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An Economic Analysis of Peasant Rice Farming in Kelantan, Malaysia*

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Summary

This study deals with rice farming in a long-established double-cropping area in Kelantan where, although rice production is the most important source of income, the average yield per acre is much lower than the national average. Production costs, profitability of rice farming, and the role of material inputs in rice production are analyzed, based on data obtained from a farm management study in a Kelantan village. Low productivity and comparatively high production costs result in negative net profit but barely positive returns to family labour, farm assets and entrepreneurship, while the use of material inputs seems to be below optimum level. This is economically interpreted as the stagnation of rice production, in that farmers lack capital to improve their rice farming which, in turn, fails to generate economic profit.

Introduction

Production of rice has been one of the most important traditional activities among Malay peasants in Kelantan. This state occupies the second largest rice land area in Peninsular Malaysia (Malaya). However, its average yield per acre is below the national average. In order to raise this low productivity, there are many complex factors to be considered. It is said that one of the possible ways of increasing productivity is a greater use of material inputs such as fertilizer and pesticide, coupled with new varieties of rice and an adequate irrigation system. The greater use of these inputs requires further capital, which may be obtained from rice production itself as a form of profit, from other sources of income, or from government and private loan. It is, however, desirable for peasant farmers to generate capital through their own farm management rather than being indebted by obtaining loan and credit (Gamba, 1958; Aziz, 1964). With these considerations in mind, this paper attempts to analyze the profitability of rice farming and the role of material inputs in the production of rice.

I Methodology

The hypothesis tested in this paper is that use of material inputs in rice production is currently below optimum level, while low productivity does not generate sufficient revenue

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for the purchase of further material inputs. To test this hypothesis, firstly, the characteristics of cost structure are discussed in order to clarify input use. Secondly, profitability of rice farming is measured by a cost-and-return analysis. Finally, in order to demonstrate the significance of further material input use, the current role of material inputs is evaluated by production function analysis.

Discussion and analysis in this paper are based on data obtained from a farm management study conducted from May 1973 to August 1974 in Kampung Hutan Chengal in the Pasir Mas Irrigation Scheme, Kelantan. This scheme was selected with a view to the fact that rice double-cropping operations were started in 1961. Twelve years of experience by the time of the interview was considered to be ample for farmers to adjust to changes in farming infrastructure. Therefore, this study can be regarded as dealin gwith a long-established rice double-cropping area in Kelantan.[1] The subject village was chosen after discussion with the State Department of Agriculture and the Farmers' Association in the area, and may be considered a representative village in the scheme in terms of size and socio-economic structure. In the farm management study, the off-season (dry-season) cropping was intensively studied, since cultivation practice in this season was generally less traditional than the main-season (rainy-season), in which many farmers planted traditional varieties and therefore applied less fertilizer.[2]

Information was collected by personal interview with all farmers engaged in double-cropping in the village. Those who planted only a single crop in the main-season, largely because of lack of irrigation facilities for their fields in off-season, were excluded from the sample for this study. Thus, a total of fifty-five farmers out of the total seventy-three households in the village was selected. The interview was conducted by the author himself, with the help of an assistant. It was also possible for the author to spend some time in general observation, since he lived with one of the farmers in the village during the period of the interview. With a view to the fact that the farmers kept no books on their farming, a pre-tested questionnaire was used. Interviewing was divided into three different periods according to the progress of the off-season cropping,[3] so that farmers were questioned while

1) The Pasir Mas Irrigation Scheme is the second oldest double-cropping area in Kelantan, following the Salor Irrigation Scheme where operations for rice double-cropping were begun in 1959.

2) In the off-season, 1973, all farmers interviewed planted only mashuri, which is one of the improved (short-term) varieties. However, in the 1973/74 main-season, only seven percent of the total farmers planted mashuri alone, twenty-four percent of the total planted mashuri combined with traditional varieties, and the rest planted traditional varieties alone. See Fujimoto, 1975, Ch. 10.

3) The pre-testing of the questionnaire was made in April 1973 in the subject village. After modification of the questionnaire, the first interview was conducted in May 1973 on population, land resources, inventories, and farming operations of field preparation, nursery and ploughing of the off-season cropping. The second interview, conducted in August 1973, covered the farming operations of transplanting and maintenance including fertilizer and pesticide application up to the time of this interview. The last interview concerned with the 1973 off-season cropping was carried out from February to March 1974. This included remaining rice operations and sale of rice, as well as on- and off-farm incomes and changes which had taken place during the off-season period (April to September, 1973). In addition, 1973/74 main-season cropping was investigated in August 1974, but little reference is made to the main-season cropping in this paper.

their memory of events was still fresh. Nevertheless, the information obtained may have been misleading, partly because the farmers could not remember precise details of newly completed operations, and partly because of possible misunderstanding between the author and the farmers. In spite of the above disadvantages, this method was considered to be the best under the given conditions.

