Financial Capacity of Rice-based Farming Households in the Mekong Delta, Vietnam

Le Canh Dung
Mekong Delta Development Research Institute
Can Tho University, Can Tho, Vietnam
Email: lcdung@ctu.edu.vn

Vo Van Ha
Mekong Delta Development Research Institute
Can Tho University, Can Tho, Vietnam
Email: vvha@ctu.edu.vn

Vo Van Tuan
Mekong Delta Development Research Institute
Can Tho University, Can Tho, Vietnam
Email: vvtuan@ctu.edu.vn

Dang Kieu Nhan
Mekong Delta Development Research Institute
Can Tho University, Can Tho, Vietnam
Email: dknhan@ctu.edu.vn

John Ward
Mekong Region Futures Institute
Bangkok, Thailand
E-mail: john.ward@merfi.org

Peter Brown
Commonwealth Scientific and Industrial Research Organization, Canberra, Australia
Email: Peter.Brown@csiro.au

ABSTRACT

This study examines financial capacity of various types of rice farming households in the Mekong Delta. Household financial capacity was elicited and quantified through interviews with 449 households practicing rice-based farming systems in four agro-ecological zones of the Mekong Delta. Household net income, long-standing debt, and savings represent the three key parameters of household financial capacity. Analysis of farm size classes revealed that financial capacity was weak, especially among households with farms that were less than one hectare. Agricultural production was the primary component of household net income. The level of diversity of non-rice crops did not contribute significantly to increased household income. Net household income was positively correlated with farm size, land use circle (i.e., number of crops in a field), and non-farm activities. Mean household savings accounted for 27 percent of total net household income, and mean long-term debt was 11 percent of household savings. The low financial capacity of rice-based farming households introduces substantial challenges for Mekong Delta farmers to recover production costs caused by irregular weather patterns associated with climate change.

Keywords: financial capacity, rice-based farming system, household, Mekong Delta

JEL Classification: Q12

INTRODUCTION

Household livelihood is comprised of capabilities, assets, and activities required to derive a means of living (Chambers and Conway 1992; Scoones 1998; Leach et al. 1999; Pretty and Ward 2001). The status of household or community livelihood attributes through time is conditional on the interactions between the current capacities, entitlements, resource endowments, institutional arrangements, and conditions of the environment where the people are located (Sen 1981; Devereux 2001). The effects of climate change on the rice-dominant Mekong Delta have introduced increasingly disadvantageous conditions for rice farmers (UNEP 2011; McElwee 2010).

Kabir et al. (2012) contend that household financial capacity is associated with access to seasonal credit support, production profit, and saving after harvesting, which aggregately affect current and near future livelihood status. Moreover, financial capacity is one of the five livelihood capitals proposed to play an important role in constraining or enabling adaptive capacity of small holdings (Chambers and Conway 1992; Scoones 1998). Weak financial capacity is argued to decrease adaptive capacity by reducing the proximity of households to natural resources of higher quality, decreasing the number of options to manage risk, and limiting strategies to recover rapidly from substantial household shocks (DFID 2004). In reference to climate change, households with low financial capacity will be more vulnerable to acute shocks (Poverty Task Force 2002), less resilient, more constrained in accessing insurance and credit (Duy 2012), less able to rebuild or emigrate from affected areas, and more exposed to health hazards (Few and Pham 2010).

Estimating the financial capacity of Mekong Delta households is necessary in identifying adaptive strategies and livelihood outcomes of households exposed to the uncertain consequences of climate change. The objectives of this paper are to quantify three critical parameters of rice-based farming households' financial capacity: net annual farm income, long-standing debt, and annual savings. Data collection was conducted between January and December 2011, and the research was completed in March 2012. Agricultural production in the rice-dominant Mekong Delta is highly vulnerable to fluctuations in water resource accessibility due to upstream hydrological dam construction and extreme weather variations under climate change (Wassmann et al. 2004; Dasgupta et al. 2007; Carew-Reid 2007; Greancen and Palettu 2007). This study, which was carried out in the context of natural and human-induced hazards, offers insight into the adaptive capacity of local rice producers.

