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Utilisation of Idle Padi Lands in Negeri Sembilan

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RINGKASAN

Masalah tanah terbiar telah menjadi satu masalah negara di tahun-tahun kebelakangan ini. Di Negeri Sembilan, 57 peratus dari luas tanah sawah yang diwartakan tinggal terbiar. Tujuan kajian ialah untuk menentukan faktor-faktor yang menyebabkan tanah-tanah sawah di Negeri Sembilan tidak diusahakan dan mencadangkan kegunaan lain tanah-tanah tersebut.

Kajian ini menunjukkan yang kekurangan tenaga buruh, kerendahan daya pengeluaran tanah sawah, pendapatan bukan ladang yang tinggi, kekurangan air dan milik tanah berganda adalah faktor-faktor yang signifikan menyebabkan petani meninggalkan sawah.

Analisa perancangan linar menunjukkan yang tanah sawah terbiar boleh diusahakan secara ekonomi dengan tanaman lada, kacang, jagung dan untuk memelihara ikan air tawar.

SUMMARY

The problem of idle padi land has attracted national attention in recent years. In Negeri Sembilan, about 57 percent of the gazetted padi land are abandoned. The objectives of the study are to determine factors that contribute to the abandonment of padi land in the state and to suggest alternative uses of the land.

The study shows that shortage of labour, low productivity of padi land, high off-farm income, shortage of water and multiple land ownership are significant variables that influence farmer's decision to abandon their padi land.

A linear programming analysis indicates that the idle padi land can be economically utilised for the cultivation of chillies, greenpeas, maize or sugar cane, and rearing of freshwater fish.

INTRODUCTION

The total area under all crops in Peninsular Malaysia is approximately 8.6 million acres. However, more than a million acres or about 12 percent of the total acreage are left idle and about 30 percent of the idle agricultural land has been found to consist of alienated padi land (Department of Agriculture, 1979, p. 6). The problem of idle padi land is especially acute in Negeri Sembilan where 20,784 acres or 57 percent of all gazetted padi land are left idle.

This study examines the factors contributing to the abandonment of padi land and to suggest alternative uses of the land.

Data for the analysis were obtained from a stratified simple random sample of 335 farmers covering all districts in the state. Stratification was based on farm size groups and the size of sample in each group reflects the total acreage of padi farms in each group (Table 1). There were 32 areas throughout the state covering all districts from which the 335 samples were taken. From the total sample size, 251 samples were padi areas which had irrigation facilities and the remaining 84 samples were from areas which depended solely on rain water.

Secondary data were also used to obtain information on land classification, production costs and yields.

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TABLE 1
Padi Farm Size Distribution
In Negeri Sembilan, 1979

Farm Size (acres)	Total Available Padi Land (acres)	Percentage to be Sampled (%)	Number of Actual Samples
Below 1	4,395	12.0	40
1 – 1.99	7,420	20.3	68
2 – 2.99	10,043	27.5	92
3 – 3.99	7,410	20.3	68
4 – 4.99	3,358	9.2	31
5 – 5.99	2,264	6.2	21
6 and above	1,566	4.3	15
Total	36,456	100	335

Source: Based on the padi farmers' Fertiliser Subsidy Scheme Register, State Department of Agriculture, 1979.

METHODOLOGY

Two main analytical tools were used in the study. Logit analysis was used to identify factors contributing to the non-utilisation of padi lands and linear programming (LP) technique to formulate an alternative land use for the padi lands.

Logit Analysis

The use of ordinary least squares (OLS) in regression analysis where the dependent variable is a dummy variable is inappropriate because the assumptions of OLS do not hold (Nerlove, 1973). Firstly the predictions based upon the OLS could well give a negative value of the dependent variable or a value exceeding one. Secondly, the error term does not have a constant variance. To overcome the problems, he suggests that dependent dichotomous variables be treated using logit analysis with maximum likelihood methods as follows:

$$\begin{aligned} P &= \Pr(Y_i = 1) \\ &= \Pr(e_i < x_i\beta) \\ &= F(X_i\beta) \qquad \text{.......... (1)} \end{aligned}$$