II Characteristics of the Area Studied[4)]

Kelantan State, whose population is approximately 700,000, is located in the northeastern part of Peninsular Malaysia. The state covers 3.7 million acres and consists of eight districts (*jajahan*), with the capital at Kota Bharu. Kampung Hutan Chengal which is the subject village of this study is situated in Pasir Mas District about seven miles away from Kota

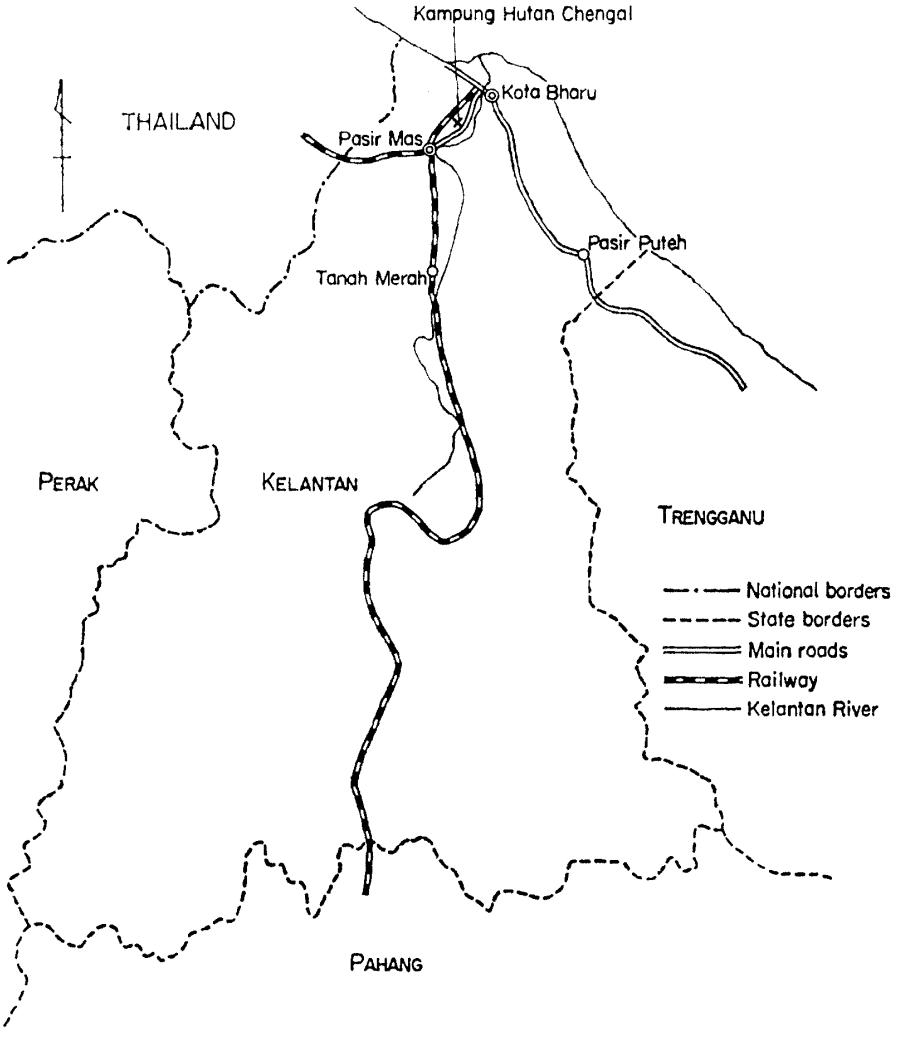

Fig. 1 Location of Kampung Hutan Chengal

4) For other characteristics of this area, refer to Fujimoto, 1974.

Bharu, and five miles from Pasir Mas town (see Figure 1).

The northeastern part of the state is a low-lying area along the Kelantan River and therefore a rice farming area. Although this state is an important rice-growing region of Malaysia in terms of cultivated acreage and production, its average yield is low. This is clearly shown in Table 1 which also presents the corresponding figures of Kampung Hutan Chengal. It is seen from Table 2 that the annual rice income in this village is among the lowest in the country.

Rainfall is the most important weather element directly affecting the rice crop in the area.[5] In 1973, the total rainfall was 148.33 inches, the December rainfall alone being 47.21 inches which often resulted in flood.[6] Generally, there was much more rain in the second half rather than the first half of the year.

Soil types in the district are sandy near the Kelantan River and clayey further away from the river. Since Kampung Hutan Chengal is located about one and a half miles north of the river, the soil type in this area ranges from light to heavy clay. These soils are among the better soils in the state and are considered suitable for rice production.[7] In terms of topo-

Table 1 Planted rice acreage and average yield per acre by state

States	Main-season (1971/72)		Off-season (1972)		Average cultivated rice acreage per farm
	Planted acreage	Average yield per acre	Planted acreage	Average yield per acre	
		gantangs		gantangs	
Johore	9,330 (1.0)	317	3,970 (0.8)	347	1.5
Kedah	293,270(33.0)	511	187,040(38.3)	543	4.0
Kelantan	170,220(19.2)	313	42,670 (8.8)	452	2.3
Malacca	28,150 (3.2)	385	5,040 (1.0)	367	2.1
N. Sembilan	18,930 (1.7)	393	15,440 (3.2)	400	1.1
Pahang	44,800 (5.0)	129	6,430 (1.3)	328	1.7
Penang	38,770 (4.4)	505	32,930 (6.8)	550	2.5
Perak	99,880(11.2)	390	103,450(21.2)	410	2.6
Perlis	65,630 (7.4)	514	30,300 (6.2)	500	4.1
Selangor	51,080 (5.7)	501	50,170(10.3)	587	3.6
Trengganu	72,600 (8.2)	271	10,410 (2.1)	380	2.3
Total and over-all average	892,660(100.0)	412	487,850(100.0)	495	3.1
Kampung Hutan Chengal	100.34	236.89	100.69	290.79	1.8

Note: Figures in parentheses are percentages. Data for Kampung Hutan Chengal are for 1973/74 main-season and 1973 off-season.