METHODS

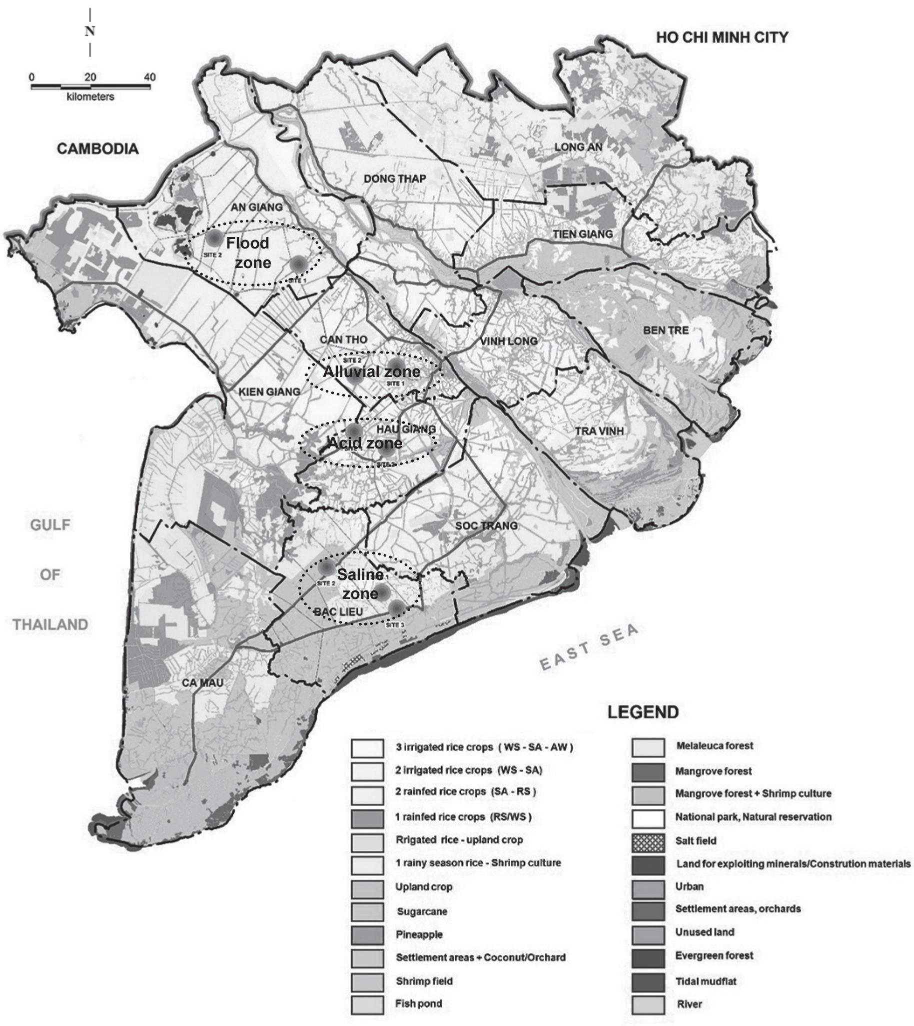
Research Site and Sample Selection

In the Mekong Delta, 1.7 million hectares (ha) of approximately 4 million ha of land are devoted to rice production. Irrigation infrastructure and technological interventions have enabled rice production in four different agro-ecological zones associated with variable cropping calendars. In addition to 2 rice crop and 3 rice crop monoculture patterns, non-rice crops are rotated or integrated in rice production. The following are the six rice-based farming systems (RBFS) evaluated in this study: (1) 2 rice crops (2R), (2) 3 rice crops (3R), (3) 2 rice crops-upland crop (2RU), (4) 2 rice crops-fish (2RF), (5) 3 rice crops-fish (3RF), and (6) rice-shrimp (RS).

Constrained access to labor resources and perceived risks of producing for novel, untried markets have limited non-rice crop production on suitable household-owned land. In contrast, non-rice production occurs on biophysically favorable plots and adheres to existing land-use policies, enabling autonomous household management. Figure 1 illustrates the geographical distribution of the RBFS located in the provinces of An Giang, Can Tho, Hau Giang, and Bac Lieu. It also illustrates the location and boundaries of the four corresponding agro-ecological zones: flood, alluvial, acid soil, and saline.

Access to freshwater and proximity to associated protective dike systems are two principal factors that shape farming patterns. Rice monoculture patterns, either 2R or 3R, exists in all agro-ecological zones. The rice-upland crop and rice-fish/shrimp patterns are specific to the acid soil and saline zones. Table 1 shows the number of sampled households practicing the six RBFS.

Figure 1. Distribution of RBFS in four agro-ecological zones



Source: Ngo Dang Phong and Reiner Wassmann et al. (2016)

Table 1. Number of sampled households by rice farming pattern and agro-ecological zone

Pattern Code	Agro-ecological Zone (Province)				Total
	Flood (An Giang)	Alluvial (Can Tho)	Acid Soil (Hau Giang)	Saline (Bac Lieu)	
2 rice crops (2R)	32	13	27	5	77
3 rice crops (3R)	56	62	70	25	213
2 rice crops-upland crop (2RU)	5	2	11	0	18
2 rice crops-fish (2RF)	0	8	11	0	19
3 rice crops-fish (3RF)	0	36	5	0	41
Rice-shrimp (RS)	0	0	0	46	46
Total (N)	93	121	124	76	414

Financial Capacity Indicators and Analysis Methods

Household financial capacity was estimated according to observed total household income, debt, and savings. The significance of determinant factors that influence total household income and saving capacity was estimated through multiple and binary regression functions, respectively.

Total Household Income

Total household income is the aggregate gross income accrued from all economic activities of a household. Household income and its composition were quantified by agro-ecological zone and farm size category. In addition to descriptive figures of household income, internal factors and farming categories of households that might influence household income were analyzed in each agro-ecological zone. This was analyzed through multiple regression analysis, in which a generic function is defined as follows, and an enter method to identify significant variables ($p<0.05$):

$$Y = \beta_0 + \beta_n X_n + \varepsilon \qquad (1)$$

where:

Y = Dependent variable; total household net income (USD per household per year),

X_n = Explanatory independent variables, including:

- X_1 = Age of household head (year)
- X_2 = Gender of household head (dummy variable, receives a value of 1 if the head is male and 0 if the head is female)
- X_3 = Education of household head (ranges from 0 to 4 and corresponds to five levels: illiterate, primary, secondary, high school, and college or university)
- X_4 = Association of household head (dummy variable, receives a value of 1 if the head is a member of a community-based organization [CBO] and 0 if the head is not a member of a CBO)
- X_5 = Labor force (number of persons in working age of 15–60 for male and 15–55 for female)
- X_6 = Non-farm activity (dummy variable, receives a value of 1 if the household has non-farm activity and 0 if the household does not have non-farm activity)

