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Livelihood Strategies and Household Income of a Paddy Farming Community in Northwest Selangor, Malaysia

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Abstract

The importance of non-farm employment to rural households was widely acknowledged. However, empirical evidence on the relationship between household assets and non-farm activities is hardly found. This study identifies the determinants of a household's selection of a livelihood strategy. Results from multinomial logistic regression showed that the size of cultivated land was a significant factor for a livelihood strategy. The average education of working members, the share of other non-farm income and the availability of credit were also the significant determinants of a diversified livelihood strategy. This indicates that any policy intervention should be distinctive for certain group of paddy farming households.

Keywords: Livelihood strategies, household income, multinational logit, paddy farming community, Malaysia

1. Introduction

The diversity of rural livelihoods has been increasingly acknowledged by scholars of rural studies. As a way of accumulating wealth and reducing income fluctuations diversification out of agriculture is the most common type of income diversification strategies. Non-farm income is already contributing between 30 per cent and 45 per cent of rural household incomes in developing countries (Haggblade, Hazell and Reardon, 2010). In view of the growing importance of non-farm sources of income to rural households, non-farm activities have been regarded as the engine of growth for rural areas. Consequently, the focus on rural development is now on the creation of greater non-farm income-earning opportunities and the enhancement of access for the rural poor to these sources of income (Berdegué et al., 2001).

Based on the livelihood approach, the type of income-generating activity undertaken and the amount of income earned by a household are determined by their assets (Barrett et al., 2005; Brown and others, 2006). According to Brown et al. (2006), a farm household will attempt to maximize its utility which is defined over stochastic income by allocating its asset endowment across a set of feasible activities. However, households who are not able to select more remunerative strategies will face a constraint that

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limits their selection. This also indicates the selection of less rewarding strategies as households are constrained in choosing strategies that offer higher returns.

Studies on livelihood strategies of rural households in other developing countries, such as Latin America, Sub-Saharan Africa, China, India, Pakistan, and Bangladesh have been focused on rural households, especially the poor, who may or may not be involved in agriculture. Their income generating activities may or may not have any government assistance or the production activities are being carried out in flood prone or drought-prone areas, hillside areas that are faced with soil erosion problems or in "secluded" areas which are far away from centres of economic activities. In Malaysia, previous studies on livelihood strategies have improved the understanding on rural household decision to diversify their income sources (Ishida and Azizan, 1998; Norsida and Sadiya, 2009; Terano and Fujimoto, 2009; Siti Hadijah and Roslan, 2011). Although the households were paddy farmers who operated in designated paddy-growing areas and received various government assistances, they tend not to specialize in paddy production. An important finding of their studies is that diversification into the non-farm sector has resulted in an increase in the number of part-time farmers in granary areas. Terano and Fujimoto (2009) had observed that part-time farmers in the Seberang Prai granary area in Penang have increased from 12 per cent in 1978 to 55 per cent in 1987.

The ability of rural households to secure employment in the non-farm sector is highly dependent on their asset endowments. Households are often involved in a portfolio of activities which is a result of various combinations of assets and activities. This will in turn determine the livelihood strategies that they pursue. However, income diversification studies among Malaysian rural households have mainly been focused on identifying the determinants of diversification into off-farm activities (Norsida and Sadiya, 2009). Furthermore, the analyses were based on a broad category of off-farm income. It does not explicitly consider the role of different components of the off-farm income, which include agricultural-wage and non-farm incomes. Non-farm jobs, for example, have different requirements, which form barriers to entering more remunerative employment. This is reflected in the nature of rural non-farm work which varies from high- to low-return activities hence resulting in different income levels and income shares from each non-farm activities.

Realizing the scarcity of empirical works on livelihood strategies in the rural sector in general and in paddy farming in particular, this study was conducted to examine the livelihood strategies and the structure of household income in a peasant community in Selangor, Malaysia. The identification of the determinants of livelihood strategy selection of paddy farming communities would contribute towards the formulation of appropriate policy interventions in tackling the poverty and low income issues in major granary areas.

In the next section we briefly outline the study areas and the sample used for data collection. In Section 3, we provide an explanation of terms and the methodology for determining livelihood strategies through the use of cluster analysis. In section 4, we describe each of the livelihood clusters. A multinomial logistic (MNL) regression is then used to estimate the determinants of livelihood strategy selection and determine if there are barriers to the adoption of high-return livelihood strategies that combines farming and non-farm employment. Section 5 concludes with remarks and observations.