Where P is the probability (e.g. probability of a famer cultivating his padi land)

Y_i is the dependent variable
e_i is the error term
x_i is the independent variable
is the regression coefficients
F is the cumulative density function (cdf)

Therefore,

$$\begin{aligned} 1 - P &= \Pr(Y_1 = 0) \\ &= 1 - F(X_i\beta) \end{aligned}$$

With this specification, P will lie between 0 and 1 since $F(-\propto) = 0$ and $F(\propto) = 1$. The choice of form of the cdf in empirical work is arbitrary but an appropriate form is to use the logit function as follows:

$$P_i = \frac{1}{1 + e^{-x_i\beta}} \qquad \text{.......... (2)}$$

$$\text{or } X_i\beta = \log \frac{(P_i)}{(1-P_i)} \qquad \text{.......... (3)}$$

The computational procedure for obtaining the estimates of the β's involves the setting up of a likelihood function in the parameters and the maximisation of this function.

A partial derivative of equation (2) would show the following relationship,

$$\frac{\partial P}{\partial X_i} = \beta_i P(1-P) \qquad \text{.......... (4)}$$

Equation (4) shows the rate of change of the probability with respect to the ith independent variable. A positive β_i indicates that the probability increases with increasing values of the independent variable.

The dependent variable for the logit analysis is a dummy variable representing utilisation and non-utilisation of padi lands. It is equal to one if the farmer actually had cultivated his land and zero if he did not do so. The utilisation and non-utilisation of the padi lands may be regarded as the choice by farmers.

The explanatory variables included in the analysis were labour, both potential and currently available, water availability, income from padi, non-padi farm income and ownership of padi lands.

Models of economic development generally assume, with differing assumptions on marginal productivity of labour, that there is a gradual relocation of excess labour from the low productivity agricultural sector to a high productivity modern capitalist sector, (Lewis, 1963; Schultz, 1965). Gallaway (1967), however, believes that a theoretical framework for discussing labour is merely a special case of the theory of consumer demand. A maximising workers will adjust his offerings of labour so that his marginal rate of substitution of income for leisure is just equal to the real wage in the market. Labour mobility on the part of an individual, therefore, consists soley of his varying the quantity of labour he supplies to the market.

The argument can be expanded to include the possibility of an individual participating in more than one labour markets. The addition of another market means that an individual must now choose between alternative wage rates and alternative locations for offering his labour services in the market place. Where the two wage rates differ, the maximising individual will choose the higher rate, *ceteris paribus*. This then is believed to be one of the key factors contributing to labour migration, hence labour shortage in the agricultural sector.

Rural-urban inter and intra-state migration does occur in Negeri Sembilan. Norconsult (1974) suggests that the reasons for such migration are due, among others, to higher income in the neighbouring towns and cities.

Water is an essential input for padi cultivation. Availability of water, therefore, is an important contributing factor to the farmers' decision whether to cultivate or not to cultivate his padi lands.

Padi yields in Negeri Sembilan are generally low, averaging about 371 gantangs per acre for the main season crop and 403 gantangs per acre during the off-season (Ministry of Agriculture, 1975). It is the contention of this study that the low padi yields have contributed to the abandonment of padi lands. It is also the contention of the study that padi farmers are being attracted away from their padi farms to work in neighbouring rubber and oil palm estates and in non-agricultural enterprises.

Nadkarni *et al.* (1979) suggests that a social factor such as land ownership could have as much impact upon the intensity of land use as any other economic or climatic factors.

In Negeri Sembilan, the 'Adat Perpatih' custom enforces the matrilineal inheritance rule on all customary lands. Much of the padi land in the state are customary lands. A parcel of land could be owned by numerous farmers because of the constant subdivision among the farmer's children on the death of the mother. As the number of owners for a parcel of land increases, the probability of the land being left idle to avoid family fued increases.

Measurement of variables

Labour availability is measured by taking into consideration both the potential and currently available family labour and is expressed in terms of mandays per padi season.