X_7 = Upland crop (dummy variable, receives a value of 1 if the household practices upland cropping and 0 if the household does not practice upland cropping)

X_8 = Aquaculture (dummy variable, receives a value of 1 if the household practices the rice-fish or rice-shrimp pattern and 0 if the household does not practice the rice-fish or rice-shrimp pattern)

X_9 = Land use circle (number of crops cultivated in the field, ranges from 2 to 4 and corresponds to any of the RBFs from 2R to 3RF

X_{10} = Farm size (ha)

ε = error, assumed to be normally distributed

Long-standing Debt

Long-standing debt is the value of total debt that households had incurred in the past three years and remained owing to creditors at the time of the survey. As long as a debt is a parameter of financial capacity, a larger residual debt is assumed to correspond to a weaker household financial capacity. The proportion of debt relative to the level of household savings in the current year was calculated and used as a proxy for household payment capacity.

Savings

Savings is defined as the amount of remaining cash after annual living expenditure is subtracted from annual total household income and compared across agro-ecological zones. A binary regressive model was used to estimate variables that significantly influence the saving capacity of a household by agro-ecological zone. The dependent variable (*Y*) represents household saving possibility, while the independent variables are household resources and attributes hypothesized to affect saving capacity. The binary regressive function has a linear form as follows:

$$Ln\left[\frac{P(Y=1)}{P(Y=0)}\right] = \beta_0 + \beta_1 X_1 + \ldots + \beta_n X_n \tag{2}$$

where:

Y_i takes 2 values of 0 or 1 with two different meanings:

$$Y_i = \begin{cases} 1\text{: if the event of saving occured} \\ 0\text{: if the event of saving did not occur} \end{cases}$$

$P_i = P(Y_i=1/X_i)$ is the probability that saving occurred or did not occur in response to variation in the X_i values, $(0 \leq P_i \leq 1)$

X_i = Explanatory independent variables, including:

X_1 = Household size (person)

X_2 = Farm size (ha)

X_3 = Land use circle (number of crops cultivated in the field, ranges from 2 to 4 and corresponds to any of the RBFs from 2R to 3RF

X_4 = Upland crop (dummy variable, receives a value of 1 if the household practices upland cropping and 0 if the household does not)

X_5 = Aquaculture (dummy variable, receives a value of 1 if the household practices the rice-fish or rice-shrimp pattern and 0 if the household does not practice the rice-fish or rice-shrimp pattern)

X_6 = Non-farm activity (dummy variable, receives a value of 1 if the household has non-farm activity and 0 if the household does not have non-farm activity)

RESULTS AND DISCUSSION

Household Resources

Land Endowment and Land Use Distribution

Land endowment is one of the most important variables that affect potential economic earning and subsequent financial capacity of farming households in the rice-dominant Mekong Delta. Table 2 shows the mean size of landholdings of sampled households, and the area and proportion of land devoted to rice production across the four agro-ecological zones. The mean area of rice land of all farms in the Mekong Delta is 1.4 ha (GSO 2012). The mean area of sampled farms was 2.03 ha. The standard deviation of land size revealed substantial variance in farm size in the four agro-ecological zones. ANOVAs identified significant differences in farm size and rice land across the four zones ($F=9.477$, $df=3$; $F=18.730$, $df=3$; $p<0.05$).

The mean share of rice land was 84.21 percent of household land across the four agro-ecological zones. In the flood zone, rice was cultivated intensively on 94.15 percent of household land, while non-rice crops were not produced widely. The mean percentage of land used for rice production in the alluvial, acid, and saline zones were 87.15 percent, 79.16 percent, and 75.48 percent, respectively. The balance of land used was for the production of non-rice crops, as well as fish or shrimp, to supplement household income.

Among sampled households, the percentage of small farms that were less than 1 ha was 16.1 percent in the flood zone and 18.4 percent in the saline zone. Higher percentages of this category were found in alluvial and acid soil zones, which ranged from 26.6 percent to 36.6 percent of 49.2 percent of sampled households, respectively. In contrast, the percentage of farms that were larger than 3 ha was 34.4 percent in the flood zone, 22.4 percent in the saline zone, 12.9 percent in the acid zone, and 9.1 percent in the alluvial zone. Figure 2 illustrates the unequal distribution of farm size categories across the four agro-ecological zones.

Rice is a dominant crop in the region. However, since the economic return of rice has no significant effect on total household income; livelihood strategies of rice-based households are formed differently by their farm-size categories. For improving household income, rice-based households with small farm sizes usually focus on farming diversification; in contrast, larger farm-size households often intensify rice production.

