AN ANALYSIS OF FARM HOUSEHOLD INCOME
IN WEST JAVA, INDONESIA
(A Study of Two Villages From the Rural Dynamic Study)

by

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D E C L A R A T I O N

Except where otherwise indicated, this dissertation is my own work.

Abrar S. Yusuf

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ABSTRACT

This study is an investigation of the structure of farmers' income in two villages in Java, Indonesia. At the same time an assessment was made of the effect on these farmers' incomes of the government sponsored rice BIMAS programme. Possibilities of increasing farm income were considered given the existing levels of technology, prices and resource available.

The data used were from two of six sample villages (a base-line data survey) collected in February 1977 by the Rural Dynamics Study, Agro Economic Survey in the Cimanuk River Basin.

The results indicate that on average people in the two sample villages lived above the poverty line, if this is taken as 240 kg milled rice equivalent per capita per year. The income distribution of the sample was less uneven than income distribution in Java because of the contribution of off-farm income. It was also found that low income farmers obtained less benefit from government assistance than high income farmers.

With respect to resource use allocation, the results of the analysis have to be treated with caution because of the inadequacy of the data. It was observed that the government programme to assist all farmers should be directed to non-rice crop production as well as to rice production. Because of conceptual problems, data limitations and statistical problems, a firm statement on policy conclusions was not attempted and further study was recommended.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Indonesia is a developing country with an agrarian economy and low agricultural productivity. Consequently, people's incomes in Indonesia are considerably low. In Java, this is exacerbated by the high pressure of population on cultivable land and the limited scope for jobs outside the agricultural sector.

Statistics show that there has been a considerable increase of gross domestic product (GDP) in the last 10 years; for example it has increased 50% in the period between 1966 and 1972 (Table 1.1). But the extent to which this development is in accordance with the government's development objectives is not readily apparent. The percentage distribution of sectoral gross domestic product through time shows a decreasing trend for the agricultural sector relative to other sectors (see Table 1.1). This raises the question as to whether there has been a real growth in the standard of living of the people in this sector.

Recent analyses of the data collected in the National Social Economic Surveys (SUSENAS) 1967, 1969/70 and 1976 showed that 80% of villagers' incomes in Java and Madura were below the poverty line.[1] PELITA I (The First Five Year Development Plan) has already

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1 The poverty line in this analysis is the one based on the concept of minimum biological need estimated by Sajogyo in Usaha Perbaikan Gizi Keluarga (Bogor: Institute Pertanian Bogor 1975). This poverty line defined a certain level of income in which 70% (in urban) and 78% (in rural) expenditure was spent for food, which, is calculated per caput per month in 1969 was Rp 2,193 in urban and Rp 1,282 in rural areas. For the years 1967, 1970 and 1976 adjustments were made by using the cost of living index in Jakarta and rural areas.

TABLE 1.1

GROSS DOMESTIC PRODUCT BY INDUSTRIAL ORIGIN

(Billion Rp)

Industrial Origin	At Constant 1960 Prices							At Constant 1973 Prices				
	1966	1967	1968	1969	1970	1971	1972	1972	1973	1974	1975	1976
1. Agriculture, Forests and Fishery	236.1	232.1	225.2	260.1	270.7	280.5	285.5	2479.0	2710.0	2811.0	2811.2	2951.7
2. Mining and Quarrying	15.4	16.7	22.8	27.7	32.2	34.0	40.7	674.0	831.0	859.0	828.1	952.3
3. Manufacturing	36.3	37.5	40.8	46.6	51.1	56.7	60.8	564.0	650.0	755.0	847.9	907.3
4. Electricity, Gas and Water Supply	1.7	2.2	2.3	2.6	3.0	3.3	3.3	26.2	30.4	37.0	41.2	46.3
5. Construction	8.4	7.3	9.2	12.1	15.2	18.0	21.2	222.0	262.0	320.0	364.8	384.5
6. Transportation and Communication	15.2	15.7	15.9	16.5	17.4	22.0	22.4	229.0	257.0	288.0	302.7	342.6
7. Wholesale and Retail Trade	64.5	70.8	78.8	88.8	100.2	108.5	126.9	1028.0	1118.0	1224.0	1293.8	1352.0
8. Banking and Financial Institution	3.4	3.4	4.0	6.6	8.6	10.2	12.9	75.0	83.0	88.0	101.6	117.4
9. Ownership and Dwelling	8.7	8.8	9.7	10.7	11.2	11.9	12.8	121.0	143.0	174.0	198.4	241.0
10. Public Administration and Defence	24.3	25.0	28.8	29.3	30.4	31.8	31.8	393.0	405.0	415.0	564.1	595.5
11. Services	27.9	28.8	29.4	30.1	30.9	31.7	32.5	256.0	264.0	270.0	277.0	284.2
Gross Domestic Product	441.9	448.3	466.9	531.1	570.9	609.4	650.8	6067.2	6753.4	7241.0	7630.8	8174.8

Source: Indonesia's Central Bureau of Statistics.

succeeded in increasing national income or per capita income but income disparity between rural and urban populations during 1967-76 has increased widely (see Table 1.2). The analyses suggested further that the rate of growth of the economy has caused the disparity of incomes between the rich and the poor to become wider in urban areas while in rural areas it has become smaller (Esmara 1977). Thus, some policy adjustment will be necessary if national objectives of growth are to be combined with social equity.

As more than 80% of the Indonesian population is rural and engaged in various forms of activity in agriculture - ranging from shifting cultivation in mountainous and forest-covered outer islands to intensive rice cultivation in Java - it is very important to gain an understanding of the regional problems and the various aspects relating to farm and household incomes of the villagers for agricultural development planning to be effective.

TABLE 1.2

RATE OF INCOME GROWTH, INCOME DISPARITY, AND POVERTY IN URBAN AND RURAL AREAS, JAVA-MADURA 1967-1970 AND 1970-1976

(in % per year)

Period	Income Growth		Income Disparity		% Population Below The Poverty Line
	Total	Bottom 40%[1]	Bottom 40%[1]	Gini-Ratio	
Urban:					
1967-1970	+ 4.26	+ 0.93	- 2.25	+ 3.36	- 1.60
1970-1976	+10.52	+ 7.90	- 3.70	+ 2.84	- 4.22
Rural:					
1967-1970	- 0.02	- 2.23	- 3.30	+ 5.06	- 1.15
1970-1976	+ 4.83	+ 6.02	+ 2.42	- 0.02	- 1.21

Note: 1 Defined on p 62.
Source: Esmara 1977, Table 31, p.53.

Clearly this would require a greater amount of accurate knowledge about the process of rural change in Indonesia. Without such information the government will continue to be hampered in initiating programmes that are designed to tackle the major problems relating to rural development in the country.

1.2 Related Studies

Various authors have reported the critical situation of villager income in rural Java. Some of those micro studies will be reviewed below.

Penny (1967), in the Bulletin of Indonesian Economic Studies suggests that quite a few latent development opportunities exist which could be turned into increased incomes. Development opportunities refers to "opportunities for increasing real income that may be perceived and used by whoever makes resource use decisions" (Penny 1967). The opportunities which could be exploited in the immediate or near future were classified according to the decision makers to whom they are available - individual farmers, village groups or government authorities. Among the possible opportunities listed by Penny were: (1) considerable scope for raising income from house-gardens, (2) the extension of a RICE BIMAS-type programme for increasing production from the whole farm rather than being confined to helping with a single crop, and (3) improvement in the environment for decision-making in the village, i.e. stimulating price policy. Above all of these, he added, the most important one is the awareness and the willingness of the decision-maker to mobilise resources for development.

Adiratma (1969) investigated the income of rice farmers in two villages in the rice producing area of the District of Krawang.

His objective in the study was to look at the production, consumption and marketing of rice by the rice producers at the village level. Data for the study were collected in a survy carried out twice a month over a period of twelve months (September 1963 - August 1964). A linear regression model was used in analyzing the factors affecting rice production and also the interrelationships between cash expenditure in rice farming and cash received and spent from selling and purchasing rice and non-rice farm activities. He found that, even though the farms in the village sample were essentially rice producing, off-farm activities still played an important part in the District's economy. For about two-thirds of the total families in the village, off-farm employment opportunities were important as a source of family income, especially for landless families.

Since the pattern of income from farming was not evenly distributed during the year (farm activity depends on weather, season and irrigation) the low income farmer often did not have enough income for family consumption. Nor was he able to purchase inputs for farming activities required at the time of land preparation and weeding. This in turn affected the yield and the farmer's cash returns. This situation exists not only within the low income group of farmers but also the medium and sometimes high income group farms. For the low income farmers the 'rice income' (the quantity of rice received annually) elasticity of the rice marketed during the harvest period was quite small. Their marginal propensity to consume is high. Hence, Adiratma emphasised the importance of considering the goal of an increased standard of living for rural families as well as the objectives of increased rice production.

Sajogyo (1973) in his work on the evaluation of the Applied Nutrition Programme collected data over the period of December 1972 to February 1973 from 1,053 households in 30 villages in 8 provinces of Indonesia. Comparative analysis, correlation and significance tests were applied and secondary data were also used to complement the primary data. One of the conclusions he drew up was that corn is the next best crop after rice as a means of increasing the calorie and protein intake for food deficient households (these households are largely poor households, as shown in the Javanese study case). He suggested that a government programme similar to the RICE BIMAS programme should be applied to corn production.

Soejono (1975) examined the growth and distributional changes of paddy farm incomes in two sample villages in Central Java. The area is considered as a rice-producing centre with adequate facilities for growing paddy twice a year. Changes investigaged were from cross sectional data collected in 1968/1969 and 1973/1974. Analytical methods used to investigage income distribution were the gini-ratio, coefficient of variation, equal share coefficient and standard deviation of the logarithms of the incomes. He concluded that the adoption of new technology in paddy production through the BIMAS programme had increased paddy farm income, and that income distribution had become more even among farmers. Additional sources of income other than from paddy had an important role in the equality of income distribution. It is worth noting however, that the findings on income distribution in the villages were different from the findings of other researchers in the same period (as will be shown later), which generally showed a worsening of income distribution. This was because the sampling framework used in Soejono's study was not specifically designed for the purpose of identifying income distribution between groups in the village. Accordingly generalisations cannot be made from this study, especially to the less favourable paddy areas.

King and Weldon (1975) studied the problem of equity and the social aspects of Indonesian development. In particular, due to the availability of labour, they attempted to determine whether there are consistent patterns and trends in the distribution of income in Java. The analysis used time series data on income distribution in the four rounds of the National Social and Economic Survey (SUSENAS) on consumption expenditures, and the data from the Cost of Living Survey in the four largest Java cities 1968-1969 and from large market and media surveys carried out in late 1970. All of these data were collected by the Central Bureau of Statistics. The methods of analysis employed for measuring income distribution and the level of living were quartiles, deciles, the Lorenz Curve, the Gini concentration ratio, the coefficient of variation and the standard deviation of logarithms of income. They reported that the result of the study was a worsening of income distribution: "Our findings of deterioration in real level of living for approximately the bottom 40% of the population, a widening gap between the capital city and other areas of Java call attention to the distributional aspects of some key policy directions" (King and Weldon 1975).

Sinaga and Sinaga (1976) conducted a study with the purpose of getting some comparison between Indonesia and the Philippines on change of income shares among the direct participants (landlords, hired labourers and operators) in the production after the adoption of modern varieties. The data used was from one of the eight villages of Soejono's (1975) study. The method of analysis they used was to calculate the real income and the shares of output accruing to the three main classes involved in production (as mentioned above) and the share transferred outside the agricultural sector to purchase current inputs. The main finding was that most of the benefits from modern varieties went to the operators and the landlords at the expense of the laborers. Unlike in the Philippines, in Indonesia there has been no significant change in the labour requirement after the introduction of modern varieties. Besides finding a relative decrease in the share of hired labor incomes, they found that the real wage had also decreased significantly.

Summarising the result of the above studies, it is evident that one of the objectives of rural development strategy has been successfully achieved i.e. increasing income and production rationally. But, on the other hand, the distributional aspects have deteriorated. This suggests that alternative strategies would have to be adopted if social equity is to be achieved. Some others have pointed out that a government programme which gives emphasis to non-rice farm income will be helpful in achieving the ultimate goal of national development without increasing income disparity.

Although these previous studies have been related to village income they were not overtly concerned with exploring the possibility of increasing incomes with equity consideration. This study will consider the structure and pattern of household incomes as a whole and suggest ways of raising the standard of living of the poorer rural dwellers.

1.3 Objectives and Scope of the Study

The major objective of this study is to get a clear understanding of the structure of rural incomes in the Cimanuk river basin and to explore the possibilities for improving rural incomes. The study will also examine the existing general policy and alternative strategies for influencing rural income. More specifically the study will be concerned with:

1. The examination of prevailing rural household incomes, using tabular analysis (t-test and F-test), of the data collected from two selected sample villages of the Rural Dynamic Study
2. An investigation of income distribution pattern of rural household incomes using the Lorenz curve and Gini concentration ratio.
3. An examination of determinants of household income using correlation and multiple regression analysis.
4. An examination of alternative income generating opportunities through improvements in allocative efficiency of peasant farmers in the two villages studied.

Growth of rice production has been noted as a success of the first and second five-year development plans. However, it has been argued that the development strategy which places emphasis on growth will be of selective benefit to only a small proportion of privileged people. In this study an attempt will be made to find alternative strategies which will benefit the less privileged members of the population. This will be attempted by a systematic study of the allocative efficiency of individual farming enterprises which are currently utilised by farmers in the different enterprises will indicate the potential for channelling resources into more productive uses. In this respect, current government policy in supporting the different farming enterprises will also be examined.

1.4 The Data

This study used the data from two of six sample villages of the Rural Dynamics Study (RDS). The RDS is a long term study of rural changes carried out by the "Agro Economic Survey"[1] in order to provide policy-makers with information and policy recommendations relating to rural development. The RDS's study area is five districts in the Cimanuk river basin i.e.: Indramayu, Cirebon, Sumedang, Majalengra and Garut. One village was selected from each district, except in Sumedang where two villages were selected. There are 800 villages in these five districts in the river basin. The study area is shown in Figure 1.1. Each sample village was selected on the following criteria: it represents the district as well as a particular 'ecological potential and accessibility' to the village which is different one from another. For example Suka Ambit represents villages in the district of Sumedang; it also represents undulating areas with good accessibility to the village and has good irrigation. Malausma represents villages in the district of Majalengka, hilly areas, less accessibility to the village and no irrigation. Accessibility to the village is assessed by the condition of roads (ground, gravel or asphalt), frequency of public four-wheel motor vehicle service to the village per day (once, four times or every hour), and the distances from the village to the capital of the district and sub-district. Ecological potentials were measured by the factors of population density and the ratio of irrigated Sawah to total village area.

Sample villages were visited in December 1976-January 1977 and a

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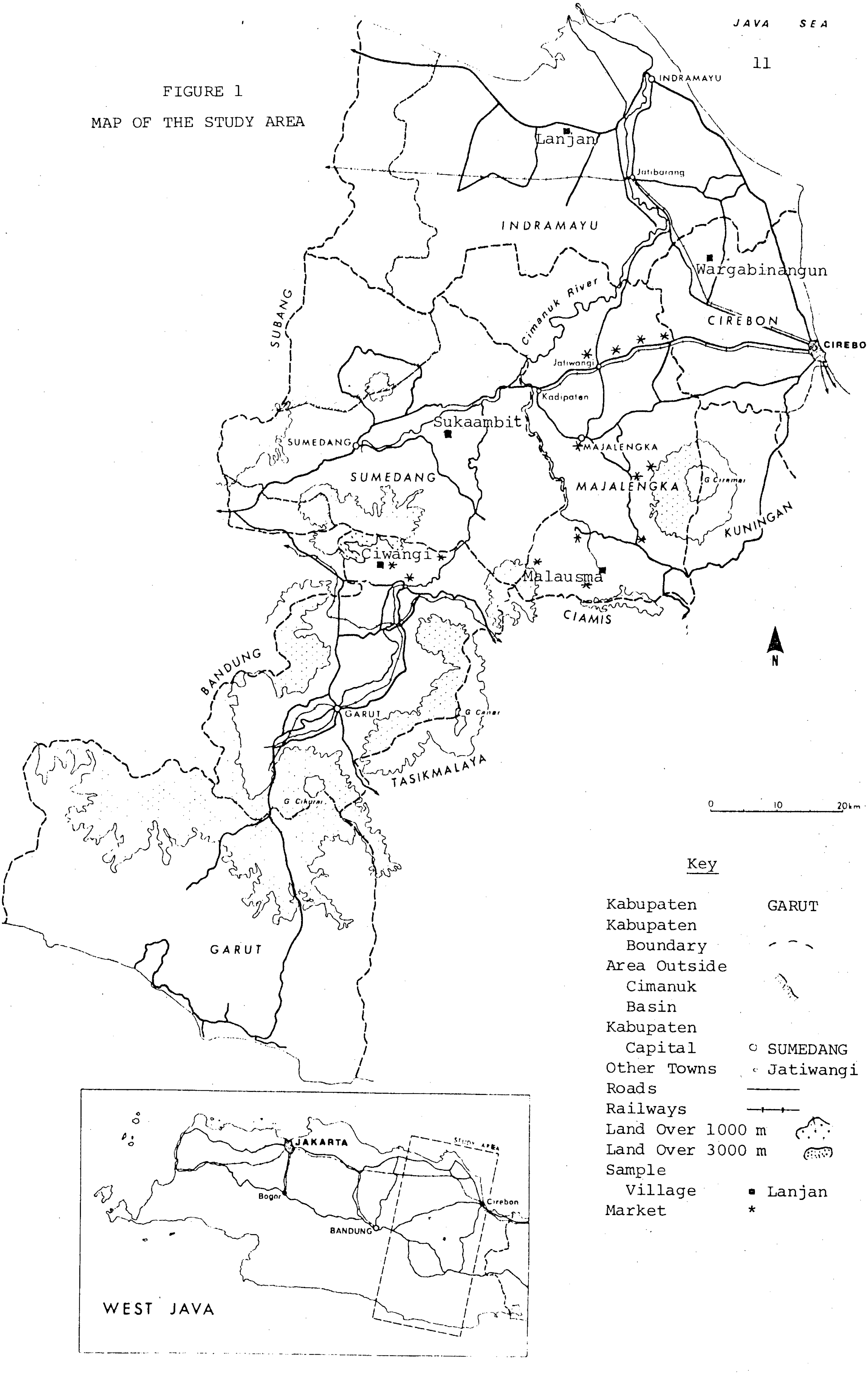
1 The Agro Economic Survey is an inter-ministerial research organization for policy analysis on the agricultural economy of Indonesia. It undertakes several broad categories of activities: research workshops for training and for the identification of basic issues, publication and documentation, and participation in a variety of policy teams.

FIGURE 1

MAP OF THE STUDY AREA



'Partial Census' of 250 households in each village was conducted. Most of the data collected in this 'Partial Census' is related to characteristics of the household: demographic information, education, occupation, landholding and household assets. Then 60 households were chosen and re-visited in February 1977 to collect information on farm input-output data, crop rotation, labour use and marketing of farm produce for one year's activity.

Two villages, Suka Ambit and Malausma were chosen purposely for this study due to the multiplicity of farming systems (on Sawah and upland) and multiplicity of farmer's occupations (from farmer, farm laborer, off-farm laborer and other off-farm occupations) which is believed to be representative of villages in general in Java. Suka Ambit has better irrigation and farming, mainly rice production in sawah , is the main source of farm household income; Malausma is a village with insufficient land and irrigation resources for rice production and the variability of multiple occupations at the farm is greater than in Suka Ambit. It is expected that a wide range of villagers' income earning activities can be examined by selecting these two sample villages, i.e. from rice production to second crop, upland crop, fishery, livestock, labouring, trading and other off-farm jobs.

In the examination of the data from the two villages 11 household samples in Suka Ambit and 3 in Malausma were excluded from this study.

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1 For further information on the sampling method, see Gunawan, M., 1976, Stratification of the villages and selection of sample villages, mimeo, SDP-SAE, Bogor

The details on the considerations of exclusing those cases and the treatment done on some selected variables for this study are presented in Appendix I.

The most common difficulty encountered in collecting data from villagers in developing countries is that of non-availability of records of farm input-output or family income/expenditure. Families must rely on their memories and most of the time they had to estimate all required information. It was probable that they have already rounded the figures they mentioned. However, all efforts have been made to get the most accurate information. Cross checks were frequently made on the data by asking the same problem in indirect and different forms of the question.

A deficiency of this data for the purpose of this study was that no detailed information was collected about the components of income derived from non-farm activity sources, e.g. property income, capital or investment and cost involved in self business employment, or trading etc. Information recorded only a rough estimation of income carried or profit in a year. It was not possible to cover all aspects of villagers from only one or two visits to the village.

Another general limitation of using income data was that they were believed to be subject to systematic errors or downward bias due to understatement of income. For one thing, the person who reported may never have knwon the complete facts about income and furthermore may not have been aware of his ignorance. Underreporting may also have occurred because of the failure to recall that income from certain sources had been received. There is also an unwillingness on the part of some people to disclose their income fully. The individual bias of the interviewer may be another cause of under or overstatement. Nevertheless, whatever may be said of data collected through questionnaire interviews, or any other method in farm management surveys, total accuracy is an impossibility.

1.5 Organisation of the Study

This study is presented as follows: Chapter 1, the introduction, discusses the background of the study, objectives and scope of the study. A description of the area under study is provided in Chapter 2. In Chapter 3 the structure of production and income earning activities of rural households are examined, which incorporates income distribution and income determinant analysis. Chapter 4 is concerned with the analysis of resource use. In particular, the allocative efficiency of farmers and the possibilities for increasing farm incomes by reshuffling present resources will be undertaken. Alternative production possibilities are also examined in this chapter by estimating production functions for each different enterprise. Chapter 5 brings together the conclusions drawn from the analysis and policy implications are suggested.

CHAPTER 2

SOCIO-ECONOMIC CONDITIONS OF THE VILLAGES

The two districts (Kabupaten) of Sumedang and Majalengka, from where the two sample villages Suka Ambit and Malausma respectively were selected for this study lie adjacent to each other in the northeast part of the province of West Java (Figure 1.1). The nearest city and sea port to these two districts is Cirebon on the northeast coast of West Java. The city of Cirebon itself is the capital city of the Cirebon District. The district capital of Sumedang and Majalengka are the towns of Sumedang and Majalengka. The Cimanuk river is the longest and widest in West Java province straddling these two districts, flowing to the sea in the north of Indramayu district. Sumedang and Majalengka cover an area of 1598 sq km and 956 sq km, where 1126 sq km (70%) and 954 sq km (94%) respectively are included in the river basin. These districts are an agricultural area receiving most of the benefit of the Cimanuk river. This chapter presents a brief description of the socio-economic situation prevailing in the villages to provide the necessary backdrop to the study.

2.1 Location and Communication of the Villages

The village of Suka Ambit is under the administration of the sub-district (kecamatan) of Situraja in the district of Sumedang. The village is located in the eastern part of the district, about 375 meters above sea level. The topography of the village area is undulating. The hamlets in the village are transversed with gravel and ground roads (ungravelled) which are capable of taking only two-wheeled vehicles. A

2 km tarred road passes through the village connecting the towns of Sumedang and Malongpong (another nearby town). The means of transportation in the village and from the village to the market are bicycle, motor bike and mini-bus (opelet and colt). During the survey, the various vehicles existing in the village were 2 opelet/colt, 3 sedans, 24 motor bikes and 24 bicycles. The nearest market from the village is the sub-district town market (Situraja) and the district market (Sumedang) which takes 5 and 15 minutes respectively by opelet or colt. These transportation services are available 5 to 7 times a day. In the village there are a few shops selling daily provisions. For buying and selling agricultural products and input factors like fertilizers, farmers go to the sub-district market of Situraja or the district market of Sumedang. Situraja market is held twice a week, on Tuesdays and Fridays. It costs - one-way - Rp 50 to Situraja and Rp 150 to Sumedang.

Malausma lies about 12 km east of the capital of the sub-district (sub-district market) Bantarujeg, while the sub-district area lies about 15 km south of the capital city Majalengka. Unlike in Suka Ambit there is no market in this village. For buying daily provisions the villagers have to go to the nearby village market about 4 km away. The topography of the village is hilly with an altitude between 600 to 1100 m about sea level. Transportation services from the capital of sub-district to the village are available every day by mini-bus (colt). Some of the roads are metalled or gravelled, but most are untarred, especially between hamlets in the village. Due to the topography of the area, bicycles are not used very much here. At the time of the study the villagers owned 2 opelet/colt, 2 sedans, 12 motor bikes and only 4 bicycles.

To summarise, Suka Ambit has a better infrastructure than Malausma in terms of road and transportation facilities, accessibility to the market and irrigation.

2.2 Cultural Background and Demographic Features

According to the 1971 Census, the total population of Sumedang and Majalengka districts were 637.9 and 749.1 thousand persons, with a population density of 473.5 and 802.7 persons per sq km. For a comparison, the total population of the province of West Java was 21,620.9 thousand persons with a density of 478.5 persons per sq km (Nurdin 1976).

According to the village statistics recorded in the survey (1976), the total population of Suka Ambit was 4,051 persons and the total land surface of the village was 578 ha, giving a population density of 700 persons per sq km. The total population of Malausma was 6,087 persons (1976) with a land surface of 909 ha giving a population density of 670 persons per sq km. These figures indicate that within the district Suka Ambit was a village of high population density, while Malausma was a village of low population density. Both villages were less densely populated than Sriharjo-Jogyakarta with 1,447 persons per sq km (Penny 1973 and Ginting 1978). For another study of Ronodiwirjo (1969) in the district of Karawang, a rice production area, the population density in its four village samples were 450, 1,200, 400 and 490 persons per sq km. The village with the highest population density in the above four sample villages was slightly different from the other villages, in that it is located on the main road and is somewhat like a small town.

The rate of population growth in West Java based on 1961 and 1971 censuses was 2.05 per cent per year. This province has the highest rate of growth among other provinces in Java (Nurdin 1978). Unluckily, there was no data available to look at the rate of population growth in Suka Ambit; meanwhile, in Malausma village statistics indicate that the rate of population growth from 1971 to 1976 was 2.17 per cent per year.[1] This high rate of growth has social and economic consequences. In 1971 the population working in the agricultural sector was noted to be 68 per cent in West Java. In 1971 it had dropped to 61 per cent mainly because the limited employment opportunities in the village cannot keep up with population growth (job seekers). Further effects are urbanisation, frustration and crime which make it very difficult for the planners to allocate economic resources for increasing the nation's welfare.

Most of the households in the rural areas of West Java consist of one family (nuclear family) father, mother, sons and daughters. However, it is not uncommon to find a household with more than one family, probably old and young families or grand-parents and relatives. The average family membership in Suka Ambit is 4.00 persons with a range from 1 to 8 persons. In Malausma the average family size is 4.4 persons with a range from 2 to 8 persons (see Table 2.1). Table 2.1 also shows that the average number of income earners is higher in Suka Ambit, while the number of dependents (children) is higher in Malausma. The average number of family members in Malausma was also higher than the district average in 1971 (3.9 persons) and for Suka Ambit it was lower than the district average (4.1 persons).

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1 Calculated from village census. See Makali 1976 'Diskripsi Keadaan Social Ekonomi Desa Malausma, Kecamatan Bantarujeg, Kabupaten Majalengka, Jawa Barat', mimeo. SDP-SAE, Bogor.

TABLE 2.1

NUMBER OF FAMILY MEMBERS IN THE HOUSEHOLD SAMPLES, 1976

	Suka Ambit (persons)	Malausma (persons)
Average	4.0	4.4
Range	1.8	2.8
Adult (income earner, $\geq$ 15 yrs old)	2.6	2.5
Children (< 15 yrs old)	1.4	1.9

Information on age and education are felt to be a relevant factor of the study of farmers' incomes. Table 2.2 shows that the general level of education of the head of the household (husband) and wife of the household sample was 3 to 6 years in primary school. Conditions are better in Suka Ambit than in Malausma as indicated by the higher percentage of persons receiving an education (lower percentage of persons who did not get any education); some of the household heads (about 10 per cent) were even educated for more than 6 years, i.e., secondary and high school, and one of them had completed university, while in Malausma only 1 person got a secondary school education.

By religion 98 per cent of the West Java population are Moslem; their daily life reflects the mixture of religious conduct and customs inherited from their ancestors which influences their spiritual and social organisational life, as well as their interaction. Table 2.2 does not tell much about religious education, except that only a few of the household heads (husbands) and wives got a religious education. However, a substantial amount of information is available from the number of education facilities recorded. For example, in Malausma there were 4 primary schools, 3 madrasah (formal religious schools), 4 pesantren (informal/traditional religious schools), 4 mosques and 18 surau (houses of worship). Unfortunately, there was no such complete information recorded for Suka Ambit, except that there were 3 primary schools in the village.

TABLE 2.2

LEVEL OF EDUCATION OF VILLAGE HOUSEHOLD, 1976

(in per cent)

	Suka Ambit				Malausma			
	None	3 yrs	6 yrs	>6 yrs	None	3 yrs	6 yrs	>6 yrs
General Education:								
Head of Household[1]	7	37	37	10	23	32	42	2
Wife	0	35	55	12	40	30	30	0
Religious Education:								
Head of Household	95	5	0	0	96	4	0	0
Wife	90	10	0	0	91	9	0	0

1 Figures do not add due to exclusion of category 'Not Stated'.

Table 2.3 presents the age distribution and average age of the household heads in both villages. A general feature revealed in both villages is that the number of children under 10 years old is greater than the number of teenagers. This indicates an expected increasing labour force in the next decade in these villages. In Malausma the number of females is greater than males. Comparing the two villages it is noted that the dependency ratio in Malausma (96 per cent) is slightly higher than in Suka Ambit (93 per cent).[1] In addition to that, farmers in Suka Ambit are older than the farmers in Malausma, as shown in Table 2.4. The older farmer is believed to be more experienced at farming. The population's age and the dependency ratio can be used as economic indicators of the level of living. There is an opinion that the greater the age of the population the better the level of living, and also the higher the dependence ratio the more difficult it is to increase the level of living as any extra income is only spent on consumption.

TABLE 2.3

AGE DISTRIBUTION OF HOUSEHOLD MEMBERS, 1976

Age (years)	Suka Ambit		Malausma	
	Male	Female	Male	Female
1 - 3	6	13	10	21
4 - 6	16	6	15	14
7 - 9	16	11	6	9
10 - 12	7	8	7	15
13 - 15	5	8	9	7
16 - 19	9	11	7	7
20 - 39	35	37	35	45
40 - 59	20	15	21	13
>60	9	14	6	4

Two kinds of occupation definition were used in this study. Firstly, occupation according to the farmer himself which is differentiated

1 The dependency ratio is the ratio of population under 15 years old and above 60 years old to the population between the age of 15-60 years.

TABLE 2.4

AVERAGE AGE OF THE FARMER, 1976

	Suka Ambit		Malausma	
	Average	Range	Average	Range
Household head (husband)	45	24-70	39	20-70
Wife	37	19-63	30	15-60

into two categories: according to the time spent, and according to income earned; and secondly, occupation as regarded by the village officials or as recorded in the village statistics (collected during the village census 1974). Table 2.5 indicates that in Suka Ambit 81 per cent of the head of household occupations are farmers according to the time spent but 74 per cent according to income earned, which is higher than the average village in the district. The percentage of farm labourers which is

TABLE 2.5

OCCUPATIONAL DISTRIBUTION OF THE HEAD OF THE HOUSEHOLD SAMPLE, 1976 (in percentage)

	Suka Ambit			Malausma		
	Head H'hold		Average Village in the District	Head H'hold		Average Village in the District
	t	i		t	i	
Farmers	81	74	48	73	38	37
Traders	2	4	7	11	12	7
Officials	6	8	5	0	2	4
Farm Labourers	4	8	28	0	0	38
Artisans, handicrafts, etc	6	6	12	16	48	14

Note: t = according to time spent; i = according to income earned.

second highest in the average village of the district is relatively low in Suka Ambit. In Malausma according to time spent, farming is the most frequent villagers' occupation (73 per cent) and the next is artisans and homecrafts (16 per cent) while according to the contribution of income earned to the household, artisans and handicrafts seems to be the main occupation (48 per cent) and farming to be the second occupation. None of the household sample claimed their occupation as farm labourer which is the second highest percentage of the average village in the district according to official records (Nurdin 1976).