2. The Study Area

The study areas were Bagan Terap and Pancang Bedena, situated in the Northwest Selangor's Integrated Agricultural Development Area (IADA). This IADA is located in the state of Selangor which is one of the most developed states in the west coast of Peninsular Malaysia. The areas are located about 100 kilometres northwest of the capital city of Kuala Lumpur. Paddy production is on a commercial scale and hence paddy cultivation is heavily mechanized. Many farm households were also involved in low- or high-return local non-farm activities. This indicates that farming and non-farm activities were relatively developed in the study areas. Therefore, this provides justification for the selection of the study areas as a developed rural area. These study areas sit at the tip of the development area, making them the last receiver of irrigated water. Therefore, these farmers are more vulnerable to unfavourable weather conditions and consequently, are more adversely affected compared to other areas in this IADA.

3. Research Methods

Household income is defined as the amount of income earned by rural households, irrespective of where it comes from - rural or urban areas (Barrett and others, 2001). Sources of income were divided into five categories, i.e. (i) farm income (rice and oil palm); (ii) agricultural-wage income; (iii) non-farm wage income; (iv) non-farm self-employment income; and (v) other non-farm income (remittances, pensions, *zakat* (tithe) and rental).

The dependent variable specified in this study was the probability of choosing a certain livelihood strategy. Following Brown et al. (2006), a household is assumed as rational decision makers in choosing a specific livelihood cluster as they would choose income earning activities that will maximize the utility they expect to derive from the income to be earned from those activities. Households would achieve a certain level of utility from the adoption of certain livelihood strategy, which is basically defined by the characteristics of their assets and the expected outcome of the livelihood strategy.

Adopting the sustainable livelihood approach, the independent variables in this study were various forms of household assets. Human capital was represented by household size (HSIZE), number of dependents (DEPENDENTS), age of the household head (AGE), number of working members (WLabor) and average education of working members (EDU). The number of family members reflects the supply of labour. The greater the household size the greater will be the probability of a household participating in non-farm wage employment as there will be more working members in the family. The number of dependents is the number of household members below 15 years old and those above 65 years old. The number of dependents is expected to have a negative effect on the probability of choosing a diversified livelihood strategy.

The age of the head of household (AGE) is expected to have a positive effect on the probability of a household choosing a livelihood strategy that combines farming and non-farm activities. In order to capture the life-cycle effect of this variable on earnings, the square of the head of household age (AGE^2) is also included. Higher average education of working members will enable greater participation in non-farm activities, hence increasing the probability of choosing a livelihood strategy with non-farm employment.

Natural capital is made up of size of cultivated land (LandSize); categories of cultivated land size; and the percentage of land owned by a household (LandOwned). A household with more cultivated land and a

greater proportion of owned land is expected to have higher farm income and total household income. As a consequence, these assets are expected to have a negative effect on the probability of choosing a diversified livelihood strategy. However, households with smaller land holdings will be more dependent on off-farm employment, especially, as a way of supplementing their farm income, thus would have a higher probability of selecting a livelihood that combines farming with either agricultural-wage employment or non-farm employment.

Physical capital consists of agricultural implements such as farm machinery, equipment, and transportation assets (EQUIP). Machinery and equipment increases labour productivity by facilitating the adoption of improved production technologies and land productivity (Jansen et al., 2006). Furthermore, the ownership of agricultural implements enables a household to offer agricultural services hence increasing the probability of choosing a livelihood that combines farming and agricultural-wage employment.

Financial capital includes the share of other non-farm income (ONFY_share) such as transfers, remittances and rental income; as well as having access to credit (CREDIT). It is expected that these two variables will have a positive effect on a household's probability of choosing a livelihood strategy that combines farming with non-farm self-employment.

Social capital (SC) is expected to have a positive effect on household involvement in agricultural-wage employment, hence increasing a household's probability of selecting a livelihood strategy that includes agricultural-wage or non-farm self-employments. Following the method by Grootaert and others (2004) a total of 14 questions were used to develop the construct representing social capital. The response was scaled from 1 ("strongly disagree") to 5 ("strongly agree"), and averaged across the number of responses for each of the constructs. The social capital index is constructed by averaging the scores from the responses from each construct and rescaling them from 0 to 100 where 100 refers to the highest possible value of the index.

Locational capital is represented by the amount of time taken to get to the nearest rural town (DTIME) as it is able to capture the differences in terrain and the quality of the roads (Mduma and Wobst, 2005). The shorter the travel time to the closest rural towns, the greater will be the opportunities for a household to participate in non-farm employment. In capturing the differences across communities, rural sub-district dummy variables for each of the study areas were also included.

A total sample of 359 farm households was selected based on a multistage random sampling. The samples were 195 farm households for Pancang Bedena and 164 households for Bagan Terap. Data for two production seasons (the second season of 2010 and the first or main season of 2011) were collected using a self-administered questionnaire. Data gathered were on six categories of household assets – human, natural, physical, financial, social, and locational capital; cost of production data for paddy production; types of income-earning activities; and level of income from each income sources.