Source: Ministry of Agriculture and Rural Development, 1974, pp. 184–5, and Selvadurai, 1972, p. 42.

5) For a relationship between rainfall and rice production in Malaysia, refer to Van, 1974.

6) This information was obtained from the Department of Agriculture, Pasir Mas, Kelantan.

7) Information concerning soil was given by A. H. Basit, Soil Research Officer, Lundang Agricultural Station, Kelantan.

Table 2 Average annual rice income of double-cropped farm by state

States	Main-season (1971/72)	Off-season (1972)	Total
	$	$	$
Johore	380.4	416.4	796.8
Kedah	1,635.2	1,737.6	3,372.8
Kelantan	575.9	831.7	1,407.6
Malacca	646.8	616.6	1,263.4
N. Sembilan	345.8	352.0	697.8
Pahang	175.4	446.1	621.5
Penang	1,010.0	1,100.0	2,110.0
Perak	811.2	852.8	1,664.0
Perlis	1,685.9	1,640.0	3,325.9
Selangor	1,442.9	1,690.6	3,133.5
Trengganu	498.6	699.2	1,197.8
Over-all average	1,021.8	1,227.6	2,249.4
Kampung Hutan Chengal	352.49	425.72	778.21

Note: Gross rice income was calculated from Table 1; (rice acreage per farm × average yield per acre × eighty cents per gantang). In the case of Kampung Hutan Chengal, the average cultivated rice acreages were 1.83 acres and 1.86 acres for 1973 off-season and 1973/74 main-season, respectively.

Table 3 Total and average on-farm incomes in Kampung Hutan Chengal during the off-season, 1973

Sources	Total on-farm income	Average on-farm income per farm	%
	$	$	
Rice	23,414.60	425.72	60.9
Rubber	2,568.50	46.70	6.7
Tobacco	1,910.00	34.73	5.0
Fruits	1,743.60	31.70	4.5
Vegetables	816.00	14.84	2.1
Livestock[1)]	6,448.00	117.24	16.7
Poultry	1,308.10	23.78	3.4
Fish	273.00	4.96	0.7
Total and over-all average	38,481.80	699.67	100.00

Note: 1) This does not include increment of livestock value during the season and refers only to sale and home consumption of animals.

graphy, Kampung Hutan Chengal is in the plains area. However, there are many small undulations which result in some rice fields being unable to be irrigated from the canal for the off-season cropping. On the other hand, in some fields there is a serious problem of flooding from rainfall every year because of low-lying land and ineffective drainage.

Although productivity is low, rice farming is a major source of on-farm (agricultural)

income in this village. Table 3 shows that sixty one percent of the total on-farm income in Kampung Hutan Chengal during the off-season was derived from rice cultivation alone.[8] For the main-season, this proportion is probably larger, since other farming activities such as rubber tapping, cultivation of tobacco and vegetables and harvesting of fruits are restricted by heavy rainfall and seasonality of fruiting. Opportunities for off-farm jobs are small and wages are low. The average wage for agricultural labour and other village odd-jobs is about two dollars a day.[9] Among the total fifty-five households, only nine villagers were engaged in off-farm jobs on a full-time basis (Fujimoto, 1974, p. 353). Thus, it may be safe to say that the farmers in this village depend largely upon rice production as their source of income and, therefore, in the following analysis we are exclusively concerned with rice production as the main source of income.

III Cost of Rice Production

1 Farm Assets

Farm assets discussed here include owned rice land, farm buildings, machines and draft animals. Farm buildings refer to storage house and livestock shed. Machines include not only large machines but also farm equipment and agricultural tools. Draft animals refer only to buffalo and cattle.

The value of rice land and draft animal were estimated according to the market values given by farmers in the interview. Productivity level or fertility was the determining factor in the price of land. Thus, the value of a one-acre double-cropped field which could produce 300 gantangs[10] of rice per season was about $ 3,000. The values of livestock shed, storage house and machines were estimated according to the original costs and straight-line depreciations.[11] Draft animals raised under *pawah* or sharing system were estimated at only half of their market values.[12]

8) Tsubouchi found in a rice single-cropping area in Kelantan that the average yield per acre was much lower than that of Kampung Hutan Chengal, and that rice income was only 4.5 percent of the total income or 9.2 percent of the total on-farm income. See Tsubouchi, 1972, p. 216, and 1973, p. 606, Table 1.

9) The currency unit used in this paper is the Malaysian dollar. At the time of the interview, US$1 was approximately M$2.3.