The availability of water is taken to be the quantity of water available within the survey area. The general principle used by the Drainage and Irrigation Department to assess the availability of water for padi lands was adopted. It is based on the determination of the catchment area expressed in sq. miles and a conversion factor of 0.25 expressed in cubic feet per second. For example one cusec of water can generally irrigate 30 acres of padi lands with a foot level of water. The quantity of water available in the farm is measured in terms of cubic feet per season.

The productivity of padi farm variable is expressed in terms of output of padi per acre per season. Where a farmer is currently not planting padi, the yield figures are based on his previous records prior to his abandoning the land. In the case of the off-padi farm income variable the income that a farmer receives per month from all sources other than from padi was used. The ownership variable is expressed in terms of the number of owners having actual ownership claims to a given parcel of padi lands.

Linear programming analysis

The linear programming technique is widely used in agricultural applications to work out optimum farm plans and to indicate its departure from existing plans. The choice of LP over other techniques such as parametric budgetting, integar programming and Monte Carlo Simulation is because of its flexibility and ability to handle efficiently the problems of choice between enterprises and to handle easily large number of constraints.

The LP model as used in this study has an objective function to be maximised, subject to various constraints as follows:

The objective function is:

$$\text{Maximise } Z = \sum_{j=1}^{n} C_j X_j$$

$$\text{Subject to } = \sum_{i=1}^{n} A_{ij} X_j \leqslant b_i \qquad (i=1, 2, \ldots.. n)$$

where C_j = per acre unit net revenue or cost of the jth activity. The net revenue being equal to the gross revenue minus variable costs such as seeds, fertilisers, etc.

X_j = jth activity, i.e. the feasible crop or non-crop activity.

A_{ij} = input-output coefficient of the ith resource for one unit of the jth activity.

The non-negativity assumption is $X_j \geqslant O$.

As in any other LP model, the basic assumptions of the model include additivity of the resources and activities, linearity of the objective and production functions, divisibility of the resources and activities; and that resource supplies, input-output coefficients and prices are known with certainty. It is also assumed that the model is a short run with a planning horizon of one year with no crop rotational requirements and except for padi, none of the other crop activities are cultivated more than once within the planning period. Climatic and soil factors were also taken into account to ensure that only suitable crop activities were incorporated into the model.

The activities incorporated into the LP model include crops, livestock and fish. The crops were padi, groundnut, tobacco, sweet potato, chillies, maize, greenpeas, bananas, and sugar cane (juice variety). The poultry, cow and goat activities consist of five table birds per unit, two cows per unit and four goats per unit respectively. Poultry were assumed to be reared on the open range in the homestead, the cows and goats were assumed to be housed in wooden sheds near the homestead.

The conceptual problem of including livestock and certain crop activities because of the revenue and cost assessment exceeding the planning period was overcome by using the annual average production and cost data.

Other activities included in the model were borrowed capital, rented land and hired labour. The cost of borrowed capital was assumed to be 10 percent per annum, rental on land was $54.80 per acre and the cost of labour was $7.00 per man-day.

The resource constraints comprise own land, family labour, working capital, hired labour, maximum cash borrowable and rented land. The own land maximum was 1.1 acres based on the average padi farm land owned by farmers. Similarly the constraint on rented land was 4 acres based on the average size of rented land in the area. The average family size potentially available was 3.5 persons per household which is equivalent to 4,320 man hours per year. It was also assumed that there was an equivalent of 2030 hours of potentially available hired labour.

Production constraints were also placed on sweet potatoes, tobacco and livestock. Based on marketing consideration and LTN production quota of Negeri Sembilan the maximum acreage for sweet potatoes and tobacco is 0.1 acres each. The constraints for goat, cow and poultry were 6 units, 2 units and 10 units respectively based on the current practice in the region.* The fish pond maximum was assumed to be 0.3 acres. Based on the findings of the survey and farmer's mortgageable properties the working capital maximum was $350 and cash borrowing maximum was $4,500.

Input-output coefficients for both crops and non-crops activities with respect to own land, working capital, family labour, cash borrowed, rented land and hired labour were computed based on survey results and secondary data sources.