Cluster analysis was used to generate the livelihood strategies of rural households. The grouping of households into distinct clusters was based on the shares of income from farming, agricultural-wage employment, and non-farm employment, in total household income. The analysis of livelihood clusters begins with agglomerative hierarchical clustering with the Ward's linkage method being used as the method for linking clusters and squared Euclidean distance as the measure of distance between clusters. In addition to cluster analysis, a one-way analysis of variance test (ANOVA) was also performed in order

to determine the significance of differences in the means of per capita income. Once the livelihood clusters are identified, a multinomial logit (MNL) regression was performed using selected household asset variables. The will enable the estimation of the probability of a household choosing a specific livelihood strategy with its available assets.

4. Empirical Results

On average, the households in the study area earned about RM2,940 per month (RM3**.059** = US$1) with farm income as the major component, constituting up to 74 per cent of the mean total household income. Basically, there were three general categories of employment in the paddy farming community, namely farming, agricultural-wage employment, and non-farm employment. Farming included the production of crops, such as paddy and oil palm. The mean income from paddy production was about RM1,662 per month, which is about 57 per cent of the mean income, while oil palm income accounted for 11 per cent of the mean income.

Local agricultural-wage employment involved 36 per cent of the rural households in activities related to paddy cultivation, such as land preparation, crop harvesting, transportation, paddy transplanting, and other paddy-related agricultural services. About 74 per cent of the sample households were involved in some form of non-farm employment, either in management or clerical work, sales and services, food processing, construction work and public services. Within the non-farm employment category, private sector employment in management and clerical work had the highest number of participation, followed by employment in the public sector.

The dendrogram resulting from hierarchical cluster analysis allowed the use of visual examination of four clusters as the optimal number of clusters. Using the *k*-means cluster procedure, 17% of all the cases (60 out of 359 cases) were reassigned to another cluster. The differences in household assets of the groups extracted by cluster analysis are described and discussed in the following section.

In the analysis of livelihood strategies, households are classified by livelihood clusters for better understanding of the relationship between diversification and household income. Based on the percentage share of income from farming, agricultural-wage employment, and non-farm employment, the 359 sample households were categorized into four clusters of mutually exclusive choice of livelihood strategies as shown in Table 1. Households with more than 50 per cent of their income from one income generating activity were considered as being specialized in the activity, whilst those with more than 75 per cent of their income from an activity were regarded as being highly specialized in the activity.

Table 1. Livelihood strategies by clusters

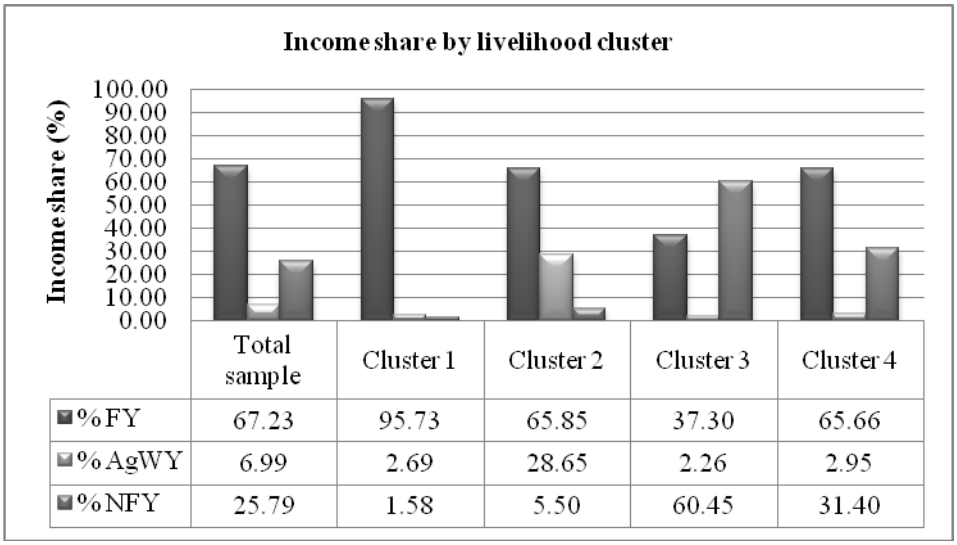
Cluster	Livelihood strategy	Number of households	Percentage
1	Highly specialized in farming	162	45.13
2	Farming/agricultural-wage employment	59	16.43
3	Specialization in non-farm employment	68	18.94
4	Farming/non-farm employment	70	19.50

Source: Based on the sample survey.