However, according to the village statistics on occupation recorded during the survey (1976), in Suka Ambit 49 per cent of the families are farmer-owner-operators, 45.5 per cent are farm labourers, 0.3 per cent officials, 4 per cent traders and 0.5 per cent other labourers. In Malausma 9 per cent are farmers, 60 per cent artisans and handicrafts, 30 per cent farm labourers and 1 per cent others. The differences in the figures above are due to definitive differences. After all, the most important feature shown was that in Suka Ambit, farming is the main occupation, while in Malausma farming and artisans/handicrafts are both important as the sources of livelihood in the villages.

2.3 Land Use and Land Tenure System

Like most other villages in West Java, land in both sample villages consists of unirrigated or rainfed wetland (sawah), dryland (tegalan and kebun), i.e., unirrigated land which includes the house garden (pekarangan) which is a piece of land surrounding the house, and fishponds. Sawah is the most important land for the villagers as it is the best land for growing food crops mainly rice and second crops (palawija), i.e., peanuts, soybeans, and vegetables and other annual crops.

Well irrigated sawah can be double-cropped to rice. Dryland can be sown to rice and other food crops or annual crops, and perennial crops such as fruit trees, bamboo etc. The same crops were also found on the house-garden but in smaller areas and quantities.

In Suka Ambit, the total area of the village is 578 ha which is composed of 175 ha of sawah, 394 ha of dryland and 9 ha of fishponds. These figures tell us that most of the land resources available are less suitable for producing rice, which is the villagers main food crop. The ratio of sawah to total cultivable land[1] if 0.30 which is virtually identical to the average ratio to cultivable land per village in the district (0.27). For the 4,051 persons population of the village, total arable land is 341.6 ha which means that the ratio of man-arable land is 0.108 ha per person. This is more than twice the amount of arable land per head as in Sriharjo (Penny 1973).

Table 2.6 presents the average land cultivated according to land use by the household sample. The average total land cultivated per household is half a hectare with only 0.30 ha and 0.24 ha sawah in the wet and dry seasons. The average farm size in Java is 0.70 ha (Census 1971). Ten per cent of the sample did not have (cultivate) any land at all. Minimum, maximum, average and skewness of sawah size reveals the inequality of land distribution in this village. However, the average size of dryland is not greater than sawah. Fishponds were only owned by 10 per cent of the sample (5 households). The Lorenz curves of land distribution among the sample households are presented in Figure 2.

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1 Some of the land is not cultivable, but is used for houseyards, graveyards, etc.

TABLE 2.6

SUKA AMBIT: AVERAGE LAND CULTIVATED BY HOUSEHOLD SAMPLE, 1976

(in ha)

Type of Land	Wet Season 1975-76	Dry Season 1976	Number in Sample[1] Absolute	%
1. Wetland (sawah)	0.30	0.24	41	86
Minimum	0.00	0.00		
Maximum	2.56	2.56		
Skewness	4.67	5.12		
2. Dryland (tegalan & kebun)	0.27	0.27	44	90
3. Housegarden	0.03	0.03	42	86
4. Fishpond	0.004	0.002	5	10
	0.54	0.51		

Note: 1 Total number of households sampled = 49.

Village statistics indicates that about 88 per cent of sawah is double-cropped to rice (72 per cent) and some is planted to rice only in the wet season whereas in the dry season palawija or vegetables are planted or it is retained fallow depending on the availability of water or rain. Hence, multiple cropping is common in both sawah and dryland (Table 2.7).

The cultivable land in Malausma is 909 ha minus 11 ha of unproductive area (graveyards and others) providing its 1,520 households population with a 617.67 ha arable land[1] which is equivalent to the 0.40 ha per household or 0.10 ha per person; this is relatively comparable to

1 Arable land was measured by its productivity. To simplify the calculation, agricultural land other than sawah is reckoned at the rate of 40 per cent in relation to sawah productivity.

TABLE 2.7

SUKA AMBIT: CROP ROTATION ON SAWAH LAND, 1976

Crop Rotation	Area of Sawah	
	ha	%
1. Paddy-paddy	125	72
2. Paddy-paddy-palawija	5	2
3. Paddy-palawija-paddy	25	14
4. Paddy-palawija-fallow	15	8
5. Paddy-vegetables	5	2

Source: Village statistics.

the man-land ratio in Suka Ambit. This agricultural land, like in Suka Ambit, comprises sawah (simple irrigation and rain fed irrigation), dry-land, houseyards, fishponds, grazing land and others, with the percentage distribution shown in Table 2.8. The ratio of sawah area to total cultivable land in the village is 0.50, which is considerably greater than in Suka Ambit (0.30). However, the percentage of rice double-cropped sawah to total land is 16 per cent lower than in Suka Ambit (Table 2.9). Accordingly, in terms of wet rice field the land resources owned by the farmers in this village are not as good as in Suka Ambit. This contributes to the explanation of why more people are engaged in the occupation of artisans/handicrafts and traders and less as farmers in Malausma compared to Suka Ambit.

Average farm size in this village is also lower than in Suka Ambit, i.e. 0.40 ha in the wet season and 0.28 ha in the dry season. Average sawah size is 0.77 ha and 0.15 ha respectively in the wet and dry seasons (Table 2.10); and dryland is 0.11 ha per household.

FIGURE 2

LORENZ CURVE OF LAND (DISTRIBUTION) AMONG THE SAMPLE HOUSEHOLDS, 1976

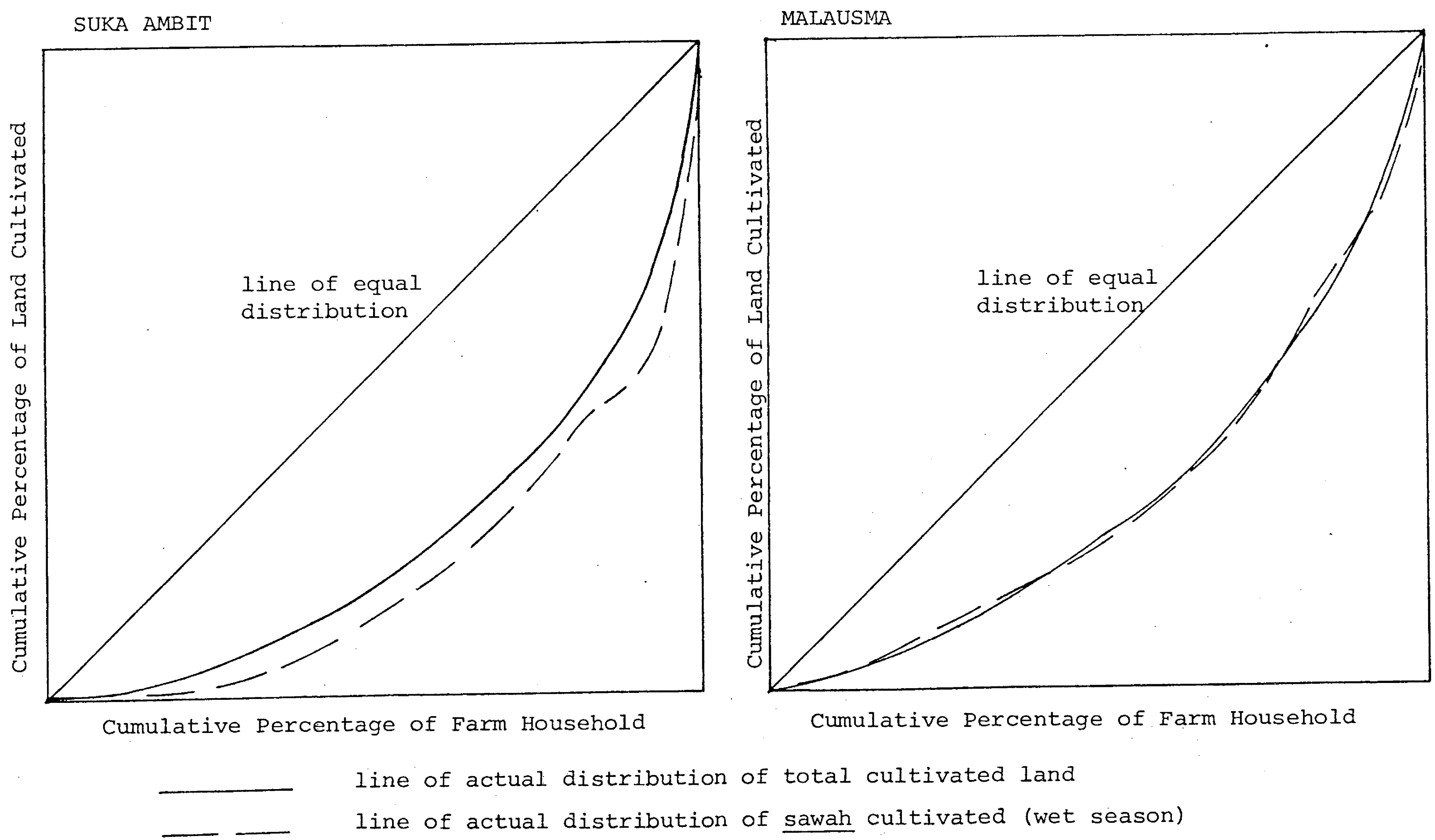

TABLE 2.8

MALAUSMA: LAND USE PATTERN IN THE VILLAGE, 1976

Land Use	Ha	%
1. Irrigated sawah	150.00	16
2. Rainfed sawah	298.86	33
3. Dryland	352.04	39
4. Housegarden	15.45	2
Fishponds	11.35	1
5. Grazing land	60.00	7
6. Other	10.00	1
7. Village square	1.15	-
Total	909.10	100

Source: Village Statistics.

TABLE 2.9

MALAUSMA: CROP ROTATION OVER ALL THE LAND IN THE VILLAGE, 1976

Crop Rotation	Percentage of Total Land
1. Paddy-paddy (sawah)	16
2. Paddy-palawija or vegetables (sawah)	33
3. Paddy-palawija) Palawija-fallow) Cassava or sweet potato)	39
4. Other (home yard)	12

Source: Village Statistics.

TABLE 2.10

MALAUSMA: AVERAGE LAND CULTIVATED
BY HOUSEHOLD SAMPLE, 1976
(in ha)

Type of Land	Wet Season 1975-76	Dry Season 1976	Number of Sample	
			Absolute	%
1. Wetland (sawah)	0.27	0.15	56	98
Minimum	0.10	0.00		
Maximum	1.12	0.70		
Skewness	1.74	1.98		
2. Dryland (tegalan & kebun)	0.11	0.11	53	93
3. Housegarden	0.01	0.01	39	68
4. Fishpond	0.007	0.007	30	53
Total	0.40	0.28	57	100

The difference between average sawah in the wet and dry season indicates that only half of the household samples sawah is planted rice twice a year. The minimum, maximum and skewness of sawah size in both seasons shows that the inequitable distribution of sawah cultivated by the farmer in Malausma is not as severe as in Suka Ambit. The Lorenz curve of land distribution in Figure 2 visually reveals the differences. Nearly all household samples cultivate the land. Fifty-three per cent of the household owned fishponds, which is higher than in Suka Ambit, even though these fishponds are not usable in the dry season. Less access to dryland and housegardens compared to the household sample in Suka Ambit was also evident in Malausma. A multi-cropping system is also practiced by the farmers either in sawah or on dryland. The types of crop rotation are presented in Table 2.9. Dryland was sown to paddy, cassava, sweet potatoes, vegetables and fruit trees. Cassava was also grown in the housegarden as well as coconuts, cloves and spices. A discussion of the size of land with regard to its economic meaning to the farmer is not complete without considering that land is varied in quality; this gives different productivities depending, among other things, on the fertility, irrigation and drainage. For example, a half of a hectare of irrigated _sawah_ double-cropped to rice does not have the same economic value to the farmer as another half hectare of rainfed _sawah_ sown to only one rice crop a year. For this reason an attempt was made to look at the farmers' resource availability where farmers are ranked in order of land area under production, or where the quality of the land cultivated is adjusted according to its production in the survey year.

The method of adjustment is as follows. For example, with _sawah_ a score of 100 was allocated if it was planted to rice in the wet season. If it was rice cropped again in the dry season then the physical area was adjusted by the ratio of the net value of productivity in the dry season to the net value in the wet season. A similar estimation was made if other crops were planted in the _sawah_. For dryland areas the same method was also applied, i.e. the actual physical area, times the ratio of net value of production to net value of rice production in _sawah_ at the same unit area. Net value in this calculation is the value of gross output minus all variable costs of production except family labour used. Thus, the area of land under crop production during the whole year is adjusted to reflect the soil fertility, and water/irrigation qualities of the land used. Net value of rice (on _sawah_) was taken as standard because rice is the main food and most of the _sawah_ owned by the farmer does not produce enough rice for the family consumption.

Table 2.11 and 2.12 were set up to look at the sawah cultivation by the household sample by farm size by taking the single largest farm, average of the top 10 large farms, average of the whole farm, average of the bottom 10 small farms and the ratio of the top 10 to the bottom 10 small farms. This table again reveals the inequality of land distribution. In Suka Ambit, the largest single farm (according to area quality adjusted) is ten times the size of the average farm area in the village and more than eighty times the average size of the production areas of the bottom 10 small farms.

The ratio of average sawah (planted to rice) for the top 10 large farms to the average of the bottom 10 small farms in both wet and dry season (ratio B to D) are even larger, 35 and 52 respectively. In Malausma, this distortion was not as large as in Suka Ambit, where the average land area under production was 0.43 ha, slightly smaller than in Suka Ambit. The skewness of the data for the average of the whole sample makes this trend more apparent. Those tables also indicate that in both villages, the bigger the farm, the more sawah double-cropped with rice. On average this is 80 per cent and 56 per cent in Suka Ambit and Malausma respectively. With regard to the percentage of sawah to total land area (quality adjusted), column 5 shows that small farmers in Suka Ambit are in a relatively better position than small farmers in Malausma.

In the area studied, the inheritance law provides that land is divided among the actual heirs. Sons and daughters receive an equal amount of land. However, if it is based on Islamic Law, the daughter receives only half the amount of land received by the son. For this reason most farms are very small and plots are scattered. The most common tenure system is owner operator, the right of land ownership is freely

TABLE 2.11

SUKA AMBIT: LAND CULTIVATED (AREA UNDER PRODUCTION) BY HOUSEHOLD SAMPLES, 1976

Suka Ambit	Area Under Production (quality adjusted) (Ha)	Sawah		% Sawah Wet Season to Total Land 3 ÷ 2
		Wet Season (Ha)	Dry Season (Ha)	
(1)	(2)	(3)	(4)	(5)
A. Largest single farm	5.16	2.56	2.56	50
B. Top 10 large farms (average)	1.54	0.70	0.52	46
C. WHOLE SAMPLE:				
Average	0.53	0.30	0.24	45
Skewness	5.16			
D. Bottom 10 small farms (average)	0.06	0.02	0.01	28
E. Ratio of B to D	25.60	35.00	52.00	28

TABLE 2.12

MALAUSMA: LAND CULTIVATED (AREA UNDER PRODUCTION) BY HOUSEHOLD SAMPLES, 1976

A. Largest single farm	1.57	0.70	0.50	45
B. Top 10 large farms (average)	1.12	0.65	0.20	58
C. WHOLE SAMPLE:				
Average	0.46	0.27	0.15	58
Skewness	4.09			
D. Bottom 10 small farms (average)	0.16	0.09	0.03	54
E. Ratio of B to D	7.00	7.22	6.67	54

transferable as somethig to be bought or sold. Inter-village marriages and migrating are also common. All of these factors help explain the existence of other forms of tenure system such as share-in, share-out, rent-in, rent-out and fragmentation of ownership. Land in a particular village can be owned by an owner from another village and vice-versa (tanah guntay). Information on these tenure systems in both sample villages is presented in Table 2.13. Unfortunately reliable data on rent-out and share-out of land were not available from the survey. Accumulation of landholdings to a few farmers (say to more than 3 ha, for example) was also not evident in this survey.[1] Table 2.13 reveals that in Suka Ambit, besides cultivating of owned land, the share-in systems are more common than rent-in. While in Malausma rent-in is found more than share-in. Seven (14%) and six (12%) of the household samples from Suka Ambit operated owned and share-in land, respectively outside the village; five (9%) of the household sample in Malausma owned land outside the village, but none of them used the share-in or rent-in system.

2.4 Labour and Capital Availability

From the age distribution data presented in Table 2.3, the potential labour supply of the household samples are derived. Since 'labour-used' data in the questionnaire are in manhours, this measurement unit will be used in the analysis. The term 'mean-hour equivalent' is used to balance the difference of male and female labour capacity. Actually, it is difficult to convert women-hours to man-hours of work

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1 There is no reliable data on landholding from the household sample. Enumerator's field notes indicate that there are 8 farmers regarded as large farmers in Suka Ambit. Two of them owned more than 15 ha inside and outside the village.

TABLE 2.13

LAND TENURE SYSTEM OF THE HOUSEHOLD SAMPLE IN SUKA AMBIT AND MALAUSMA, 1976

(number of household in percentage)

Type of Land Tenure	Suka Ambit			Malausma		
	Sawah			Sawah		
	Wet Season	Dry Season	Dry-land	Wet Season	Dry Season	Dry-land
Owned	71	70	98	96	89	93
Share-in	37	47	18	9	11	2
Rent-in	6	8	0	14	12	0

because of the differences in types of job and wages received, and also the age of each sex causes different performances. However, to simplify calculation in this study only the difference in the wage received for pre-harvest jobs in rice production is used as the conversion rate, i.e. women-hour of work is assumed to be equivalent to 0.625 man-hours. The average working hours per day is equal in both villages, i.e. ploughing (a man plus 2 water buffaloes) 4 hours, hoeing (man) 9 hours, replanting and working (man or woman) 5 hours. As an average we took 6 hours per day. Taking male and female from the age of above 15 years to less than 60 years as the potential labour supply in the family (Table 2.3) the average potential labour supply per household is 777 working days equivalent or 4430 man-hours equivalent per year in Suka Ambit and 673 working days equivalent or 3817 man-hours equivalent per year in Malausma, assuming 300 working days per year.[1] From this potential labour supply

1 Several studies used the range of age 15 to 59 or 65 or 69 years for potential full time employment (Yotopoulos 1967) and 300 working days per year with an average 6 hours in the farm sector, and 8 or 9 hours in the non-farm sector (Penny 1973, Ginting 1978).

TABLE 2.14

AVERAGE LABOUR SUPPLY AND LABOUR USED PER HOUSEHOLD, 1976

(man hours)

Labour Used Per Activity	Suka Ambit		Malausma	
	Family Labour	Hired Labour	Family Labour	Hired Labour
Farm - Rice	163	690	229	332
- Second crop	20	22	56	19
- Dryland crop	315	51	70	12
- Husbandry and Fishery	35		35	
- Exchange labour	2		47	
	535		438	
Off-Farm				
- Farm labour	357		57	
- Non-farm labour	500		128	
- Self Bus. Employ	417		1324	
- Exchange labour	262		162	
	1536		1671	
Total family labour used	2071 (47.0%)		2109 (55.3%)	
Family labour unused	2359 (53.0%)		1708 (44.5%)	
Labour supply	4430		3817	

each household distributed its labour use to different income earning activities in farm or off-farm activities as presented in Table 2.14. As can be read from the table, it is evident that unused family labour is 53.0% in Suka Ambit and 44.5% in Malausma. However, it is not correct to say this percentage is the level of unemployment in the sample villages. The figures will be more appropriate if in the calculation of labour supply, the number of potential family members who cannot work (such as those sick, the man hours worked as officials for the village or government and the contribution of children) are accounted for.

The farm activity which absorbs most of the family labour in Suka Ambit is dryland crops. Rice absorbs only a little family labour despite the fact that hired labour is used a lot. After farm activities the activity which absorbs most family labour is non-farm labouring and self business employment. The latter income earning activity includes furniture making, trading, food stalls, artisans and handicrafts. In Malausma self business employment seems to have absorbed most family labour. This activity involves trading, food stalls, artisan and handicrafts (rope-making).

Even though there was unused family labour, the farmer still used paid labour. This is for two reasons: firstly because of the nature of agriculture each job has to be finished in a short time. However, considering that the farm sizes were relatively small, family labour alone should be enough to complete the job. Hence, another explanation is probable, based on non-economic factors such as the use of redundant labour in rice harvesting (as shown in Table 2.13 most paid labour is used for rice production). Geertz (1963) mentioned this phenomenon as 'sharing poverty',i.e. even though the rice owner only has a small plot, for social reasons they have to share what little they have by allowing more harvesters to work in the rice fields.

The high percentage of unused family labour also indicates the shortage of employment opportunities in the village. It is understandable why seasonal migration (urbanisation) to the city is common from the village. Jakarta, Bandung and other cities in West and Central Java are their destinations as labourers or petty traders. This happens after rice harvesting.

Theoretically the assets or capital used in the process of agricultural production are distinguished into fixed capital and working capital. The latter is capital which is used up and replaced within a single production cycle of usually one season or year. In the area studied, the working capital is mainly seed, fertilizer and chemicals. Seed is usually met out of reserves from past production. As has been noted, the farmer lacks this working capital. Credit for this was provided by government to the farmers participating in the rice intensification programme (BIMAS). Farmers who need working capital for other crops should use their own funds or borrow from private lenders or relations in the village. To get a static view of the farmers' fixed capital, the survey covered an inventory of household assets, tools and equipment, livestock and working animals. The value of house, plants, trees, tools and equipment, and depreciation of these assets are very difficult to obtain, hence are not available in the questionnaire. Table 2.15 shows the ownership of household assets and capital used in some cases also the number of items owned. It is evident that farmers in Suka Ambit had more household assets with an average value double that of the farmers in Malausma. As an indicator of the standard of living this shows that the villagers in Suka Ambit were more prosperous than in Malausma. Eventually, they could afford to have more fixed capital. With respect to the tools and equipment owned most of the farmers had only hoes, arit (bent knives for weeding) and parang (heavy knives). Each of these tools was worth not more than Rp 1000 (=US$2). Only about half of the household owned landak (rotary weeders) and caplak (rice replanting liners) which are worth not more than US$3 and US$1 respectively. Only a few farmers in Suka Ambit had ploughs, garu (tillers) and hand sprayers. None of them had any tractors or bullocks.

TABLE 2.15

NUMBER OF HOUSEHOLDS OWNING HOUSEHOLD ASSETS, TOOLS AND EQUIPMENT AND WORKING ANIMALS AND LIVESTOCK, 1976

Household Assets/Indicator of Standard of Living	Suka Ambit			Malausma		
	Household No.	%	Range of Number Owned	Household No.	%	Range of Number Owned
Dining Room	21	(43)	0 - 1	6	(11)	0 - 2
verandah	39	(80)	0 - 2	24	(42)	0 - 2
bedroom	45	(92)	0 - 4	40	(70)	0 - 2
mattress	49	(100)	0 - 5	57	(100)	1 - 3
cupboard	43	(88)	0 - 4	19	(33)	0 - 2
food cupboard	12	(25)	0 - 2	3	(5)	0 - 1
buffet	41	(84)	0 - 3	31	(54)	0 - 3
iron	9	(18)	0 - 1	2	(4)	0 - 1
gasolin stove	17	(35)	0 - 2	1	(2)	0 - 2
o'clock	7	(14)	0 - 1	0	(0)	-
radio	19	(39)	0 - 1	11	(19)	0 - 1
cassette player	3	(6)	0 - 1	1	(2)	0 - 1
sewing machine	7	(14)	0 - 1	3	(5)	0 - 1
bicycle	4	(8)	0 - 1	0	(0)	-
motor-bike	1	(2)	0 - 1	0	(0)	-
Average value (in thousand rupiah)	65.2		5 - 433	30.6		3 - 99
Tools and Equipment						
hoe	45	(92)	0 - 3	53	(93)	0 - 4
arit (bent knives)	43	(88)	0 - 3	51	(90)	0 - 4
garu (tiller)	8	(16)	0 - 1	1	(2)	0 - 1
plough	8	(16)	0 - 1	1	(2)	0 - 1
hand sprayer	4	(8)	0 - 1	0	(0)	-
irrigation pump	1	(2)	0 - 1	0	(0)	-
landak (rotary weeder)	23	(47)	0 - 5	19	(33)	0 - 3
caplak (planting liner)	21	(43)	0 - 2	26	(46)	0 - 3
parang (heavy knives)	39	(80)	0 - 2	44	(77)	0 - 5
hand tractor	0	(0)	-	0	(0)	-
jala	6	(12)	0 - 1	1	(2)	0 - 1
Working Animals & Livestock						
water buffalo	0	(0)	-	4	(7)	0 - 2
goat	4	(8)	0 - 7	2	(4)	0 - 6
sheep	21	(43)	0 - 5	28	(49)	0 - 7
chickens	40	(82)	0 - 30	48	(84)	0 - 12
duck	0	(0)	-	3	(5)	0 - 3

The working animal owned are water buffaloes which were possessed by 4 householders in Malausma. About half of them possessed sheep and goats; nearly all households kept chickens, but ducks were only kept by 3 households in Malausma. All of this data indicates the lack of capital owned by the farmers in the study area.

2.5 Rural Institutions

The discussion of rural institutions in this section is distinguished into government directed institutions and non-government institutions. With respect to the first mentioned, there are about 60 institutions under the direction of 12 separate government departments in the capital city, which in theory operate at village level in Indonesia (Sinaga 1976). However, those most common and relevant to this study are institutions raised for the purpose of agricultural extension services.

The BUUD/KUD (Village Unit Cooperative). The BUUD or 'Village Unit Enterprise Board' is a merger of all existing village-level cooperatives (such as Kooperta or Farmers' Cooperative) into a single organisation, fused in 1972. The BUUDs under this new policy were to be subsequently raised to the status of KUD, 'Village Unit Cooperative' with the full legal status of cooperative, after fulfilling certain conditions. The BUUD/KUD in its original conception was intended to become:

> '...an economic organisation of the population, created by the people and for the people, which gradually should progress until it carried out all the economic activities required by society, and particularly those required in the development of the rural agricultural economy.'

Hence, the function of the BUUD/KUD officially is to be a general agricultural cooperative providing the farmers with a number of services to help them overcome their production and marketing problems within the framework of the Rice BIMAS programme. The BIMAS programme as a whole aims to provide all 'agri-support' activities through, for example, the bank (credit), the extension service (extension and experimentation), and the BUUD/KUD (provision of fertilizers and other inputs, processing and marketing services for agricultural products). It is for this reason that the BRI (Bank Rakyat Indonesia = People's Bank), Extension and BUUD/KUD programmes are all organised to operate within the same geographical units, a unit of 600-1000 ha called '*Wilud*' (Wilayah Unit Desa = Village Unit Region). Hence, a *Wilud* may cover two or more villages and for each *Wilud* there is an agricultural extension field staff (PPL), a Village Unit of the People's Bank of Indonesia, *BRI Unit Desa*, and a BUUD/KUD.

Farmers in Suka Ambit have long been participating in the BIMAS programme for rice as well as the INMAS programme. BIMAS participants get credit from the government for input factors like fertilizer, insecticides and 'cost of living'. The difference between the BIMAS and INMAS programmes is that in the first programme the government provides credit to the farmer while in the INMAS programme farmers are encouraged to buy input factors from their own funds.

In Malausma, BIMAS was introduced in 1971. Nowadays almost all farmers who fulfil the requirement for participation take part in this scheme. However, unlike in Suka Ambit, farmers have to go to neighbouring villages to obtain credit and fertilizer because this village shares its BUUD/KUD and Village Unit Bank (BRI) with other villages, except in the peak time when BIMAS enrolment bank officials come to the village and fertilizer is delivered either through BUUD or by appointed private distributors to the village office.

Farmers' Organisation. The Agricultural Extension Service operates locally through a system of Farmers' Association (Kelompok Tani) which consist of about 50 members (farmers) where a couple of them are Contact Farmers (Kontak Tani). The extension worker (PPL) visits the Contact Farmer regularly; the Contact Farmer should bring or spread the information from PPL to the Farmers' Association members. Besides the Farmers' Association, farmers may also group into Farmers' Radio Listener Group (Kelompok Pendengar) whose activity is to listen and discuss the agricultural extension programme broadcast over the radio. Unfortunately not all of these associations work properly in both sample villages.

Lumbung Bahagia is one type of non-government directed institution existing in each hamlet in the village. It is a lending cooperative which serves members only. Some amount of paddy is contributed by members at harvest time. Loan is granted to members usually for six months repayment at 20% interest.

Another type of a hamlet-based saving association is beas parelek (spoonfuls of rice) whose members are housewives. The association collects a spoon of rice per day, and lends rice ranging from 2-15 kg to members, usually in the difficult pre-harvest months. Loan is repaid at harvest time, free of interest if used for consumption, 4% a month is charged if not used for consumption.

CHAPTER 3

ANALYSIS OF FARM HOUSEHOLD INCOME

3.1 Composition of Household Income

Farm household income is derived both from farming activities and off-farming activities. Income from the farming activity derives from such diverse production as from sawah, drylands, fishponds, livestock and poultry. Off-farm income covers various returns to labour, non-farm assets/capital and services such as wages, salaries, gains from self-employed businesses in cash or in kind.

The term income is used in this study to refer to 'family labour income', i.e., the gross value of total production in one year, including receipts from sales; the value of products consumed at home (at farm gate prices, except for rice[1]) and the quantity retained for other uses; wages in cash and kind earned, and gross receipts from contract work with own equipment; changes in the value of livestock; less the cost of all inputs and rents paid (variable costs) other than family labour. Hence 'gross income' in this study refers to total revenue and 'net income' refers to gross margin, that is total revenue minus variable cost. By subtracting gross farm expenses and paid labour from gross farm receipts (total revenue) a return can be calculated which represents the earnings of the farmer for his labour, management and capital. The value of fixed costs in farm production are ignored because they are relatively small and data on depreciation is not available. Farm expenses covers running costs such

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1 See Appendix I.

as seeds, fertilizer and chemicals (pesticides and insecticides).

Farm Income: The components of farm income are rice income (produced on sawah), second crop (palawija) income (produced on sawah), dryland crop income and livestock and fishery income. Rice income is the main component of farm income, as most of the land resource is sawah, wetland used to grow rice. Rice is produced for family consumption mainly in the wet season. In the dry season rice is sown only if enough water is available. Rice cultivation is labour intensive. It absorbs a great deal of family labour and paid labour for land preparation, replanting, weeding and harvesting. Most of the jobs are done by human labour. Only 6 out of 49 sample farmers in Suka Ambit, and none in Malausma, used animal labour (water buffalo) to draw the plough for land preparation. The likely explanation for this is the small size of sawah, on average 0.30 ha in Suka Ambit and 0.27 ha in Malausma (Table 2.12), and potential family labour supply of which only 47% and 55% per year per household in Suka Ambit and Malausma was used (Table 2.14). The average rice yield is 36 qt in Suka Ambit and 34 qt in Malausma, which is low. None of the sample in Malausma grew high yielding varieties.

The figure for gross rice income in this study was derived by multiplying gross output by the average rice price in the village per year (See Appendix I, Data Treatment). Because the size of sawah is small, rice production is not sufficient to fulfil family consumption requirements. Accordingly, planting another crop after the rice harvest is one way of meeting consumption needs. The second crops are sweet potatoes, talas, maise, pumpkin, and vegetables which do not need much water to grow. For some crops intensive care is needed in terms of labour used and other inputs such as fertilizer, insecticide and pesticide, for example in growing chili (vegetables). As a result, returns per ha are also high which allows some of the yield to be sold in the market. Income figures from these crops are assessed by the value of the total product less the cost of paid labour, fertilizer and chemical used. Some farmers use organic manure from their own livestock, which is not included in the calculation.