The conventional linear programming matrix consisting of 27 activities and 35 constraints is as shown in Table 2. The row indicates the objective function and the column indicates the various constraints.

Sensitivity Analysis

As indicated earlier the optimum solution to the programming model is based on a single price expectation. In reality it is not possible to predict future prices with certainty. To ascertain the viability of the plan with respect to changes in prices of the selected commodities a sensitivity analysis was also carried out. The prices assumed were based on the lowest price recorded by the Federal Agricultural Marketing Authority (FAMA).

RESULTS

Table 3 shows the estimates of regression coefficients, standard errors and elasticities of the logit analysis. The positive coefficients for labour, water and productivity indicate that as labour and water availability increase or as productivity of

* A single goat unit comprises four goats; a single cow unit comprises two cows and a single poultry unit comprises five table birds.

TABLE 4
The optimum Solution for The Linear Programming

Activity Items		CHIL (X_1)	GPEA (X_2)	FISH (X_3)	RCAP (R_1)	RLAN (R_2)	HLMY (R_3)	HLJN (R_4)	HLJY (R_5)	HLAG (R_6)	HLST (R_7)	HLOT (R_8)
Objective function	11040.67	2.55	2.25	0.3	2398.3	4.0	60	37.79	28.78	35.62	24.1	18.37
Total land	5.10	2.55	2.25	0.3	–	–	–	–	–	–	–	–
Invested capital	2748.30	535.5	180	381.75	–	219.2	–	–	–	–	–	–
Lab. Jan.	10.50	–	–	–	–	–	–	–	–	–	–	–
Feb.	3.00	–	–	–	–	–	–	–	–	–	–	–
March	3.00	–	–	–	–	–	–	–	–	–	–	–
April	134.83	–	–	–	–	–	–	–	–	–	–	–
May	960.00	–	–	–	–	–	420	–	–	–	–	–
June	542.32	–	–	–	–	–	–	264.53	–	–	–	–
July	470.25	–	–	–	–	–	–	–	201.46	–	–	–
Aug.	524.92	–	–	–	–	–	–	–	–	249.34	–	–
Sept.	432.45	–	–	–	–	–	–	–	–	–	168.70	–
Oct.	386.94	–	–	–	–	–	–	–	–	–	–	128.59
Nov.	–	–	–	–	–	–	–	–	–	–	–	–
Dec.	–	–	–	–	–	–	–	–	–	–	–	–
Interest on	–	–	–	–	–	–	–	–	–	–	–	–
B. capital	–	–	–	–	239.83	–	–	–	–	–	–	–

Note: The symbols X and R are used for the activities merely to differentiate between the revenue activities X_1 to X_3 and cost activities R_1 to R_8.

TABLE 5
Optimum Plans at Different Price Levels of Selected Activities

Activity Varied	Total Area Used (ac.)	Total Capital Used ($)	Chillie (ac.)	Greenpeas (ac.)	Maize (ac.)	Sugarcane (ac.)	Cows (units)	Fish (ac.)	Family Labour (manhours)	Hired Labour (manhours)	Income ($)
Unaltered (initial solution)	5.1	2748.30	2.55	2.25	–	–	–	0.3	1831.33	1638.88	11,040.67
Chillies only	5.1	3016.51	2.2	0.1	1.8	0.7	2	0.3	2872.52	1445.48	6,261.74
Chillies & Maize	5.1	3349.30	2.3	2.5	–	–	1.5	0.3	2337.48	1982.52	6,089.74
Chillies, Maize & Greenpeas	5.1	2634.19	2.3	–	0.7	1.8	1	0.3	3110.35	1209.65	6,028.28
Chillies, Maize, Greenpeas & Fish	5.1	2634.19	2.3	–	0.7	1.8	1	0.3	3110.35	1209.65	5,908.28

labour, does not require irrigation facilities, excessive amounts of water, or changes in the existing land tenure systems, and it can generate income commensurate with returns from alternative services.

Nonetheless research in other complementary areas has to be undertaken before the recommendations of this study can be put into practice. There is a need to ascertain the marketing and processing potentials of the selected enterprises and to devise the best implementation strategy for the linear programming model.

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