The proportion of income from each income source for each livelihood cluster is shown in Figure 1. It is observed that most households in all the four livelihood clusters had a significant share of farm income

in their total household income, ranging from 66 per cent to 96 per cent, except for households in Cluster 3 (about 37 per cent of farm income only). The significant share of farm income is expected as these households were paddy farmers operating in a designated rice granary area.

Figure 1. Household income shares by income sources



	Total sample	Cluster 1	Cluster 2	Cluster 3	Cluster 4
%FY	67.23	95.73	65.85	37.30	65.66
%AgWY	6.99	2.69	28.65	2.26	2.95
%NFY	25.79	1.58	5.50	60.45	31.40

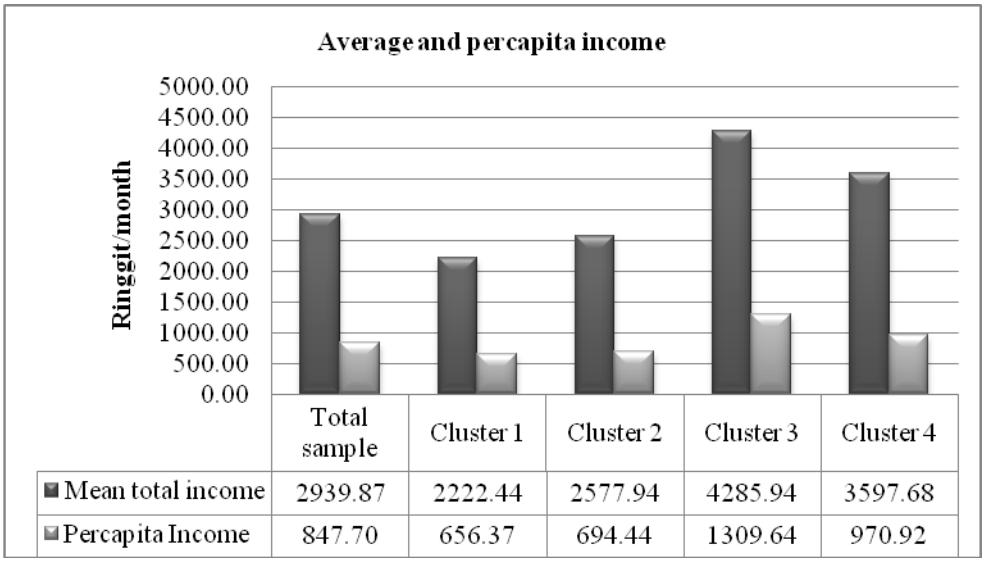
Source: Based on the sample survey.

Note: FY = Farm income; AgWY = Agricultural-wage income; NFY = Non-farm income

The households in Cluster 1, who were full-time farmers, earned 96 per cent of their household income solely from farming. Thus, this livelihood strategy was labelled as 'highly specialized in farming'. With an average farm income share of 66 per cent, the households in Cluster 2 obtained about 29 per cent of their income share from agricultural-wage employment. Since the share of agricultural-wage income was high, relative to those in the other three clusters, households were grouped as 'farming and agricultural-wage employment'. The households in Cluster 3 earned a significant share of their income from non-farm income sources (61 per cent) and only 37 per cent of their income from farming. This livelihood cluster was thus labelled as 'specialization in non-farm employment'. Finally, as in the other two clusters, the households in Cluster 4 also received a significant portion of their income from farming (66 per cent). In addition they also had a non-farm income share of almost half of the share of farm income (31 per cent), but this share did not imply specialization in non-farm employment as in Cluster 3. Hence, the label 'farming and non-farm employment' was used to identify the fourth livelihood cluster.

The level of average and per capita income for each livelihood cluster is displayed in Figure 2. The households whose livelihood activities were dominated by non-farm activities (Cluster 3) had the highest per capita income (RM1,310), compared to those in the other clusters. In this connection, the households in Cluster 1 had the lowest per capita income (RM656 per month), followed by the households in Cluster 2 (RM694 per month) and Cluster 4 (RM971 per month). All of the livelihood strategies in the granary area have enabled the households to generate an average monthly income above the poverty line income of RM760 per month.

Figure 2. Monthly per capita income by livelihood strategy



Source: Based on the sample survey.

Analysis of variance (ANOVA) was used to examine the variation of income across livelihood clusters. Table 2 reports the results from the pair-wise comparison (*t*-statistics) of the statistical differences between mean per capita incomes among livelihood clusters. It can be concluded that the livelihood clusters, which combined farming and non-farm employment (Clusters 3 and 4) resulted in a higher per capita income.