Human resource

Table 3 shows the main attributes of human and social resources of the sampled households. The mean size of a farming household was 4.25 persons. The on-farm labor force was approximately three people per household or 72.20 percent of household size. For the household labor force, 18.25 percent was

Table 2. Farm size and rice land by agro-ecological zone

Parameter	Flood	Alluvial	Acid Soil	Saline	Total
Farm size (per ha)	2.78 ± 2.21^{a}	1.59 ± 1.11^{b}	1.75 ± 1.24^{b}	2.55 ± 3.12^{a}	2.08 ± 1.98
Rice land (per ha)	2.67 ± 2.19^{a}	1.37 ± 1.00^{b}	1.40 ± 1.07^{b}	1.72 ± 1.20^{b}	1.73 ± 1.49
Share of rice land (%)	94.15 ± 13.30^{a}	87.15 ± 13.98^{b}	79.16 ± 16.27^{c}	75.48 ± 18.11^{c}	84.21 ± 16.76

Note: Numbers with the same superscript within a row are not significantly different at 5% level by Tukey's test; hh = household engaged in non-farm activities. The differences for all variables across the four zones were not significant ($p \geq 0.05$).

Dung (2010) contends that education level and social network influence the managerial capacity of the household head and are important factors of production efficiency. Table 3 shows that the mean education level of the household head in all zones corresponded to a moderate level of middle secondary school. Household head education in the flood zone was significantly higher compared to the other three zones ($F=3.808$, $df=3$; $p<0.05$).

The social network of rice farming households in the region was referenced by the household head's membership in the local

Figure 2. Distribution of farm size categories in four agro-ecological zones

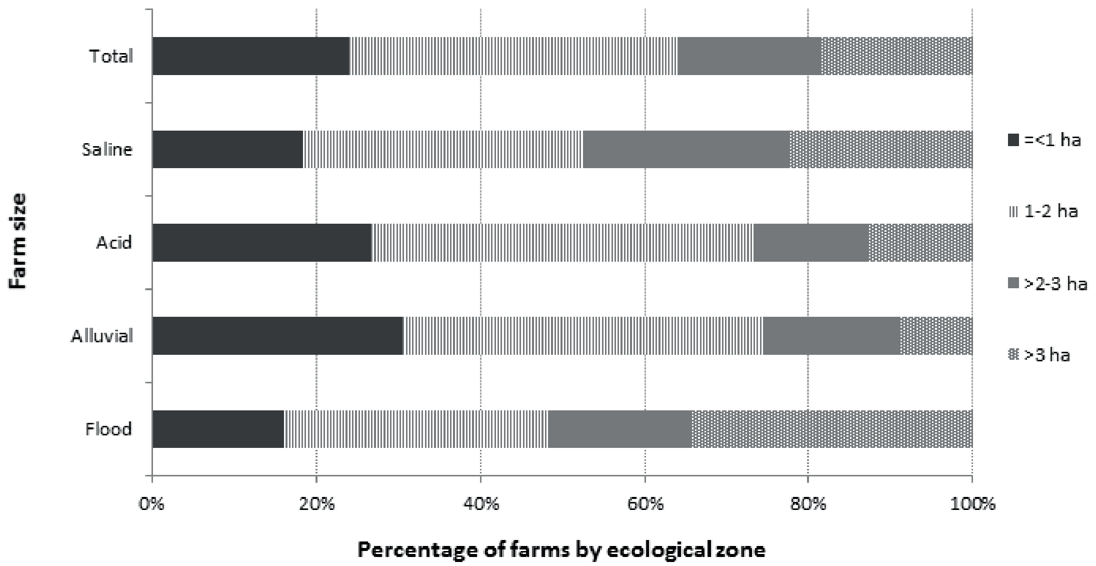


Table 3. Main characteristics of household human resource by agro-ecological zone

Parameter	Flood	Alluvial	Acid Soil	Saline	Total
Age of head (year)	50.31±11.54[a]	51.26±12.71[a]	54.02±12.24[a]	50.61±11.84[a]	51.76±12.21
Head education (level)	1.75±0.88[a]	1.38±0.78[b]	1.60±0.88[ab]	1.66±0.80[ab]	1.58±0.85
Household size (person)	4.25±1.14[a]	4.46±1.31[a]	4.44±1.37[a]	4.38±1.28[a]	4.39±1.29
Labor (person)	2.94±1.15[a]	3.07±1.26[a]	3.26±1.35[a]	3.29±1.23[a]	3.14±1.26
Labor rate (%)	70.14±21.22[a]	69.49±22.71[a]	73.74±25.11[a]	76.51±21.45[a]	72.20±22.99
Non-farm labor (person)	0.47±0.76[a]	0.68±0.93[a]	0.65±0.98[a]	0.62±1.06[a]	0.61±0.94
Non-farm labor rate (%)	14.55±23.35[a]	22.09±30.48[a]	18.01±26.91[a]	17.04±28.25[a]	18.25±27.56
Participation in CBO (%)	30.11	32.23	37.90	23.68	31.88

Note: Number with the same superscript within a row is not significantly different at 5% level by Tukey's test; education level: 0 = illiterate, 1= primary from class 1 to 5, 2 = secondary from class 6 to 9, 3 = high school from class 10 to 12, 4 = college or university

CBOs, such as Farmer Association, Agricultural Cooperatives, Agricultural Extension Club, and Rice Seed Production Club. Numerous CBOs have been formed in the Mekong Delta. However, their role in production outcomes and relative influence across zones have not been fully explored. Household heads in the alluvial and acid soil zones seem to have participated in CBOs at a faster rate than those in the flood and saline zones. However, the Chi-square test revealed no significant difference among them (Pearson Chi-Square = 0.207, df = 3).