Dryland is planted to annual and perennial crops. Annual crops include cassava, nuts (legumes), sweet potatoes and maise. These crops are also called dryland palawija. Rice is also sown on the dryland. Seven sample farmers were reported to be growing rice in the dryland in Suka Ambit and four in Malausma. The average yield is 27 qt which is lower than the rice production in sawah because the dryland is usually less fertile and has no irrigation. The rice varieties are also different from those varieties sown on sawah. Like growing rice in sawah, dryland rice is a labour intensive activity and at a certain stage such as land preparation and harvesting, non-family paid labour is also used.

The housegarden is a plot of land surrounding the house. Various crops are sown on this land. One can find a mixture of many plant types including annuals and herbaceous plants as well as perennials, especially fruit trees and all the other crops which can be grown in combination with fruit trees but are not grown in large commercial quantities as on sawah and dryland.

The importance of the housegarden and dryland to the villagers' economy has been mentioned in several studies. For example, Terra and Ochse (1934) in their study in Koetowinangoen in 1932 pointed out the great importance of the housegarden and tegalan in the monetary domestic economy of the farmer. For the poorer class, sawah, so far as cash incomes are concerned, is of little significance and the tegalan are primarily a source of cash income.

Terra and Ochse estimated that about 15% of the arable land in Java and Madura is taken up by the housegardens. The housegarden has also considerable dietary importance to the farmer.

This study concluded that:

> 'The amount allotted to the compound and the intensity with which it is planted to fruit trees (bananas, jack-fruit, coconut etc.) increases as the total land owned per caput of the inhabitants decreases down to the point where the average land owned is only about 0.15 ha.' (Ochse and Terra 1934)

A more interesting result emerged from Stoler's (1975) study in investigating the nature and uses of home gardens in the Central Javanese village of Kali Loro, through an intensive study of the household economy in 1973. The result among other things showed a significant curvilinear correlation (r = .63) between intensity and household income, a market correlation (r = .64) between rice purchased and the intensity of rice production, and an inverse relation (r = -.57) between garden size and garden intensity and also between labour inputs and garden size.

The percentage of garden produce sold varied between 26% and 31% while Ochse and Terra's (1934) and Penny and Singarimbun's study indicate that as much as 68% of garden produce was converted into cash.

In Miri-Sriharjo 1972 49% of farmers' income was from house-gardens, 35% from sawah; others were from off-farm income (Ginting 1978). In the questionnaire for this study most income from the housegardens came from fruit trees. Only a few farmers reported that palawija (annual crops) and work production also contributed to housegarden income. However, since separate questions on the use of labour and other input factors to this activity are not available, income from housegardens has been included in the analysis of income for dryland.

Income from livestock is assessed by finding the difference between the value of livestock at the beginning and end of the year. Added to this value is the difference between the value of livestock sold and bought. Unfortunately no information was recorded on the value of livestock consumed and the cost of keeping the livestock. Income from fisheries is assessed by valuing the fish produced in the fishpond in one year; the farmer's estimate was used because the fish produced are usually for home consumption.

Off-farm Income: This income consists of farm labour income, off-farm labour income, self business employment and handicraft income and other income. Farm labour income is all forms of earnings and receipts derived from works on other farms, i.e., wages, receipt in kind (include meals), or money value. The work includes hoeing, transplanting, weeding and harvesting. Income earned through the ceblokan system is also included in this category. Ceblokan is a system of working on other peoples rice fields where the labourers transplant, weed and sometimes plough without pay. The labourer is then allowed to harvest the rice, receiving a much larger share (one-fourth) then the common harvesting paid system. The common harvesting system is called the bawon system where the harvester is paid one-tenth of the rice harvested. In Central Java this ceblokan system is called the kedokan system (Collier et. al 1974). Off-farm labour income includes incomes or wage receipt from labouring on the off-farm sector such as carpentering, bricklaying or becak driving in the city after the harvesting period where there is seasonal urbanisation. Self business employment and handicraft incomes include activities such as village petty trading, running a foodstall or shop, handicraft rope making from bamboo and middleman trading of agricultural and handicraft products to the city. Other incomes include receipt pensions, interest, land rent, etc.

The recapitulation of farm household income, following the classification explained above, is presented in Appendix II: Tables 1 and 2 and condensed in Table 3.1. On average, farm household income in Suka Ambit is greater than in Malausma, being Rp 191,160 and Rp 134,525 respectively. An analysis of this total farm household incomes for Malausma and Suka Ambit (Table 3.1, Columns 2 and 7) reveals that 61 per cent and 52 per cent were the contribution of farm income whereas the income from rice enterprise was 32 per cent and 30 per cent respectively. This higher total income and higher contribution of farm income in Suka Ambit is to be expected on the basis of differences between these two villages selected for this study.

When comparing the contribution of each activity to total household income in Suka Ambit, certain factors are of interest. Ranking the average component of income in money term (Rupiah), the highest is from rice income (32%), next from off-farm labour income (18%) and the third is from upland crop income (14%). However, it would be misleading to consider only the average value of each activity contribution without also considering the number of farmers actually involved in each activity. This could lead to a false conclusion about income sources for the whole village if a general inference is made from the high value of an average which is only true for a few people. Hence, an order of activity contribution to total income according to the number of the sample involved in each income earning activity was also made, as shown in

TABLE 3.1

TOTAL FARM HOUSEHOLD INCOME IN SUKA AMBIT AND MALAUSMA, 1976

	SUKAAMBIT					MALAUSMA				
	Average A		Proportion of Sample Reporting		Average B	Average A		Proportion of Sample Reporting		Average B
	Rp	%	n	%	Rp	Rp	%	n	%	Rp
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Total Household Income -per household	191,160	100	49	100	191,160	134,525	100	57	100	134,525
-per caput	49,212					32,811				
1. Income from rice on sawah	60,438	32	42	86	70,511	40,667	30	56	98	41,393
2. Income from second crop on <u>sawah</u>	4,367	2	17	35	12,586	3,097	2	44	77	4,012
3. Income from dryland crop	25,849	14	44	90	28,786	13,472	10	54	95	14,220
4. Income from housegarden	3,849	2	29	59	6,503	5,081	4	41	72	7,064
5. Income from livestock and fishery	21,603	11	28	57	37,805	7,117	5	23	40	17,637
Total Farm Income - per household	116,106	61	49	100	116,106	69,434	52	56	98	70,673
- per capita	29,027					16,816				
1. Income from farm labouring	22,468	12	23	47	47,867	2,756	2	23	40	6,830
2. Income from off-farm labouring	34,754	18	18	37	94,608	11,414	8	12	21	54,217
3. Income from self business employment and handicraft	9,094	5	9	18	49,511	49,935	37	56	98	50,827
4. Income from other sources	8,738	4	7	14	61,163	986	1	1	2	56,200
Total Off-Farm Income - per household	75,054	39	38	78	96,780	65,091	48	57	100	65,091
- per caput	18,764					14,827				

Average A accounted for total sample.

Average B accounted for the sample involved only.

columns 4 and 9 in Table 3.1. It can be seen from this classification that all farm income activities (except second crop) seem significantly important for the villagers in Suka Ambit; namely, dryland crop income (90%), rice income (86%), income from housegarden (59%) and income from livestock and fishery (57%). Villagers also have off-farm income earning activities: 47% from farm labouring and 37% from off-farm labouring, to mention two high percentage examples.

In Malausma, the contributions of major income earning activities to total household income are income from self employed business and handicraft (37%), rice income (30%), income from upland crop (10%) and income from off-farm labouring (8%) (Column 7, Table 3.1). According to the number of the sample involved in each activity, the order of percentage is rice income and self employed business and handicraft income (each 98%), upland crop income (95%), second crop income (77%), and income from housegarden (72%).

Focusing upon the three most important income earning activities, by combining the two criteria high average income and most people involved the following pattern can be seen. In Suka Ambit the major income sources are rice income, upland crop, plus housegarden income, and livestock and fishery income. As a supplement to farm income, farm and off-farm labouring activities seem also important for quite a few farmers. In Malausma, the order of importance for sources of income is self-employed business and handicraft income, rice income and from upland crop. Many people are also involved in farm labouring but the return is very small, lower than for the same job in Suka Ambit. Columns 5 and 10 of Table 3.1 present an average income derived from specific activities in which each farmer is involved.

The result indicates the actual income earned as contribution to the household income. It is apparent for both villages in general that average income earned from off-farm activities was mostly high and often even higher than farm income. However, such income earning opportunities are not available to all households. For example, income from off-farm labouring in Suka Ambit gives the highest return per household (Rp 94,608), but only 37% of the sample were involved in the income earning activities.

The average income from rice, taking only the household grown rice, was Rp 70,511 in Suka Ambit and Rp 41,393 in Malausma. Stated in milled rice equivalents this is 148 kg in Suka Ambit and 89 kg in Malausma per year per capita. Compared to the average national rice consumption requirement of 125 kg rice per capita, it can be seen that on average farmers in Suka Ambit are able to produce enough rice for family consumption but in Malausma rice production falls below this level. In this calculation, there is no consideration of the amount of rice sold by the farmer. One sample in Malausma and seven in Suka Ambit did not

TABLE 3.2

NET RICE PRODUCTION PER CAPITA
IN SAWAH, 1976
(Rice growing families only)

Net Rice Income Per Capita Per Year (kg milled rice equivalent)	Proportion of Total Growers (%)	
	Suka Ambit	Malausma
Less than 124 kg	63	73
125 kg and above	37	27

grow rice either on sawah or on upland. Table 3.2 shows that only 37% of the rice growers in Suka Ambit and 27% in Malausma are able to produce enough rice to satisfy the level of national rice consumption per head per year.

Summing up the above findings, a farmer in Suka Ambit has an opportunity to earn an adequate income mostly from farming; while on the other hand, in Malausma a farmer has to work on farm and off-farm to supplement the insufficient farm income. Moreover, even with this supplementary source of income the average total household income in Malausma was still below the average achieved by farmers in Suka Ambit. A likely explanation is the differences in the agricultural resource endowment between these two villages, in particular such factors as the availability of land and irrigation.

The variation of total household income within each village was also examined and the main findings are presented in Table 3.3. The top ten large farms and the bottom ten small farms are classified according to land area under production adjusted by land quality (see p.30) and are contrasted. Data in Table 3.1 show that the differences in the size of land under production between the large and small farms do not proportionally reflect the differences in total household incomes. In Suka Ambit, for example, the ratio of land under production for each group (large and small farms) is a factor of 25 while the ratio of total household income is only 3. In Malausma, the gap between large and small farms was also large but not as great as in Suka Ambit, where land ratio was 7 as opposed to a household income ratio of 1.8. These findings suggest that small farmers rely much more on off-farm income, and indeed the table shows that for the bottom ten small farms in Suka

TABLE 3.3

SOURCE OF INCOME OF THE HOUSEHOLDS IN SUKA AMBIT AND MALAUSMA, 1976. SAMPLE GROUPS ACCORDING TO LAND AREA UNDER PRODUCTION

(In Rupiah)

Suka Ambit	Area Under Production (Quality Adjusted) (Ha)	Income (Rp)		
		Total	Farm Income	Off-farm Income
(1)	(2)	(3)	(4)	(5)
A. Largest single farm	5.16	851,467	851,467	0
B. Top ten large farms (average)	1.54	403,443	341,242 80%	62,201 16%
C. WHOLE SAMPLE (average)	0.54	191,160	116,106 60%	75,054 40%
D. Bottom ten small farms (average)	0.06	138,931	23,608 17%	115,323 83%
E. Ratio B to D	25.6	2.90	14.45	0.54
Malausma				
A. Largest single farm	1.57	261,734	251,334	10,400
B. Top ten large farms (average)	1.12	178,487	135,774 76%	42,713 24%
C. WHOLE SAMPLE (average)	0.46	134,525	69,434 52%	65,091 48%
D. Bottom ten small farms (average)	0.16	100,678	26,202 26%	74,476 74%
E. Ratio B to D	7.0	1.78	5.18	0.57

Ambit, off-farm activities contributed 83% to total income while in Malausma the contribution was 74%.

Table 3.4 shows total household income stated in milled rice equivalent. Surprisingly, neither the whole sample nor the bottom ten small farms earned an average income lower than the poverty line of 240 kg milled rice equivalent as calculated by Sajogyo (1975)[1]. Moreover the gap between the large and the small farmer both for total income per household and per capita is not as wide as the ratio B to D in either village, though Suka Ambit shows a more distinct difference. This also implies that the variation on the area of land cultivated by household has become less and less important in explaining the variability of total household income, especially in Malausma.

Limited access to agricultural land seems to have encouraged farmers to devote more of their labour, which is their main economic resource, to farm and to off-farm activities, as shown in Table 3.5. The farmer in Suka Ambit has a higher ratio of working hours on farm activities to off-farm activities than a farmer in Malausma. This is probably because 75% of sawah in Suka Ambit can be double cropped to rice.

However, the figures for working hours on farm activity in Suka Ambit should be used with caution, because they are probably over estimate, as has already been indicated in discussing Table 2.14 (page 35). The data for the largest single farm also has shortcomings. The working

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1 "Sajogyo's 'poverty line' of 240 kg m.r.e. per head has a physical/ material basis, and is derived from the science of human nutrition. It is pitched at a modest level, just over double the amount of physical sustenance needed to avoid starvation. The line he has designated is also recognised by the Javanese peasants, who have long possessed a minimum income concept which they call cukupan, or enoughness". (Penny 1979)

TABLE 3.4

AVERAGE ANNUAL INCOME OF THE HOUSEHOLDS IN SUKA AMBIT AND MALAUSMA, 1976. SAMPLE GROUPS ACCORDING TO AREA UNDER PRODUCTION

(Kilograms Milled Rice Equivalents)

Suka Ambit	Area Under Production (Quality Adjusted) (Ha)	Income (kg MRE)	
		Total	Per Caput
(1)	(2)	(3)	(4)
A. Largest single farm	5.16	7,152	1,069
B. Top ten large farms (average)	1.54	3,389	812
C. WHOLE SAMPLE (average)	0.54	1,606	495
D. Bottom ten small farms (average)	0.06	1,167	435
E. Ratio B to D	25.6	2.90	1.87
Malausma			
A. Largest single farm	1.57	2,468	676
B. Top ten large farms (average)	1.12	1,683	362
C. WHOLE SAMPLE (average)	0.46	1,269	364
D. Bottom ten small farms (average)	0.16	949	324
E. Ratio B to D	7.0	1.77	1.12

TABLE 3.5

LABOUR USED IN SUKA AMBIT AND MALAUSMA, 1976

Suka Ambit	Area Under Production (Quality Adjusted) (Ha)	Labour Used (Hours in Adult Male Equivalent)			Potential Labour in the Family
		For Farm Activity	For Non-Farm Activity	Total	
(1)	(2)	(3)	(4)	(5)	(6)
A. Largest single farm	5.16	64	3,600	3,664	16,800
B. Top ten large farms (average)	1.54	1,176	1,371	2,548	9,120
C. WHOLE SAMPLE (average)	0.54	1,186	1,274	2,460	6,220
D. Bottom ten small farms (average)	0.06	973	1,395	2,368	4,800
E. Ratio of B to D	25.6	1.21	0.98	1.08	1.90
Malausma					
A. Largest single farm	1.57	611	1,620	2,231	7,200
B. Top ten large farms (average)	1.12	613	1,001	1,614	8,160
C. WHOLE SAMPLE (average)	0.46	391	1,508	1,899	5,895
D. Bottom ten small farms (average)	0.16	187	2,078	2,264	5,520
E. Ratio of B to D	7.0	3.28	0.48	0.71	1.48

hours, of this farmer as recorded in the questionnaire are mostly spent on off-farm activity as he is a full time trader and nearly all the farming jobs were done by paid labour. Although there are seven adult members in this household, information on the use of labour of family members are not available.

In Malausma a household family on average spent more than four times the working hours on off-farm activities than on farming activities. The top ten large farm groups worked 1½ times as much on off-farm than on-farm activities while the bottom small farm group worked 11 times as much off-farm. Even the data for the large farm shows that working hours for handicrafting and off-farm activity greatly exceeded time spent on farm.

3.2 Comparative Analysis of High and Low Income Groups

The previous analysis using simple tabular method has given some indication that the area of land under production per-se can not explain the variability of household incomes within the village. It was observed that the increasing importance of off-farm income to supplement the inadequate farm income could also contribute to variability.

This encouraged us to pursue another type of analysis in an attempt to obtain further insight on the factors affecting the variability of total household income and to make a comparative analysis between high income and low income groups in each village. In order to test the significance of differences between the groups means, a statistical test is incorporated.

High and low income farmers were identified by comparing the total household income with the minimum subsistence income requirement. This minimum requirement was computed by taking the value of food nutrient intake of each family member, as recommended by the Indonesian Institute of Science, plus the value of other requirements, i.e., housing, clothing, medicine, children's education, etc. (See Appendix I: Data Treatment.) The last column of Tables 1 and 2, Appendix III indicate high and low income farmers. There were 31 farmers (63%) in the high income groups and 18 farmers (37%) in low income groups in Suka Ambit; and 31 (54%) and 26 (46%) farmers in the high and low income groups respectively in Malausma.

Variables or ratios included in the analysis are grouped according to whether they are indicators of land, labour, capital, management or productivity. The results obtained are therefore comparable with those of the marginal economic analysis and of the regression analysis which will be carried out later.

The results of the analysis are shown in Tables 3.6 and 3.7.

A test of equality of variance was applied to the two groups. The null hypothesis is that the two groups are drawn from populations with the same variance, i.e., $H_0 : \sigma_1^2 = \sigma_2^2$. The alternative hypothesis is that the variances are different or $H_1 : \sigma_1^2 \neq \sigma_2^2$. If the probability for the F-value is greater than the 'significance level' chosen, say at five per cent, the null hypothesis is accepted. The T-value is used to test the significance of the difference between group means, and is based on pooled variance estimate (assuming equal variance), (column 6). If the probability of the estimated value of F is less than or equal to the significance level chosen, the null hypothesis is rejected. The T-test for a test of the mean's significance is then based on a different variance estimate.

TABLE 3.6

SUKA AMBIT: COMPARATIVE ANALYSIS OF THE FACTORS INFLUENCING FARM HOUSEHOLD INCOMES

	Means of Farm Variables				Test of Sample Variance		Test of Mean's Significance	
	High Income Group		Low Income Group		F-ratio	Probability Less Than	T-value	Probability Less Than
(1)	(2)		(3)		(4)	(5)	(6)	(7)
anagement								
- Age (years)	37.9	(31)	39.1	(18)	1.56	.28	.33	.75
- Formal education	5.2	(29)	4.5	(15)	2.30	.10	1.10	.28
- Fertilizer and chem. used per hectare (Rp):								
- rice	30897	(27)	32838	(15)	2.58	.03	.41	.69
- second crop	18377	(12)	19146	(2)	2.57	.27	.09	.93
- upland crop	15410	(6)	87650	(6)	32.95	.02	2.05*	.10
- Yield per hectare:								
- rice wet season (kg)	3776	(27)	3568	(14)	1.61	.37	.54	.59
- rice dry season (kg)	3859	(25)	3276	(12)	1.65	.30	1.41	.17
- second crop (Rp)	128676	(13)	101269	(4)	1.07	1.00	.48	.64
- upland crop (Rp)	134176	(26)	76542	(17)	12.37	.00	1.88*	.07
and and Labour Resources								
- No of household members (male equivalent)	3.4	(31)	2.9	(18)	1.03	.91	.87	.39
- No of income earners	2.7	(31)	2.3	(18)	1.49	.39	1.06	.30
- Total land operated (ha)	1.0	(30)	0.3	(18)	36.08	.00	2.78***	.00
- Percentage of rice double-cropped in *sawah*	40	(25)	30	(12)	2.34	.14	1.34	.19
- Crop intensity: *sawah* (%)	192	(27)	191	(14)	1.17	.71	.04	.97
total land (%)	151	(30)	128	(18)	1.61	.30	2.57***	.01
- Percentage of land for:								
- rice	58	(27)	38	(14)	1.77	.28	3.04***	.00
- secondary crops	24	(13)	25	(4)	4.26	.30	.04	.97
- dryland crops	40	(29)	36	(16)	1.40	.43	.35	.73
- housegardens	11	(26)	7	(16)	25.28	.00	1.03	.31
Income Earning								
1. Farm								
- total labour used (man hour equivalent)	2032	(29)	1320	(17)	14.26	.00	1.54	.13
- % hired labour used	52	(27)	26	(14)	2.02	.19	2.76***	.00
- net farm return	158994	(31)	42242	(18)	41.67	.00	3.27***	.00
- total paid costs	53864	(27)	15274	(17)	26.80	.00	2.30***	.02
- % paid labour to total costs	56	(27)	42	(13)	2.79	.03	1.93*	.07
2. Non-Farm								
- total labour used	1996	(22)	1542	(12)	3.01	.03	.74	.47
- net return	127863	(21)	47030	(12)	7.56	.01	3.41***	.00
- return per man hour equivalent (Rp): hoeing	56	(10)	59	(8)	1.70	.50	.43	.67
harvesting	78	(9)	65	(8)	1.23	.80	1.13	.27
trade	63	(2)	54	(2)	52.32	.18	.17	.88
artisan	35	(4)	60	(1)	.00	1.00	.95	.41
other non farm labour	68	(14)	54	(4)	1.40	.89	.54	.59

ures in brackets are number of households

significant at least at the 10 percent level
significant at least at the 5 percent level
significant at least at the 1 percent level

TABLE 3.7

MALAUSMA: COMPARATIVE ANALYSIS OF THE FACTORS INFLUENCING FARM HOUSEHOLD INCOMES

	Means of Farm Variables				Test of Sample Variance		Test of Mean's Significance	
	High Income Group		Low Income Group		F-ratio	Probability Less Than	T-value	Probability Less Than
(1)	(2)		(3)		(4)	(5)	(6)	(7)
anagement								
Age (years)	34.6	(31)	34.7	(26)	2.32	.04	.04	.97
Formal education	4.3	(22)	3.7	(23)	1.08	.86	1.07	.29
Fertilizer and chem. used per hectare (Rp):								
- rice	32452	(27)	31962	(26)	1.75	.16	.14	.89
- second crop	2483	(10)	9649	(15)	7.72	.00	2.63**	.02
- upland crop	190360	(23)	89601	(16)	3.76	.01	1.65*	.11
Yield per hectare:								
- rice wet season (kg)	3675	(30)	3110	(26)	3.25	.00	2.32**	.03
- rice dry season (kg)	3390	(24)	2655	(17)	1.60	.30	2.07**	.05
- second crop (Rp)	69891	(22)	40635	(20)	36.42	.00	.87	.39
- upland crop (Rp)	157932	(30)	162471	(23)	1.23	.60	.12	.91
and and Labour Resources								
No of household members (male equivalent)	3.2	(31)	3.9	(26)	1.40	.48	2.32**	.02
No of income earner	2.4	(31)	2.6	(26)	1.50	.29	.90	.37
Total land operated (ha)	.65	(30)	.58	(26)	1.37	.43	.58	.57
Percentage of rice double cropped in sawah	36	(26)	34	(18)	2.07	.10	.27	.79
Crop intensity: sawah (%)	199	(30)	188	(26)	6.48	.00	.45	.66
total land (%)	170	(30)	165	(26)	3.58	.00	.28	.78
Percentage of land for:								
- rice	72	(30)	69	(26)	2.99	.01	.73	.47
- secondary crops	51	(23)	50	(21)	3.97	.00	.05	.96
- dryland crops	5	(23)	19	(20)	10.77	.00	3.00***	.01
- housegardens	3	(22)	4	(17)	1.07	.88	.30	.76
ncome Earning								
. Farm								
- total labour used (man hour equivalent)	818	(30)	678	(26)	1.14	.74	1.03	.31
- % hired labour used	49	(29)	52	(25)	1.12	.76	.38	.70
- net farm return	86660	(30)	52227	(26)	2.24	.04	2.75***	.01
- total paid costs	23198	(30)	20089	(26)	1.15	.71	.61	.54
- % paid labour to total costs	39	(27)	35	(23)	1.43	.38	.70	.49
. Non-Farm								
- total labour used	1601	(31)	1454	(25)	1.70	.19	.62	.54
- net return	85659	(31)	39942	(25)	4.88	.00	4.59***	.00
- total paid costs	46600	(4)	3600	(1)	0.00	1.00	.29	.79
- return per man hour equivalent (Rp): hoeing	46	(6)	47	(2)	382.93	.08	.02	.99
harvesting	79	(13)	81	(9)	4.82	.02	.15	.88
trade	80	(18)	74	(9)	1.04	1.00	.44	.67
artisan	38	(27)	19	(24)	5.94	.00	3.48***	.00
other non farm labour	85	(8)	75	(3)	1.29	1.00	.38	.71

es in brackets are number of households

ignificant at least at the 10 percent level
ignificant at least at the 5 percent level
ignificant at least at the 1 percent level

With respect to the test of the difference between the groups' means, the null hypothesis is $H_0 : \mu_1 = \mu_2$ and the alternative hypothesis is $H_1 : \mu_1 \neq \mu_2$. If the probability computed (column 7) is smaller than the significance level chosen, H_0 is rejected in favour of the hypothesis that the mean for each group is different.

In Suka Ambit, of the thirty-two variables considered in the comparison, ten had significant differences between group means at the 10% or better level of probability. These variables are: (1) the value of seed, fertilizer and chemical used; (2) the yield of upland crops all under the heading of management/productivity; (3) the number of income earners; (4) crop intensity (of total land); (5) percentage of land planted to rice on the proxy of land and labour resources owned; (6) the percentage of hired labour used; (7) net farm return; (8) total paid costs; (9) percentage of paid labour to total costs on the proxy of farm income earning; and (10) net return from off-farm income earning. Three out of these ten variables, i.e., crop intensity of total land, percentage land planted to rice and percentage of hired labour used have an equal variance.

Nothing can be said about the means of the other variables in this particular analysis except that the group means are not statistically different, as indicated by the t-values.

In Malausma, the variables which show a significant difference in group means are: the value of seed, fertilizer and chemical used per hectare for second crop and upland crop; rice yield (in wet and dry season); number of household members; percentage of land for upland crop; net farm and non-farm return and return per manhour of artisan job. Only two variables have equal variance, i.e., rice yield in the dry season and number of household members.

With few exceptions, the group means for high income farmers are higher than the group means for low income farmers in both villages. The exceptions are the higher mean for the lower income farmers and also the significant means of certain variables: value of seed, fertilizer and chemical used for upland crops in Suka Ambit, and value of the same items for the second crop in Malausma. The different means for land operated, crop intensity and ratio of sawah to total land (higher mean for high income) are significant only in Suka Ambit. Thus, there is an inverse relationship between input per unit area to farm size, as shown by this analysis. This inverse relationship has been observed elsewhere in developing countries, especially in studies of the comparative efficiency of small farms as distinguished from large farms (Yotopoulos and Nugent 1976). Findings in Table 2.2 about the difference in family size between the groups are statistically confirmed in this table. The conclusion drawn from the data on Malausma is that the high income group obtained a higher net farm income which is in line with the higher productivity of land under production, mainly sawah (wet and dry seasons). However, the difference in the amount of total land operated is not statistically significant. Net income from non-farm activities, mostly artisan work, was also higher for the high income group.

The conclusion that emerges from the analysis of these variables in Suka Ambit is that the high income group has a larger area of land operated, a higher land productivity on upland and sawah, a higher ratio of sawah to total land, and also a higher crop intensity. The high income group also uses more labour and has total costs which are higher than those of the low income group. The net return from non-farm activities is also significantly higher for the high income group, but there is no indicative variable to show which types of activities cause this difference.

3.3 Income Distribution

There are various methods and statistical techniques devised for measuring the degree of inequality of income distribution. Computing the data of average income from the top ten largest and bottom ten smallest farms and presenting the ratio between them in comparison with the rates of land under cultivation (Tables 3.5 and 3.6) points to the inequality of income distribution in the sample villages.

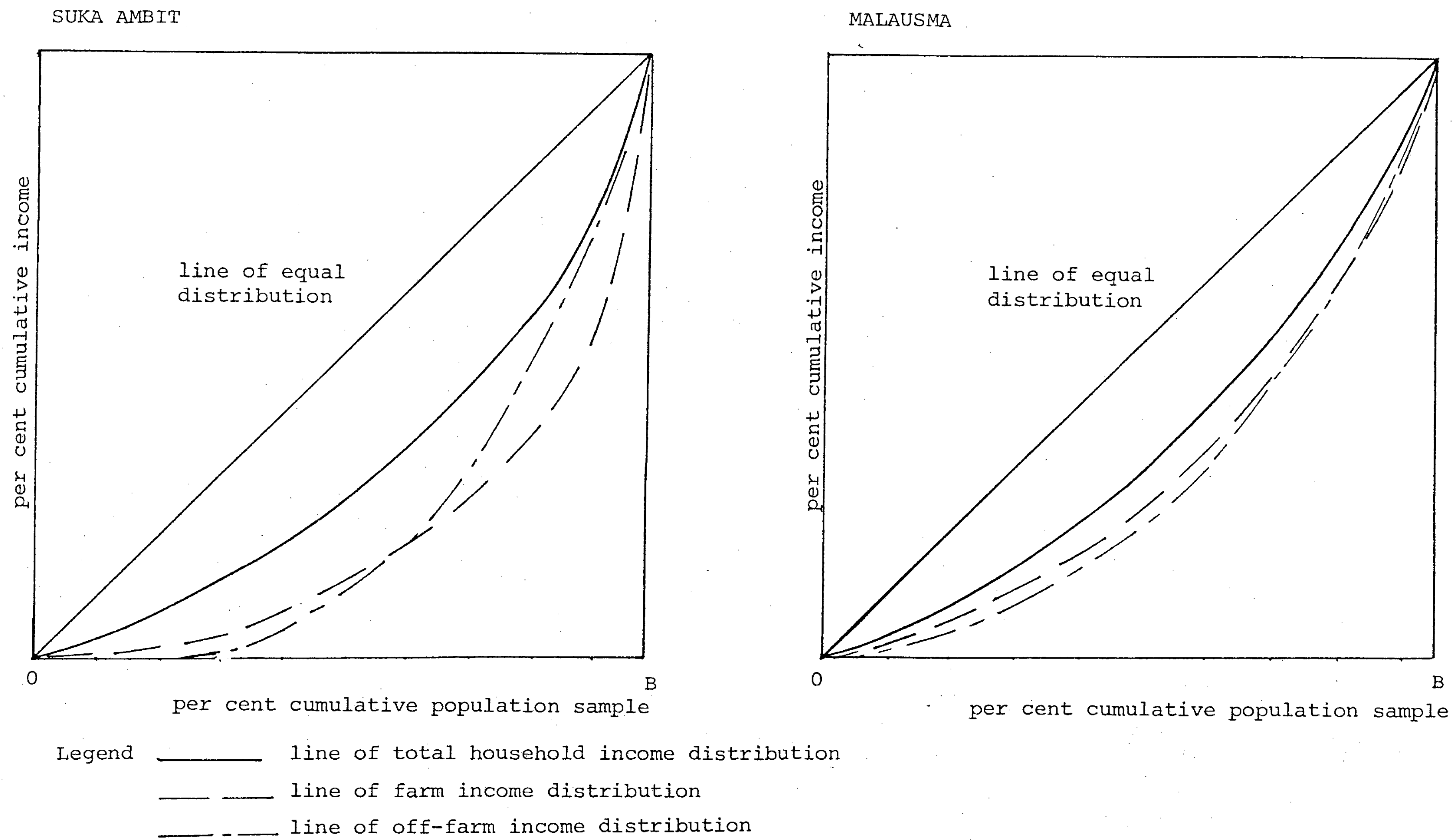
The methods most commonly used in empirical work to examine income inequality are: (1) the variance v^2; (2) the coefficient of variation $\frac{v}{u}$; (3) the relative mean deviation $\int_o^{\bar{y}} \frac{y}{u} - 1/f(y)\ dy$; (4) the Gini coefficient $\frac{\int_o^{\bar{y}} [yF(y) - u\phi(y)] f(y) dy}{2u}$; and (5) the standard deviation of logarithms, $\int_o^{\bar{y}} [\log(y/u^*)]^2\ f(y)\ dy$ where u^* is the geometric mean.