Table 2. Two cluster comparison t-test for equality of means

Hypothesis	Mean Difference	Std. Error Difference	t	df	Sig. (2-tailed)	Decision
H_0: $\mu_3 = \mu_1$; H_a: $\mu_3 > \mu_1$	653.27	126.36	5.17	77.29	0.000	Reject H_0
H_0: $\mu_3 = \mu_2$; H_a: $\mu_3 > \mu_2$	615.19	134.46	4.58	94.17	0.000	Reject H_0
H_0: $\mu_3 = \mu_4$; H_a: $\mu_3 > \mu_4$	338.72	139.88	2.42	105.95	0.017	Reject H_0
H_0: $\mu_4 = \mu_1$; H_a: $\mu_4 > \mu_1$	314.55	76.39	4.12	103.12	0.000	Reject H_0
H_0: $\mu_4 = \mu_2$; H_a: $\mu_3 > \mu_2$	276.48	89.15	3.10	125.72	0.002	Reject H_0

Source: Based on the sample survey.

Notes: H_0 = null hypothesis that household participation in non-farm activities does not affect the mean incomes among household livelihood clusters; H_a = the alternative hypothesis that households who participated in non-farm activities will have a higher mean income.

Table 3 presents the one-way ANOVA results and confirms that the variations in mean per capita income were statistically significant across the clusters (F (3,355) = 20.730, p = .05). Therefore, this finding confirms that the livelihood strategies that combine farming with non-farm activities have resulted in significantly higher per capita income.

Table 3. One-way ANOVA for mean per capita income

Source of variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22889255.33	3	7629751.78	20.730	0.000
Within Groups	130658733.40	355	368052.77		
Total	153547988.73	358			

Source: Based on the sample survey.

The distribution of households in each cluster according to income terciles is provided in Table 4. This classification is provided to determine whether households in the low and high income groups differ in terms of the livelihood strategies chosen.

Table 4. Distribution of cluster membership

	Total sample		Top 20%		Middle 40%		Bottom 40%	
Clusters	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
1	162	45.1	4	12.9	58	34.3	100	62.9
2	59	16.4	2	6.5	24	14.2	33	20.8
3	68	18.9	16	51.6	46	27.2	6	3.8
4	70	19.5	9	29.0	41	24.3	20	12.6
Total	**359**	**100.0**	**31**	**100.0**	**169**	**100.0**	**159**	**100.0**

Source: Based on the sample survey.

In general, the distribution of households from each livelihood cluster is quite even in the middle 40 per cent income group. This is in contrast to the uneven distribution of cluster memberships in the high and low income groups. A majority of the households in the low income group (63 per cent) as well as 34 per cent from the middle income group mainly consisted of those who chose Cluster 1, which is the cluster with the lowest average income compared to the other livelihood clusters. About 96 per cent of their income came from farming and only 2 per cent from non-farm activities. In contrast, households in Cluster 3 fall in the high and middle income groups. In terms of percentage, 52 per cent of the households were in the high income group, while 27 per cent belonged to the middle income group. This cluster contributed to the highest per capita income to households, which was about RM1,310 per month, with the main source emanated from non-farm income (61 per cent) and only 37 per cent came from farm income. The fact that only 19 per cent of the sample chose Cluster 3 as their livelihood strategy, suggest the existence of barriers for adopting the most remunerative livelihood cluster.

In order to further describe each of the livelihood strategies, Table 5 provides data on asset ownership for each cluster. Cluster 1 is the largest cluster which was the option for 162 households, or 45 per cent of

the total household in the sample. Therefore, this cluster was the most common livelihood in the Sungai Besar granary area. Households in this cluster had the lowest level of average education compared to the households in the other three livelihood strategies. In terms of landholdings, these households had the mean cultivated area of about 2.3 hectares, which is the second highest after those in Cluster 4 with a holding size of 2.4 hectares. On average, they had the second highest average value of agricultural implements owned (RM4,841). Most of the equipment, such as multi-purpose sprayers, grass cutter, and water pumps, they possessed were merely used on their farms.

Table 5. Summary statistics of household assets by livelihood strategies

	Total sample (N = 359)		Cluster 1 (N = 162)		Cluster 2 (N = 59)		Cluster 3 (N = 68)		Cluster 4 (N = 70)	
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Human capital										
Age of household head (years)	52	10.92	52	11.42	53	10.51	52	10.33	53	9.64
Number of household members	4.06	1.68	4.10	0.92	4.22	1.73	4.97	1.61	3.91	1.58
Number of dependents	1.11	1.25	1.17	0.10	1.15	1.30	0.99	1.13	1.04	1.21
Number of working member	2.98	1.30	2.54	0.10	2.87	1.23	3.76	1.42	2.99	1.27
Average education of working age labour (years)	9.54	5.95	7.16	2.62	9.17	2.18	10.93	12.70	9.39	2.18
Natural capital										
Total cultivated area (hectares)	2.09	1.26	2.27	1.26	1.85	1.24	1.54	0.87	2.40	1.41
Percentage of land owned	65.43	40.13	65.87	37.78	58.48	46.10	71.54	40.97	64.31	39.10
Financial capital										
Share of other non-farm income	3.80	8.67	1.29	3.87	4.25	6.58	6.38	11.65	6.71	12.63
Physical capital										
Value of equipment (Ringgit)	5410.89	3618.10	4840.91	3087.92	6560.25	3947.15	5275.29	5892.97	4488.86	4090.13
Social capital										
Social capital index	86.93	9.52	86.41	8.88	88.56	9.36	75.57	7.92	88.10	12.07
Locational capital										
Time taken to reach rural town (minutes)	24.62	5.24	28.44	5.30	24.49	4.90	20.49	4.49	27.57	4.98