Financial Capacity

Household Net Income

Table 4 shows the household net income by agro-ecological zone. Household income is one of the three hypothesized components of financial capacity. The income of sampled households came from diverse economic activities and was not constrained to farming activities. However, income derived from farming activities had the largest share in the total household income. The mean annual household income was USD 5,919. On-farm activities contributed 85.15 percent to the total household income.

The mean total household income ranged from USD 4,456 (acid soil) to USD 9,860 (flood) across agro-ecological zones. Income in the flood zone was significantly higher than in the remaining zones (F=19.585, df=3; $p<0.05$). Rice was the dominant crop in the flood zone and had the largest share in the total household income. In alluvial, acid, and saline zones, where the majority of households had small and medium farms, income derived from non-farm activities had a large share in the total household income.

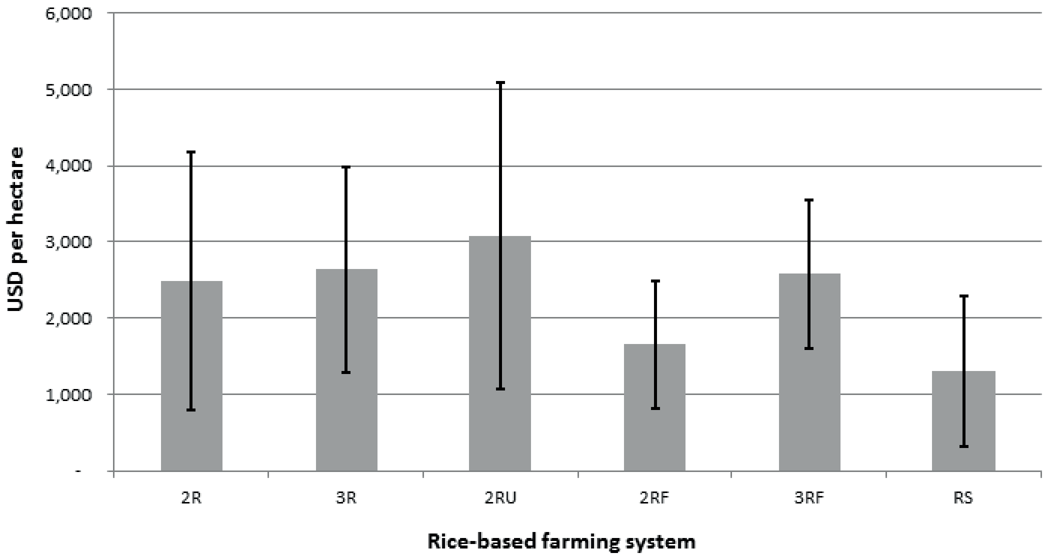
The household net income was obtained primarily from on-farm activities (85.15%), which was characterized by diverse RBFS. Figure 3 illustrates the gross margin of six RBFS in the four agro-ecological zones. The mean gross margin ranged from approximately USD 1,200 to more than USD 3,000 per ha. The 2R, 3R, and 3RF RBFS increased their gross margin according to land use ratio from 2 to 3, respectively. The 2RU was characterized by a substantially increased mean gross margin associated with high variability.

Table 4. Household net income (USD) by agro-ecological zone

Zone	On-farm	Non-farm	In-kind Gift	Total
Flood	8,982±8,468[a] (88.58)	08±63[a] (0.10)	870±1,716[a] (11.32)	9,860±8,984[a] (100.00)
Alluvial	3,967±3,255[b] (85.49)	109±882[a] (1.34)	608±1,300[a] (13.18)	4,684±3,594[b] (100.00)
Acid soil	3,388±2,993[b] (83.54)	100±725[a] (1.17)	969±3,198[a] (15.28)	4,456±4,572[b] (100.00)
Saline	4,637±4,798[b] (83.05)	26±147[a] (0.56)	786±1,502[a] (16.39)	5,449±4,887[b] (100.00)
Total	5,043±5,530 (85.15)	68±624 (0.87)	808±2,150 (13.98)	5,919±6,076 (100.00)

Note: Numbers in parentheses are percentage of income structure; exchange rate: 1 USD = 20,000 VND by 2011; number with the same superscript within a column is not significantly different at 5% level by Tukey's test

Figure 3. Gross margin of six RBFS in four agro-ecological zones



Determinants of Household Net Income

Subject to the biophysical, social, and economic conditions characterizing each agro-ecological zone, household net income was treated as a function of resource endowments, access to labor force, and management capacity generically described previously. Enter Method regressed household net income against explanatory variables for households practicing RBFS in the four agro-ecological zones. Table 5 shows the multi-variable regression results by agro-ecological zone.

Farm size, land use circle, and CBO participation influence household net income significantly. The participation of the household head in a CBO, which primarily represents the management capacity of the household, was significant at $p<0.10$. The coefficient of the land use circle, which represents the intensity of rice production, indicates that it is the most influential variable in the net income of households in the flood zone. Farm size and land use circle were significant at $p<0.05$.

Household income in the alluvial zone was significantly dependent on the variance in farm size, upland cropping practice, and non-farm activity. Fish was not significant, although it was rotated or integrated in rice production. A relatively small production area for upland crops, household labor force limitations, and risks associated with entering novel markets are possible causes of a moderate level of coefficient for upland crops.