Ahluwalia (1975) used the share of total income of the lowest 40 per cent of the population as a standard in measuring income distribution. If the share is less than 12 per cent, there is a situation of high inequality; if it is between 12 per cent and 17 per cent, there is a moderate inequality; and if it is 17 per cent or about there is low inequality. This index is especially useful if the purpose of the study of inequality is well defined with respect to a certain group of population, for example, to improve the lot of the bottom 20 per cent. For a view of inequality with respect to all income groups, the cumulative distribution of income is usually plotted as the Lorenz curve and is described by the Gini coefficient of concentration (Yotopoulos and Nugent 1976).

FIGURE 3.1

LORENZ CURVE OF INCOME DISTRIBUTION

(per capita)



Several reports on income inequality in rural Java have been prepared using methods of income share, Lorenz curve, and Gini coefficient of concentration, such as those by Soejono (1975), King and Weldon (1977), Esmara (1977) and Ginting (1978). In order to obtain the advantage of being able to compare our result and those of previous studies, we used the same methods for our sample data.

Cumulative income distribution (per capita) of the sample farmers in Suka Ambit and Malausma is plotted as Lorenz curve, shown in Figure 3.1. In each figure, cumulative distribution of total household income, farm income and off-farm income are shown together. Line OO' is the line of equal distribution, as it indicates n per cent of the population earned n per cent of cumulative total income. The curve between O and O' is a Lorenz curve, that is the plotted cumulative distribution of income. The convexity of the curve indicates the degree of inequality. As an example, the fact that 20 per cent of the population earned below 20 per cent of the cumulative total income is, in terms of the graph, a result of its convexity in this region. The greater the convexity of the curve, the greater the inequality of income distribution. The Gini coefficient of inequality or 'Gini Ratio' is the ratio of the area between equality line OO' and curve OO; and the total area in the triangle OBO'. Hence, the value of the Gini Ratio is between zero and one. The method of calculation of the Gini Ratio in this study follows Yotopoulos and Nugent (1976):

$$G = \frac{\int_{o}^{100} [x-f(x) \, dx}{\frac{1}{2}\,(100)^2}$$

where x is cumulative per cent population and f(x) is cumulative per cent income.

The computed Gini coefficient for Suka Ambit is 0.354 and for Malausma is 0.289, which implies that income distribution in Suka Ambit is more uneven than in Malausma. Gini coefficients calculated by King and Weldon (1977) and Esmara (1977) for rural Java have never been more than 0.31. This suggests that income distribution in Suka Ambit is less equal than that for rural Java on average, while in Malausma it is, on average, about the same as that for rural Java.

However, a comparison between both the Gini Ratio calculated by Soejono (1977) and the one in Sriharjo with our result in this study shows that income distribution in the present study is more evenly distributed. Applying the standard proposed by Ahluwalia(1975), we find that the share of the lowest 40 per cent of the population is greater than 17 per cent, suggesting that there is a situation of very low inequality. Bearing in mind that Soejono's study area was a well-irrigated rice production area (also Sriharjo); data in Table 3.8 indicates that income distribution is more uneven in rice producing areas than in non-rice producing areas. In the Soejono study the top 20 per cent of population get most of the total income while in Sriharjo the middle 40 per cent of the population share most.

Figure 3.1 also reveals that the addition of income from off-farm sources has caused the curve of total cumulative income distribution to shift left, suggesting that off-farm income has contributed to a more equal income distribution when the whole population is taken into account.

3.4 Determinants of Farm Household Incomes and Farm Incomes

In this section an attempt is made to throw some light on the importance of each factor affecting net farm household incomes. As has already been discussed in the previous section, farm household income can

TABLE 3.8

RELATIVE DISTRIBUTION OF INCOME PER CAPITA AND THE GINI COEFFICIENT IN RURAL JAVA, SRIHARJO, SUKA AMBIT AND MALAUSMA

(selected years)

Quantile [a]	Rural Java as Calculated By:							Sriharjo	Suka Ambit	Malausma
	King and Weldon		Esmara			Soejono [b]				
	1967	1969/1970	1967	1969/1970	1976	1968/69	1973/74	1972	1976	1976
$Q_1 + Q_2$ (Lower 40%)	22.4	21.3	21.5	21.1	22.6	10.4	12.2	17.2	21.2	19.1
$Q_3 + Q_4$ (Middle 40%)	21.3	30.9	40.7	36.9	37.4	32.3	31.7	51.2	43.2	37.5
Q_5 (Top 20%)	36.8	39.8	36.8	39.3	39.7	57.3	56.1	31.6	35.6	43.4
Gini Coefficient	0.263	0.309	0.257	0.298	0.295	0.533	0.495	0.441	0.354	0.289

Notes: a Lowest Q_1, highest Q_5.

b From 8 sample villages in well-irrigated areas in Central Java.

Sources: King and Weldon (1977), Esmara (1977), Sriharjo (Ginting 1978) cited from Ginting (1978); Soejono (1975).

be derived from farm activities and off-farm activities. Income from farm activity is determined by the price and quantity of agricultural production (output) which includes production from sawah, uplands, housegarden, fishponds, livestock and poultry. Off-farm income is determined by wage levels, number of household members and individual household economic resources devoted to this activity such as assets, capital (including human capital) and the availability of opportunity for off-farm income. Differences of endowments owned by the farmers with respect to management capabilities, money capital, land and other physical resources have resulted in income differences.

3.4.1 Method of Analysis

The method used in examining the effect of various socio-economic factors as determinants of farm household incomes and farm incomes are correlation analysis and multivariate regression analysis. Correlation analysis is used to check if there is any relation between net farm household income and farm income with the socio-economic factors as described below. Regression analysis is applied in order to gain more information about the nature of any association and to check how closely it represents the facts. In the correlation analysis the two variables examined play a symmetric role, with no single variable being designated as the dependent or independent variable. In the regression model (as will be used in this analysis), one variable is designated as the dependent variable and one or more other variables as explanatory or independent variables; the dependent variable can be predicted from the other independent variable or variables. The size of the regression coefficient tells nothing about the closeness of the association, and is dependent upon the units of measurement of the variables. The correlation coefficient has the same sign (+ or -) as the regression coefficient; it is useless for prediction but only summarizes closeness of association (Finney 1972).

3.4.2 Specification of Variables

Dependent variables (y)

1. Net farm household income per household in Rupiah (y_1).
2. Net farm income per household in Rupiah (y_2).

Independent variables (x)

The socio-economic factors chosen as explanatory variables or expected to show an association with farm household income and farm income are those which are considered *a priori* to be important in influencing farm household income. These factors represent the economic resources of land, labour, capital and management.

Land: Three variables are taken to represent this factor: land cultivated, *sawah* planted to rice and crop intensity.

x_1 - Land cultivated in hectares. In the previous section it was called land under production (quality adjusted). This is an indicator of farm size. It is common practice to use farm size as a quick reference for estimating farm income. A study on factor input productivity in West Java by Nazir (1974) reported that farm size is the most important factor determining farm income. However, in the preceding section, using a simple tabular analysis, it is shown that variability of household income is not proportionate to variability of land under production. It is therefore, necessary to look more closely at this farm size variable.

x_2 - Sawah acreage planted to paddy in wet and dry season in hectares. This is usually the best farm land cultivated by the farmer and also the most important because the main food crops are sown here and it is more intensively cultivated.

x_3 - Crop intensity in per cent. This variable is an indicator of the intensity of land use throughout the year.

Labour: Two variables are selected to represent labour factor, namely household size and potential labour supply in the household.

x_4 - Household size is number of family members in the household including adults (income earners) and children (dependents).

x_5 - Potential family labour supply in manhours equivalent. This variable consists only of adult family members (income earner) over 15 years old. Women hours are converted to men hours as described in Section 2.4.

Capital: Because of the limited data available, only working capital is taken to represent this factor in the analysis.

x_6 - Total expenditure spent on farm activities including paid labour, the value of seed, fertilizer and chemicals, stated in Rupiah.

x_7 - Total expenditure spent on off-farm activities including paid labour, and the value of other input factors of variable cost, stated in Rupiah.

Management: A proxy is used for the management variable. Taib (1975) in a study of socio-economic factors affecting rice farm productivities in Malaysia used management ability as an explanatory variable for rice production. He followed the

Nielson (1962) management model as the conceptual framework for the measurement of management ability; the component of this model are biography, drives and motivations, ability and management process. Taib's sample farmers were classified into relatively homogeneous management groups using the method of cluster analysis by adopting a dichotomous scoring system for the personal characteristics of the farmers, such as age, education, attitude towards credit, relative income aspiration, knowledge of and attitude to agricultural input uses, and the use of information, etc. to mention some. The findings of the study showed that the inclusion of a management variable set marginally improved the regression fit of the rice production function analysis. The better management group showed the following characteristics: younger, most below 40 years old; better educated; better knowledge of paddy production; appreciative of credit for agricultural supplies; and appreciate and utilize agricultural information supplied by the Department of Agriculture. For technical reasons, only the variables age, education and the use of modern input were used in this study. Each variable is included separately in explaining income.

x_8 - Age of the farmer and his wife (average) in years. This variable is taken as an indicator of the farmer's experience. It is considered that, over time, a farmer's knowledge and skill increase, which help him to achieve better yields in farming as well as require income from off-farming. However, older farmers (say, over 40 years ; following Taib's finding) probably earned a lower income than younger farmers due to their declining physical condition.

x_9 - Education or schooling level of the farmer and his wife (average) in years. A farmer who has a high level of education is expected to have a higher income. The reason for taking average age and education of both the farmer and his wife is that it is considered that the decision-making in the farm household is taken together by the husband and wife.

x_{10}- The use of modern input factors; this is the value of seed, fertilizer, and chemicals on food crops (rice and other food crops) per hectare in rupiahs.

x_{11}- In examining net farm income, net off-farm income is also used as an explanatory variable, in rupiah, as an index of a farmer's economic initiative and drive. It is assumed that a person with greater drive and entrepreneurial vigour is likely also to engage in more off-farm income activities. The *a priori* expectation is that such a farmer will also have higher net farm income.[1] Also a farmer with a higher farm income may have non-labour resources which he can involve in off-farm activity.

Modern input factor for rice cultivation, such as seed, fertilizer and chemicals provided by the government through the rice BIMAS programme. This is available to the farmer participants in the programme according to their area planted to rice. Thus, there will be not much variation in the input used (as reported). For this reason, we include the value

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1 Bhati (1971) used income from supplementary enterprises (non-rice farm and off-farm income) as an explanatory variable to rice yield in his study of economic determinants of income on irrigated poor farms in Tanjong Karang Malaysia.

of inputs used in other food crops, (such as on second crops and upland crops) which are not provided via government credit.

The Pearson product moment correlation coefficient was calculated for all pairs of variables using the facilities provided by the DEC-10 computer.

It should be borne in mind that the correlation coefficient (r) is computed only for the linear association between the pair of variables examined. When the r value is zero or close to zero, it suggests there is no linear relationship between those variables. Hence the correlation analysis was done only to the strength of the 'linear' relationship.

An attempt to examine the existence of a curvilinear relationship is made in the next (regression) analysis. Three mathematically different multiple regression models were fitted to the data:

1. $y_j = a + \sum_{i=1}^{11} \beta_{ij} x_{ij} + e_{ij}$ (linear)

2. $\log y_i = a + \sum_{i=1}^{11} \beta_{ij} x_{ij} + e_{ij}$ (semi-log linear)

3. $\log y_j = \log a + \sum_{i=1}^{11} \log \beta_{ij} x_{ij} + e_{ij}$ (double-log linear)

where, y_j = net income (farm household income and farm income) of the household j, per household, in rupiah per year.

j = number of observations (j = 1,..., 49 for Suka Ambit, j = 1,..., 57 for Malausma).

a = constant term

β_i = the parameter associated with the i-th factor

x_1 = land under production in hectares

x_2 = sawah planted to rice in hectares

x_3 = crop intensity, in per cent

x_4 = household size in persons

x_5 = potential family labour in manhour equivalents

x_6 = farm expenditure in rupiahs

x_7 = off-farm expenditure in rupiahs

x_8 = farmer's age

x_9 = farmer's education

x_{10} = the value of modern input factors used (seed, fertilizer and chemicals for food crops only) per hectare, in rupiahs

x_{11} = off-farm income, in rupiah. Explanatory variables to farm income only.

e_i = error term

As the above models are linear the ordinary least squares methods was applied to find the values of the regression coefficients. In determining the functional form which best fits the data, several considerations were paramount. The model should be simple, rely on economic theory, have a 'good' predictive power, i.e., high value of R^2 or $\bar{R}^2$, and a 'good' residual plot pattern (Hu 1975). The assumptions made on the derivation of the formulae of least square estimations should also hold true:

1. the error terms are random with zero mean;
2. the error terms are uncorrelated and have a common variance;
3. the explanatory variables are not correlated with the error terms;

4. there is no severe multicollinearity among the independent variables;

5. the number of observations is greater than the number of parameters to be estimated.

Any violation of these assumptions causes the estimated parameters derived to be biased and to loose their minimum variance property. The application of the least squares method has been well discussed in many econometric text books, e.g. Ezekiel and Fox (1959), Chu (1972), Koutsoyiannis (1973), and Hu (1975).

Allowing for all the above conditions to be fulfilled, a double log-linear function seems the most appropriate for farm income and linear function for farm household income data in both villages for this study. These choices were made after considering goodness of fit as measured by $\bar{R}^2$, overall significance as measured by F-ratio and a residual plot to check for randomness and constant variance (homoscedasticity). Besides, double log-linear conforms more closely with the theory commonly used for the analysis of farm data. Several variables are excluded because of the existence of severe multi-collinearity among independent variables.

3.4.3 Results and Discussion

a. Correlation Analysis

The matrices of correlation coefficients are presented in Table 3.9 and Table 3.10 for Suka Ambit and Malausma respectively. Our prime interest in presenting this table is to obtain an initial picture or to explain farm household income and farm income per household in terms of the other variables. Hence, the correlation coefficients of prime interest will be the first and second top row of each table. Significant correlation between two variables does not necessarily imply that one is causally related to the other; two variables may move together because some third variable or collection of variables influences both. Likewise, lack of correlation does not necessarily mean that variables are not associated with each other. The association may be non-linear or be masked by variations in other variables.

Table 3.9 shows that in Suka Ambit nearly all the selected socio-economic factors have positive and strong linear relationships with farm household income. The same relationships also hold true for the association of these variables with farm income. One additional variable, off-farm income, was found to have a negative but non-significant correlation with farm income.

Finney (1972) suggests the phrase 'close relationship' should not refer to any correlation coefficient smaller than 0.7 and greater than 0.85 as 'very close relation'. Following Finney's phrase, data on Table 3.9 shows that the factors, land under production (x_1), sawah planted to rice (x_2), and farm expenditure (x_6), have a close relationship to both farm household income and farm income; and the first one (land under production, x_1) can even be said to have a very close linear relationship with farm income. Approximately 76 per cent ($r^2_{y_1y_2} = 0.76$) of the variance of farm household income is associated with the variance of farm income, and about 72 per cent of the variation of farm income can be explained by the variation of land under production ($r^2_{y_2x_1} = 0.72$) or farm expenditure ($r^2_{y_2x_6} = 0.72$). These relationships indicate the importance of farm activity to the household; and in the farm activity itself, growing rice is the mainstay as suggested by the highly significant (and positively) correlation coefficient of variables land under

TABLE 3.9

SUKA AMBIT: PEARSON CORRELATION COEFFICIENTS AND CORRELATION MATRIX OF FARM HOUSEHOLD INCOME AND SOCIO-ECONOMIC FACTORS AFFECTING INCOME, 1976

		y_1	y_2	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}
Farm household income =	y_1	1.00	.87***	.74***	.71***	.13	.54***	.63***	.74***	.09	.08	.41***	.25*	.30**
Farm income =	y_2		1.00	.85***	.81***	.18	.36***	.59***	.82***	.14	.15	.22	.23*	-.18
Land under production =	x_1			1.00	.97***	.28**	.37***	.60***	.96***	.12	.15	.23	.27	-.16
<u>Sawah</u> planted to rice =	x_2				1.00	.32**	.31**	.53***	.98***	.15	.07	.23	.32	-.13
Crop intensity =	x_3					1.00	.00	.06	.30**	.14	-.19	.13	.58	-.04
Household size =	x_4						1.00	.85***	.32**	.03	.22	.45	-.02	.39
Potential family labour =	x_5							1.00	.52***	-.07	.34**	.35	.08	.12
Farm expenditure =	x_6								1.00	.21	.09	.23	.34	-.10
Off-farm expenditure =	x_7									1.00	-.16	.10	.09	.12
Farmer's age =	x_8										1.00	-.24	-.09	-.18
Farmer's education =	x_9											1.00	.17	.36***
Modern input =	x_{10}												1.00	.12
Off-farm income =	x_{11}													1.00

<u>Note</u>: The asterisks indicate the level of significance; ***, ** and * representing at least 1%, 5% and 10% significance.

TABLE 3.10

MALAUSMA: PEARSON CORRELATION AND CORRELATION MATRIX OF FARM HOUSEHOLD INCOME AND SOCIO-ECONOMIC FACTORS AFFECTING INCOME, 1976

		y_1	y_2	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}
Farm household income =	y_1	1.00	.71***	.43***	.56***	-.06	.23*	.22*	.45***	-.07	.33***	-.20	-.05	.60***
Farm income =	y_2		1.00	.75***	.85***	-.07	.33***	.31**	.64***	-.17	.38***	-.37***	-.06	-.13
Land under production =	x_1			1.00	.91***	-.11	.50***	.53***	.78***	-.04	.37**	-.23*	.16	.22*
Sawah planted to rice =	x_2				1.00	-.08	.44***	.42***	.85***	-.11	.35**	-.23**	-.02	-.16
Crop intensity =	x_3					1.00	-.16	-.01	-.11	-.01	-.16	.10	-.18	.00
Household size =	x_4						1.00	.65***	.35***	.25*	.41***	-.32**	-.16	-.01
Potential family labour =	x_5							1.00	.26**	.23*	.48***	-.28**	-.21	-.03
Farm expenditure =	x_6								1.00	-.01	.29**	-.15	.24**	-.07
Off-farm expenditure =	x_7									1.00	.09	-.08	.37***	.11
Farmer's age =	x_8										1.00	-.62	-.16	-.02
Farmer's education =	x_9											1.00	-.02	.17
Modern input =	x_{10}												1.00	-.01
Off-farm income =	x_{11}													1.00

Note: The asterisks indicate the level of significance; ***, ** and *, representing at least 1%, 5% and 10% significance.

production and sawah planted to rice ($r_{x_1x_2}$ = 0.97)[1].

The variables, household size (x_4) and potential family labour (x_5) have a positively and highly significant relationship with both farm household income and farm income. This conforms with a priori expectations as an increase in either of these variables should result in increased income.

With regard to farmer's education (x_9), positive relationships are noted with both farm household income and farm income. However, the coefficient of (x_9) is significant only in the household income equation (at the 1 per cent level). One possible explanation of this difference is that the level of farmer's education is nearly homogeneous and relatively low (average of 4,5 years of primary school), and has no affect on farming practices, but those who have a higher education are able to obtain more income from off-farm work. The positively and highly significant (at less than 1 per cent level) correlation coefficient between farmer's education and off-farm income ($r_{x_9x_{11}}$ = 0.36) enhances this explanation.

The modern input variable $x_{(10)}$ is observed to have a positive relationship with both farm household income and farm income. This conforms to a priori expectations, as the positive effect of the use of this input factor is to increase yield. The low level of significance and the low coefficient probably occur because the use of this input is mainly limited to the rice crop and is not yet widely used for other crops. Government made this input easily available for farmers growing this crop, as we have pointed out earlier.

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1 The high correlation between farm expenditure and both land under production and sawah planted to rice ($r_{x_6x_1}$ = 0.96 and $r_{x_6x_2}$ = 0.98) is also an indication of the importance of rice production, as most of the farm expenditure is absorbed by the rice entreprise.

A negative relationship is observed in the correlation between off-farm income and farm income. This finding seems contrary to _a priori_ expectation that farmers who have greater drive and entrepreneurial vigour in farming will also engage in more off-farm activity. In fact the coefficient correlation indicates that farmers who have higher farm income tend to have less off-farm income, as they neglect off-farm activities. Nevertheless, the coefficient is not significant which means it has low reliability.

The other three variables, crop intensity (x_3), off-farm expenditure (x_7), and farmer's age (x_8) have a positive linear relationship with farm household income and farm income which is as expected; however, the coefficients are not significant which means they do not have a strong power in explaining the variability of farmer's income on the basis of pair wise linear relationships.

The result of the correlation analysis in Malausma is reported in Table 3.10. The conditions in this village are slightly different from Suka Ambit, as discussed earlier, that the importance of the contribution of farm income is not as great. Table 3.10 shows that only 50 per cent of the variance of farm household income is determined by the variance of farm income, while in Suka Ambit the figure is 76 per cent (derived from $r_{y_1y_2}$ squared). A very close relationship is noted only between the variable, _sawah_ planted to rice and farm income ($r_{y_2x_2}$ = 0.85). A close relationship is observed only between farm household income and farm income ($r_{y_1y_2}$ = 0.71) and farm income with land under production ($r_{y_2x_1}$ = 0.75). This indicates that growing rice is the main source of income for the farmer like those in Suka Ambit.

The relationships of other factors to farm household income and farm income are not as strong as in Suka Ambit, even in some cases the associations are in inverse direction, although some of them are not significant. The strongest associations are those between farm expenditure and farm household income ($r_{y_1 x_6}$ = 0.45) and between farm income and farm expenditure ($r_{y_2 x_6}$ = 0.64). In both case r is significantly different from zero (at least at 1 per cent level). The corresponding findings in Suka Ambit are $r_{y_1 x_6}$ = 0.74 and $r_{y_2 x_6}$ = 0.82 respectively.

The variables crop intensity, off-farm expenditure,farmer's education and modern input factors used have a negative relationship to farm household income and farm income, but the coefficients are not significantly different from zero except for the relation between farmer's education and farm income. The non-existence of linear relationships of these factors to farmer's income is probably because homogeneity of the factors exists among the sample farmers. The inverse relationship between farmer's education and farm income could be because the better educated people in the village are less dependent on farming activity.

An interesting feature found in Malausma but not in Suka Ambit is that farmer's age has a positively and highly significant relationship with both farm household income and farm income. Even though the coefficient is fairly low (r = .33 and .38 respectively), the data suggests it is a good indicator of the variability of farmer's income in this village.

In sum, the results of the correlation analysis suggest that the most important socio-economic factors as determinants of income vary between the two sample villages. The common factors are land under production, mainly sawah planted to rice, and farm expenditure (farm-cost).

Other factors are also common but their degree of importance differs between the two villages. Crop intensity and off-farm expenditure are less important in explaining the variability of villager's income in both villages.

b. Regression Analysis

Initially all explanatory variables considered (as discussed in the previous section) were included and fitted into: linear, semi-log linear and double-log functional forms for the multiple regression analysis. The results obtained from the computer output were then compared in order to choose the function which gives the best fit to the data on the basis of $\bar{R}^2$, F-ratio, and residuals.[1] The equations below represent the final choices, after taking a priori economic considerations into account.

For Suka Ambit:

Farm household income: (linear function)

$$y_1 = 108{,}501.60 + 117{,}549.60\ x_2 - 673.58\ x_3 + 16.60\ x_5 + 0.22\ x_7 - 562.70\ x_8 + 11{,}832.33\ x_9 + 1.53\ x_{10} \quad (3.1)$$

Farm income: (double-log linear function)

$$\log y_2 = \log 0.6519 + 0.23 \log x_2 - 0.17 \log x_3 + 1.17 \log x_5 - 0.02 \log x_7 + 0.28 \log x_8 - 0.01 \log x_9 - 0.04 \log x_{11} \quad (3.2)$$

For Malausma:

Farm household income: (linear function

$$y_1 = 55{,}659.41 + 125{,}350.60\ x_2 - 1.25\ x_3 - 3053.12\ x_9 - 2.53\ x_5 - 0.29 \log x_7 + 1066.56 \log x_8 + 70.16 \log x_9 - 0.29\ x_{10} \quad (3.3)$$

Farm income: (double-log linear function)

$$\log y_2 = \log 3.0961 + 0.86 \log x_2 + 0.47 \log x_3 + 0.22 \log x_4 - 0.10 \log x_5 - 0.01 \log x_7 + 0.05 \log x_8 - 0.02 \log x_9 + 0.27 \log x_{10} + 0.02 \log x_{11} \quad (3.4)$$

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1 For the basis for choosing the functional forms, see p.73.

The selected statistical information of the estimated regression coefficients is presented in Tables 3.11 and 3.12 and simple correlation coefficient matrices of the included variables are presented in Tables 3.13 and 3.14. The estimated regression coefficients for high and low income groups in each village are also examined and presented in Tables 3.11 and 3.12.

The variables, land under production (x_1) and farm expenditure (x_6) are omitted from all equations because both are highly correlated with the variable <u>sawah</u> planted to rice (x_2) which causes severe multicollinearity. The choice of x_2 rather than x_1 or x_6 was made on economic grounds, i.e. <u>sawah</u> is the most important in determining farmers income than others. The choice was also made between variable household size (x_4) and potential labour supply (x_5) on economic grounds. The variable household size (x_4) is omitted from equation (3.1) and (3.2) because $R^2 < r_{x_5 x_4} < 0.8$; applying Dillon's (1962) and Huang's (1964)[1] criterion of the existence of severe multicollinearity. The same reason also applies to the omission of the variable modern input factors used (x_{10}) in equation (3.2), because $R^2 < r_{x_2 x_{10}} < 0.8$.

The coefficients of determinationof the regression equations in Suka Ambit indicate that 64 per cent and 66 per cent (as indicated by R^2 adjusted) of the variability of farm household income and farm income can be said to be explained by the set of independent variables included in the equation. These figures are highly significantly different from zero (at least at 1% level), as indicated by the F-ratio (Table 3.11). Three

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1 Dillon (1962) suggests that severe multicollinearity exists if simple correlation coefficient between two independent variables, r greater than 0.8, while Huang (1964) suggests that multicollinearity in multiple correlation is severe if correlation coefficient r is greater than coefficient of determination or $r > R^2$.

TABLE 3.11

SUKA AMBIT: ESTIMATED REGRESSION COEFFICIENTS

AND OTHER STATISTICAL INFORMATION OF NET FARM HOUSEHOLD INCOME, 1976

	Farm Income x_2	Crop Intensity x_3	Potential Family Labour x_5	Off-Farm Expenditure x_7	Age x_8	Education x_9	Modern Input x_{10}	Off-Farm Income x_{11}	R^2	$\bar{R}^2$	F-ratio	n d.f.	F*-ra Chow-t
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14
I. FHI - Total Sample (linear)	$117,549.60^{***}$ (26,934.40)	- 673.58 (531.10)	16.60^{**} (7.05)	0.22 (1.02)	- 562.70 (1,549.34)	$11,832.33^{+}$ (7,789.46)	1.53 (1.66)		0.64^{***}	0.58	10.6509	49 (7;41)	
Ia. FHI - High Income Group (linear)	$91,145.27^{***}$ (31,263.89)	-1222.66^{*} (648.79)	21.93^{**} (9.71)	-0.08 (1.13)	-1258.54 (2,381.11)	4,459.00 (10,185.06	3.96^{*} (2.37)		0.71^{***}	0.62	7.9543	31 (7;23)	
Ib. FHI - Low Income Group (linear)	-25,909.24 (108,279.53)	- 16.79 (704.23)	4.91 (3.90)	1.96^{*} (1.04)	554.42 (728.32)	$10,213.45^{*}$ (5.052.15)	-0.40 (0.89)		$0.62^{n.s.}$	0.36	2.3389	18 (7;10)	2.94
II. FI - Total Sample (double-log linear)	0.23^{***} (0.04)	- 0.17^{***} (0.06)	1.17^{***} (0.34)	0.02 (0.02)	0.28 (0.47)	0.01 (0.04)		-0.04^{***} (0.01)	0.66^{***}	0.60	11.3130	49 (7;41)	
IIa. FI - High Income Group (double-log linear)	0.23^{***} (0.05)	- 0.18^{***} (0.06)	1.18^{***} (0.40)	0.03^{+} (0.02)	0.42 (0.60)	$- 0.07^{+}$ (0.05)		-0.05^{***} (0.01)	0.73^{***}	0.65	8.8666	31 (7;23)	
IIb. FI - Low Income Group (double-log linear)	0.22^{***} (0.06)	0.08 (1.05)	-0.61 (0.75)	-0.05^{+} (0.03)	2.03^{**} (0.95)	0.02 (0.06)		0.05^{+} (0.03)	0.78^{**}	0.62	5.0372	18 (7;10)	2.59

Notes: (1) Figures in parenthesis indicate the standard errors of the estimate.

(2) Stars denote the level of significance as follows:

*** significant at least at the 1 per cent level

** significant at least at the 5 per cent level

* significant at least at the 10 per cent level

+ significant at least at the 20 per cent level

(3) FHI = Farm Household Income

FI = Farm Income

n = Number of Observation

d.f. = Degrees of Freedom

n.s. = Not Significant

MALAUSMA: ESTIMATED REGRESSION COEFFICIENTS AND

OTHER STATISTICAL INFORMATION OF NET FARM HOUSEHOLD INCOME, 1976

	Farm Income x_2	Crop Intensity x_3	Household Size x_4	Potential Family Labour x_5	Off-Farm Expenditure x_7	Age x_8	Education x_9	Modern Input x_{10}	Off-Farm Income x_{11}	R^2	$\bar{R}^2$	F-ratio	n d.f.	F*-ratio Chow-test
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
I. FHI - Total Sample (linear)	$125,350.60^{***}$ (32,310.36)	-1.25 (98.68)	-3053.12 (9312.74)	-2.53 (4.86)	0.29 (1.37)	1066.56 (975.02)	70.16 (4144.36)	-0.29 (0.90)		0.35^{***}	0.24	3.1953	57 (8;48)	
Ia. FHI - High Income Group (linear)	$-84,562.95^{**}$ (35,967.19)	18.71 (104.51)	17191.68^{+} (12641.51)	-4.24 (6.43)	1.34 (1.98)	1178.87 (1042.04)	1893.50 (4671.29)	-0.44 (1.02)		0.49^{**}	0.30	2.6243	31 (8;22)	7.68^{***}
Ib. FHI - Low Income Group (linear)	$53,579.72^{**}$ (24,637.95)	78.48 (95.10)	18366.46^{***} (5785.92)	1.14 (2.98)	-1.61^{**} (0.78)	136.74 (892.67)	3117.62 (3050.35)	0.86^{*} (0.63)		0.79^{***}	0.69	7.9529	26 (8;17)	
II. FI - Total Sample (double-log linear)	0.86^{***} (0.11)	0.47^{***} (0.12)	0.22 (0.24)	-0.10 (0.26)	-0.01 (0.01)	0.05 (0.25)	-0.02^{*} (0.01)	0.27^{***} (0.09)	0.02 (0.02)	0.98^{***}	0.98	284.5080	57 (9;47)	
IIa. FI - High Income Group (double-log linear)	0.52^{***} (0.19)	0.65^{***} (0.16)	0.64^{*} (0.36)	-0.65^{*} (0.37)	0.01 (0.02)	0.44^{*} (0.30)	0.01 (0.02)	0.30^{***} (0.10)	0.17^{+} (0.13)	0.99^{***}	0.99	295.9605	31 (9;21)	3.47^{***}
IIb. FI - Low Income Group (double-log linear)	0.49^{***} (0.14)	-0.43^{*} (0.24)	0.23 (0.28)	0.23 (0.25)	0.02^{+} (0.01)	-0.11 (0.36)	-0.01 (0.02)	0.09 (0.15)	0.01 (0.02)	0.86^{***}	0.78	10.7614	26 (9;16)	

Notes: (1) Figures in parenthesis indicate the standard errors of the estimate.