Source: Based on the sample survey.

Note: Cluster 1 is highly specialized in farming; Cluster 2 is farming/agricultural-wage employment; Cluster 3 is specialization in non-farm employment; and Cluster 4 is farming/non-farm employment. The reference category is Cluster 1: highly specialized in farming.

The households in Cluster 2 represent the smallest cluster with only 16 per cent of the total sample (59 households), making it the least common livelihood strategy. Households in this cluster had the mean cultivated area of about 1.9 hectares, signifying the significant contribution of farm income in the total household income. The mean value of farm equipment owned is the highest among the four clusters with an average of RM6,560 per household. In addition to multipurpose blowers, grass cutters and water pumps, the households in this cluster also owned tractors (either two-wheels or 4-wheels), which were used in land preparation, either on their own farms or on other farms with a certain amount of payment. By providing agricultural services to other farms, this has enabled all of the 59 households to supplement their household income with agricultural wage income, which was rather low (29 per cent of the total household income).

Cluster 3 represents only about 19 per cent of the total sample. The households in this cluster had the lowest number of dependents. On average, this cluster also had the highest number of working members and the highest level of education that became the pull factor for the household participation in non-farm employment. As a result of this, the share of non-farm labour income in the total household income for this cluster was 54 per cent, which was the highest compared to the other three clusters. Out of this percentage, 46 per cent were made up of non-farm wage income and 8 per cent were from self-employment income.

In terms of cultivated area, the households in Cluster 3 possessed the lowest cultivated landholding of only 1.54 hectares; hence they earned a low farm income (37 per cent of the total household income). However, with a greater participation in non-farm employment, these households earned more than double the average income of those in Cluster 1. The small size of cultivated land seems to "push" these households into alternative employment activities, such as non-farm activities. The non-farm employment gave these households an alternative to small landholdings which was consistent with the findings by de Janvry, Sadoulet and Zhu (2005) for rural China. This also implies that the households in this cluster are less vulnerable to risks associated with agricultural production compared to the other clusters. They also had the second highest average value for farm implements (RM5,275). This enables some of the households in this cluster to supplement their income with agricultural-wage employment. The proximity to rural town centres have encouraged the households to participate in non-farm employment.

The distinguishing feature of Cluster 4 is their largest size of cultivated area of about 2.4 hectares. This is reflected in their greater reliance on farming as the main source of income. Although the size of cultivated land was higher compared to those in Cluster 1, the contribution of farm income to the total household income was much lower to those in Cluster 1. Another comparable cluster is the households in Cluster 2, which received about the same amount of farm income (66 per cent) in the total household income, but with a much smaller size of cultivated land. The differences in the size of cultivated land and the share of farm income in total household income may be due to the difference in the cluster sizes, which contributed to the difference in the mean values for cultivated land size and share of farm income.

The mean educational years of all working members of the households in Cluster 4 was higher compared to those in Cluster 1. This may explain why the contribution of non-farm labour income was higher compared to those in Cluster 1. About 29 per cent of the households had at least one household member working in agricultural-wage employment. This was made possible partly by the types of farm implements they owned. The households in this cluster also had the lowest mean value of farm equipment owned (RM4,489). The types of farm implements were the same as those in Cluster 2.

The choice of a livelihood strategy is a polychotomous choice variable, hence multinomial logit (MNL) regression is used to explain the households' choice of a livelihood strategy (Greene 2008). Results of the MNL regression are shown in Table 6, with Cluster 1 as the reference category. Overall, the model is 64% accurate in predicting the selected livelihood strategies. More specifically, the households in Cluster 1 were predicted most accurately (88 per cent). This is followed by the prediction for the households in Cluster 3 with 60 per cent accuracy; Cluster 4 with 38 per cent accuracy and finally for the households in Cluster 2 with a 31 per cent accuracy.