10) One gantang is equivalent to one English gallon (4.56 litres). 400 gantangs of unhusked rice grain is approximately one metric ton. It must be noted that the term 'rice' is used to mean unhusked rice grain (paddy) throughout this paper, and that no reference is made to husked rice.

11) In calculating the depreciations, for both livestock shed and storage house, normal life of twenty years was assumed with zero disposal value. Pedestrian tractor was also assumed to have zero disposal value after ten years of life, for second-hand market for tractors was not yet developed in this area.

12) This estimation was based on the fact that the price of an animal under *pawah* system is equally shared between owner and raiser of the animal, when the animal is sold. According to this system, calves produced by the animal in question are alternatively owned by two parties; the first calf goes to the raiser, the second to the owner, the third to the raiser, and so forth. Raiser also holds complete permission to use the animal for his ploughing.

Table 4 shows the total value of farm assets as $ 4,915.21 per farm on the average. Rice land had the largest value, occupying eighty-eight percent of the total. As is seen from Table 5, it follows that owner farmers had the largest farm assets, followed by owner-tenant farmers. Capital intensity (value of capital assets excluding rice land per family worker engaged in rice farming) is observed to decline slightly as cultivated rice farm size becomes larger, with the exception of the largest farm which owns a pedestrian tractor.[13] In terms of ownership of rice land, owner-tenant farmers had on the average the highest capital intensity, while tenant farmers had the lowest.

Table 4 Average farm assets per farm

Assets	Values	%
	$	
Rice land	4,309.09	87.7
Farm buildings	113.84	2.3
Machines	265.19	5.4
Draft animals	227.09	4.6
Total	4,915.21	100.0

Table 5 Average farm assets and capital intensity

Groups	No. of farms	Average cultivated rice acreage	Average farm assets per farm	Capital intensity
			$	$
0<a≦1 acre	9	0.85	3,230.71	293.49
1<a≦2	33	1.71	4,753.66	214.22
2<a≦3	12	2.67	6,003.26	205.93
3<a	1	4.50	12,351.00	570.20
Owner farmers	23	1.86	7,049.74	229.33
Owner-tenants	26	1.88	4,054.96	251.29
Tenant farmers	6	1.53	460.73	157.29
Total and over-all average	55	1.83	4,915.21	231.85

2 Evaluation of Production Costs

Two sets of cost components were evaluated; one was calculated according to operation performed and the other by the type of expenses. Estimation of costs was made using the following assumptions. Hired labour cost consisted of the actual expenses, including both labour wage and expenses for food and drinks served for hired labour. Unpaid family labour cost was estimated according to the predominating wage rate in the village (two dollars

13) Pedestrian tractor was owned by four farmers in this village at the time of the interview. Three of them were owner-tenant farmers, and the other an owner farmer. Except for one farmer cultivating 4.5 acres, their average cultivated rice acreage (2.22 acres) was not much larger than the village average (1.83 acres).

a day, regardless of sex). Seeds were estimated at sixty cents per gantang. Rent paid in rice was converted into monetary terms, assuming the price of rice to be eighty cents per gantang.[14] Costs for fertilizer and pesticide were the actual expenses paid by the farmers. Fertilizer supplied by landlords under share-cropping tenancy was not included in the cost calculation.[15] Land tax and water rate were again the actual expenses paid by the cultivators,[16] and those paid by the landlord for rented land were excluded from the calculation. Interest on farm assets was estimated at a six percent annual rate.[17]

3 Classification and Presentation of Production Costs

Both the average production costs per acre and per 100 gantangs of rice produced are presented in Tables 6 and 7. In terms of rice operations, transplanting and harvesting occupied more than thirty-seven percent of the total cost. This was due to the heavy labour inputs

Table 6 Average cost of rice production according to operation; off-season, 1973

Operations	Production costs per acre	Production costs per 100 gantangs of rice	%
	$	$	
Field preparation[1]	6.69	2.30	2.0
Ploughing	25.16	8.65	7.4
Nursery work	9.67	3.33	2.8
Transplanting	66.63	22.91	19.6
Fertilizer application	30.17	10.38	8.9
Weeding, pesticide application and maintenance	11.74	4.04	3.4
Harvesting[2]	59.94	20.60	17.6
Land tax and water rate	8.54	2.94	2.5
Rent	41.01	14.10	12.1
Interest on farm assets	80.57	27.71	23.7
Total	340.12	116.96	100.0

Note: 1) Refers to slashing and burning weeds, and repairing bunds and drains, all of which are carried out before ploughing.
2) Includes threshing, winnowing and transportation of rice from the field to house.

14) Price of rice increased rapidly during the season studied. At the time of transplanting, the price was sixty cents per gantang which was the same as in previous years, but it was eighty cents at the time of harvesting. After the harvest, i.e., at the beginning of the 1973/74 main-season cropping, the price came up to nearly one dollar per gantang. Thus, although it may be common practice to take the average price for the past several years, in this estimation the actual price was taken, because the average price showed an unrealistic figure compared to the current price.

15) The predominating tenancy contract in this area is share-cropping or *bagi-dua* (93 percent of the total agreements), which equally divides the total output between two parties. Under this contract, the tenant is to supply all the labour, and the landlord is to supply all the fertilizer and to pay land tax and water rate. However, it was sometimes observed that fertilizer cost was entirely or partially met by the tenant.