(2) Stars denote the level of significance as follows:

*** significant at least at the 1 per cent level

** significant at least at the 5 per cent level

* significant at least at the 10 per cent level

+ significant at least at the 20 per cent level

(3) FHI = Farm Household Income

FI = Farm Income

n = Number of Observation

d.f. = Degrees of Freedom

out of six regression coefficients of the independent variables for farm household income, and four out of seven coefficients for farm income are significant. The levels of significance and the values of coefficients indicate the variables which seem to effect income more strongly. For example, for farm household income the strongest is <u>sawah</u> planted to rice (x_2), next potential family labour (x_5) and then farmer's level of education (x_9).

When variables have no significant coefficient, this implies that no statistical inference can be drawn with confidence on the basis of linear relationship.

When the regression model was fitted to the high and low income group farmers, it seemed that this model gave good fit only to the data for high income group, as indicated by the significance level of the coefficient of determination in each group. The F-ratio for the low income group of 2.3589, with degrees of freedom 7;10 was neither significant at the 1 nor 5 per cent level. The Chow-test[1] was applied to examine statistically the difference between the two sets of regression coefficients. The test resulted in an F*-ratio of 2.94 which is significantly different from zero at 5 per cent level (Table 3.11, Column 14). This indicated that the explanatory variables were related to farm income of high income and low income farmers in significantly different ways.

The regression coefficients for the high income group suggest that the most important factor affecting farm household income is <u>sawah</u> size (x_2), the next is potential family labour supply (x_5), then modern input used

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1 For an explanation of Chow-test see Chow (1960), Koutsoyiannis (1977) and for an example in application, see Etherington (1973), Teo (1976) and Ginting (1978).

(x_{10}) and the last is crop intensity (x_3) which gives a negative effect.

Using the same regression model of analysis for low income farmers, the most important factor is farmer's education (x_9) and off-farm expenditure (x_7), which coefficient for both are significant only at 10 per cent level.

The findings with regard to the variable modern input factors used (x_{10}) substantiate the results of previous studies that the rice BIMAS programme has benefited only some priviliged groups of villagers, i.e. the high income farmers.

The regression coefficients for farm income indicate that variables affecting farm incomes are (in order of importance) sawah planted to rice (x_2), potential family labour supply (x_5), off-farm income (x_{11}) and crop intensity (x_3). The last two variables cause a negative effect to farm income.

The regression model used seems also to have a better fit with the data of high income than low income farmers as indicated by $\bar{R}^2$ and F-ratio. However, the coefficient of determination (R^2) are both significant at the 1 and 5 per cent levels for high and low income respectively.

With the exception of the variable sawah planted to rice (x_2), the degree of influence of the set of independent variables under consideration differs for high and low income groups. The difference is indicated by each variables regression coefficient and its level of significance. The statistical difference of the regression coefficients for the two groups were tested using the Chow-test; and the results indicate that the F*-ratio calculated is significant at the 5 per cent level.

For high income farmers the order of importance of socio-economic factors affecting farm income are: <u>sawah</u> size planted to rice (x_2), off-farm income (x_{11}), crop intensity (x_3), potential family labour (x_5), off-farm expenditure (x_7) and farmer's level of education. Variables x_3, x_7 and x_9 cause a negative effect to farm income.

For low income farmers the most important factors are <u>sawah</u> (x_2), farmer's age (x_8), off-farm income (x_{11}) and the last, off-farm expenditure (x_7) with a negative effect.

For the total sample and for the high income group the coefficient of the variable off-farm income (x_{11}) (Table 3.11, Column 9) has an inverse effect to farm income as indicated by the negative sign attached to the highly significant regression coefficient. This does not support our previous argument that the farmer who get enough (relatively high) income from farming tends to be more involved in off-farm activities, but, in fact, from this analysis the farmer who earns less income from farming will earn more supplementary income from off-farm sector, and vice versa.

For low income farmers the variable off-farm income has a positive coefficient. Though the level of significance is 20 per cent, nonetheless it indicates some influence of this factor as an explanatory variable to farm income.

The importance of <u>sawah</u> size and potential labour supply as the determinants of income is not surprising, as it is confirmed by the result of the previous correlation analysis. An interesting feature is the significant and negative effect of crop intensity on both farm income and off-farm income. The regression coefficient indicates the marginal increase of income due to the marginal increase of one unit of cropping intensity, thus, the negative coefficient suggests that increasing cropping intensity will decrease marginal net income (diminishing return). This may happen if the level of productivity is low, then increasing cropping intensity will only increase cost but not yield. The low level of significance of the regression coefficient of modern input factors used (significant only at the 20 per cent level) on farm household income equation seems to substantiate this explanation. Unfortunately this variable is omitted from the farm income equation in order to get rid of multicollinearity. As a result we have no information on the effect of the modern input factors used on farm income. The previous correlation analysis also suggests that only 6 per cent and 5 per cent of the variance of the farm household income and farm income respectively, were explained by the variance of the variable modern input factors used.

In Malausma (Table 3.12) the coefficients of multiple determination are 0.35 for farm household income and 0.98 for farm income (which is considered to be very high), and the value of F-ratios indicate that the coefficients are highly significantly different from zero.

The explanation for the very low percentage for farm household income probably lies in the importance of off-farm activity for farm household income. The corresponding figure is high in Suka Ambit. In addition most of the explanatory variables are farm resources rather than off-farm resources.

With respect to the fit of the model to the data for farm household income, $\bar{R}^2$ (R^2 adjusted) indicates that this model is the best fit to the data for low income farmers rather than for high income farmers or for the total sample in the village. The F*-ratio calculated, applying the Chow-test, suggests that the difference of the set of regression coefficients for high and low income is significant at the 1 per cent level.

As indicated by the regression coefficient and its level of significance, for the total sample equation the most important factor (and the only one) is sawah planted to rice (x_2). The same holds true for high income farmers with an addition of household size (x_4) as the second variable which is significant only at the 20 per cent level. Other variables are not able to explain the variability of farm household income using this model as suggested by the non-significant regression coefficients.

For low income farmers the order of importance of explanatory variables are household size (x_4) sawah size planted to rice (x_2), off-farm expenditure (x_7) with a negative effect, and the least is modern input factors used (x_{10}). It is shown here that the role of sawah size has decreased as a determinant of farm household income.

An unexpected feature found in low income groups is the fact that the coefficient of the modern input variable (x_{10}) is positive and significant at the 10 per cent level. This was not the case for the total sample nor for the high income group. One possible explanation is the inadequacy of the model for the data of the total sample and high income groups. The significance of x_{10} in the total household income for the low income group equation will be compared with its effect in the farm income equation.

The fact that variable household size (x_4) is more important than sawah size (x_2) in explaining total household income is attributed to the less sawah owned by the farmer in low income groups and most of the farm income are derived from farming on non-sawah land.

With regard to socio-economic factors affecting farm income for the total sample the regression coefficients indicate that the most important factor is sawah planted to rice (x_2); the second, cropping intensity (x_3); the third, input factor used (x_{10}); and, the fourth, farmer's level of education (x_9) with a negative effect. The first three variables have a significant regression coefficient at the plausible level of significance.

Yet, the different effects of these explanatory variables on farm income for high and low income farmers are also evident. The F*-ratio collated using the Chow-test indicates that the difference is statistically different at the 1 per cent level. The use of modern input factors is one of the most distinctly different in favour of the high income group. This weakens our above findings that for the low income farmer this variable has a positive influence on farm household income.

The regression coefficients for high income farmers suggest that the most important factors effecting farm income are cropping intensity (x_3) and, subsequently, modern input factor used (x_{10}), sawah size (x_2), household size (x_4), potential labour supply (x_5) with a negative effect, farmer's age (x_8) and off-farm income (x_{11}) both at a low level (20 per cent) of significance.

For the low income farmers the order is as follows: sawah size (x_2), cropping intensity (x_3) with negative influence, and the last is off-farm expenditure (x_7) at a low level (20 per cent) of significance. Modern input factor used (x_{10}) has a positive sign of coefficient but not significant.

To sum up. The analysis shows the crucial importance of the land factor (mainly for growing rice) and also that the benefit of modern input factor go mainly to the high income farmers.

TABLE 3.13

SUKA AMBIT: CORRELATION MATRICES OF FARM HOUSEHOLD INCOME FUNCTIONS

Whole Farmers	y	x_2	x_3	x_5	x_7	x_8	x_9	x_{10}
y	1.00	0.71	0.13	0.63	0.09	0.08	0.41	0.25
x_2		1.00	0.32	0.53	0.15	0.07	0.23	0.32
x_3			1.00	0.06	0.14	-0.19	0.13	0.58
x_5				1.00	-0.07	0.34	0.35	0.08
x_7					1.00	-0.16	0.10	0.09
x_8						1.00	-0.24	0.09
x_9							1.00	0.17
x_{10}								1.00
High Income Farmers								
y	1.00	0.72	0.01	0.71	0.01	0.15	0.36	0.34
x_2		1.00	0.27	0.61	0.12	0.12	0.21	0.35
x_3			1.00	0.01	0.11	-0.19	-0.03	0.61
x_5				1.00	-0.10	0.42	0.30	0.17
x_7					1.00	-0.18	0.08	0.07
x_8						1.00	-0.25	-0.16
x_9							1.00	0.21
x_{10}								1.00
Low Income Farmers								
y	1.00	-0.03	0.13	0.54	0.34	0.10	0.59	-0.12
x_2		1.00	0.80	-0.10	0.18	-0.01	0.17	0.56
x_3			1.00	0.09	0.18	-0.19	0.42	0.57
x_5				1.00	-0.07	0.26	0.39	-0.13
x_7					1.00	-0.14	0.08	0.14
x_8						1.00	-0.20	0.01
x_9							1.00	0.07
x_{10}								1.00

y = Net Farm Household Income

x_2 = Sawah size

x_3 = Crop Intensity

x_5 = Potential Family Labour

x_7 = Off-Farm Expenditure

x_8 = Age

x_9 = Education

x_{10} = Modern Input

TABLE 3.13a

SUKA AMBIT: CORRELATION MATRICES OF FARM INCOME FUNCTION

Whole Farmers	y	x_2	x_3	x_5	x_7	x_8	x_9	x_{10}	x_{11}
y	1.00	0.57	0.03	0.49	-0.004	0.23	0.15	0.32	-0.18
x_2		1.00	0.40	0.13	0.01	-0.02	-0.07	-0.80	0.04
x_3			1.00	0.05	0.05	0.20	-0.04	0.47	-0.10
x_5				1.00	-0.01	0.39	0.59	0.03	0.18
x_7					1.00	-0.11	0.12	-0.09	0.25
x_8						1.00	0.14	-0.01	-0.24
x_9							1.00	-0.10	0.37
x_{10}								1.00	0.05
x_{11}									1.00
High Income Farmers									
y	1.00	0.53	0.05	0.52	-0.05	0.31	-0.03		0.36
x_2		1.00	0.50	0.20	-0.07	0.17	-0.10		0.04
x_3			1.00	0.07	0.07	0.27	-0.08		-0.14
x_5				1.00	-0.02	0.45	0.48		-0.06
x_7					1.00	-0.12	0.10		0.26
x_8						1.00	0.09		-0.15
x_9							1.00		0.15
x_{11}									1.00
Low Income Farmers									
y	1.00	0.67	0.56	0.36	-0.07	0.17	0.31		0.17
x_2		1.00	0.59	-0.05	0.14	-0.30	-0.09		0.02
x_3			1.00	0.25	0.17	-0.15	0.45		0.32
x_5				1.00	-0.03	0.33	0.75		0.63
x_7					1.00	-0.12	0.11		0.20
x_8						1.00	0.20		-0.38
x_9							1.00		0.66
x_{11}									1.00

y = net farm income
x_2 = *sawah* size
x_3 = crop intensity
x_5 = potential family labour
x_7 = off-farm expenditure
x_8 = age
x_9 = education
x_{11} = off-farm income

TABLE 3.14

MALAUSMA: CORRELATION MATRICES OF FARM HOUSEHOLD INCOME FUNCTIONS

	y	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
Whole Farmers									
y	1.00	0.56	-0.06	0.23	0.22	-0.06	0.33	-0.20	-0.05
x_2		1.00	0.08	0.44	0.42	-0.11	0.35	0.23	0.02
x_3			1.00	-0.16	-0.01	-0.01	-0.16	0.11	-0.18
x_4				1.00	0.65	0.25	0.41	-0.31	-0.16
x_5					1.00	0.23	0.47	-0.28	-0.21
x_7						1.00	0.09	-0.08	0.37
x_8							1.00	-0.62	-0.16
x_9								1.00	-0.05
x_{10}									1.00
High Income Farmers									
y	1.00	0.58	-0.03	0.52	0.32	0.23	0.44	-0.27	-0.10
x_2		1.00	0.03	0.41	0.28	0.01	0.30	-0.20	-0.03
x_3			1.00	-0.08	0.17	-0.08	-0.14	0.03	-0.28
x_4				1.00	0.61	0.42	0.40	-0.41	-0.02
x_5					1.00	0.37	0.48	-0.31	-0.12
x_7						1.00	0.28	-0.37	0.38
x_8							1.00	-0.57	-0.18
x_9								1.00	-0.11
x_{10}									1.00
Low Income Farmers									
y	1.00	0.79	-0.25	0.71	0.54	-0.23	0.40	-0.12	-0.12
x_2		1.00	-0.35	0.61	0.62	-0.19	0.48	-0.27	-0.02
x_3			1.00	0.37	-0.34	0.11	-0.22	0.33	0.05
x_4				1.00	0.68	0.06	0.53	-0.28	0.33
x_5					1.00	0.10	0.53	-0.26	0.32
x_7						1.00	-0.16	0.22	0.39
x_8							1.00	-0.73	-0.12
x_9								1.00	0.05
x_{10}									1.00

y = Net Farm Household Income
x_2 = <u>Sawah</u> size
x_3 = Crop Intensity
x_4 = Household Size
x_5 = Potential Family Labour
x_7 = Off-Farm Expenditure
x_8 = Age
x_9 = Education
x_{10} = Modern Input

TABLE 3.14a

MALAUSMA: CORRELATION MATRICES OF FARM INCOME FUNCTIONS

	y	x_2	x_3	x_4	x_5	x_7	x_8	x_9	x_{10}	x_{11}
Whole Farmers										
y	1.00	0.96	0.96	0.18	0.13	0.30	0.08	-0.15	0.96	-0.12
x_2		1.00	0.88	0.26	0.23	0.17	0.15	-0.15	0.88	-0.19
x_3			1.00	0.08	0.05	0.40	-0.02	-0.09	0.97	-0.05
x_4				1.00	0.62	-0.02	0.49	-0.03	0.08	-0.23
x_5					1.00	0.05	0.55	-0.14	0.01	-0.21
x_7						1.00	-0.02	-0.08	0.37	0.36
x_8							1.00	-0.40	0.03	-0.18
x_9								1.00	-0.10	0.31
x_{10}									1.00	-0.08
x_{11}										1.00
High Income Farmers										
y	1.00	0.97	0.98	0.16	0.09	0.42	0.05	-0.18	0.98	-0.23
x_2		1.00	0.94	0.22	0.14	0.32	0.09	-0.15	0.94	-0.24
x_3			1.00	0.09	0.09	0.48	-0.02	-0.14	0.97	-0.18
x_4				1.00	0.55	0.03	0.47	-0.12	0.09	0.28
x_5					1.00	0.17	0.57	-0.23	0.04	0.08
x_7						1.00	0.12	-0.28	0.46	-0.02
x_8							1.00	-0.40	-0.03	-0.03
x_9								1.00	-0.13	0.37
x_{10}									1.00	-0.18
x_{11}										1.00
Low Income Farmers										
y	1.00	0.88	-0.60	0.64	0.65	-0.47	0.51	-0.26	-0.21	-0.52
x_2		1.00	-0.50	0.58	0.63	-0.41	0.49	-0.23	-0.11	0.51
x_3			1.00	-0.37	-0.30	0.17	-0.20	0.07	0.19	0.19
x_4				1.00	0.69	-0.17	0.55	-0.06	-0.36	-0.32
x_5					1.00	-0.12	0.56	-0.09	-0.38	-0.27
x_7						1.00	-0.33	0.37	-0.14	0.69
x_8							1.00	-0.48	-0.13	0.33
x_9								1.00	-0.25	0.60
x_{10}									1.00	-0.14
x_{11}										1.00

y = Net Farm Income; x_7 = Off-Farm Expenditure

x_2 = _Sawah_ Size; x_8 = Age

x_3 = Crop Intensity; x_9 = Education

x_4 = Household Size; x_{10} = Modern Input

x_5 = Potential Family Labour; x_{11} = Off-Farm Income

CHAPTER 4

ALLOCATIVE EFFICIENCY OF FARM RESOURCE USE

The possibility of obtaining increased incomes along with an equitable income distribution are two objectives which are examined in this study. Farm household income will be increased either by raising agricultural output or by creating more (off-farm and farm) employment opportunities. The scope for raising output hinges on opportunities for the profitable use of additional quantities of inputs, and on opportunities for using the given stock of resources more efficiently. The efficiency of resource use can be increased either by improving the level of technology or by reallocating existing resources. This chapter deals with the last objective of this study, i.e. the search for possible ways of increasing farmer's income from the existing set of resources available.

4.1 The Concept of Allocative Efficiency

Allocative efficiency relates to the degree to which the given stock of resources is used - given the level of technology - to maximize net output. A farmer achieves efficiency in this sense by allocating inputs among crops so as to equate the marginal productivity of each input in every use. Any discrepancy in the marginal productivities of a factor in different uses implies that output can be raised with no increase in resources. Stigler (1960) defines efficiency as:

> 'the ratio of actual output to maximum output for given resources. Optimum efficiency, a ratio of unity, is achieved when the value of marginal product of each productive service equals its alternative cost.'

Hence, in the context of production economics, there are two components of economic efficiency: firstly, physical or technical efficiency and secondly, price efficiency or allocative efficiency, which takes into account the price of inputs. A firm is economically efficient if it is both technically efficient and price efficient. Failure in economic efficiency may be due to failure in technical efficiency and/or price efficiency. Technical efficiency and allocative efficiency are necessary conditions. When both are occurring jointly, they became sufficient condition for economic efficiency.[1]

The production function is widely used to assess the allocative efficiency of average farmers through its marginal analysis. The underlying assumptions are (Yotopoulos and Nugent 1976):

1. The farm-firms under study used the same technology, in other words all firms had the same production function, that is, the same technical knowledge and identical fixed factors.
2. All firms faced the same prices in the product and factor markets.
3. All firms maximized profits perfectly and instantaneously.

A comparison is made between the marginal product and the opportunity cost of the 'average' farm-firm and a t-test was used to obtain the statistical significant difference of the ratio to unity.

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1 The detailed economic theory of technical and allocative efficiency are found in many text books such as: Heady and Dillon (1972), Yotopoulos and Nugent (1976) and are also reviewed in a few M.A.D.E. thesis, such as: Sharma (1974), Taib (1976) and Ginting (1978). Hence in this study only some important points will be reviewed.

The detailed procedures followed in this study are (Yotopoulos and Nugent 1976):

1. A stochastic isoquant for the 'representative' firm (i.e. the isoquant that minimizes the sum of squares of positive and negative deviations) is determined by fitting the production function.
2. The physical marginal productivities are expressed in units of output per unit of each input. They are converted into marginal value productivities, Rupiah per unit of input, by multiplying by the price of output. These marginal value products represent the implicit price of each factor of production.
3. The implicit price of each factor is compared with the explicit, that is, market factor price. Allocative efficiency implies, for example, that the employment of labour should expand to the point at which its marginal value product is equal to its opportunity cost. This comparison can easily be done by computing an index of marginal value product to opportunity cost, the expected value of which would be one.

However, this approach to allocative efficiency suffers from some constraining assumptions used in measuring as well as from technical econometric defects that greatly limit its usefulness.

One conceptual defect is that it refers to the 'average' input price and then compares it to the 'average' point on the fitted isoquant in order to draw conclusions about the extent of resource misallocation. With respect to the above assumptions, in the real world farms produce homogeneous outputs with different factor intensities and varying average factor productivities. Farmers do not behave as if they maximized profit. Econometric defects exist on the assumption of profit maximizing behaviour. This assumption introduces relationships between input and output which hold simultaneously with the technological relationships of the production function (Walters 1963). This simultaneous equation bias caused the estimation of production function can not be estimated by ordinary least squares. To overcome this defect Yotopoulos and Nugent (1968) suggest that expected output might be specified with the error term excluded, i.e. assuming error terms equal one.

Another method proposed by Anderson and Dillon (1971) is based on the concept of expected opportunity loss - a central concept of the modern branch of statistics generally known as Bayesian statistics. This method involves the assumption of profit maximisation as in the conventional approach but deviates from the latter in the use of the probabilistic estimate of the production elasticities instead of point estimates, reflecting non-homogeneity due to variations in resource endowments, weather effects, managerial services and attitudes.[1]

Aigner and Chu (1968) proposed a method of using the frontier function by fitting single sign 'least lines' by linear programming techniques instead of using average farmers production function (those estimated by the least square method). The assumptions embodied in

---

1 This method is also reviewed in a M.A.D.E. thesis: Hada (1978).

this approach are: (i) the disturbances are of one sign, i.e. the observed points in the production space lie on or above the frontier only; (ii) that errors of measurement in all variables are negligible; and (iii) that all the differences in technical efficiency are included in the disturbance.[1]

4.2 The Model of Production

The production function is a technical relationship between input and output. Economic considerations such as prices, costs and market phenomena are not relevant to the production function itself, though variables may be expressed in value units without reducing the validity of the relationship.

In any set of observations of a production process the production function may be expressed as:

$$Y = f(X_1, \ldots, X_i, \ldots, X_n)$$

where Y is the observed output of firms having different sets of inputs, $X_1, \ldots, X_i, \ldots, X_n$. Numerous algebraic forms may be used and there is no presumption that a single form should be used to characterize agricultural production under all environmental conditions. Various functional forms have been discussed in detail and the advantages and deficiencies of their properties by Heady and Dillon (1972), reviewed by Steeper (1971) and Hada (1978). In choosing a specific algebraic form to describe this function, prior knowledge of the subject relationship and data must be taken into consideration, though ultimately, goodness of fit and reasonable results are the best criteria of an appropriate

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1 This method is reviewed and followed in two M.A.D.E. thesis: S.R. Sharma (1974) and Teo Choo Kian (1976).

choice. The choice is usually made on the basis of such criteria as compliance with a priori notions about the engineering and the economic laws of production, computational manageability, and so on (Yotopoulos and Nugent 1976).

In this study, the unrestricted Cobb-Douglas firm, that is, an equation linear in the logarithms of the variables, was chosen mainly because its basic consistency with the established body of economic theory, partly because of its computational simplicity and ease of interpretation and lastly for its good fit to the data. With respect to the last reason, regression analysis of farm income in Chapter 2 also suggested that the double-log linear function was the best fit to the data rather than the linear or semi-log linear function.

The Cobb-Douglas production function is commonly stated as:

$$Y = AX_1^{b_1},\ldots,X_i^{b_i},\ldots X_n^{b_n}$$

where Y is output, X_i are the inputs, A is a constant term, and b_i defines the transformation parameter for the level of input, X_i.

In logarithms we may write:

$$\log Y = \log A + b_1 \log X_1 + \ldots\ldots + b_i \log X_i + \ldots + b_n \log X_n$$

Some of the important features of the properties of the Cobb-Douglas production function are:[1]

1. The marginal productivity of each factor is the partial derivative of the output with respect

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1 Only the properties which may be utilized in the empirical part of this study are pointed out here. More detailed discussions are found in Yotopoulos (1967), Yotopoulos and Nugent (1976). In some M.A.D.E. thesis reviews are also found: in Hada (1978) and in more detail in Ginting (1978).

to an input, which represents the change in output that results from a (small) change in any one input, when all the other inputs are held constant. The marginal product of any factor declines as the level of the input of that factor increases, and rises with an increase in any other factor.

2. The elasticity of production is given directly by the respective input exponents and is constant.

3. The Cobb-Douglas function allows decreasing, increasing and constant returns to scale, as defined, by the sum of the elasticities less than, greater than and equal to unity, respectively.

4. Under the assumption of perfect markets, comparison can be made directly between the marginal productivity of a factor and its opportunity cost in order to ascertain the existence of resource misallocation.

5. The elasticity of substitution is constant and equal to one.

Those properties which seem unrealistic, and which have been criticised in the Cobb-Douglas function are the unitary elasticity of substitution among factors and its constant elasticity of production.

Arrow, Chenery, Minhas and Solow jointly developed an alternative form of production function which also assumes a constant elasticity of substitution but which is not restricted to unity. This is called CES (Constant Elasticity Substitution); but is more difficult to estimate as it requires either the use of non linear estimation or good data on factor prices.

The assumption of perfect markets, which is necessary if we are to say anything about resource misallocation is also very restrictive (Yotopoulos 1967).

However, given the available data, it was decided to concentrate on the use of the Cobb-Douglas production function in this study. The statistical properties of the Cobb-Douglas function is that the function which is transformed into log linear form can be estimated using the ordinary least squares method. The assumption necessary for the least squares computational method to be applied has already been discussed in Section 3.4.2, page .

4.3 The Analysis

The production function analysis in the present study is carried out under the assumption that the same functional relationships apply to all farms, i.e. that data collected from different farms reflects the same production function.

Firstly, the aggregate farm production function was estimated to assess the existence of mis-allocation of resource use in the farm as a whole.

Then, to shed further light on the possibilities of gaining from resource use reallocation more specifically, production functions are also estimated for different crops/enterprises. They are, wet season crops on sawah (rice); dry season crops on sawah (rice in Suka Ambit and second crop (palawija) in Malausma);and dryland crops (all crops grown on dryland include crop production from housegardens). In this analysis allocative efficiency implies that the marginal value product of each input is equalized in the production of each output. If, for example, the marginal value product of labour is higher in the production of a dryland crop than it is in the production of rice, efficiency in the allocation of resources calls for shifting labour from rice to the dryland crop until the implicit factor price is the same for each crop.

In order to obtain an insight into the different contribution of inputs to output for high and low income farmers, production functions are also fitted to the input-output relationships where sample data are grouped as high and low income farmers. High income farmers are defined as households who earned incomes equal to or exceed the household subsistence needs in a year. Low income farmers are those who earned incomes are less than the subsistence requirement in the year of the survey. The method of calculation of this subsistence need is discussed in Appendix I.

Several reasons are offered for conjecturing that different relationships might hold if we distinguish the overall sample of farms into two different groups. In Chapter 3, it was indicated that socio-economic factors affecting income worked in a significantly different way for high income and low income groups. This suggests that the sample observations of the underlying population may not obey the same low over the entire range of Xs (explanatory variable). Therefore, fitting a single function is a misspecification of the 'true' functional form. Another reason in support of this supposition is that some variables may exist, not explicitly introduced in the function, that are correlated with farm size, e.g. credit accessibility. Thus by distinguishing the two groups we hold the missing variables constant, in the sense those variables vary over a smaller range than before. Finally, if one suspects that the distribution of the values of the error terms is heteroscedastic, splitting the data in different cells is one way to avoid infringement of a basic property of the least squares method (Yotopoulos 1967).

One of the criticisms of the approach of estimating the most efficient production function by fitting the average production function (the one obtained with least square errors) is that this approach does not take the variation existing in all observations into consideration. Following Bressler (1967) said, it disregards the information available in the vast majority of observations and uses only the marginal observations; Hall and Winsten (1959) added that this method neglects differences in the environment of different firms unless the different environments can be quantified and included in the production function (Sharma 1974). As an example, a farmer with a small farm may be efficient in the use of land for one crop but not in the use of labour; similar variation may also be found in large farms. In order to lessen these shortcomings it was decided to examine and contrast farm resource use of the high and low income farmers. This will be done for both aggregate farm and inter-crop (inter enterprise) production functions.

4.4 Specification of Model and Variables

The form of function of the model used (stated in logarithms) is:

$$\log Y_{ijm} = a_{oi} + \alpha_{1ij} \log L_{ijm} + \alpha_{2ij} \log FH_{ijm} + \alpha_{3ij} \log PH_{ijm} + \alpha_{4ij} \log MI_{ijm} + \alpha_{5ij} \log A_{ijm} + \alpha_{6ij} \log E_{ijm} + \varepsilon$$

where Y = Gross value of production in Rupiah

a_{oi} = constant term (in log)

L = land in hectares

FH = family labour input in standardized man-hour equivalent

PH = hired (paid) labour input in standardized man-hour equivalent

MI = modern input factor, i.e. the value of seed, fertilizer and chemicals in Rupiah

A = average age of the farmer and his wife

E = average schooling level of the farmer and his wife

i = the crop: 1, aggregate farm crops; 2, wet season rice on sawah; 3, dry season rice (in Suka Ambit) or second crop (in Malausma); and 4, upland crops

j = 1, whole samples; 2, high income farmers; 3, low income farmers

m = the number of observations

α = the elasticities

ε = the disturbance terms

A brief description of the variables included in the equation is as follows:

Gross Value of Production (Y). Output is defined in terms of gross value of agricultural production. Because farm households grow various crops, the physical output, which would have been a more appropriate variable in a production function, had to be homogenized by the use of farm-gate prices to give the dependent variable:

$$Y_{ijm} = q_{ijm} \times p_{ijm}$$

where Y = gross value of production, q = the product, p = the price of the product, i = 1, aggregate farm production in a year including rice in wet and dry seasons on sawah, second crops on sawah, upland crops including housegarden crops, but excluding livestock and fishery production; 2, rice in wet season on sawah land; 3, dry season crops: rice in Suka Ambit and second crop in Malausma; 4, dryland crops which consist of various annual and perennial crops grown on dryland and housegarden; j = 1, whole farm, 2, high income farmer, 3, low income farmer; m = the m-th farm. Because the production cycle of the main crop (rice) is six months (one season) and the results of estimation (marginal value product) will be compared, dryland crop production data (output and input data) inputed to the production function is also taken as one season by dividing one years production in half. With regard to the price of rice production, the average fortnightly price for the year in the nearest village market was used instead of the farm-gate price. The reason for, and the shortcomings of using this price, are discussed in Appendix I.

Land (L): The existence of double cropping, multi cropping or of leaving land fallow means that the land actually cultivated will sometimes be greater and sometimes less than the total physical area. By land input was meant the acreage which is actually planted to each crop. There is no data available to eliminate the soil difference among the farms. However, an attempt was made to overcome the difference in land productivity by multiplying the physical area with the productivity index as discussed in Section 2.3. A difficulty was encountered in deflating or inflating the land area for upland and housegardens, because crops in this land are planted in a mixed cropping system in which individual crops cannot be identified by specific area. Hence the physical area used here is probably an over or underestimate. No attempt was made to overcome this problem because of lack of information. The standard unit of this variable is hectares.

Labour (Family Labour FH, and Hired Labour PH): The human labour variable as an independent variable input is included in the production function analysis separately as non-paid family labour and paid non-family labour. The reason for this separation is economically clear, because to use non-family labour the farmer has to pay either in kind or cash which is scarce, while family labour is abundantly available within the family. Labour input means the actual labour used as an input in the process of production of the farm. The variable is measured as the sum of all labour used from the preparation of seed-beds and land preparation to the pre-harvesting period in the case of rice and to the harvesting and drying in the case of other crops. This is measured in man-hours equivalent, by converting woman hours to man-hours equivalent according to average wages received in rice production (see Section 2.4). The data do not provide information on children's and old persons' work in the labour used. It includes only man and woman hours required in each activity.