The coefficients represent the effect of each variable on the ratio of the probability of the household selecting Cluster 1, which is the most common livelihood strategy among the households in the study area. The results show that the cultivated land sizes between 0.01 and 0.99 hectares (Land_cat1) as well as between 1.00 and 1.99 hectares (Land_cat2) were the significant determinants of household selection for a livelihood strategy. Both land size categories had an exponential coefficient (Exp (B)) of greater than 1 in the probability of selecting a diversified livelihood cluster. This means that the odds of selecting a diversified livelihood will significantly increase with any positive changes in these land categories. On the contrary, having a cultivated land of more than 2 hectares had a negative effect on the probability of selecting a diversified livelihood cluster. The greatest effect was on the selection of Cluster 3 where the odds of choosing Cluster 3 increased by a factor of 63, followed by a factor of 34 for the odds of choosing Cluster 4.

In addition to the above factors, the selection of Cluster 2 was also significantly affected by the share of other non-farm income, borrowing experience, and the value of equipment owned. All of these variables had positive coefficients (B) and Exp (B) values of greater than 1, which imply an increase in the odds of choosing Cluster 2 or a reduction in the probability of choosing Cluster 1. In particular, the odds of a household selecting livelihood Cluster 2 increased by 2 per cent for each additional percentage increase in the share of other non-farm income; a factor of 3 for households with borrowing experiences compared to those who did not have such experience; and 39 per cent for each additional percentage increase in the value of farm equipment owned. In contrast, each additional percentage increase in the size of cultivated land reduced the probability of choosing Cluster 2 by 68 per cent.

The odds of selecting Cluster 3 was also affected by household size (HSIZE), number of working members (WLabor) and average education of working members (EDU), in addition to the size of cultivated land and smaller land size categories, i.e. category 1 (0.01 – 0.99 hectares) and category 2 (1.00 – 1.99 hectares). In particular, the odds of a household selecting livelihood Cluster 3 increased by 43 per cent for each additional year of education; 44 per cent for each additional increase the number of household per adult equivalent; 34 per cent for each additional increase in the number of working-age labour; a factor of 79 for households with land size category 1 and a factor of 14 for households with land size category 2 compared to households without each of these two land categories. Each additional percentage increase in the size of cultivated land also had a decreasing effect of 17 per cent on the probability of choosing a livelihood that is based on specialization in non-farm employment. The significance of education to the selection of Cluster 3 indicates that higher education level of working members is a form of barrier for other households to choose this more remunerative cluster.

Table 6: Determinants of livelihood strategies (multinomial logit regression)[a]

Variable	Cluster 2			Cluster 3			Cluster 4		
	B	Std. Error	Exp(B)	B	Std. Error	Exp(B)	B	Std. Error	Exp(B)
AGE	0.02	0.18	1.02	-0.12	0.32	0.89	0.01	0.02	1.01
HSIZE	0.05	0.19	1.05	0.37	0.15	1.44**	0.26	0.19	1.30
WLabor	0.88	0.79	1.08	0.35	0.12	1.34**	0.17	0.48	1.18
DEPENDENTS	-0.32	0.25	0.73	-0.06	0.23	0.94	-0.08	0.22	0.92
EDU	-0.27	0.28	0.76	0.36	0.17	1.43**	0.27	0.43	1.31
LandSize	-0.08	0.03	0.92**	-0.19	0.06	0.83**	-1.28	0.27	0.25**
LandOwned	-0.12	0.11	0.89	-0.09	0.57	0.92	-0.15	0.59	0.86
Cultivated land category[a]									
Land_cat1	3.17	1.67	23.81**	4.15	2.18	63.43**	3.51	2.14	33.45**
Land_cat2	2.13	1.13	8.41**	3.25	1.83	25.79**	2.61	1.61	13.60**
Land_cat3	-2.43	1.73	0.09	-2.18	1.87	0.11	-2.13	1.95	0.12
Land_cat4	-1.73	1.62	0.18	-1.59	1.18	0.20	-1.22	1.15	0.30
ONFY_share	0.02	0.01	1.02**	0.03	0.25	1.03	0.49	0.23	1.63**
CREDIT	1.14	0.46	3.12**	0.75	0.61	2.11	1.03	0.47	2.80**
EQUIP	0.33	0.15	1.39**	-0.04	0.50	0.97	-0.08	0.45	0.93
SC	1.13	0.87	8.44	0.11	0.27	1.12	0.03	0.04	1.03
DTIME	-0.07	0.89	0.93	-0.28	0.74	0.75	-0.18	0.83	0.85
AREA	0.05	0.41	1.05	0.16	0.44	1.18	-0.14	0.40	0.87
Pseudo R-Square	0.58								
Percent correctly predicted	63.69%								

Source: Based on the sample survey.