In the acid soil zone, variance in household income was dependent on on-farm income as well as income derived from non-farm and off-farm activities. A small farm size combined with reduced agricultural productivity because of acid soil are likely factors that compel households to seek additional income through non-farm and off-farm activities (e.g., selling labor).

In the saline zone, variance in household income is a function of both farm and off-farm income represented by labor force coefficient. Off-farm activities represent additional income sources that households in this zone seek during periods of reduced returns from RS and 3R farming.

Generally, household incomes in the four agro-ecological zones are primarily influenced by farm size and land use circle, and partly by off-farm, upland cropping, and non-farm activities.

Table 5. Multi-variable regression results by agro-ecological zone

Variable	Coefficient (β) by Agro-ecological Zone	Non-farm	In-kind Gift	Total
	Flood	Alluvial	Acid	Saline
X1 (Age)	20^{ns}	-37*	0^{ns}	6^{ns}
X2 (Gender)	20^{ns}	8^{ns}	$1,654^{ns}$	856^{ns}
X3 (Education)	790^{ns}	-68^{ns}	697^{ns}	-127^{ns}
X4 (Head's association)	2,222*	-270^{ns}	$-1,185^{ns}$	207^{ns}
X5 (Labor force)	809^{ns}	188^{ns}	652**	889**
X6 (Non-farm)	$-1,116^{ns}$	1,037**	2,436***	242^{ns}
X7 (Upland crop)	-537^{ns}	708**	776^{ns}	$-1,384^{ns}$
X8 (Aquaculture)	$2,319^{ns}$	-564^{ns}	546^{ns}	91^{ns}
X9 (Land use circle)	2,598**	778^{ns}	918^{ns}	1,804**
X10 (Farm size)	3,216***	2,462***	1,530***	798***
Observation:	93	121	124	76
Significant value:	0.000	0.000	0.000	0.000
R2:	0.714	0.584	0.327	0.372
Durbin-Watson:	1.894	1.611	1.700	1.773

Note: Coefficients marked by *, **, and *** are significantly different at 10%, 5%, and 1% level, respectively; ns: not significantly different

Debt and Saving Capacity

Table 6 shows the amount of long-standing debt, which was either overdue or unpaid at the time of the survey, and savings after the annual production cycle across the four agro-ecological zones. The mean long-standing debt of all sampled households was USD 374 per household. There was no significant difference across zones. The mean annual savings was USD 1,586 per household, which was significantly higher in households located in the flood zone. Savings accounted for 27 percent of the total household net income, while the mean ratio of overdue debt to savings was 11 percent.

Household saving capacity was low in households with small farm sizes. Table 7 shows that 57 percent of households had money to save. The highest saved income, which was 68.8 percent, was in the flood zone. Households with farms that were less than 1 ha had a very low rate of saving at 8.5 percent.

Figure 4 illustrates that the amount of savings among households with saved income (saving volume >0) was dependent primarily on farm size. Households with less than 1 ha of land or less than 2 ha of land saved about USD 1,000 a year, indicating restricted capacity to manage increased costs of living and risks of climate change-induced reductions in agricultural productivity.

Determinants of saving possibility

Factors that contribute significantly to the saving capacity of zonal households were estimated using binary logistic regression. Table 8 shows the variable coefficients and regression statistics of saving capacity in the flood zone.

The proportion of correct predictions of the binary regression model is 73.1 percent of observations. Among the five variables assumed, farm size was the only variable that

Table 6. Long-standing debt and saving volume per household (hh) by agro-ecological zone

Agro-ecological Zone	Long-standing Debt (USD/hh)	Savings (USD/hh)	Savings over Total Net Income (%)	Debt/Save Ratio (%)
Flood	722±2435[a]	3,366±4778[a]	31±34[a]	15±5[a]
Alluvial	256±910[a]	1,004±1744[b]	29±90[a]	7±44[a]
Acid soil	259±718[a]	991±1465[b]	24±30[a]	13±68[a]
Saline	323.5±609[a]	1,308±2055[b]	25±40[a]	10±53[a]
Total	374±1348	1,586±2882	27±57	11±55

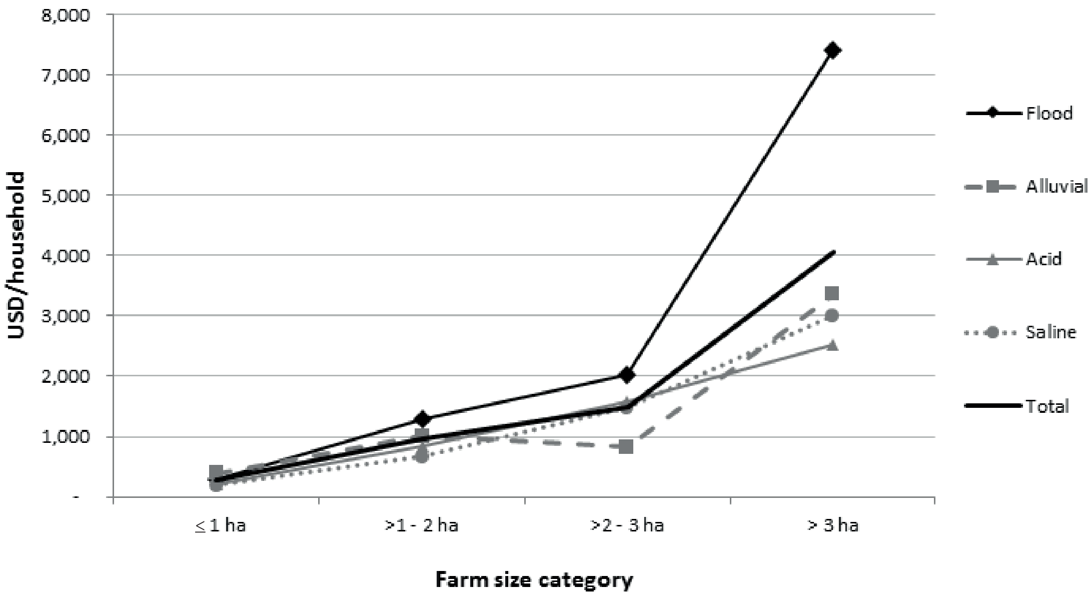
Note: Number with superscript within a column is not significantly different at 5% level by Tukey's test