16) Land tax and water rate were three dollars and ten dollars, respectively, per acre annually for double-cropped field.

17) Although the bank rate of interest in 1976 is higher than this rate, it was close to six percent in 1973.

Table 7 Average cost of rice production according to type of expenses; off-season, 1973

Types of expense	Production costs per acre	Production costs per 100 gantangs of rice	%
	$	$	
Seeds and seedlings	5.41	1.86	1.6
Fertilizer and pesticide	30.62	10.53	9.0
Ploughing cost[1)]	21.68	7.45	6.4
Hired labour	13.52	4.65	3.9
Unpaid family labour	138.76	47.72	40.8
Land tax and water rate	8.54	2.94	2.5
Rent	41.01	14.10	12.1
Interest on farm assets	80.57	27.71	23.7
Total	340.12	116.96	100.0

Note: 1) This refers to tractor and buffalo ploughing on contract. Those who ploughed using own buffalo were regarded to have no cost of this type, and their labour cost for ploughing was included under the heading of 'unpaid family labour'. The cost of own tractor ploughing was divided into two types of expense; labour input in family labour cost and cost of fuel and oil in this ploughing cost.

in the two operations, which amounted to eighty-three percent of the total labour input (Fujimoto, 1976). The sum of the cost of all operations was 61.5 percent of the total cost.

Table 7 shows that more than forty percent of the total cost was attributed to unpaid family labour. Fertilizer and pesticide expenses constituted only nine percent of the total, while rent was twelve percent of the total on the average. Nearly one quarter of the total cost was in the form of interest on farm assets. It should be noted that *zakat* or religious tax was not included as a cost component. According to the farmers, those who harvested more than 380 gantangs of rice in each season were obliged to pay ten percent of their total yield for *zakat*. This was imposed not only on owner farmers but also on tenant farmers, who apparently have to pay ten percent of the total yield before rent has been paid off.[18)]

The major characteristic of production costs in this village is a traditional feature of the cost structure. Nearly forty percent of the total cost was due to rent, land tax, and interest on farm assets. On the other hand, purchased material inputs such as fertilizer and pesticide accounted for less than ten percent of the total. Family labour cost occupied a high proportion of the total cost, which enables us to say that rice farming in this village depends largely upon family labour. In Province Wellesley (Penang State), where the average yield per acre is considerably higher than the national average, hired labour cost was more than two-fold of family labour cost (Selvadurai, 1972, p. 83), while in this village it is only ten percent of family labour cost. This difference is only one of many existing between the East Coast and

18) This was not rigid. Some tenants did not pay at all, while some paid, even though the total yield was below 380 gantangs. Tsubouchi stated minimum yield above which *zakat* has to be paid was 300 gantangs (Tsubouchi, 1972, p. 228), however, the difference between the two figures remains unexplained.

Table 8 Average production costs per 100 gantangs of rice produced in Province Wellesley; off-season, 1975

Types of expense	$	%
Seeds and seedlings	1.01	1.1
Fertilizer and pesticide	14.73	16.1
Ploughing cost	8.21	9.0
Hired labour	21.22	23.1
Unpaid family labour	8.36	9.1
Land tax and water rate	0.66	0.7
Rent	7.29	8.0
Interest on farm assets	30.20	32.9
Total	91.69	100.0
Average production costs per acre	493.15	
Average yield per acre (gantangs)	537.84	

Note: These data were obtained by the author's own investigation in 1975 in Bumbung Lima area; Fujimoto and Tsujimoto, "Padi Mechanization and Farm Economy in Bumbung Lima, Malaysia" (to be published). In estimating family labour cost in Bumbung Lima, family labour was evaluated at $3 per 8-hour day, considering higher wage rate. Interest rate was assumed at 7.5% annually. Other methods and assumptions were exactly the same as for Kampung Hutan Chengal, presented earlier in the present paper. The Government's report shows much lower cost of production for both Kelantan and Penang States; see Selvadurai, 1972, p. 84.

the West Coast of the Malay Peninsula in customary practice of rice production, including type of farm management and tenancy form.[19] This paper does not deal with these differences in depth, other than presenting Table 8 for the further clarification of the characteristics of production costs in Kampung Hutan Chengal. It is clearly shown that rice farming in Province Wellesley depends upon hired labour, while in this village the family forms the basis of the labour force. It is important to note that the average production costs per 100 gantangs of rice produced in this village is remarkably higher than that of Province Wellesley, in spite of lower production costs per acre. This is due to the low yield per acre in this village.

Table 9 shows that both the average yield and production costs per acre generally decline as the rice farm size increases. This is consistent with the prevailing theory that intensity of input use declines, and therefore productivity declines, as farm size increases. A previous study made by Huang also confirmed this point in Kelantan. He estimated elasticity of the input use with respect to farm size for family labour, variable inputs, and hired labour. The estimated coefficients were, respectively, 0.887, 0.839, and 0.262, all of which are below unity, indicating that "farmers do not maintain their intensity of input use as farm size increases" (Huang, 1971, p. 516). It is also noted here that, in terms of ownership of rice land, owner-

19) Recently, one attempt was made to ascertain these differences, however, much greater research is required in the social as well as natural sciences. See Jackson, 1972.