Animal labour is used only by 4 farmers in Suka Ambit and by none in Malausma. Animal labour hours worked is also converted to a man-hour equivalent at the rate of 8:1 as discussed in Section 2.4.

Modern Input (MI): This input variable is the sum of the values of seed, fertilizer and chemicals in Rupiah. This is also dictated by the availability of data. Some farmers may have used good quality (high yielding variety) seed, others may have used seed from last year's crop which is of doubtful quality. In Suka Ambit some farmers used high yielding or recommended rice varieties, while in Malausma most of the seed used was of local varieties. No attempt is made to eliminate these differences because no adequate information is available to separate either the value of seed from fertilizer or the use of improved seed or HYV. In facing this problem it should be borne in mind that the main objective in collecting data for this study was a different one to undertaking production function analysis.

Management: In this study an attempt was made to include management variables: the average age of the farmer and his wife (A) and the average number of years' schooling of the farmer and his wife (E) as a management proxy. These two variables were included to overcome the specification error caused by the omission of relevant variables. Griliches (1957) has shown that the specification error resulting from the omission of variables depends on the correlation between the omitted variable and the variables included in the function. The estimated coefficients will thus be biased upwards, downwards, or will have no bias according to whether the correlation is positive, negative, or zero with the omitted variable. Running the regression without these two variables results in a lower regression coefficient of the included variables than the coefficient obtained if both variables are included; though the regression coefficients of the two variables are not significant. This suggests evidence of the existence of correlation between the management factor and the included variables. For this reason, it was decided to include these two variables in the equation. Their inclusion should decrease specification bias in the estimated marginal productivities of the physical factor inputs. For a review of production function studies incorporating proxy variables for management in similar semi-traditional rural situations, refer to Upton (1970).

4.5 Empirical Results: Statistical Estimation and Interpretation

This section discusses the empirical findings of the production function fitted to the cross sectional data as described in Section 4.3. Multiple regression analyses for the estimation were run on the DEC-10 computer using the SPSS package (Nie, et al. 1975). The estimated coefficients and the related statistics are summarized in Tables 4.1 and 4.2 for Suka Ambit and Malausma respectively.

4.5.1.a Aggregate Farm Production Function

Regression I in Tables 4.1 and 4.2 for Suka Ambit and Malausma has a multiple coefficient of determination 0.96 and 0.79 respectively. The F-ratio (the ratio of the regression mean squares to the error mean squares) indicates that the fitted function turned out to be highly significant at all plausible levels of significance. Thus, the null hypothesis that the input factors, as a whole, have no influence on the gross output was rejected; in other words, the alternative hypothesis, that the input factors as a whole influence the gross output, was accepted.

The production coefficient for land is 1.01 in Suka Ambit and 0.67 in Malausma; both are highly significant. Another variable which is also highly significant in Suka Ambit is modern input (0.06); however, this is not the case for Malausma. The variable family labour turned out to be significant at the 20 per cent level (0.22) in

SUKA AMBIT: ESTIMATED REGRESSION COEFFICIENTS

AND SELECTED STATISTICAL INFORMATION OF FARM PRODUCTION FUNCTION, 1976

Regression Number		Simple Correlation Coefficient (r)[1]	Constant (in log)	Land L	Family Labour FH	Paid Labour PH	Modern Input MI[2]	Age A	Education E	R^2	$\bar{R}^2$	F-ratio	Error of Est.	n d.f.	F*-ratio (Chow-test)	Sum of Elasticities
R1	WHOLE FARM: all sample		5.16	1.01*** (0.08)	-0.01 (0.03)	-0.03+ (0.02)	0.06*** (0.01)	0.08 (0.20)	0.01 (0.02)	0.96***	0.91	74.98	0.17	47 (6;40)		1.12
R1a	high income	$r_{PH,MI}$=0.98	5.50	0.88*** (0.12)	-0.09 (0.05)	0.11 (0.13)	0.005 (0.10)	-0.09 (0.30)	0.03 (0.04)	0.91***	0.88	35.62	0.17	29 (6;22)	1.84	0.835
R1a'	high income		5.44	0.93*** (0.11)	-0.07* (0.04)	-	0.07** (0.03)	0.08 (0.29)	0.04 (0.03)	0.90***	0.88	43.23	0.17	29 (5;23)		1.05
R1b	low income		4.27	0.87*** (0.18)	0.14 (0.12)	-0.02 (0.03)	0.05*** (0.01)	0.34 (0.23)	0.03 (0.03)	0.95***	0.93	36.39	0.13	18 (6;11)		1.41
R2	RICE, WET SEASON: all sample	$r_{L,MI}$=0.87	5.03	0.96*** (0.11)	-0.002 (0.02)	-0.02 (0.03)	0.13+ (0.09)	-0.04 (0.16)	0.0002 (0.02)	0.93***	0.92	77.54	0.12	41 (6;34)		1.05
R2'	all sample		5.57	1.08*** (0.08)	-0.005 (0.02)	-0.02 (0.03)	-	0.03 (0.16)	0.01 (0.02)	0.93***	0.92	89.87	0.12	41 (5;35)		1.06
R2a	high income	$r_{L,MI}$=0.85 $r_{L,PH}$=0.81	4.94	0.89*** (0.12)	-0.01 (0.02)	-0.10 (0.07)	0.23** (0.09)	-0.11 (0.16)	0.06 (0.02)	0.96***	0.95	76.29	0.10	27 (6;20)		1.07
R2a'	high income		5.96	1.12*** (0.10)	-0.01 (0.02)	0.10 (0.08)	-	-0.11 (0.18)	-0.03 (0.02)	0.94***	0.93	70.31	0.11	27 (5;21)	2.21	1.07
R2b	low income		4.21	0.58 (0.64)	-0.10 (0.19)	0.03 (0.09)	0.21 (0.25)	0.12 (0.38)	0.07 (0.06)	0.90***	0.81	10.45	0.15	14 (6;7)		1.94
R2b'	low income		5.07	0.88+ (0.53)	0.59	0.23	-	0.18 (0.36)	0.06 (0.06)	0.89***	0.82	12.83	0.15	14 (5;8)		1.94
R3	RICE, DRY SEASON: all sample		5.20	0.97*** (0.14)	0.10*** (0.03)	0.05* (0.03)	-0.0004 (0.03)	-0.05 (0.25)	-0.01 (0.03)	0.85***	0.83	29.32	0.18	37 (6;30)		1.06
R3a	high income	$r_{L,PH}$=0.898 $r_{L,MI}$=0.834 $r_{PH,MI}$=0.817	4.55	0.79*** (0.18)	0.003 (0.03)	-0.02 (0.11)	0.21* (0.10)	0.001 (0.22)	-0.03 (0.02)	0.93***	0.90	39.00	0.12	25 (6;18)		0.95
R3a'	high income	$r_{L,MI}$=0.83	4.48	0.77*** (0.13)	0.003 (0.03)	-	0.21** (0.10)	0.01 (0.21)	-0.03 (0.02)	0.93***	0.91	49.29	0.12	25 (5;19)	7.94***	0.96
R3b	low income		5.17	0.87** (0.35)	0.24*** (0.05)	0.001 (0.04)	0.03 (0.03)	-0.27 (0.32)	0.003 (0.05)	0.96***	0.91	18.56	0.13	12 (6;5)		0.87
R4	DRYLAND CROP: all sample		4.14	0.71*** (0.20)	-0.10** (0.04)	0.01* (0.03)	0.004 (0.03)	0.62 (0.57)	0.06 (0.06)	0.46***	0.37	5.24	0.44	44 (6;37)	n.a.	1.32
R4a	high income		5.63	0.83*** (0.27)	-0.10* (0.05)	-0.03 (0.05)	-0.03 (0.04)	-0.27 (0.98)	0.05 (0.11)	0.49**	0.34	3.22	0.49	27 (6;20)	1.17	0.45
R4b	low income		2.64	0.96** (0.40)	0.34* (0.17)	0.03 (0.05)	0.01 (0.04)	1.17*** (0.55)	0.07 (0.06)	0.70**	0.53	3.97	0.30	17 (6;10)		2.58

Notes: *) Figures in parenthesis is the standard error of estimate.

1 Only r which is high in magnitude (> 0.8) is presented to indicate the existence of multicollinearity.

2 Modern input factor is included as the value of seed, fertilizer and chemicals.

(-) Blanks indicate that the input is excluded from the regression to test the existence of multicollinearity.

***, **, * and + indicates significant at 1%, 5%, 10% and 20% levels.

TABLE 4.2

MALAUSMA: ESTIMATED REGRESSION COEFFICIENTS*) AND SELECTED

STATISTICAL INFORMATION OF FARM PRODUCTION FUNCTION, 1976

Regression Number		Simple Correlation Coefficient (r)[1]	Constant (in log)	Land L	Family Labour FH	Paid Labour PH	Modern Input MI[2]	Age A	Education E	R^2	$\bar{R}^2$	R-ratio	Error of Est.	n d.f.	F*-ratio (Chow-test)	Sum of Elasticities
R1	WHOLE FARM: all sample		4.07	0.67*** (0.12)	0.22 (0.14)	0.01 (0.02)	0.14 (0.05)	0.02 (0.17)	0.02 (0.02)	0.79	0.76	30.47	0.15	56 (6;49)		1.08
R1a	high income		4.21	0.69*** (0.21)	0.20 (0.22)	0.02 (0.03)	0.12+ (0.08)	0.01 (0.24)	-0.01 (0.02)	0.74***	0.67	10.87	0.17	30 (6;23)	0.98	1.03
R1b	low income		3.98	0.71*** (0.15)	0.12 (0.20)	-0.01 (0.02)	0.14*** (0.05)	0.20 (0.31)	-0.02 (0.03)	0.87***	0.83	21.36	0.12	26 (6;19)		1.14
R2	RICE, WET SEASON: all sample	$r_{L,MI}$=0.84	4.34	0.70*** (0.13)	0.01 (0.09)	0.01 (0.01)	0.21 (0.10)	-0.06 (0.14)	0.03 (0.01)	0.86***	0.84	48.91	0.12	56 (6;49)		0.90
R2'	all sample		5.37	0.89*** (0.10)	0.02 (0.10)	0.02 (0.01)	-	-0.13 (0.14)	0.03 (0.01)	0.84***	0.83	53.93	0.13	56 (5;50)		0.83
R2a	high income		4.52	0.79***	0.02 (0.14)	0.02 (0.02)	0.20 (0.15)	-0.11 (0.19)	-0.04** (0.02)	0.82***	0.77	17.64	0.14	30 (6;23)	1.20	0.88
R2b	low income	$r_{L,MI}$=0.89	4.16	0.69*** (0.19)	-0.11 (0.13)	0.01 (0.01)	0.20+ (0.14)	0.23 (0.22)	0.001 (0.02)	0.92***	0.90	37.97	0.10	26 (6;19)		0.82
R2b'	low income		5.12	0.90*** (0.12)	0.13 (0.13)	0.80 (0.10)	-	0.23 (0.23)	0.003 (0.02)	0.91***	0.89	42.62	0.10	26 (5;20)		2.06
R3	SEC. CROP: all sample		2.62	0.17** (0.08)	-0.54*** (0.17)	0.91*** (0.20)	0.03 (0.01)	0.23 (0.23)	-0.01 (0.02)	0.73***	0.69	16.45	0.19	43 (6;36)		0.79
R3a	high income	$r_{FH,PH}$-0.889	2.05	0.12 (0.10)	0.70+ (0.45)	1.31** (0.59)	0.03+ (0.02)	0.28 (0.30)	0.02 (0.03)	0.76***	0.68	8.65	0.20	23 (6;16)	1.64	2.46
R3a'	high income		2.04	0.19* (0.10)	-	0.50* (0.30)	0.03 (0.02)	0.51* (0.27)	0.01 (0.03)	0.73***	0.65	9.10	0.21	23 (5;17)		1.24
R3b	low income		3.33	0.14 (0.27)	-0.60** (0.25)	0.91*** (0.31)	0.03 (0.03)	0.18 (0.71)	-0.02 (0.05)	0.68***	0.54	4.69	0.21	20 (6;13)		0.64
R4	DRYLAND CROPS: all sample		4.41	0.52*** (0.11)	0.01 (0.07)	-0.01 (0.02)	0.05 (0.05)	0.13 (0.32)	-0.04 (0.02)	0.44***	0.37	6.27	0.28	54 (6;47)		0.66
R4a	high income		2.99	0.44* (0.30)	0.43 (0.24)	0.01 (0.03)	0.27 (0.21)	0.08 (0.35)	-0.01 (0.03)	0.61***	0.50	5.91	0.26	30 (6;23)	2.02	1.22
R4b	low income		4.88	0.49*** (0.15)	-0.03 (0.08)	-0.03 (0.03)	0.05 (0.05)	-0.20 (0.78)	-0.09 (0.07)	0.50**	0.33	2.87	0.28	24 (6;17)		.19

Notes: See Table 4.1.

Malausma, but not in Suka Ambit. The variable paid labour is significant in Suka Ambit (- 0.03) but not in Malausma.

The production coefficients (elasticities) indicate for each input the expected percentage increase (or decrease) in gross value of output if the amount of that input increased (or decreased) by one per cent, other input levels being held constant (Yotopoulos 1967). Thus, for farm income in Suka Ambit, a one per cent increase in the land used input would lead to a 1.01 per cent increase in the gross value of output. In Malausma, a one per cent increase in the land input would lead to a 0.67 per cent increase in the gross value of output. A similar interpretation holds for the other coefficients which in fact have a very low coefficient or are not significant at all.

The higher value and highly significant coefficient of the variable land in both villages indicates the crucial importance of this factor for increasing farm income, or in other words this variable is the limiting factor in deriving farm income. This result is not surprising as it has already been pointed out in the previous section how small the size of farms in the village are.

The sum of production elasticities amounted to 1.12 in Suka Ambit and 1.08 in Malausma. This can serve in measuring returns to scale. These sums indicate that a one per cent increase in all resource inputs would lead to a more than one per cent increase in the gross value of agricultural output, which suggests increasing return to scale exist.

The existence of multicollinearity which often besets the production analysis using multivariate regression does not seem to be a problem in this case, as none of the correlation coefficients between independent variables exceeded 0.8 (Heady and Dillon 1972). The highest simple correlation coefficient between explanatory variables observed is between the variables paid labour and modern inputs ($r_{PH,MI}$ = 0.70) in Suka Ambit and between the variables land and family labour in Malausma ($r_{L,FH}$ = 0.73).

4.5.1.b Farm Production Function for the High and Low Income Farmers

A statistical question that arises refers to the confidence one can place in the distinction of the farmer into two groups. Are the functions fitted for the two sub groups and the overall relation significantly different one from the other? A Chow-test was applied to test the null hypothesis that $\alpha_{12} = \alpha_{13} = \alpha_{11}$, where the α's are, respectively, the coefficient vectors of the high income group, the low income group and the whole sample farmer; i.e. the regressions R1, R1a and R1b in Tables 4.1 and 4.2. It is found that the F*-ratios are not significant at any conventional level of significance; hence the null hypothesis was accepted (for both villages) that the two relationships (for high and low income groups) do not differ significantly.

In Suka Ambit there is a near perfect correlation between the variables paid labour and modern input factors as indicated by the simple correlation coefficient ($r_{PH,MI}$ = 0.90) for the high income group which is not the case for the low income one. According to Heady and Dillon (1972) $r > |0.8|$ is an indication of the presence of multicollinearity. Compared to the R^2 it is observed that $r_{PH,MI} > R^2$; which is another indication of the existence of severe multicollinearity. This may cause the estimated coefficient to be unreliable, variance may be large and the acceptance region for the hypothesis, that a given regression coefficient is zero, will be wide. This seems to be the case here as the standard error estimate of the variable modern input/factor is 0.10 against the coefficient of 0.005 which is not significant. The estimated coefficient of Regression 1a' is the result after omitting one of each pair of the highly correlated variables as suggested by Heady and Dillon (1961), Jae-on Kim and Kohout (1972); whereas in this case the variable paid labour (PH) is omitted. The coefficient of the variables, land (L) increased from 0.88 to 0.93, modern inputs (MI) increased from 0.005 to 0.07 which was previously not significant, but now is; and nearly all standard error estimates of each coefficient decreased. However, $\bar{R}^2$ is unchanged, suggesting that this equation is not better than the previous one. In addition, the present estimate is no more comparable with the low income equation (because the number of explanatory variables now is not the same). Hence, we keep our previous judgement, i.e. of omitting the coefficient for high and low incomes and further economic interpretation will be made only from Regression 1.

4.5.2.a Sawah and Upland Crops Production Function

The estimated coefficients for the production functions of sawah and upland crops are presented in Tables 4.1 and 4.2 is R2, R3 and R4. The proportion of the variances in crop outputs explained by the observed explanatory variables vary. The coefficient of multiple determination for rice in the wet season, for example in Suka Ambit, is very high (0.93), for rice in the dry season it is 0.83 and for upland crops it is 0.46, which is in fact very low. In Malausma, those figures are 0.86, 0.73 and 0.44 respectively for wet season rice, second crops and upland crops.

All of these coefficients are highly significant (at least at the 1 per cent level) as indicated by the value of the F-ratio.

In consideration of saving space, it is not possible to present all the simple correlation coefficients of the functions considered. It is worth mentioning that the correlation coefficients for the wet season rice function seems high in magnitude between the variables land and modern inputs, i.e. $r_{L,MI} = 0.87$ in Suka Ambit and $r_{L,MI} = 0.84$ in Malausma. Rerunning the regression and omitting variable modern inputs (MI) results in a higher coefficient for the variable land (L) and decreases its standard error of the estimate (see R 2') . This suggests the existence of perfect correlation between these variables. However, since $r_{L,MI}$ in the first regression (R 2) is small in relation to the coefficient of multicorrelation R (= $\sqrt{R^2}$) in each function we justified that on the first regression (R 2) the production coefficients for both villages are well estimated and multicollinearity is probably not a serious problem at this stage, and the statistical interpretation of the estimated parameters can, now, be proceded with.

First the factors that are most important (as evidenced by the level of significance of the coefficient) in explaining intercrop differences in output are considered. (Attention should be concentrated on R2, R3 and R4.)

Land is statistically significant in all crop production functions under consideration in Suka Ambit; while in Malausma land is highly significant on wet season rice and upland crop functions, but neither the most nor the highest in the magnitude of its coefficient for the second crop function. For the last mentioned crop paid labour is observed as the most important factor for explaining the variability of output. Land is only significant at the 5 per cent level of confidence and its coefficient is 0.17 against 0.91 for paid labour.

Family labour is observed to be highly significant in the dry season rice production in Suka Ambit, but the magnitude of the coefficient is relatively low (0.10). In Malausma the coefficient is 0.54 and highly significant with a negative sign. A significant and negative coefficient is also observed for this variable on upland crop production in Suka Ambit with a low magnitude (- 0.10 at the 5 per cent level of significance). A negative coefficient for this input factor does not conform with economic theory or the logic of technical relationships in input-output analysis. The insignificance of this input variable in production of other crops may be attributed to the fact that the maximum use of this factor has been achieved and the negative and highly significant coefficient indicates that maximum use has been exceeded which causes a decrease in output. The same explanation holds true for other input variables.

Paid labour is also significant (at the 10 per cent level) on dry season rice and upland crop production in Suka Ambit at a relatively low magnitude, i.e. 0.05 and 0.01 respectively (besides for second crop production in Malausma as mentioned above). A one per cent increase in the use of this input factor, other factors held constant, can be expected to increase output of these crops production by 0.05 and 0.01 per cent.

Modern input factors was significant only in wet season rice production in Suka Ambit at a low level of significance (20 per cent).

Overall, land appears to be a limiting factor, as one would expect. Paid labour also appears to be quite important in increasing second crop output in Malausma, and family labour for dry season rice production in Suka Ambit.

4.5.2.b Intra Crop Production Function for the High and Low Income Farmer

The estimated regression for the high and low income groups are presented as R2a, R2b, R3a, R3b, R4a, R4b in Tables 4.1 and 4.2 respectively for Suka Ambit and Malausma. Like in the previous analysis, the t-test, F-test and Chow-test are the statistical tests applied to obtain the confidence levels for every coefficient observed. The existence of multicollinearity is also examined and tested.

On the estimated regression R2a collinearity is found between the variables land and modern inputs ($r_{L,MI}$ = 0.85), land and paid labour ($r_{L,HP}$ = 0.81). The omission of the variable modern inputs (MI) causes the coefficient of the variable land to be increased from 0.89 to 1.12 and the standard error of the estimate of these coefficients to decrease from 0.12 to 0.10 (R2a). However, since the multiple correlation coefficient of the first regression is greater than the simple correlation of those variables which has a perfect correlation, this multicollinearity can be considered to be not too severe and the coefficients for the regression R2a are well estimated.

The same explanation is also applicable to regression R3a in Suka Ambit and regression R2b in Malausma. An exception is found in regression R3b in Malausma where the perfect correlation between variables family labour and paid labour probably beset the estimated regression coefficients obtained. This is indicated by the high magnitude of

$r_{FH,PH}$ (0.89) in relation to the magnitude of R (0.76). Consequently, statistical interpretation from the coefficients of Regression R 3b has to be undertaken with great caution and in the remaining discussion we shall dismiss the regressions R2a', R2b' and R3b'.

The next question to attempt answering is whether it is worthwhile to fit regression to the different groups of high and low income farmer. The Chow-test is applied to test the null hypothesis that $\alpha_{i2} = \alpha_{i3} = \alpha_{i1}$, where the α's are, respectively, the coefficient vectors of the high income group, the low income group and the whole sample for each crop production function. The null hypothesis is rejected only for dry season rice production in Suka Ambit at less than the 1 per cent significant level. This implies that regressions R3a and R3b are statistically drawn from different populations. The set of explanatory variables contribute significantly in different ways to high and low income farmers.

For the high income group, land is the most important variable in explaining the variability of putput; the variable modern inputs is the second most important variable (significant at less than the 1 per cent level). For the low income farmer family labour is observed as the most important variable (significant at the 1 per cent level) and then land (significant at the 5 per cent level). Coefficients of multiple determination for these two groups is even higher than for the total sample, i.e. 0.93 and 0.96 for high and low incomes respectively against 0.85 for the total sample. Those coefficients are statistically highly significant.

4.6 Gains From Resource Reallocation

From the estimated coefficients presented in Tables 4.1 and 4.2, elasticities of production and marginal productivities are derived and presented in Table 4.3 for the aggregate farm production, and Tables 4.5 and 4.6 for different crop productions. The marginal productivity of factor x in producing crop i is denoted by MVP_{x_i} and is given by:[1]

$$MVP_{x_i} = \frac{E_{x_i} Y_i}{x_i}$$

where E_{x_i} = the elasticity of factor x in producing crop i = regression coefficient of factor x_i.

Y_i = the output of crop i

x_i = the amount of input x used in producing crop i.

The estimated marginal productivities are calculated at the geometric means of the variables Y_i and x_i. These geometric means are also presented in Tables 4.3 and 4.4. Only the four conventional input factors are calculated because for most functions, the regression coefficients of the variables age and education are not significant.

The geometric means are used because the average values of the factors inputed into the regression are in logarithm transformation. If the distribution of variables are close to normal there will not be a great difference between the geometric and arithmatic sample mean values. The estimation of the point of geometric means serves also to convey information about the scale of operation to which each estimate refers (Yotopoulos 1967).

The Marginal Factors Cost (MFC) or the opportunity cost of an input resource is the cost in terms of the value of the alternatives or

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1 See Massel and Johnson 1968.

AGGREGATE PRODUCTION FUNCTIONS FOR THE VILLAGES, 1976

(WHOLE SAMPLE, HIGH INCOME AND LOW INCOME)

	Unit	Suka Ambit			Malausma		
		Whole Sample	High Income	Low Income	Whole Sample	High Income	Low Income
Production Elasticities:							
Land		1.01***	0.88***	0.87***	0.67***	0.69***	0.71***
Family Labour		-0.01	-0.09*	0.14	0.22+	0.20	0.12
Paid Labour		-0.03+	0.11	-0.02	0.01	0.02	-0.01
Modern Input. 1)		0.06***	-0.005	0.05***	0.14	0.12+	0.14***
Age		0.08	0.09	0.34	0.02	0.01	0.20
Education		0.01	-0.09	0.03	0.02	-0.01	-0.02
Returns to Scale (Sum of Elasticities)		1.12***	0.84	1.41	1.08	1.03	1.14
Geometric Means: Output	Rupiah	79,104	122,152	39,283	75,614	90,803	61,235
Land	hectare	0.83	0.47	0.18	0.38	0.40	0.36
Family Labour	man hour	274.7	261.1	298.3	328.3	369.1	286.8
Paid Labour	man hour	79.9	257.7	12.1	171.4	200.2	143.3
Modern Input 1)	Rupiah	1156.10	3618.30	183.90	6469.90	7801.10	5214.30
Age	year	37.2	37.3	36.9	32.9	32.3	33.6
Education	year	1.8	2.6	1.1	0.6	0.3	1.2
Marginal Value Products:							
Land	Rp per hectare	242,106	228,710	189,868	133,319	156,635	120,769
Family Labour	Rp per m.hour	neg.	neg.	18.40	50.70	49.20	25.60
Paid Labour	Rp per m.hour	neg.	52.10	neg.	4.40	9.10	neg.
Modern Input 1)	Rp per Rp	4.10	neg.	10.70	1.64	1.40	1.60
Opportunity Cost:							
Land	Rupiah	181,818	181,818	181,818	139,860	139,860	139,860
Labour	Rupiah	71.40	71.40	71.40	68	68	68
Modern Input	Rupiah	1.30	1.30	1.30	1.30	1.30	1.30
Marginal Return to Opportunity Cost Ratio:							
Land		1.33***	1.25+	1.04	0.95	1.12	0.86
Family Labour		..	..	0.26***	0.75	0.72	0.38
Paid Labour		..	0.73	..	0.06***	0.13***	..
Modern Input		3.15	..	8.23***	1.26	1.08	1.23

Notes: 1) Modern input is the value of seed, fertilizer and chemicals.

.. Can not be counted

neg. = negative

***,**, * and + indicates significant at 1%, 5%, 10% and 20% level other opportunities which have to be forgone in order to achieve a particular output. Generally, in production function analysis, the opportunity costs are derived from the prevailing market prices.

The opportunity costs of land used are Rp 139,860 per hectare in Malausma and Rp 181,818 per hectare for one season (6 months) in Suka Ambit. These figures are calculated from the price of renting sawah recorded at the time of the survey in Malausma, i.e. Rp 400/bata/year which is equivalent to Rp 279,720/hectare/year or Rp 139,860 per hectare/per one season (six months).[1] Because, there is no information available for Suka Ambit, a thirty per cent above the rent in Malausma is considered reasonable, under the consideration that sawah in Suka Ambit has better irrigation than in Malausma.[2]

Because insufficient information is available, no attempt was made to distinguish between the opportunity cost of sawah and dryland, and for high income and low income farmers which is probably different.

The marginal factor cost of labour was derived from the wage paid for an hour of man labour which is Rp 71.40 in Suka Ambit and Rp 68.00 in Malausma. These marginal costs are assumed to be equal for family labour and paid labour and for high income and low income farmers.

The marginal factor cost of modern inputs is calculated as one rupiah spent for this input plus the relevant seasonal interest rate. The interest rate of credit provided by the government via a Village Unit of the People's Bank of Indonesia is 1½ per cent a month. A lumbung bahagia granted loans to members at 20 per cent interest over six months.

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1 1 bata = 0.143 ha.

2 The ratio of sawah price in both villages is Rp 7000/bata to Rp 5000/bata respectively for Suka Ambit and Malausma.

A 4 per cent interest loan a month is also found in the village (see Section 2.5). Loan in kind (usually unmilled rice) granted in the difficult preharvest time at the rate of 15 per cent interest a month was also reported as common practice by the 'rich' to the 'poor' at the time of the survey. Hence, five per cent interest a month is considered reasonable for the calculation of the marginal factor cost of modern inputs used, that is, Rp 1.30 for each rupiah spent on seed, fertilizer and chemicals in one season (six months). This is also applied to all crops, high income and low income farmers, and is equal for both villages.

Next, we will proceed to a discussion of the economic efficiency of resource use. To ascertain that the input factors were used in an efficient way, given factor prices are constant, the marginal value productivities of those variables must be equal to their respective marginal factor costs or the ratios should be equal to unity.

To test the hypothesis that one variable is not being utilized efficiently, one must determine with the t-test if there is a significant difference between the marginal value product of factor x_i (MVP_{x_i}) and its marginal factor cost (MFC_{x_i}):

$$t = \frac{MVP_{x_i} - MFC_{x_i}}{\sqrt{Sb_i^{\,2} (\frac{\bar{Q}}{x_i})^2}}$$

where Sb_i is the standard error of factor x_i's estimate production elasticity and $\bar{Q}$ is the average output.

The ratio of marginal value productivities to opportunity costs of the aggregate farm production function in both villages (for the whole sample, high income and low income) are presented at the bottom of Table 4.3.

If a marginal value productivity of an input factor far exceeds its marginal factor cost (the ratio is significantly greater than one) this indicates that this input is too sparingly used and should be increased. Such factors are: land for the whole sample and high income function, and modern inputs for the low income function in Suka Ambit.

By contrast a marginal value productivity which is far smaller than the marginal factor cost (its ratio is less than one and statistically significant) indicates that the input factor in question is used too much and should be decreased. Such input factors, as shown in Table 4.3 are: family labour used by the low income farmer in Suka Ambit, paid labour on the whole farm and high income functions in Malausma.

It is observed that some other variables have a marginal productivity to opportunity cost ratio which is greater or less than one. However, because the t-test indicates that the difference between the marginal productivities and opportunity costs of the variables in question are not statistically significant, no inference can be made from these ratios. Besides, the ratio for some factors could not be calculated because the marginal value product was negative.

The insignificant difference between the marginal productivity of a factor and its opportunity cost suggests that this factor is being used efficiently, given the existence of factor price ratio and level of technology. This case is found in the use of land by the low income farmers in Suka Ambit, by the farmers in Malausma (for whole sample, high and low income farmers); also in the use of modern inputs in Malausma;

and in Suka Ambit particularly indicated on the whole sample function.

Overall, in Suka Ambit the data suggests that the farmer should expand the use of land, and especially for low income farmers to decrease the use of family labour and increase the use of modern inputs; while in Malausma the result arrived at suggests a decrease in the use of paid labour.

The last part of the analysis in this study is to assess the allocative efficiency by comparing the marginal productivity of each different crop or enterprise. To maintain the homogeneity of the time in making a comparison the inputs used on wet season rice production will be compared to those on dryland crop production; and between those used for dry season rice (or second crop) and dryland crop production. The length of time for each production process is considered as one season (six months). The marginal productivities are presented in Tables 4.4 and 4.5 for Suka Ambit and Malausma respectively.