Note:
Cluster 1 is highly specialized in farming; Cluster 2 is farming/agricultural-wage employment; Cluster 3 is specialization in non-farm employment; and Cluster 4 is farming/non-farm employment. The reference category is Cluster 1: highly specialized in farming.
[a]Land_cat1 = 0.01-0.99 ha; Land_cat2 = 1.0-1.99 ha; Land_cat3 = 2.0-2.99 ha; and Land_cat4 = more than 3.0 ha.

As with Cluster 2, the odds of selecting Cluster 4 were also affected by share of other non-farm income and borrowing experience. The odds of choosing livelihood Cluster 4 augmented by 63 per cent for each additional percentage increase in the share of other non-farm income and a factor of 2.8 for households having borrowing experiences. However, as with the odds of choosing Clusters 2 and 3, the size of cultivated land also had a decreasing effect on the odds of choosing Cluster 4. Each additional percentage increase in the size of cultivated land also decreases the probability of choosing Cluster 4 by 75 per cent, which is the largest negative effect compared to the selection of the other two clusters.

Social capital as represented by the social capital index has a positive effect on the selection of all three livelihood strategies compared to Cluster 1; however, the effect is not significant. The positive effect

implies that an increase in the index of social capital will increase the probability of choosing livelihood Clusters 2, 3, and 4 while decreasing the probability of choosing livelihood Cluster 1. This is because being self-employed in businesses and securing employment in someone else's farm, either as a hired labour or agricultural services providers to other farmers, requires some level of networking. The greater the level of networking, the greater is the probability of being employed in agricultural-wage activities and non-farm self-employment.

The value of farm implements owned by farm households is another household asset found to be insignificant on the selection of a livelihood strategy except for Cluster 2. This variable had a negative effect on the probability of choosing Cluster 3 and Cluster 4 compared to Cluster 1. On the other hand, the value of farm equipment owned decreased the probability of choosing Cluster 1 compared to Cluster 2. With more farm equipment, the households were able to reduce their cost of paddy production; hence it increased the probability of choosing a livelihood strategy that is based on being highly specialized in farming. It also opened a greater opportunity for the households to participate in agricultural-wage employment, which reduced the probability of choosing highly specialized in farming.

5. Conclusion

The objective of this study was to identify the determinants of livelihood strategies of a paddy farming community in Malaysia. Using cluster analysis, this study extracted four livelihood strategies, i.e. highly specialized in farming (Cluster 1); farming and agricultural-wage employment (Cluster 2); specialization in non-farm employment (Cluster 3); and farming and non-farm employment (Cluster 4). The results show that the households adopting a livelihood strategy that combined farming and non-farm activities earned significantly higher incomes than the households, who were heavily specialized in farming.

The multinomial logit regression used has identified assets determining livelihood strategies for higher household incomes. The households in Cluster 3 were much better-off in terms of income relative to the other households. This finding implies that even without a sizable cultivated land, the households in Cluster 3 were able to earn higher per capita income because they had higher education, compared to the households in the other clusters. However, higher education can also serve as a barrier for choosing this higher return livelihood cluster. An in-depth study of the successful livelihood strategy of households in this cluster in future research could provide more insights on how to overcome poverty traps, especially among farm households located in less developed states in Malaysia.

Policy lessons can also be drawn from land-rich households in Cluster 4, which has the highest average cultivated land area. Policies targeting these relatively land-rich households should focus on incentives that would increase their paddy production. The households in Cluster 2 had a much smaller average cultivated land compared to the households in Cluster 4, but the contribution of farm income to the total household income was much higher for the households in Cluster 2. Efforts must be made in the future research to analyze why households with relatively abundant land are not producing more paddy. As market-oriented producers are faced with higher risks compared to subsistence farmers, a greater access to credit facilities may be an important factor to income diversification.

Interestingly, the percentage of land owned had no significant statistical association with the selection of livelihood strategies. This suggests that greater land ownership alone is not a guarantee for higher income. The combination of owned and rented land significantly decreased the probability of choosing a diversified livelihood strategy, hence reducing the probability of earning higher income. This also implies

that greater land ownership is also associated with a higher probability of a household choosing to be highly specialized in farming.

The higher social capital index for the studied households implies greater participation in some form of association which could assist in securing access to start-up capital, credit and networks for marketing their products and services. Policies must be focused on enhancing the potential of the local off-farm labour markets and small-scale businesses that would absorb the surplus rural labour. If a significant number of low-income farmers are able to generate income from local off-farm activities they may spend or invest the increase in earnings in other sectors in the local economy. This would further spur local economic development. In general, this study concludes that in implementing policies targeted for specific rural groups, the initial step is to identify the barriers for specific rural household groups. Policy interventions should be distinctive and should be targeted at diverse groups of vulnerable Malaysian farmers.

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