Table 9 Average yield and production costs per acre according to cultivated rice farm size and ownership of rice land

Groups	Average yield per acre	Average cost of rice production per acre	Average cost of rice production per 100 gantangs
	gantangs	$	$
0<a≦1 acre	418.09	455.72	109.00
1<a≦2	279.53	367.45	131.46
2<a≦3	258.75	268.91	103.93
3<a	444.44	306.06	68.86
Owner farmers	268.45	347.78	129.56
Owner-tenants	318.03	341.10	107.26
Tenant farmers	250.00	298.92	119.57
Over-all average	290.79	340.12	116.96

tenant farmers recorded the highest average yield per acre, followed by owner farmers. This, however, does not mean that the owner-tenant farmers are the smallest in cultivated rice farm size (see Table 5), but it points to other complex factors for productivity determination.[20]

IV Profitability of Rice Farming

Profitability of rice farming is measured by a cost-and-return analysis. Table 10 presents both net profit per acre and family labour earnings per day from rice production in the off-season, 1973. Since in calculation of family labour earnings the interest of farm assets

Table 10 Net profit per acre and family labour earnings per day according to cultivated rice farm size and ownership of rice land

Groups	Net profit per acre	Family labour earnings per day
	$	$
0<a≦1 acre	−121.25	0.37
1<a≦2	−143.83	0.27
2<a≦3	−61.91	0.79
3<a	49.49	3.62
Owner farmers	−133.02	0.14
Owner-tenants	−86.68	0.72
Tenant farmers	−98.92	0.53
Over-all average	−107.49	0.45

Note: Net profit=Gross rice income−Production costs. Gross rice income was estimated at eighty cents per gantang of rice.
Family labour earnings=Net profit+Family labour cost.

20) The largest farm group, which consists of only one owner-tenant farmer, recorded the highest average productivity per acre. This was partially due to the large amount of fertilizer applied. See Fujimoto, 1976.

is retained as a cost component, the concept of family labour earnings represents the net return to family labour devoted to cultivation of rice after the return to farm assets has been taken into account.

It is seen that most of the farmers recorded a negative net profit from their rice farming, averaging —$ 107.49 per acre. Only three farmers or 5.5 percent of the total actually had a positive net profit from rice farming. This negative net profit was due to comparatively high production costs and low productivity per acre in this village. In contrast, farmers in Province Wellesley had a positive net profit, averaging $ 88.87 per acre in the off-season, 1975 (author's own investigation), owing to high productivity per acre and higher price of rice ($ 1.10 per gantang). In Kampung Hutan Chengal, however, as long as family labour cost is assumed to be zero, the return from rice cultivation is positive. Farmers recorded family labour earnings of $ 0.45 per day on the average. Since the average family labour input in rice production was 1,018.2 man-hours or 127.28 man-days per farm, the total earnings for the 6-month period of rice cultivation come to $ 57.28. This gives only $ 9.55 per month, on the average, as returns to family labour devoted to rice cultivation.[21]

It is true that there is considerable variation in the profitability of rice farming among farmers in the subject village. In order to examine this variation, family labour earnings instead of net profit are used as a criterion, for the former may be more practicable in analyzing the rice income of peasants whose farming is family labour dependent. Table 11 shows the number of farmers according to their family labour earnings per day. Thirty-nine farmers recorded positive earnings. In terms of ownership of rice land, eighty-five percent of the

Table 11 Number of farmers according to family labour earnings per day

Earnings / Categories	Less than −$1.00	−$1.00≦E<0	0≦E<$1.50	$1.50 or more	Total	Chi-square values
Owner farmers	3(13.0)	7(30.5)	10(43.5)	3(13.0)	23(100.0)	6.03**
Owner-tenants	2 (7.7)	2 (7.7)	19(73.1)	3(11.5)	26(100.0)	32.16***
Tenant farmers	0 (0.0)	2(33.3)	3(50.0)	1(16.7)	6(100.0)	3.34*
F. A. members	4(10.0)	9(22.5)	21(52.5)	6(15.0)	40(100.0)	17.40***
F. A. non-members	1 (6.7)	2(13.3)	11(73.3)	1 (6.7)	15(100.0)	20.88***
Total	5 (9.1)	11(20.0)	32(58.2)	7(12.7)	55(100.0)	33.65***

Note: Figures in parentheses are percentages.
*** Denotes significance at the one percent level.
** Denotes significance at the twenty-five percent level.
* Denotes significance at the fifty percent level.

21) It was indicated that rice farming is relatively less profitable than the alternative crops such as tobacco, watermelon, groundnuts and maize in Malaysia (Huang, 1972). However, for the farmers in this village it seems difficult to change the crop to be cultivated in irrigated fields where the drainage system is inadequate for crops other than rice. Wherever feasible, some farmers actually cultivate, in addition to rice, tobacco, vegetables, groundnuts, etc. in this area.

owner-tenant farmers had positive earnings, while only fifty-seven and sixty-seven percent of the owner and the tenant farmers, respectively, had positive earnings.