Table 4.4 for Suka Ambit shows that for the whole sample and the high income farmer, the comparison can only be done for the factor land. The marginal productivities of other factors are not comparable because most of them are negative (and can not be calculated). The highest marginal productivity of land for the whole sample function is for the wet season rice production. This is also true for high income and low income farmers. The lowest marginal productivity of land is for dryland crop production except for the high income farmer where the lowest is for dry season rice production. Theoretically this result suggests that given the inputs of other factors, the value of output would be raised by shifting land from dryland crop production to sawah

TABLE 4.4

SUKA AMBIT: PRODUCTION ELASTICITIES, MARGINAL PRODUCTS AND OPPORTUNITY COST RESOURCES OF FARM PRODUCTION, 1976

	Unit	Whole Sample			High Income			Low Income		
		Rice W.S.	Rice D.S.	Dryland	Rice W.S.	Rice D.S.	Dryland	Rice W.S.	Rice D.S.	Dryland
Production Elasticities:										
Land		0.96***	0.97***	0.71***	0.89	0.79***	0.83***	0.87**	0.87**	0.96**
Family Labour		-0.002	0.10***	-0.10**	-0.01	0.003	-0.10*	0.24	0.24	0.34*
Paid Labour		-0.02	0.05*	-0.01	-0.10	-0.02	-0.03	0.001	0.001	0.03
Modern Input 1)		0.13	-0.0004	-0.004	0.23**	0.21*	-0.03	0.03	0.03	0.01
Age		-0.04	0.05	0.62	0.11	0.001	-0.27	-0.27	-0.27	1.17***
Education		0.002	-0.01	0.06	0.06	-0.03	0.05	0.003	0.003	0.07
Sum of Elasticities		1.05	1.06	1.32	1.07	0.95	0.45	0.87	0.87	2.58
Geometric Means: Output	Rupiah	47,698	34,594	6,619	64,476	46,345	7,838	26,680	18,810	5,061
Land	hectare	0.18	0.14	0.03	0.24	.17	0.03	0.11	0.10	0.05
Family Labour	man hour	63.3	41.1	40.4	57.7	49.3	23.4	75.5	28.1	193.1
Paid Labour	man hour	161.0	55.8	0.03	291.7	226.6	0.04	51.2	3.1	0.02
Modern Input 1)	Rupiah	5285.70	2777.20	0.05	6749.90	4526.80	0.02	3298.40	1004.20	0.21
Age	year	36.4	36.1	37.7	37.0	36.4	37.9	35.4	35.5	37.4
Education	year	1.6	2.3	2.1	2.4	2.4	2.4	0.7	2.1	1.6
Marginal Value Products:										
Land	Rp per hectare	254,389	239,687	156,650	239,099	215,368	216,851	211,015	163,647	97,171
Family Labour	Rp per m.hour	neg.	84.20	neg.	neg.	2.80	neg.	84.80	160.65	17.80
Paid Labour	Rp per m.hour	neg.	31.00	neg.	neg.	neg.	neg.	0.52	6.10	7591.50
Modern Input 1)	Rp per Rp	1.17	neg.	neg.	50.80	2.15	neg.	0.25	0.60	241.00

Notes: See Table 4.3.

TABLE 4.5

MALAUSMA: PRODUCTION ELASTICITIES, MARGINAL PRODUCTS AND OPPORTUNITY COST RESOURCES OF FARM PRODUCTION, 1976

	Unit	Whole Sample			High Income			Low Income		
		Rice W.S.	Rice D.S.	Dryland	Rice W.S.	Rice D.S.	Dryland	Rice W.S.	Rice D.S.	Dryland
Production Elasticities:										
Land		0.70***	0.17**	0.52***	0.79***	0.12	0.44+	0.69***	0.14	0.49***
Family Labour		0.01	0.54***	0.01	0.02	-0.70+	0.43*	-0.11	-0.60**	-0.03
Paid Labour		0.01	0.91***	-0.01	0.02	1.31**	0.01	0.01	0.91***	-0.03
Modern Input 1)		0.21	0.03	0.05	0.20	0.03+	0.27	0.20+	0.03	0.05
Age		-0.06	0.23	0.13	-0.11	0.28	0.08	0.23	0.18	-0.20
Education		0.03	-0.01	-0.04	-0.04	-0.02	-0.01	-0.001	-0.02	-0.09
Sum of Elasticities		0.90	0.79	0.66	0.18	2.46	1.22	1.02	0.64	0.19
Geometric Means: Output	Rupiah	44,177	3,698	6,586	52,107	3,117	7,175	36,517	4,503	5,916
Land	hectare	0.21	0.08	0.03	0.24	0.07	0.03	0.19	0.10	0.03
Family Labour	man hour	135.0	63.2	31.2	147.0	62.4	42.3	122.4	64.1	21.4
Paid Labour	man hour	49.2	81.9	0.02	62.7	74.6	0.02	37.1	91.0	0.02
Modern Input 1)	Rupiah	6453.60	1.80	230.80	7148.30	0.20	378.70	5734.60	22.10	124.30
Age	year	32.9	32.6	33.0	32.3	30.5	32.3	33.6	35.1	33.9
Education	year	0.6	1.4	0.5	3.2	0.6	0.3	1.2	0.9	1.1
Marginal Value Product:										
Land	Rp per hectare	147,257	7858.25	114,157	171,519	5,343	105,233	132,614	6,304	96,628
Family Labour	Rp per m.hour	3.30	31.60	2.10	7.10	neg.	72.90	32.80	neg.	neg.
Paid Labour	Rp per m.hour	9.00	41.10	neg.	16.62	65.40	3587.50	9.80	45.00	neg.
Modern Input 1)	Rp per Rp	1.40	61.63	1.43	1.45	1.25	5.10	1.27	6.10	2.40

Notes: See Table 4.3.

(wet land) for producing rice. This is hardly surprising. All farmers know it. But, it is not easy to convert dryland to wet land. This needs a great deal of investment to terrace the land to enable the land to retain water or to provide irrigation. Investments in other inputs are, relatively speaking, much easier to do than on land. Unluckily, only the estimated marginal productivities of the factors for the low income farmers can be examined. The results are as follows.

The marginal productivity of family labour is higher for wet season rice production than for dryland crops production, and the comparison of these values on dry season rice and dryland crop production shows that the value for dry season rice is even higher than all other crop productions. This also implies that farmers are recommended to use more family labour on rice production and to withdraw some of the family labour used for dryland crop production.

With regard to the use of paid labour and modern inputs, the marginal productivity values indicate the same trend for both inputs, that is, a much lower value for rice production (in wet and dry season) than for dryland crops. The low marginal value productivity of these variables on rice production, relative to dryland crop production, is attributed to an intensive use of these inputs (labour and fertilizer); while for dryland crops the application of modern inputs is at an extremely low level. This is also related to the very limited land available for dryland crops. Accordingly, there will also be less labour used on these crops.

In Malausma, slightly different results are observed. Regardless of the insignificance of estimated production elasticities, only a few marginal value productivities could not be calculated, as shown in Table 4.5.

The estimated marginal value productivities of the factor land indicate the same trend for the whole sample, high income and low income farmers. The highest value is found for rice (wet season) production and the lowest is for second crop production. There is no doubt that more land should be available to grow rice in order to contribute more income to the farmer.

On the use of family labour, the calculation relating to the whole sample shows evidence that a potential gain exists if more family labour is employed in rice production instead of in dryland crop production; even higher if it is spent on second crops. For the high income farmer the data suggest a different course of action where potential gain exists if more family labour is spent on upland crops; and for the low income group no comparison is made. The high value of marginal value productivities of land on upland for high income farmers is an indication of less labour spent on this crop by this group.

Turning to the use of paid labour, no comparison can be made for the whole sample and the low income farmers, because marginal value productivities are not available. For the high income farmers, there is evidence that more paid labour should be spent on dryland crops instead of on rice and second crop production.

With respect to modern inputs, for the whole sample and low income farmers, potential of greater gain exists if modern inputs are increasingly applied to second crops rather than to upland crops. However, this is not the case for high income farmers. One probable explanation for this difference is that the marginal value productivity calculated for this variable is derived from the estimated production elasticity of a regression where a high multicollinearity exists.

In relation to the comparison between the use of modern inputs on rice and dryland production, the analysis suggests a higher use of this input on dryland crops as evidenced by the marginal value productivity of modern input to be equated for either the whole sample or for different group high and low income farmers.

Overall, all of the above interpretations are only useful if and only if the previous regression estimates hold true. An overestimation or underestimation of the regression coefficient of a variable will give an overestimation or underestimation respectively of the marginal value productivity of the variable in question. The significance (or insignificance) of the coefficients used, have already been pointed out earlier since the data does not seem to be complete and accurate, the emphasis of this work is more useful as an exercise in methodology than for expecting good results from the analysis.

Provided more accurate and reliable estimates became available, the analysis should be more useful if the calculations are made for:

1. The expected value of output (whether raised or decreased) if the marginal value product of an input factor is equalized in the production functions of the crops in the comparison.
2. The expected value of output (whether raised or decreased) if the marginal value productivity of an input factor is equalized to its marginal factor cost (by increasing or decreasing the use

of the factor in question, depending on the magnitude of its marginal value productivity to marginal cost ratio) in the production function of every crop in the analysis.

3. The expected value of output (raised or decreased) if the marginal value productivities of two or more input factors are equalized to each marginal factor cost simultaneously in the production functions of every crop in the analysis.

4. The marginal value productivity to marginal cost ratios of every significant variable in the functions for every individual sample, as well as for the average production function, to see the dispersions of those ratios around the one for the average farms, in order to see the scope of potential gains from reallocation of resource use to individual farmers.

4.7 Allocative Efficiency for Other Farm Income and Off-Farm Income Activities

It was observed in Chapter 3 that off-farm income activity had an important role in the fulfilment of the household subsistence daily requirements and in making the distribution of income more equal. As shown in Table 3.1 in Suka Ambit off-farm income comprised 39 per cent and in Malausma 48 per cent of the total household income. Unfortunately, because of the great variability encountered either in the kind of activity, or the number of farm households involved, or the kind and number of resources used and returns gained from such activities, it is very difficult to carry out an analysis on input-output relationships using the present available data.

In this chapter, income from livestock, poultry and fisheries were also excluded from the analysis because insufficient information was available. As a result, no analysis of resource use efficiency was made for these income activities.

In addition to these difficulties, it was realized that the opportunity to be involved in a certain activity is not the same for all villagers, though some activities generate high income. Non-farm labour in Suka Ambit, for example, generated relatively high income, but only to a portion of the household (see Table 4.6). Its return per man-hour job is the highest but the range is considerably wide. In Malausma, apart from a wide range in return per man-hour, poultry and fishery have the highest average, but are also available only to a half of the sample. All of the households took part to some extent in self business employment, i.e. either as petty traders or as artisans (rope or hat making), but returns per man-hour were the lowest of all. Not much can be said in detail, except that it makes a significant contribution to the great variability in supplementing farm income. Could there be potential for increasing rural income in these ways? This is merely an introduction to the questions that must be included if further study for the formulation of strategies for increasing rural income should be done.

TABLE 4.6

AVERAGE[1] INCOME PER HOUSEHOLD AND RETURN PER MAN-HOUR FROM POULTRY AND FISHERIES AND OFF-FARM INCOME ACTIVITIES

	n	Average Income per Farm		Income per Man Hour	
		in m.r.e	in Rupiah	average	range
Suka Ambit: n = 49					
Poultry and Fishery	37	325	37,805	23	1-157
Farm Labour Income	23	402	47,867	57	29- 86
Non-Farm Labour	18	795	94,608	65	7-189
Self Business Employment	9	416	49,511	48	4-104
Malausma: n = 56					
Poultry and Fishery	23	166	17,637	353	63-538
Farm Labour Income	23	64	6,830	67	29-100
Non-Farm Labour	12	511	54,217	82	33-150
Self Business Employment	56	479	50,827	43	6-158

1 Only from the existing farm

m.r.e. = milled rice equivalent

CHAPTER 5

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

The main purpose of this study has been to explore the economic conditions of the villagers in the Cimanuk river basin, in order to gain an understanding of the structure of rural incomes. This was undertaken through investigating the certain socio-economic factors believed to affect income, and exploring the existing pattern of income distribution, thus throwing some light on the economic efficiency of the main farm resource use at the given level of farming technology.

A subsidiary objective of the study is to examine the existing general policy and to investigate possible alternative strategies for influencing rural incomes. Government assistance such as the rice intensification programme (BIMAS) has achieved notable results. However, there is growing concern that only a section - within even the relatively privileged land-owning class in the rural areas - has benefited so far from such programmes (Krishnaswamy 1977). It is acknowledged that the BIMAS programme particularly in Java, has succeeded in pushing up the upper level farmers to participate in national development and growth, and an increased share of the distribution of income has been achieved among them (Soejono and Birowo 1976). Nevertheless, this selectivity of results should be discouraged as the objective of the government's assistance programme was to increase the income of a broad base of farmers in general, and the rural poor in particular.

With respect to the latter objective, an attempt was made by undertaking a systematic study of the allocative efficiency of individual farming enterprises for high and low income farmers. High income farmers are distinguished from low income farmers depending on the ratio of net farm household income earned to subsistence income needs; high income farmers have a ratio of more than 1, while low income farmers have a ratio approaching or equal to 1.

Schultz's (1964) argument that there are few significant inefficiencies in the allocation of the factors of production in traditional agriculture leads this study to adopt a general hypothesis that there are some other possible policy alternatives which the government could follow to raise income either in the farm sector or in the non-farm sector. In this study, this implies that an exploration of policy alternatives is needed if the existing policy of increasing food (rice) production is less effective.

Most economists who are familiar with the economic condition of countries faced with growing population pressures on the available land and with low crop yields, must also be familiar with rural Java's general economic problem, i.e.

1. Over half the population of rural Java is poor, when measured either on the real income they obtain (approximately 240 kg milled rice equivalent (Sajogyo 1975)) of $75 annual income per caput (the international poverty line (Esmara 1977)).
2. 'Not enough land for too many people' is the main cause of this poverty (Penny and Singarimbun 1973); about 57% of farmers operated land areas which averaged 0.25 hectare, 25% at an average of 0.68 hectare and 18% at an average of 1.80 hectare (SUSENAS 1976).

3. It is essential for the farmer to have a multi-occupation to obtain a supporting income because the size of individual farms is 'Lilliputian' (borrowing Geertz's term, (Geertz 1963)) and generating enough farm income for family subsistence is generally impossible. Thus, off-farm income (as well as non-rice income) has become very important for the small (poor) farmer.

4. Employment opportunities have declined to the point where wage employment is available in rice for only 20 man-days a season on average. If wage employment is available, the wage rate tends to zero, just as the interest rate tends to unity and the rental rate for land to unity especially for the poor (Penny 1979).

Nevertheless, in spite of the heavy population increase and the small possibility of expanding the cultivated area, there has been some success in maintaining the calorie intake level of the diet, due principally to the intensification of rotation on rice fields and more intensive use of dryland (Geertz 1963).

The data used for this study were collected from two villages, Suka Ambit and Malausma (West Java) of the Rural Dynamic Study in a single visit survey covering a whole year's activity, in February 1977. It was necessary to go through all the data for each farm and edit it for inconsistencies and missing observations. In many cases it was not possible to make satisfactory corrections and in some cases farms had to be excluded from the subsequent statistical analysis. The villages are of different environments in terms of the availability of water in sawah as a mainstay of rice income generation. Farmers in Malausma have less double cropped rice in sawah as well as less access to upland. Thus, non-rice farm income and off-farm income earning activity provides a more significant contribution to total household income than in Suka Ambit.

The framework within which the analyses were carried out involved classifying the farmer's activities into two types: farm income and off-farm income activities. Farm income activities are distinguished into crop production on sawah and on dryland: crop production on sawah is wet season rice and dry season rice. In Malausma, second crop production was taken instead of dry season rice. Off-farm income included labouring, self employed business, etc.

When the data was set out in a comparative analysis of the top ten large farms and the bottom ten small farms in each village, it indicated that the distortion of the distribution of land (total area of land under production where the quality was adjusted according to the productivity of the land) in Suka Ambit is quite high, higher than in Malausma. This is revealed significantly when using the method of the Lorenz curve of cumulative percentage of land distribution. In Suka Ambit 75% was rice double cropped, while in Malausma only 30% was rice double cropped. The average land controlled by a household in Suka Ambit was 0.53 hectare, while in Malausma it was 0.46 hectare, and the average sawah planted to rice was 0.27 hectare and 0.22 hectare respectively for each village.

In the comparison of large and small farms the data shows that differences in the size of land under production does not proportionately reflect variations in the total household income earned. It was evident that small landholders relied much more on off-farm income. Limited access to agricultural land has encouraged farmers to devote more of their labour to earning income in the off-farm sector. In Malausma, not only the small farmer had a high dependence on off-farm income, but nearly all of the households were involved in some off-farm activity; 48% of total household income was earned from off-farm activity, while in Suka Ambit it was lower at 40%.

Under-utilization of family labour was also disclosed by the survey data. Comparison of actual labour used and potential labour available within the household reveals that, on average, only one half of the potential labour available was used. The remaining half indicates the prevailing unemployment or underemployment in the villages.

Comparing subsistence income requirements (based on the calculation of recommended food intake by the Indonesian Institute of Science, plus 20% non-food requirement) with the total household income earned in the survey year showed that 37% of the households were below subsistence income level in Suka Ambit, and 46% in Malausma (low income group).

Stated in kilograms of milled rice equivalent (kg m.r.e.) high income farmers in Suka Ambit earned the equivalent of 546 kilograms (256 kilograms from rice income and 166 kilograms from other farm income) per capita a year, and low income farmers earned 186 kilograms (67 kilograms from rice income and 55 kilograms from other farm income) per capita a year. In Malausma, high income farmers earned 424 kilograms (125 kilograms from rice income and 88 kilograms from other farm income) per capita a year, and low income farmers earned 173 kilograms (57 kilograms from rice income and 43 kilograms from other farm income) per capita a year. As a whole, it was found that people in both villages, on average, were above the poverty line set at the level of 240 kg of milled rice equivalent per capita per year.

Simple tabular comparative analysis between group means of high and low income farmers (F-test and t-test were incorporated) indicated that in Suka Ambit, the high income farmers operated more land, spent more for hired labour used in farm income earning activity, and obtained higher yields for upland crops per hectare than did the low income group. However, low income farmers spent more on seed, fertilizer and chemicals per hectare than did high income farmers. In Malausma there was no significant difference in the area of land operated and paid labour used by the two income groups, but the high income group obtained a higher rice yield per hectare (in wet and dry seasons) and spent more on seed, fertilizer and chemicals on upland crop production than did the low income group. However, the low income group applied more fertilizer and chemicals per hectare and the average number of their household members was also greater than the high income group.

In the analysis of income distribution the methods used were: the share of total income of the lowest 40 per cent of the population, the Gini ratio and the Lorenz curve. The first method showed the existence of very low income inequality in both villages. The Gini coefficient ratio for Suka Ambit was 0.35 and for Malausma was 0.29.

Comparing this result with other studies, income distribution in Suka Ambit is less equal than for rural Java on average, and in Malausma it was average, about the same as that for rural Java. It was also evidenced that income distribution, to a limited extent, is more uneven in rice producing areas than in non-rice producing areas.

The investigation of socio-economic determinants affecting farm household income was undertaken by using simple correlation and multiple regression analysis. The socio-economic variables included in the analysis as determinants of farm household incomes were: total land, acreage of sawah, crop intensity, household size, potential family labour, farm expenditure, off-farm expenditure, age of the farmer, education of the farmer and use of modern inputs.

The correlation analysis results were used to choose appropriate explanatory variables for the regression analysis. Dependent variables were net farm household income and net farm income. The results suggested by the estimated regression coefficients are as follows.

In Suka Ambit the most significant determinant of income is sawah acreage. This is shown by the correlation analysis that approximately 55 per cent and 72 per cent of the variation in net farm household income and farm income respectively could be explained by the size of sawah planted to rice.

The multiple regression technique showed that approximately 64 per cent and 66 per cent of the variability of farm household income and farm income could be said to be explained by the set of seven explanatory variables taken in the analysis. For farm household income, the strongest explanatory power is sawah size, next is potential family labour and then the number of years of the farmer's education.

Applying the same technique to the high and low income farmers, it was observed that: for high income farmers the order of importance of income determinants are sawah size, potential family labour, modern inputs and lastly crop intensity (which shows a reverse effect), and for low income farmers are farmer's education and off-farm expenditure.

Because farm household income is composed largely of farm income, an investigation of farm income determinants using a multiple regression technique was also undertaken. It was evident that, on average, the most important explanatory variables are sawah size and potential family labour; off-farm income and crop intensity cause a reverse effect on farm income.

A difference between high and low income farmers was also observed. For the high income farmer crop intensity (which shows a reverse effect) and potential family labour and level of education (also a reverse effect) seem to be farm income determinants rather than the farmer's age for the low income farmers.

Some tentative conclusions may be drawn from these findings:

1. Farm income is the main element of farm household income.
2. Land (mainly sawah for planting rice) is the most limiting factor for increasing farm income and, thus also for farm household income.
3. Potential labour supply is the second important factor, in explaining the variability of farm household income as well as farm income.
4. Modern inputs (seed, fertilizer and chemicals)

play an important role in explaining the variability of farmers' income of high income farmers only. It was not the case for low income farmers. This finding substantiates the results of previous studies that the 'green revolution' which in this case is government assistance in the form of the rice BIMAS programme has benefited only some privileged groups of villagers.

5. Off-farm income variability was found to be an important factor in explaining the variability of farm income for both high and low income farmers. However, off-farm expenditure was observed to have a reverse effect on farm income.

6. At the existing level of technology, crop intensity was observed not to increase farm income. This was found for the high income farmer, and for the low income farmer; this factor can not explain the variability of farmers income since off-farm income was observed to contribute significantly to farm income (either for the high or low income farmer) it is reasonable for them to work on off-farm income instead of on higher cropping rates in their land.

In Malausma, the results of multiple regression analysis indicated that 35 per cent and 98 per cent of the variability of farm household income and farm income are explained by the set of explanatory variables in the model. The relatively low multiple determination coefficient of farm household income is due to the fact that nearly a half of the farmer's income was derived from the off-farm sector, while most of the explanatory variables are relevant to the farming activity.

The most significant factor affecting farm household income was, as expected, land (i.e. sawah to grow rice). For the high income group the most important explanatory variable was sawah and the second was household size while for the low income group it was the other way round. That is, the first factor was household size and the second sawah size.

Farm income, on average, was determined by the size of land (sawah), cropping intensity and modern inputs. The same factors hold true for the high income farmer, but for the low income farmer only sawah size resulted as a major factor. Crop intensity was observed to decrease farm income of this low income farmer, while off-farm expenditure seemed to increase income slightly.

The conclusion which might be drawn from this finding was approximately the same as for Suka Ambit, but with more emphasis on the effect of more limited availability of land resources to the structure of farm household income. The increasing importance of off-farm activity has simultaneously occurred with the decreasing role of land as a determinant of villager's income as evidenced mainly for the low income farmer. It seems more worthwhile for the farmer to spend more resources on the off-farm sector rather than on modern inputs or more intensive cropping. It was also observed in both villages that: relatively speaking, with respect to the equality of income distribution, the study results suggest that off-farm income has contributed to a more equal income distribution when the whole population is taken into consideration.

The final analysis in this study deals with the efficiency of farm resource use, to investigate possible ways of increasing farmers' income from the existing set of available resources. The Cobb-Douglas production function was used to assess the allocative efficiency of average farmers through its marginal analysis. The underlying assumptions in this analysis were that the same functional form applies to all the sample farms, farmers were assumed to maximise returns from the factors available and to be acting rationally within the economic environment facing them. The concept of optimality was used as a criterion to test the efficiency of the use of the resources.

It became evident that inferences drawn from the results of the analysis have to be treated with great caution. Most of the coefficients obtained were not statistically significant. Some of the coefficients were negative and significant, which is not to be expected on a priori grounds. For example, a negative coefficient of the factor labour does not conform with economic theory or the logic underlying the technical relationships in input-output analysis under normal conditions. One possible explanation of this is the poor quality of the data or mis-specification of the variables included in the model. Considering that the data were collected in a single visit survey to collect information on the whole year and there were no written records against which to check the accuracy of the information reported by the respondents, the first possibility seems the most likely reason. Accordingly, the marginal products of most of the inputs used could not be estimated.

Because insufficient information was available, the marginal factor cost (MFC) used for the input factors under consideration were also very restrictive. The MFC of land used in Suka Ambit was Rp 181,818 and in Malausma was Rp 139,860 per hectare. The MFC of an hour of man equivalent labour used was Rp 71.40 and Rp 68.00 in Suka Ambit and Malausma respectively. The MFC of modern inputs was Rp 1.30 for each rupiah spent on seed, fertilizer and chemicals, and was taken to be equal for both villages. All of these MFC's were taken as equal for all crops and for high and low income farmers (of each corresponding input) which is not the case in reality. However, these values had to be used for the purposes of comparison.

In the case of aggregate farm production, the results arrived at indicate the following conclusion: in Suka Ambit inefficiency was encountered in the use of the factor land and in Malausma in the use of paid labour, when the calculation was based on the average farm production of the whole sample. When the calculation was split into high and low income farmers it was observed in Suka Ambit that inefficiency in the use of the factor land occurred for the high income farmer, but only at a low level of significance (20 per cent), while for the low income farmer inefficiency was encountered in the use of family labour and modern inputs. In Malausma, inefficiency (in the use of paid labour) was encountered only for the high income group, and none for the low income farmer. The implications for Suka Ambit are to expand the use of land, and (especially for the low income farmer) to decrease the use of family labour and to increase the use of modern inputs. In Malausma, the implication in order to be efficient is to decrease the use of paid labour.

Another method of assessing allocative efficiency explored in this study was by comparing the marginal productivity of inputs for different uses. In this study comparison was made between the marginal productivity of inputs used on wet season rice production and those on dryland crop production; and between those used for dry season rice (or second crop) on _sawah_ and dryland crop production.

On the use of the factor land, the result was generally the same in both villages as calculated either from the whole sample or from high and low income group farmers. Maximizing output may be possible by reallocating all land to the production of rice. However, this seems less feasible at this stage for many reasons. All suitable land for growing wet land rice has already been changed into _sawah_. What is left now is only suitable as dryland. Even if there were any left, a great deal of investment would be needed to transform it into _sawah_. Probably the best interpretation of this finding is again an indication of the critical importance of land and its limited availability.

However, with respect to the comparison of the marginal product of the factor land for second crop production and dryland crop production in Malausma, the latter gave a higher return. Here again we arrived at an impractical implication. It is not feasible to suggest that the farmer should transform his _sawah_ for the six months when he is not growing rice (i.e. in dry season when he normally grows a second crop), because although the return on dryland is high this is probably attributed to the inclusion of perennials in this category.

It is easier to reallocate the use of labour (family labour and paid labour) and modern inputs. In Suka Ambit, reference is available with respect to these factors only for low income farmers. Family labour should be curtailed from dryland activity, to be redistributed to rice production in wet and dry season rice in sawah. In Malausma, family labour should be reallocated to dryland crops from wet season rice production by the high income group. Low income farmers in Suka Ambit should use more paid labour and modern inputs on dryland crops as should high income farmers in Malausma.

The use of modern inputs has an important implication from the government policy point of view in relation to the last objective of this study. It was observed that if government funds for fertilizer and chemicals for rice crops were shifted to non rice crop (for example for second crop or other dryland crop), it would help low income farmers in Suka Ambit (for use in dryland crops) and all farmers in Malausma (for use in second crop or dryland crops).

Ideally, recommendations on resource use allocation should be based on the statistically reliable estimation of marginal return to opportunity cost ratios. The estimated coefficient from which the marginal productivity of inputs is derived must be significant at a certain level of confidence. As it is not possible to provide such a base in the present study, further investigation to cover this deficiency is needed to make these results more useful. Furthermore, any analysis of resource allocation would not be complete if it omitted to take account of people's aspirations, needs, potentialities, cultural levels and national sentiments (Heady and Dillon 1972).

Policy Implications

As a developing nation where the economic life of most people is dependent on smallholding agricultural production, production for own consumption is the main type of income earning activity. The importance of rice as the main-stay of income generation is evident from this study. But, with the high pressure of population on land, rice income, even when included with other farm income, is often not enough to provide a subsistence income level. Most of the people have to depend on a variety of income sources. The importance of off-farm income in total household income is especially evident in the village of Malausma in this study.

The study shows that families still manage to exist in spite of reporting an income level (as recorded by enumerators) which is below subsistence level. Obviously some disguised income in money or kind could exist which has not been identified by the survey. It is also difficult to identify and relate income earned (as reported) to a need for a minimum area of land. However, of the income areas studied and resource use (as reported) analysed, land was shown to be a most important input and constraint in the production of farm generated income.

The persistence of under employed (unpaid) family labour in comparison with what is reported available is also evident. However, in Indonesia with its great pressure of population growth problem, it is not the problem of lack of incentive to work for more than a subsistence income, as is experienced in some other developing countries, but rather the problem of declining opportunities of earning income for enough to eat.

> 'they are willing to work hard (sometimes for very low returns indeed); and there is no waste ... except for human labour and human hopes' (Penny and Singarimbun 1973).

The presence of a variety of non-rice income sources means there are problems for government in developing a comprehensive programme of assistance. Some of the possible programmes which this study suggests should be explored.

It was observed in this study that increasing income through rice production was only possible by transforming more land into sawah to grow more rice. Non-rice crop (food) production was the other alternative suggested by this study, either as a second crop on sawah or as an upland crop on dryland or housegarden. Since this study has not ordered the crops according to their importance in this section explicitly, further analysis toward this end should be very valuable. However, given that palawija (legumes, cassava and vegetables) is the second most important common crop planted either in sawah or upland, some comments on these crops will be made below.

In order to encourage farmers to shift some of their available scarce resources to non-rice food production, government has to make some particular efforts. Farmers are not familiar with the production methods of these crops in an economic way. Educating farmers through a specific intensive extension programme is needed. In the past the government has neglected this in giving high priority to rice production methods.

Research will be necessary to develop high yielding varieties. It has been noted that most of the palawija productivities are very low, far behind the productivities in neighbouring and other countries. Lack of improved seed and application of fertilizer, and the high cost of production because production techniques are not developed, are to some extent responsible for the low productivity (Teken and Kuntjoro 1978). Thus, the expansion and increased effectiveness of the palawija BIMAS is necessary, so that farmers are guaranteed the availability of better seed, fertilizer and chemicals, at the right time and place at reasonable cost.

Since most of the second crop production is not solely consumed by the household, especially if it is produced in a large quantity, the marketing problem should be handled in a different way from rice marketing. Improved processing for export plus strengthened export marketing activity would also be essential. In the past, with export channels and processing relatively undeveloped, increased corn production has brought rapidly declining farm prices, forcing farmers to revert to production of other crops (Mears 1976). Thus a guaranteed minimum price for specific crops for say the first 3 years of the assistance programme should be fully considered.

On sawah land second crops are planted in a multiple (inter-crop) cropping pattern with rice, and on upland with other non rice crops. Each crop has a different growth period, input requirements and techniques of production. Accordingly, each crop in a different cropping combination will generate a different level of income (benefit). Hence, in estimating the cost of the programme, a feasibility study incorporating a benefit/cost ratio estimate for different crops and combinations is necessary. On top of this, of course, before the government decides to put its funds and resources into a particular programme (project), consideration of the social benefits as well as the economic benefits to be gained from each programme and the alternatives, is very important.

A programme which gives high economic benefits, say the rice BIMAS programme, has to be launched together with one that gives lesser economic benefits but high social benefits. In this case, some transfer of the rice BIMAS budget to the alternative crop is necessary in order to achieve the general aims of rural development.

Several important questions have been raised that warrant further study to provide policy guidance. This study provides only a small hint of what might be done. With respect to off-farm income, the study was of little assistance because of insufficient data. Extension of the study beyond these two villages with better quality data especially on input-output of non-rice and off-farm income earning activities is very important to support this study's results before making any recommendation to government.

Several reasons have been put forward as to why too much weight should not be placed on the empirical results, and why therefore policy conclusions should be placed in terms of questions for further study rather than firm statements. These reasons can be grouped under three headings: conceptual problems, data limitations and statistical problems.

