158	419
WS 1981/82	244	145	410
DS 1982	263	157	446
WS 1982/83	267	156	444
DS 1983	266	176	454
Monthly growth (%)	2,1	2,2	3,4

*) DS = Dry Season, WS = Wet Season.

Source: Husein Sawit (1986) "Perubahan Kesempatan Kerja dan Tingkat Upah di Pedesaan Jawa", Jurnal Penelitian dan Pengembangan Pertanian, Volume V, Nomor 2.

Table 19. Changes in rice harvested area and rice intensity.

Province		Period	Growth (%)
West Java	Total Area	1969 - 85	0.2
	Harvested Area	1969 - 85	1.
	Rice Intensity	1969 - 85	1.5
West Sumatera	Total Area	1983 - 85	1.1
	Harvested Area	1979 - 85	2.6
	Rice Intensity	1983 - 85	1.2
South Sulawesi	Total Area	1980 - 85	3.2
	Harvested Area	1975 - 85	1.7
	Rice Intensity	1980 - 85	0.2

example, in four districts of Jatiluhur irrigation system in West Java harvested area increased by 3.8-6.7 percent per year while rice intensity index increased by 3.6-5.6 percent per year for 1964-1985. All these imply the increase in labor requirement per season because of shorter duration of land preparation or harvesting. This situation along with inadequate supply of labor have increased the number of tractors and threshers. Siregar (1986) pointed out that factors affecting

the diffusion of agriculture machinery were the existence of increasing relative scarcity of labor, extension service, availability of dealers and workshops, availability of credits and rural labor relation (see also Siregar and Kikuchi, 1987).

The development of mechanization in Indonesia, however, is not without constraints both on the side of producers (i.e. expertise, capital, market and scale economy) and users (e.g. capital, economy of scale, infrastructure, maintenance services). The only possible solution for such problems is appropriate government support to help both sides. It is, therefore essential that potential demand be estimated on the basis of planned agricultural production and labor requirement (Kasryno and Sudrajat, 1987).

CONCLUSIONS AND POLICY IMPLICATIONS

In the last decade, the government has been implementing a set of policies on agricultural incentives (i.e. subsidies for key inputs and credit, research and extension, development of rural infrastructure and institutions) so as to increase land and labor productivities in rural areas. As a result, the growth rate of agriculture has been more than 4 percents per annum over the past decade. The role of agriculture in the economy in terms of overall GDP, however, has been decreasing since the growth rate of the rest of the economy has been higher than that of the agricultural sector.

Since rice has received particularly strong support as part of the drive for self sufficiency, its impressive growth rate was 6.6 percents per annum in 1976-1985. The increase in rice yield, resulting from the use of modern inputs, under population pressure has induced farmers to minimize costs by reducing labor use per unit of output in harvesting. Total labor use per unit of land for one crop season, however, has not been decreasing but relative share of labor has decreased. Conversely, relative share of land and operator's residual has been increasing. Therefore, it induces land owners to seek additional cultivated land under tenancy arrangement and purchase and, consequently, the proportion of farm areas less than 0.5 hectare has been decreasing.

Since landlessness has been increasing, non-agricultural employment becomes more important for rural people especially for those in low income brackets. The high growth rates of agriculture and non-agriculture have been improving overall per capita income. The percentage of households below poverty line, defined as all households earning below 360 kg of milled rice/cap./year, decreased from 50 percents in 1976 to 30 percents in 1983. However, around 50 percents of households being at the low income group in 1976 were still in the same position in

1983. The improvement of non-agricultural employment in rural areas is an induce type of employment linkage as the result of increase in the farmers income. The indirect linkage of employment seems to be very weak.

A remarkable increase in rural income has reduced poverty incident and changed rural consumption structure. The share of staple foods (cereals and tubers) on households expenditures has significantly reduced while the shares of manufacture goods, consumer durables and services have been increasing.

Government incentive policies in agriculture have increase productivity and income of the rural households. These changes together with improvement in labor mobility and migration (comutation and circulation) to urban areas have increased rural labor productivity and rural labor market competition. Improvement of rural labor mobility and migration make rural and urban labor markets more integrated and competitive. This factor has induced upward pressure on agricultural wage rate and labor saving technological innovation.

In relation to sectoral changes of income, the major stimulant to the income growth of low income households come from non-agriculture. This is also true for the other income groups, but subsectors contributing to income gain varied from place to place. Wage labor activity accounted for a very substantial share to non-agricultural income gain for low income group, trade activity for high income group and both activities for medium income group. This is related to the accessibility of each group with respect to new employment opportunities in non-agricultural sectors.

As technology is a critical determinant of the transaction costs, especially the cost of labor procurement and supervision, the shift to farm mechanization is at the expense of landless farm laborers and thereby exacerbating polarization. Credit programs with subsidized interest rates speed up this process. Taxation, such as land taxes and sales taxes on the price of machinery, can counteract these processes. In addition, taxation is also a means of transferring income from tax payers (land-owners and machinery purchasers) to poorer groups.

To improve the level of living or to increase the income of the rural poor, various efforts should be undertaken including population control, inducing spontaneous transmigration, creation of off-farm employment opportunities through labor-using appropriate technology and increasing cropping intensity through better water management and scheduling.

After the achievement of self sufficiency in rice there is strong policy for diversification of agriculture at national level and a trend to specialized agriculture at regional level. This trends will also reduce employment prospect for agriculture because rice is the most labor intensive farming in Indonesia. It is expected that employment in agriculture will continue to decline in relative and absolute terms.

In other words migration of labor from rural to urban or from primary to secondary (manufacture) and tertiary (services) sectors will continue to increase in the future.

The government roles to facilitate agricultural diversification include: (a) investment on research to generate complete technological packages; (b) improve and expand extension effort to diliver appropriate package of technology; (c) investment on infrastructures; (d) induce development or investment on agro-industry complexes in rural areas; (e) provision of credit to farmers and agro-industry sector at market rate of interest; (f) induce development of private seed industry to deliver improved seeds to farmers; (g) flexible agricultural price policy.

Main elements of adjustment in agricultural development strategies for the next decade will include the following :

- (1) Development of agricultural production system based on comparative advantages supported by the development of agro-industry and agri-bussiness in the rural areas.
- (2) Eliminating of pesticides subsidies and relay more on integrated pest management.
- (3) Gradually reduce subsidy on fertilizer.
- (4) Increase support to agricultural research with emphasize more on non-rice food crops, fishery, animal production, fruit and vegetables and export crops.
- (5) Research strategy should be oriented towards development of complete technological packages of commodity system and farming system.
- (6) Agricultural policy should be relayed more on market mechanism rather than administrative target.
- (7) Improve farming system for non-rice agricultural commodities to support the development of efficient agri-bussinesses and support services.

Improve linkages between agricultural sector and agro-industry and services will induce employment opportunity in rural areas. This issue will become important in the future growth of rural employment and income.

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