Farmers' Association (F.A.) is the government body which promotes agricultural modernization policy at the farm level, and therefore it is considered to play a crucial role for improved farm management. One of its activities is the dissemination of government recommendations concerning farming practice. It follows that member farmers of the association had clearly a better knowledge of the recommendations than non-member farmers in this village (Fujimoto, 1974). However, our analysis here indicates that the farming results of the non-member farmers were no worse than those of the member farmers in the village. This is perhaps because the less knowledgeable farmers tended to follow the progressive farmers, and some cultivation techniques such as use of improved variety in off-season, preparation of wet nursery and square transplanting method, have been firmly established among farmers in this village with no direct connection to the current recommendations. The proof lies in the fact that, if actual farming practices are compared with those of recommendations, all farmers are judged to have implemented around half of all recommended practices and/or methods of farming, regardless of their knowledge of the recommendations (Fujimoto, 1976). Thus, it is clear that farming results (family labour earnings) were more strongly determined by factors other than membership of the F. A. or knowledge of the government recommendations. It was even suggested that the recommendations might be irrelevant to the actual conditions facing farmers in this area (Fujimoto, 1975, Ch. 9), but further inquiry into this point is beyond the scope of the present paper.

Although sixteen farmers recorded negative family labour earnings, this does not necessarily mean that they would have been better off if they ceased to cultivate rice, because we retained interest on farm assets as a cost component. There do exist positive returns to family labour, farm assets and entrepreneurship from rice production, averaging $ 111.87 per acre, which, although small, enables farmers to continue cultivation of rice.

V Role of Material Inputs in Rice Production

In the preceding analyses, cost and profit structure of rice production in this village has been clarified. It is now necessary to examine the role currently played by material inputs such as fertilizer, pesticide and new seeds in rice production in order to demonstrate possible means of increasing productivity by a greater use of these inputs. If we fail to discover a significant contribution of material inputs in increasing rice income, greater use of those inputs will make no sense at all in improving rice farm management in this area. This analysis is presented by the Cobb-Douglas production function with the following form;[22]

$$\log Y = \log a + b_1 \cdot \log X_1 + b_2 \cdot \log X_2 + b_3 \cdot \log X_3 + b_4 \cdot \log X_4 + b_5 \cdot \log X_5$$

22) Evaluation of inputs data follows from those presented in a preceding section of production costs. The variable X_1 was expressed in monetary terms (price of cultivated rice land) in order to reflect its fertility.

Where, Y is gross income from rice ($),
X_1 is cultivated rice land value ($),
X_2 is total family labour inputs ($),
X_3 is total material inputs such as seeds, pesticide and fertilizer ($),
X_4 is farmer's ability index (see Appendix to this paper), and
X_5 is damaged rice acreage (% to total planted acreage).

Among these independent variables, we are particularly interested in X_3 and X_4. Quantity of material inputs used was put forward in the preceding section of production costs. However, for this analysis we included, in addition, those fertilizers supplied by landlords under share-cropping tenancy. The ability index of the farmers was included in this regression so as to confirm our previous conclusion on profitability of rice farming with respect to the knowledge of the government recommendations.

This production function was fitted to the cross-sectional data of the fifty-five samples. None of the correlation coefficients among the independent variables in the regression equation shows high correlation, as is presented in Table 12. Therefore, the problem of multicollinearity is not serious in this estimation.[23]

The results of the estimation are presented in Table 13. Although these results are frequently used to discuss returns to scale and efficiency of resource allocation, we restrict ourselves to the variables X_3 and X_4. The regression coefficient for material inputs is significantly different from zero at the ten percent probability level. In the case of the Cobb-Douglas production function, the regression coefficient of a variable is equivalent to its factor elasticity of production. We can also easily calculate the marginal productivity of the variable, using this factor elasticity. Thus, in our estimation, the factor elasticity of the material inputs is 0.2778, and its marginal value product(MVP) is, on the average, $ 1.537 per one dollar value of the material inputs.

An examination of the ratio of MVP to opportunity cost(OC) for the variable can indicate whether the current level of input use is optimum or not. The opportunity cost was estimated at six percent annual rate of interest, therefore, for a 6-month period the opportunity cost of each dollar of material inputs is $ 1.03. Accordingly, our MVP/OC ratio becomes 1.49, which is significant at the twenty percent level. If we assumed the annual interest rate to be ten percent, this ratio would become 1.46. The corresponding ratios for rice land and family labour, at the six percent annual interest rate, are 0.03 and 0.30, respectively, both significant at the five percent level. Theoretically, since the MVP/OC ratio for material inputs is greater than unity, we conclude that the current level of material input use is below optimum.[24] Thus, there is evidence that farmers in this village can probably generate higher

23) The problem of multicollinearity may arise when the correlation coefficient is larger than 0.8, and this results in an insignificant regression coefficient (Heady and Dillon, 1961, p. 115).

24) It may be true that under actual conditions farmers try to avoid risks and uncertainties, resulting in input use which is below optimum level.