In this sense, it is hoped the present study will serve as a guide for further investigation of production relationships, economic efficiency, and the returns to productive factors in Indonesia's rural development study. Perhaps the principal value of this work is showing how limited data, collected for other purposes, can be used effectively to shed light on the economics of agricultural development. Massel and Johnson (1968) describe:

> 'A vast amount of data has been collected relating to agricultural production in many parts of the underdeveloped world. Although some of this material has been processed, a great deal more information can still be extracted. Unfortunately there are many gaps. However, one is seldom able to find "ideal" data upon which to base a study. Instead, the investigator has to use what information is available, filling in the gaps and making adjustments as best he can. He has to make do with methods that allow for inadequacies of the data and that nevertheless permit one to estimate the underlying economic relationships, albeit in a less-than-perfect way.'

Bearing this in mind, some of the conclusions derived from these results are interesting and have important policy implications of both intellectual interest and policy relevance. The results thus obtained, while far from ideal, are nevertheless the best we can obtain, and it is hoped, can still be useful in forming conclusions and making policy recommendations.

BIBLIOGRAPHY

Adiratma, E.R. 1969. Income and Expenditure Pattern of Rice Producers in Relation to Production and Rice Marketed, Unpublished Ph.D. thesis, Bogor Agricultural University, Bogor.

Ahluwalia, M.S. 1975. 'Income Inequality: Some Dimensions of the Problem', in H. Chenery et al. 1975, as cited in Ginting 1978.

Aigner, D.J. and Chu, S.F. 1968. 'On Estimating the Industry Production Function', The American Economic Review, Vol. 58, No. 4, pp.826-39, as cited by Sharma 1974.

Anderson, J.R. and Dillon, J.L. 1971. 'On Estimating Allocative Efficiency in Cross-Sectional Analysis of Production', Australian Journal of Agricultural Economics, Vol. 15, No. 3, pp.146-50, as cited in Hada 1978.

Bhati, U.N. 1971. 'Economic Determinants of Income on Irrigated Paddy Farms in Tanjong Karang, West Malaysia', Unpublished Ph.D. thesis, The Australian National University, Canberra.

Bressler, R.G. 1967. 'The Measurement of Productive Efficiency', Western Farm Economics Association, 1966 Proceedings. Pullman, Washington, pp.137-42, as cited in Sharma 1974.

Chiswick, B.R. and Chiswick, J.R. 1974. Statistics and Econometrics: A Problem Solving Text, University Park Press, Baltimore.

Chow, C.C. 1960. 'Test of Equality Between Sets of Coefficients in Two Linear Regressions', Econometrica, Vol. 28, pp.591-605.

Chu, K. 1972. Principles of Econometrics, 2nd edition, Intext Educational Publishers, London.

Esmara, H. 1975. 'Regional Income Disparities', Bulletin of Indonesian Economic Studies, Vol. XI, No. 1, A.N.U., Canberra.

________ 1975. 'Regional Income Disparities', Bulletin of Indonesian Economic Studies, Vol. XI, No. 5, A.N.U., Canberra.

________ 1977. Pertumbuhan Ekonomi, Pembagian Pendapatan dan Tingkat Kemiskinan di Jawa - Madura 1967-1976, Fakultas Ekonomi Universitas Andalas, Padang.

Etherington, D.M. 1973. Smallholder Tea Production in Kenya - An Econometric Study, East African Literature Bureau, Nairobi.

Ezekiel, M. and Fox, K.A. 1959. Methods of Correlation and Regression Analysis, John Wiley & Sons, Inc., New York.

Finney, D.J. 1972. An Introduction to Statistical Science in Agriculture, Oxford.

Ginting, M. 1978. 'A Study of Poverty and Allocative Efficiency in Sriharjo, Rural Java, Indonesia', unpublished M.A.D.E. thesis, The Australian National University.

Griliches, Z. 1957. 'Specification Bias in Estimates of Production Function', Journal of Farm Economics, Vol. 38, pp.8-20, as cited in Sharma 1974.

Griliches, Z. 1963. 'Estimate of the Aggregate Production Function From Cross-Sectional Data', Journal of Farm Economics, Vol. 45, pp.419-28.

Gunawan, M. 1976. 'Stratification of the Villages and Selection of Sample Villages', mimeo, SDP-SAE, Bogor.

Hada, K.P. 1978. 'A Study of Farm Household Income and Resource Allocation in the Eastern Hills of Nepal (with special reference to Barbote panchayat)', unpublished M.A.D.E. thesis, The Australian National University, Canberra.

Hall, M.L. and Winsten, G. 1959. 'The Ambiguous Notion of Efficiency', The Economic Journal, Vol. 69, pp.71-86.

Hart, G. 1977. Patterns of Household Labour Allocation in a Javanese Village, Project on Ecology of Coastal Village - Agro Economic Survey, Jakarta. Mimeo.

Heady, E.O. and Dillon, J.L. 1972. Agricultural Production Function, 1st ed., fourth printing, Iowa State University Press, Iowa.

Hu, T.W. 1975. Econometrics: An Introductory Analysis, University Park Press, Baltimore, London, Tokyo.

Huang, D.S. 1964. Regression and Econometric Methods, John Wiley & Sons, Inc., New York.

Jae-On Kim and Kohout, F.J. 1975. 'Multiple Regression Analysis: Sub Program Regression', pp.320-67 in N.H. Nie et al. 1975.

Johnston, J. 1972. Econometric Methods, 2nd edition, McGraw Hill Kogabusha Ltd., Tokyo.

Karmel, P.H. 1963. Applied Statistics for Economics, Pitman and Sons Ltd., Melbourne.

King, D.Y. and Weldon, P.D. 1977. 'Income Distribution and Levels of Living in Java, 1963-1970', Economic Development and Cultural Change, Vol. 25, No. 4, pp.669-711.

Koutsoyiannis, A. 1977. Theory of Econometrics, 2nd edition, The MacMillan Press Ltd., London and Basingstoke.

Krishnaswamy, P.B. 1977. Micro-Macro Links in Planning, Development Studies Centre Monograph, No. 9, The Australian National University.

Lau, L.J. and Yotopoulos, P.A. 1971. 'A Test for Relative Efficiency and Application to Indian Agriculture', The American Economic Review, Vol. 61, No. 1, pp.95-109, cited in Yotopoulos and Nugent 1976.

Makali, 1976. 'Diskripsi Keadaan Social Ekonomi Desa Malausma, Kecamatan Bantarujeg, Kabupaten Majalengka, Jawa Barat', Mimeo, SDP-SAE, Bogor.

Massell, B.F. and Johnson, R.W.M. 1960. 'Economics of Smallholder Farming in Rhodesia, A Cross-Section Analysis of Two Areas', Food Research Institute Studies, No. 8, Supplementary, Stanford, California.

Mear, L.A. 1976. Indonesia's Food Problems, Pelita II/III. Draft to be published in Ekonomi dan Keuangan Indonesia, Vol. XXIV, No. 2, Jakarta.

Muljono, D. and Yusuf, A.S. 1973. Tingkat Hidup Buruh Pertanian Pangan di Beberapa Wilayah Berpenghasilan Rendah, Laporan Survey No. 06/73/LS., Survey Agro Ekonomi, Jakarta.

Nie, N.H. et al. 1975. Statistical Package for Social Sciences, 2nd ed., McGraw Hill, New York.

Nurdin, Hal Ikhwal Penduduk di Propinsi Jawa Barat, Lembaga Demographi Fakultas Ekonomi Universitas Indonesia, Jakarta.

Penny, D.H. 1964. 'The Transition From Subsistence to Commercial Family Farming in North Sumatra', unpublished Ph.D. dissertation, Cornell University, Ithaca.

Penny, D.H. 1967. 'Development Opportunities in Indonesian Agriculture', Bulletin of Indonesian Economic Studies, No. 8, pp.35-64, A.N.U., Canberra.

Penny, D.H. 1979. 'The Economics of Peasant Starvation', Paper of the Australian Agricultural Economic Society 1979 Conference, Canberra.

Penny, D.H. and Singarimbun, M. 1973. Population and Poverty in Rural Java: Some Economic Arithmatic From Sriharjo, International Development Mimeograph, No. 41, Cornell University, Ithaca.

Rao, P. and Miller, R.L. 1972. Applied Econometrics, Wudsworth Publishing Co., Belmont, California.

Republik Indonesia 1969. Rencana Pembangunan Lima Tahun Kesatu, 1969/1970 - 1973/1974, Departemen Penerangan, Jakarta.

Republik Indonesia 1974. Rencana Pembangunan Lima Tahun Kedua, 1974/1975 - 1978/1979, Departemen Penerangan, Jakarta.

Ronodiwirjo, F.S. 1969. 'Struktur Perkreditan Pertaniandi Daerah Produksi Padi: Suatu Penelitian Pedesaan di Krawang', unpublished Ph.D. dissertation, IPB, Bogor.

Sajogyo 1975. Usaha Perbaikan Gizi Keluarga (ANP Evaluation Study), Institut Pertanian Bogor, Bogor.

Sajogyo 1977. 'Golongan Miskin dan Partisipasi dalam Pembangunan Desa', Prisma, No. 3, pp.10-17.

Schultz, T.W. 1965. Transforming Traditional Agriculture, Yale University Press, New Haven, cited in Penny 1978.

Sharma, S.R. 1974. 'Technical Efficiency in Traditional Agriculture: An Econometric Analysis of the Rupandehi District of Nepal', M.A.D.E. thesis, The Australian National University, Canberra.

Sinaga, R.S. 1976. 'Rural Institutions Serving Small Farmers and Labourers in the Village of Sukagalih, Garut Regency, West Java', unpublished paper for ESCAP Expert Group Meeting in Bangkok, December 1976.

Sinaga, R.S. and Sinaga, B.M. 1976. The Impact of New Rice Technology on the Share of Farm Earnings: The Indonesian and Philippines Case Compared, Bogor Agricultural University (IPB), Bogor.

Sinaga, et al. 1976. Indonesia Case Study, Rural Institution Serving Small Farmers and Labourers in the Village of Sukagalih, Garut Regency, West Java, paper for ESCAP Group Meeting in Bangkok.

Singarimbun, M. 1976. 'Sriharjo Revisited', Bulletin of Indonesian Economic Studies (BIES), Vol. XII, No. 2, pp.117-225, A.N.U., Canberra.

Soejono, I. 1975. Growth and Distributional Changes of Paddy Farm Income in Central Java, 1968/1969 - 1973/1974, AESSEA, Jakarta.

Soelistyo 1975. 'Creating Employment Opportunities in the Rural Areas of East Java', unpublished Ph.D. thesis, University of Colorado.

Steeper, N.J. 'Methods of Analysis of Cross-Sectional Survey Data', unpublished Masters of Agricultural Economic thesis, U.N.E., Armidale.

Stoler, A. 1976. How Do Your Garden Grow? A Study of Garden Use and Household Economy in Rural Java, .

Sujono, I. and Birowo, A.T. 1976. 'Distribusi Pendapatan di Pedesaan Padi Sawah di Jawa Tengah', Prisma, No. 1, pp.26-32.

Sukamto, 1962. 'Laporan Penjelidikan Biaja Hidup Untuk Daerah Istimewa Jogjakarta 1954-1960', Laporan Kongres Ilmu Pertanian Indonesia Kedua, Vol. 9, pp.329-78, cited in Penny and Singarimbun 1973.

Taib, A.B. 1976. 'Socio-Economic Factors Affecting Rice Farm Productivities, Krian Irrigation Scheme, Malaysia', unpublished M.A.D.E. thesis, The Australian National University, Canberra.

Teo, C.K. 1976. 'Production Function Analysis of Small Rubber Farms in Sri Lanka', unpublished M.A.D.E. thesis, The Australian National University, Canberra.

Terra, G.J.A. and Ochse, J.J. 1930. English Summary of: Geld-en Producten - Huishouding Volksvoeding en Gezonsheid in Koetowinangun, Departement van Economische Zaken, Archipel Drukkerij, Buitenzorg.

Upton, M. 1970. 'The Influence of Management on Farm Production on a Sample of Nigerian Farms', Farm Economist, Vol. 11, No. 12, as cited in Taib 1975.

Walters, A.A. 1963. 'Production Function and Cost Functions: An Econometric Survey', Econometrica, Vol. 31, pp.1-66, as cited in Yotopoulos and Nugent 1976.

White B. 1976. Population Involution and Employment in Rural Java, A/D/C Staff Paper 76-4, New York, 10019.

Whyte, R.O. 1974. Rural Nutrition in Monsoon Asia, Oxford University Press, London, New York, Melbourne, Kuala Lumpur.

Yotopoulos, P.A. 1967. Allocative Efficiency in Economic Development, Research Monograph Series 18, Center of Planning and Economic Research, Athens.

Yotopoulos, P.A. and Nugent, J.B. 1976. Economics of Development: Empirical Investigation, Harper & Row Publishers, New York.

Zahri, A. 1974. 'Inflation and Growth: The Case of Indonesia', Inflation and Growth. V.V. Bhanoji Rao (ed), Singapore.

A P P E N D I C E S

APPENDIX I

DATA TREATMENT

It has already been mentioned in Chapter 3 that the data used for this study were collected by the Rural Dynamics Study in two sample villages. In each village 60 household samples were interviewed. In the analysis, the households sampled were grouped into a low income group and a high income group. This differentiation was based on the total family income earned by the household compared to the subsistence income requirement of each household in the year surveyed. Total family income is defined as the sum of incomes earned by the family members and includes returns to land and capital owned, family labour, services and wages which the household received as the return to its members' economic activity.

The subsistence income requirement for each member of the household sample is calculated in food caloric requirement by counting the recommended food intake (biological need) of family members, adjusted by age and sex, as recommended by the Indonesian Institute of Science (1968) (see Appendix II); following this, needs other than food (clothes, shelter, children's education, etc.) were allowed for by adding on a further 20% of the food requirement (Sajogyo 1975).

This subsistence food calorie need measurement was then transformed into a milled rice equivalent (kg). The calculation estimated the daily subsistence needs of the respective family households. This was then adjusted to cover the full year (multiplied by 365). The estimated annual family subsistence income requirements were then compared to the total family income disclosed by the survey in the same unit (Rupiah) by using the average rice price in a year at the village level. Households which earned more than subsistence income need were classified as belonging to the high income group and the others as belonging to the low income group.

After inspecting the whole data set for 120 households sampled from the two villages and counting the total income and subsistence income needs of each household sample, it was found that some household samples did not have adequate information for inclusion in further analysis: i.e., 2 household samples from village 1 (Malausma) and 10 from village 2 (Suka Ambit). Most of these excluded survey farms did not have enough information to show how they supported their families in terms of earned income to cover minimum biological needs. This situation was evident when a comparison was made between the total farm household income and the estimated subsistence income need. Households which did not show that their income was at least 40% of the subsistence used[1] were excluded.

Apart from the above criteria for excluding household samples, one of the households in village 1 (Malausma), i.e., sample no. 041, was excluded because there was no information about the number of family members, hence household subsistence income needs could not be computed.

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1 Penny's experience (the author of Population and Poverty in Rural Java) in calculating Indonesian farmer's income suggests that it is statistically acceptable if computed respondent's income to one third of his subsistence need, but not less than that. Considering that the data for this study were collected in "a single visit" interview, the limit was increased from one third to 40%. Incorporation of statistical probability (Mean $\pm$ standard deviation) in this context is not applicable, for example, it is good if a villager has an income level far above the mean + standard deviation and it is accepted that many samples have an income below the mean - standard deviation.

One sample in village 2 (Suka Ambit) was excluded because of an extremely high income stated to accrue from farm labour activity. This extremely high income from farm labour activity resulted from the recorded number of man-hours of family labour spent exceeding the total potential man-hours of family labour available,[1] and no other information was available to make any reasonable adjustment. It was considered that the data from this particular household sample was unreliable.

Including any of these cases in further analysis could have led to an underestimate or overestimate of the villagers' incomes resulting in wrong conclusions and wrong policy implication from the study.

Examination of the rice income figures reported by the farms sampled revealed that they lacked consistency with the rice production figures reported. It was decided that the rice income for each farm would be estimated by multiplying the physical product (kg) by the average village price per kg obtained for unmilled rice. This average village rice price was obtained by calculating the arithmetic mean of the prices received from price data for both milled and unmilled rice collected fortnightly from each village during the survey year. However, we have to be aware of the shortcomings of using the average of the price where price fluctuation appears. Farmers who sell during harvest time get lower prices than selling two or more months later.

For the village of Malausma it was further found that the prices per kg of unmilled rice reported in some periods appeared unrealistic; however, the price series for milled rice appeared realistic.

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1 Potential total man hours of family labour is computed by multiplying the number of adult members by 8 hours per day and 300 working days a year.

Unmilled rice prices were therefore recalculated by deducting the cost of milling from the milled rice price series. An assumption was made that milling costs for the two villages were the same and the cost of milling was estimated as the difference between milled and unmilled rice prices from the rice price series collected from the village of Suka Ambit.

While it was possible to check, and adjust where necessary, the rice income figures reported for the sample farms in this way, it was not possible to carry out similar checks and adjustments on the costs reported for farm inputs used in rice production.

There were some other adjustments made to suspect values for particular variables. For example, if the value was extremely low or high, the possibility of a mis-punch on a computer card was investigated and correction was detected through the adjacent or related variables. If there was no error detected using this method, the extreme value was deleted and the average value of this variable (of the other cases) was imputed in its place. To take a specific example: case no. 151 in the village of Suka Ambit. Wages received for farm labouring were originally recorded as Rp 107,750 and represented 172 man hours of family labour employed. This would require a rate of wage per man hour of Rp 621, which is impossible. The average rate of wage per man hour for other cases was Rp 58. Hence, the wages received for this particular sample were adjusted to 175 x Rp 58 which equals Rp 9,900. Case no. 145 of the village of Malausma has the value of earnings from trade as Rp 168,000 at 192 man hours a year, which gives a return per man hour of Rp 875. It is unlikely that the return per man hour of trading activity in the village would be as high as this value. Since no other information from other variables could be found to defend this figure, it was assumed that this figure should be read as Rp 16,800, which means a return per man hour of work equal to Rp 87.50. This value is more realistic, since the average value of the same variable in other cases was Rp 86.00 per man hour.

It is important to mention that in making adjustments to this data there was no opportunity to refer back to the original questionnaire in cases where unexpected data was found. As a result of having to exclude household units from the sample, the final number of households used for further analysis was 57 in the village Malausma and 49 in Suka Ambit.

Applying the above criteria in grouping household samples according to total household income, led to the discovery that 46% of the households are below subsistence income level in Malausma, and 37% in Suka Ambit. There are two possible explanations for these high percentages:

(a) Bad recording of information collected in the survey, even though some cases have already been excluded (mostly in the village of Suka Ambit). It is impossible to get written records in addition to the estimations made by the respondents on, for example, income for the whole year at one time.

(b) The cost of obtaining subsistence food requirements using the milled rice price was over-estimated, and that in fact, subsistence requirements can be obtained at a lower price.

If the subsistence food requirements could be obtained at say the price equivalent to the price of unmilled rice, then the recalculated income requirement when compared with the actual income earned showed that only 17% of households in Malausma and 18% in Suka Ambit would have an income below the subsistence level and fewer cases would have been dropped from the analysis. This would be the case if the lower income group could buy unmilled rice for their own consumption (which is unlikely because usually rice producers sell unmilled rice to the trader; the traders mill and sell milled rice to the consumers or other traders). Moreover, it was common in the village low income group or farm labourers to earn wages for pounding high income group's unmilled rice.

APPENDIX II

RECOMMENDED NUTRIENT INTAKES FOR INDONESIA

(incalorie per day)

Age Group	Male	Female
6 - 12 month	900	900
1 - 3 years	1200	1200
4 - 6 years	1600	1600
7 - 9 years	1900	1900
10 - 12 years	2300	2300
13 - 15 years	2900	2400
16 - 19 years	3000	2100
20 - 39 years	2600	2000
pregnant		extra 300
nursing		extra 800
40 - 59 years	2400	1900
60 years	2400	1600

Source: Indonesia Institute of Sciences, 1968. Cited by WHYTE, on Rural Nutrition in Monsoon Asia, p.106.

TABLE 1

SUKA AMBIT: COMPOSITION OF FARM HOUSEHOLD INCOME

(in Rupiah)

(List from the lowest to the highest income per capita)

Farmers' Identification Number	Total HH Income Per Household	Total HH Income Per Capita	Rice	Sec. Crop	Dryland Crop	Home Garden	Livestock and Fish	Total HH Income Per Household	Farm Labour	Off-Farm Labour	Self Bus. Emp. and Handicraft	Other Income	Total Off-Farm Income	Household Size	High and Low Income 1)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
008	98168	49084	31368	12000	54600	200	0	49084	0	0	0	0	0	2	1
013	277413	92471	114763	34850	22200	0	0	57271	0	0	0	105600	35200	3	1
014	851467	106433	802797	14670	14000	20000	0	106433	0	0	0	0	0	8	1
015	251376	62844	26759	12000	146500	0	5000	47565	31117	30000	0	0	15279	4	1
016	673605	168401	401605	0	248000	24000	0	168401	0	0	0	0	0	4	1
017	204000	34000	0	0	174000	0	30000	34000	0	0	0	0	0	6	1
020	126653	31663	76103	25400	4750	1200	0	26863	0	0	19200	0	4800	4	1
028	163041	163041	133791	0	3750	4500	0	142041	0	0	0	21000	21000	1	1
032	49136	49136	43963	0	3750	0	0	47713	1423	0	0	0	1423	1	1
040	91783	22946	42436	0	6000	0	3000	12859	17847	22500	0	0	10087	4	0
041	373338	186669	212938	7500	152900	0	0	186669	0	0	0	0	0	2	1
045	81905	27302	61354	0	15551	0	5000	27302	0	0	0	0	0	3	0
046	127280	63640	0	0	2750	930	0	1840	0	0	0	123600	61800	2	1
057	73113	18278	15990	0	14500	15450	56	11499	27117	0	0	0	6779	4	0
060	157853	31571	0	0	9050	100	0	1830	7403	0	0	141300	29741	5	0
062	61891	20630	27891	0	6500	2500	25000	20630	0	0	0	0	0	3	0
069	455716	65102	31816	8750	2150	0	5000	6817	0	408000	0	0	58286	7	1
071	143802	35951	3690	0	17952	14500	0	9036	68460	39200	0	0	26915	4	1
072	109017	27254	0	0	5000	0	0	1250	104017	0	0	0	26004	4	0
076	102539	14648	17938	3000	5500	0	13101	5648	0	63000	0	0	9000	7	0
077	32290	16145	0	0	8700	450	0	4575	0	0	0	23140	11570	2	0
080	66179	33090	34029	0	31350	800	0	33090	0	0	0	0	0	2	1
081	248001	31000	57482	0	31175	8250	124216	27640	26878	0	0	0	3360	8	1
086	22164	22164	8814	12100	0	0	1250	22164	0	0	0	0	0	1	0
088	13079	13079	1939	0	4140	1500	0	7579	0	0	0	5500	5500	1	0
112	204406	40881	8306	2300	13800	0	0	4881	0	180000	0	0	36000	5	1
116	142939	23823	3700	0	5025	2200	79716	15107	50298	2000	0	0	8716	6	0
120	20813	20813	6278	0	8525	500	5510	20813	0	0	0	0	0	1	0
129	275881	34485	14381	1500	4000	2000	4000	3235	0	250000	0	0	31250	8	1
131	222342	44468	3608	0	1000	0	164000	33722	53734	0	0	0	10747	5	1
135	313425	52238	32605	13900	26900	35000	205020	52238	0	0	0	0	0	6	1
136	109115	27279	45248	0	7000	0	0	13062	14867	42000	0	0	14217	4	0
141	143460	28692	12420	0	9400	700	500	4604	30440	0	90000	0	24088	5	0
143	116839	16691	10334	0	55300	26950	500	13298	23755	0	0	0	3394	7	0
146	180900	45225	0	0	0	3000	0	750	3500	60000	114400	0	44475	4	1
159	158635	52878	2920	0	3500	0	8512	4977	98203	15500	30000	0	47901	3	1
161	159648	39912	68548	0	19600	4500	7000	24912	0	60000	0	0	15000	4	1
162	140645	46882	25995	0	0	4000	6000	11998	104650	0	0	0	34883	3	1
167	129410	43137	14317	7500	32150	900	27750	27539	43043	3750	0	0	15598	3	1
168	236883	47377	5868	0	0	0	6015	2377	0	225000	0	0	45000	5	1
169	45004	15001	8204	1000	800	1000	0	3668	0	14000	20000	0	11333	3	0
172	203124	50781	122004	0	11120	10000	0	35781	0	54000	6000	0	15000	4	1
174	248423	82808	0	0	0	0	60000	20000	188423	0	0	0	62808	3	1
186	143196	71598	26862	0	1950	0	150	14481	14234	0	100000	0	57117	2	1
197	93575	23394	26238	7600	24000	960	2500	15325	2277	0	30000	0	8069	4	0
198	85289	28430	53742	0	9850	500	10350	24814	2847	0	0	8000	3616	3	0
199	168888	33778	61888	0	10000	0	31000	20578	0	66000	0	0	13200	5	1
201	305231	43604	111500	8200	14900	2025	0	19518	606	168000	0	0	24087	7	1
204	663938	110656	149033	41700	23000	0	228400	73689	185805	0	36000	0	36968	6	1
Average	191160	49212	60438	4367	25849	3849	21603	116106	22468	34754	9094	8738	75054	4.04	
(%)	100	-	32	2	14	2	11	61	12	18	5	4	39	-	
n	49	-	42	17	44	29	28	49	23	18	9	7	38	-	

Note: 1) 0 = Low Income

1 = High Income

TABLE 2

MALAUSMA: COMPOSITION OF FARM HOUSEHOLD INCOME

(in Rupiah)

(List from the lowest to the highest income per capita)

Farmers' Identification Number	Total HH Income		Rice	Sec. Crop	Dryland Crop	Home Garden	Livestock and Fish	Total HH Income Per Household	Farm Labour	Off-Farm Labour	Self Bus. Emp. and Handicraft	Other Income	Total Off-Farm Income	Household Size	High and Low Income 1)
	Per Household	Per Capita													
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
002	286878	71720	70858	4200	9520	1500	0	21520	3200	150000	47600	0	50200	4	1
006	169296	28216	29296	1650	25500	7650	0	10683	0	0	105200	0	17533	6	1
032	73547	12258	28447	3650	18250	0	0	8358	0	0	23400	0	3900	6	0
034	127243	18178	34193	2100	8750	16200	0	8749	0	0	66000	0	9429	7	0
036	41542	13847	6857	0	14885	600	7000	9847	0	0	12000	0	4000	3	0
037	79827	19957	23982	0	15720	4125	0	10957	0	0	36000	0	9400	4	0
042	73465	18366	33065	5600	13200	0	0	12966	0	0	21600	0	5400	4	0
043	136148	45383	60288	5850	9310	0	12000	29149	0	0	48700	0	16233	3	1
044	199737	39947	28607	0	9930	2000	0	8107	0	120000	39200	0	31840	5	1
046	143000	47667	0	0	0	0	0	0	0	0	143000	0	47667	3	1
049	229450	45890	37550	0	18000	36200	0	18350	0	0	137700	0	27540	5	1
058	116042	38681	20741	11700	5685	5380	7000	16835	7200	0	58336	0	21845	3	1
063	89915	22479	32115	9350	16050	2400	0	14979	0	0	30000	0	7500	4	0
064	65691	16423	17985	0	9506	0	0	6873	2500	6900	28800	0	9550	4	0
067	77285	19321	21794	5620	8815	0	5600	10457	2000	0	33456	0	8864	4	0
069	173787	43447	26402	1215	55520	35000	24350	35622	800	0	30500	0	7825	4	1
075	133686	44562	27416	2550	7920	0	0	12629	4000	0	91800	0	31933	3	1
077	109746	36582	23336	0	3935	0	0	9090	6875	42000	33600	0	27492	3	1
092	86043	28681	35993	1750	7300	8600	12000	21881	0	11200	9200	0	6600	3	1
095	283217	70804	93981	700	85000	2400	0	45520	0	0	101136	0	25284	4	1
099	91109	18222	18459	5875	3550	0	0	5577	10225	36000	17000	0	12645	5	0
101	96341	24085	12941	0	4000	2000	0	4735	0	0	77400	0	19350	4	1
109	246920	61730	63715	3700	9105	0	37800	28580	0	0	132600	0	33150	4	1
112	84856	16971	18256	0	4300	1500	0	4811	0	0	60800	0	12160	5	0
117	126616	21103	14416	24600	36400	4800	0	13369	0	0	46400	0	7735	6	0
122	261734	65434	72284	17550	62000	39500	60000	62834	0	0	10400	0	2600	4	1
124	57932	19311	20532	0	4400	0	0	8311	6000	0	27000	0	11000	3	0
125	192315	24039	148715	900	38500	4200	0	24039	0	0	0	0	0	8	0
134	133725	66863	36005	750	5320	9250	15000	33163	0	0	11200	56200	33700	2	1
135	58560	14640	13510	4000	2450	2100	0	5515	0	0	36500	0	9125	4	0
137	124853	31213	39543	0	5460	4200	0	12301	4950	0	70700	0	18913	4	1
138	226801	37800	54941	0	11410	7800	10500	14109	6450	32500	103200	0	23692	6	1
142	134517	33629	29967	6000	4350	6000	2800	12279	0	24000	61400	0	21350	4	1
145	154628	38657	111223	4500	4105	1000	13000	33457	4000	0	16800	0	5200	4	1
150	105193	15028	21388	1100	4905	5000	0	4628	4000	45000	23800	0	10400	7	0
155	208441	29777	151241	0	15200	24400	0	27263	0	0	17600	0	2514	7	1
161	119760	19960	29768	3130	5230	5810	27750	11948	6000	0	42072	0	8012	6	0
162	202204	40441	91469	2055	3830	0	33350	26141	12000	0	59500	0	14300	5	1
167	180531	45133	39956	1720	15355	0	22500	19883	5000	45000	51000	0	25250	4	1
168	150628	37657	26448	2875	7605	2500	48400	21957	8200	0	54600	0	15700	4	1
169	126246	25249	19946	0	8600	13500	0	8409	0	0	84200	0	16840	5	0
171	242338	80779	124124	3900	12514	5000	8400	51313	5600	0	82800	0	29467	3	1
173	192978	64326	49028	2850	1400	4500	3200	20326	0	98000	34000	0	44000	3	1
176	110712	22142	57802	2660	34930	1620	0	19402	1800	0	11900	0	2740	5	0
179	35652	11884	16552	3900	0	1400	0	7284	0	0	13800	0	4600	3	0
183	77885	38943	17235	900	6150	3100	3000	15193	0	0	47500	0	23750	2	1
189	63172	12634	20032	1195	2455	1890	7000	6514	1200	0	29400	0	6120	5	0
191	144261	28852	10586	2820	5855	0	17000	7252	41600	0	66400	0	21600	5	1
192	178744	44686	15144	750	4750	600	0	5311	0	0	157500	0	39375	4	1
193	115181	28795	68006	2220	20655	500	0	22845	0	0	23800	0	5950	4	0
201	74505	12418	15805	2400	14600	3400	0	6034	9500	0	28800	0	6383	6	0
203	80853	40427	37558	2125	2870	0	10500	26527	4000	0	23800	0	13900	2	1
205	34019	11340	12369	6650	4000	500	0	7840	0	0	10500	0	3500	3	0
208	145980	24330	54610	2115	19855	0	17500	15680	0	40000	11900	0	8650	6	0
210	206056	41211	86856	2400	21500	800	0	22311	0	0	94500	0	18900	5	1
212	78644	11235	31244	2700	17700	8600	0	8606	0	0	18400	0	2629	7	0
213	107501	26875	13451	2250	0	1900	0	4400	0	0	89900	0	22475	4	0
Average	134525	32811	40667	3097	13472	5081	7117	69434	2756	11414	49935	986	65091	4.39	
(%)	100	-	30	2	10	4	5	52	2	8	37	1	48	-	
n	57	-	56	44	54	41	23	56	23	12	56	1	57	-	

Note: See Table 1 (Appendix III).