Table 7. Percentage (%) of reported saved household income by agro-ecological zone and farm size category

Agro-ecological Zone	≤ 1 ha	>1 – 2 ha	> 2 – 3 ha	> 3 ha	Total
Flood	5.4	18.3	12.9	32.3	68.8
Alluvial	14.0	23.1	8.3	7.4	52.9
Acid soil	7.3	25.0	12.1	10.5	54.8
Saline	5.3	14.5	17.1	15.8	52.6
Total	8.5	21.0	12.1	15.5	57.0

Note: Number with the same superscript within a column is not significantly different at 5% level by Tukey's test

Figure 4. Savings by farm size and agro-ecological zone



increased saving ability by a scalar of 2.254 times. Therefore, farm size was the sole variable that significantly influenced household saving capacity.

Table 9 shows the results of binary logistic regression in the alluvial zone. The proportion of correct predictions of the binary regression model is 62.8 percent of observations. Despite the diversification of upland crops and the rotation of fish and rice, their low net return was significantly associated with farm size only, which increased household saving capacity by 1.531 times.

Table 10 shows the results of binary logistic regression in the acid soil zone. The proportion of correct predictions of the binary regression model is 71.8 percent of observations. Farm size significantly increased household saving capacity by a scalar of 1.85 ($p<0.05$).

Table 11 shows the results of binary logistic regression in the saline zone. The proportion of correct predictions of the binary regression model is 75 percent of observations. Farm size significantly increased household saving capacity up to 1.904 times ($p<0.05$). In the saline zone, freshwater is available for rice monoculture as well as the rotational RS system. A mean of saving capacity of households practicing the 3R system was 4.835 times compared to that of households practicing the 2R system. A mean of saving capacity of households adopting the RS system was 3.555 times compared to that of households practicing rice monoculture.

Table 8. Properties of the binary regression function on savings in the flood zone

Variables	B	S.E.	Wald	Df	Sig.	Exp(B)
X1 (Household size)	-0.483	0.253	3.649	1	0.056	0.617
X2 (Farm size)	0.813	0.240	11.495	1	0.001	2.254
X3 (Land use circle)	-0.202	0.533	0.144	1	0.705	0.817
X4 (Upland crop)	1.244	1.150	1.172	1	0.279	3.471
X6 (Non-farm)	0.099	0.592	0.028	1	0.867	1.104
Constant	1.450	1.753	0.685	1	0.408	4.265
-2 Log likelihood =89.045; Cox & Snell R Square=0.247; Nagelkerke R Square=0.347						

Table 9. Properties of the binary regression function on savings in the alluvial zone

Variables	B	S.E.	Wald	Df	Sig.	Exp(B)
X1 (Household size)	-0.160	0.156	1.050	1	0.306	0.852
X2 (Farm size)	0.426	0.232	3.386	1	0.066	1.531
X3 (Land use circle)	-0.833	0.610	1.867	1	0.172	0.435
X4 (Upland crop)	-0.492	0.368	1.782	1	0.182	0.612
X5 (Aquaculture)	-0.517	0.355	2.114	1	0.146	0.596
X6 (Non-farm)	0.388	0.392	0.976	1	0.323	1.473
Constant	2.706	2.067	1.714	1	0.190	14.966
-2 Log likelihood =157.621; Cox & Snell R Square=0.077; Nagelkerke R Square=0.103						

Table 10. Properties of the binary regression function on savings in the acid soil zone

Variables	B	S.E.	Wald	Df	Sig.	Exp(B)
X1 (Household size)	0.065	0.152	0.186	1	0.666	1.068
X2 (Farm size)	0.806	0.259	9.697	1	0.002	2.238
X3 (Land use circle)	-0.267	0.376	0.506	1	0.477	0.765
X4 (Upland crop)	-0.363	0.416	0.763	1	0.382	0.696
X5 (Aquaculture)	0.097	0.364	0.071	1	0.789	1.102
X6 (Non-farm)	0.301	0.421	0.510	1	0.475	1.351
Constant	-0.815	1.164	0.490	1	0.484	0.443
-2 Log likelihood =150.072; Cox & Snell R Square=0.154; Nagelkerke R Square=0.205						

Table 11. Properties of the binary regression function on savings in the saline zone