Table 12 Matrix of correlation coefficients among the variables in the production function analysis

	Y	X_1	X_2	X_3	X_4	X_5
Y	1.000					
X_1	0.706	1.000				
X_2	0.363	0.449	1.000			
X_3	0.696	0.702	0.522	1.000		
X_4	0.311	0.415	0.008	0.211	1.000	
X_5	−0.281	0.174	0.101	0.063	0.078	1.000

Table 13 Estimates of Cobb-Douglas production function

Variables	Estimated regression coefficients	Standard errors of regression coefficients	Geometric means
Constant, a	−0.3817		
Rice land ($), b_1	0.5629**	0.1900	6,383.0
Family labour ($), b_2	0.1849*	0.1177	231.6
Material input ($), b_3	0.2778*	0.1336	68.9
Ability index, b_4	0.0239	0.1083	7.7
Damaged area (%), b_5	−0.1376**	0.0326	11.7
Sum of coefficients	0.9116		
No. of samples	55		
R^2	0.5607		

** Denotes significance at the one percent level.
* Denotes significance at the ten percent level.

rice income by using more purchased material inputs such as fertilizer and pesticide.

Concerning the variable X_4, as is seen from the appendix to this paper, this index of farmer's ability was largely determined by testing their knowledge of the government recommendations concerning farming practice. Hence, the fact that the regression coefficient for the ability index is not statistically significant at the ten percent level is to some extent consistent with our previous conclusion that family labour earnings were not strongly determined by level of the knowledge of the recommendations. It is, however, necessary to consider the following two points; 1) our evaluation of farmer's ability may not accurately reflect the real situation, and 2) there may not be significant differences among the sample farms in terms of farming practice and rice income. Supposing our evaluation to be acceptable, we may conclude that the farmer's ability is not statistically a significant determinant of rice income. If the second point is the case, it may mean that farmer's ability or knowledge of the recommendations has not been effectively utilized in farming. Thus, although Bhati revealed that farmer's technical knowledge was a significant determinant of farm income

in the Tanjong Karang area, Selangor, his conclusion does not seem to hold true in this village (Bhati, 1973).

VI Conclusion

Rice production is clearly the predominating source of income in this village. However, productivity per acre is very low and production costs are comparatively high. It appears that intensity of input use and the average productivity per acre decline as cultivated rice farm size increases. Rice farming in this area is strongly dependent on family labour in the sense that a large proportion of the production costs consists of unpaid family labour cost, while use of purchased material inputs such as fertilizer and pesticide is rather low.

Almost all farmers in this village record a negative net profit from rice farming. Nevertheless, the continuation of rice cultivation is assured by positive returns, however, small, to family labour, farm assets and entrepreneurship. Using family labour earnings as a criterion of the results of farm management, owner-tenant farmers appear to be the most successful, followed by tenant farmers. Owner farmers obtained the lowest family labour earnings per day on the average. Membership of the Farmers' Association and level of technical knowledge of the government recommendations concerning farming practice do not appear to have influenced the degree of profitability of rice farming in this village.

In spite of farmers' failure to generate positive net profit which could be utilized for improved farm management, there exists evidence that a higher rice income can probably be generated by a greater use of material inputs such as fertilizer, pesticide and new seeds. The current situation therefore may be interpreted economically as stagnant reproduction of rice, in that farmers are lacking capital to improve their rice farming which, in turn, fails to provide positive net profit. Unless this cycle is broken at some point, it is obvious that poverty of peasant farmers will not be eliminated.

This paper suggests that further study may profitably be concentrated on the following points; 1) implementation of loan and credit policy; 2) technology to increase productivity in the local conditions; and 3) means of reducing cost of rice production, and associated problems.

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Appendix: Scoring Method of Farmer's Ability Index

Three factors, education, farming experience and knowledge of the recommendations of the Department of Agriculture, were considered to form the ability index of farmers. These three factors were scored in such a way that the maximum possible score would be twenty points in order to simplify the calculation. The allocation of points among the three factors were as follows; five points for farming experience, five points for education, and ten points for technical knowledge. The largest number of points was allocated to technical knowledge, which was considered the most vital factor in the farmer's ability.

1) School education was scored in the following manner.

Education period	Points
More than 10 years	5
7–9 years	4
4–6	3
2–3	2
1	1
0	0

The *pondok* education was scored as follows;

10 years (one farmer)	3 points
3 years (two farmers)	1

The one farmer who studied at *pondok* for one year after finishing schooling for three years was given three points. Another farmer who educated himself was given one point.

2) Farming experience was scored in the following manner.

Experience	Points
More than 20 years	5
10–19 years	4
6–9	3
3–5	2
2	1
1	0

3) The Government recommendations were divided into sixteen items, each of which was examined as to whether farmers knew exactly or not. The rate of correct answers to the total questions was measured and according to it the scoring was carried out, as follows.

Rate of correct answers	Points
100%	10
90–99	9
80–89	8
70–79	7
60–69	6
50–59	5
40–49	4
30–39	3
20–29	2
10–19	1
0–9	0

4) After having scored the three factors by the above method, the correlation coefficients among these factors were computed, with the following results, which indicate that these factors are not strongly correlated.

	Education	Experience	Knowledge
Education	1.000		
Experience	−0.323	1.000	
Knowledge	0.214	0.143	1.000