Variables	B	S.E.	Wald	Df	Sig.	Exp(B)
X1 (Household size)	-0.324	0.230	1.983	1	0.159	0.723
X2 (Farm size)	0.644	0.235	7.501	1	0.006	1.904
X3 (Land use circle)	1.576	0.476	10.971	1	0.001	4.835
X5 (Aquaculture)	1.268	0.551	5.291	1	0.021	3.555
X6 (Non-farm)	0.193	0.612	0.100	1	0.752	1.213
Constant	-3.715	1.522	5.959	1	0.015	0.024
-2 Log likelihood =80.101; Cox & Snell R Square=0.281; Nagelkerke R Square=0.375						

CONCLUSION AND RECOMMENDATIONS

This study examined several key parameters of the financial capacity of rice-farming households in four designated agro-ecological zones in the Vietnamese Mekong Delta. The aggregate income of households depended primarily on agricultural production (i.e., on-farm activities) and non-farm activities. Farm diversity, which relies on alternating agricultural production, had no significant contribution to household income. Net income was based mainly on farm size and land use factors, with partial contribution from non-farm activities. The participation of household heads in CBOs had a positive influence on the net income of farmers in the flood zones. It had no significant effect on household income in alluvial, acid soil, and saline zones.

Mean household savings were described as low to moderate at USD 1,586 per household per year, accounting for approximately 27 percent of the total household income. Households with small farm sizes had a lower proportion of savings compared to total income. Long-standing debt represented 11 percent of savings. The combined effect of low income and low saving capacity will likely escalate the challenge of managing long-standing debt among households with small farm sizes.

The analysis of financial capacity suggests that the efficiency of land use, primarily devoted to rice production, was not high. Diversification into alternate non-rice crops and aquaculture has no significant contribution to household income and saving capacity. In the saline and alluvial zones, diversification reduced household saving capacity, possibly due to risks associated with the fluctuating prices of these agricultural products. This problem intensifies pressure to expand intensive cultivation and develop supporting policies to increase the efficiency of land use, especially for households with farms that are less than 1 ha. Increases in non-agricultural employment had a positive and significant impact on the financial capacity of households across agro-ecological zones, suggesting a future rural policy initiative.

REFERENCES

Carew-Reid, J. 2007. "Rapid Assessment of the Extent and Impact of Sea Level Rise in Viet Nam." *Climate Change Discussion Paper 1.* Brisbane: International Centre for Environmental Management.

Chambers, R., and G. Conway. 1992. "Substantial Rural Livelihoods: Practical Concepts for the 21st Century." *Discussion Paper 296.* Brighton: Institute for Development Studies, University of Sussex.

Dasgupta, S., B. Laplante, C. Meisner, D. Wheeler, and J. Yan. 2007. "The Impact of Sea Level Rise on the Developing Countries: A Comparative Analysis." *World Bank Policy Research Working Paper 4136.* Washington DC: World Bank.

Devereux, S. 2001. "Sen's Entitlement Approach: Critiques and Counter-critiques." *Oxford Development Studies* 29 (3): 245–263.

DFID (Department for International Development). 2004. *The Impact of Climate Change on the Vulnerability of the Poor.* London: DFID.

Dung L.C., N.C. Toan, N.H. Tin, N.V.N. Em, and T.H.V. Kiet. 2011. "Effect of Management Capacity on Efficiency of Household Agricultural Production in the Mekong Delta." *Scientific Journal of Can Tho University* 18: 277– 286. http://sj.ctu.edu.vn/ql/docgia/tacgia-5770/baibao-5501.html (In Vietnamese)

Duy, V.Q. 2012. "Determinants of Household Access to Formal Credit in the Rural Areas of the Mekong Delta, Vietnam." *MPRA Paper No. 38202.* Ghent: Ghent University of Belgium.

Few, R., and G.T. Pham. 2010. Climatic Hazards, Health and Poverty: Exploring the Connections in Vietnam. *DEV Working Paper.* Norwich: School of International Development, University of East Anglia.

Greancen, C., and A. Palettu. 2007. "Electricity Sector Planning and Hydropower." In *Democratizing Water Governance in the Mekong Region* edited by L. Lebel, J. Dore, R. Daniel, and Y.S. Koma, 93-126. Chiang Mai: USER Mekong Press.

GSO (General Statistics Office of Vietnam). 2012. *Results of the 2011 Rural, Agricultural and Fishery Census.* Hanoi: Statistical Publishing House.

Kabir, M.S., X. Hou, R. Akther, J. Wang, and L. Wang. 2012. "Impact of Small Entrepreneurship on Sustainable Livelihood Assets of Rural Poor Women in Bangladesh." *International Journal of Economics and Finance* 4 (3): 265–280.

Leach, M., R. Mearns, and I. Scoones. 1999. "Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management." *World Development* 27 (2): 225–247.

Ngo Dang Phong, R. Wassmann, L.Q. Tri, N.X. Hien, N.T. Lang, L.V. Hoa, D.K. Nhan, N.H. Trung, C.V. Phung. 2016. Climate Change Affecting Land Use in the Mekong Delta: Adaptation of Rice-based Cropping Systems (CLUES): Final Report. Australian Centre for International Agricultural Research (ACIAR). Canberra, Australia. http://aciar.gov.au/files/smcn-2009-021_-_clues-finalreport.pdf

McElwee, P. 2010. "The Social Dimensions of Adaptation to Climate Change in Vietnam." *Development and Climate Change Discussion Paper No. 17.* Washington DC: World Bank. http://documents.worldbank.org/curated/en/955101468326176513/The-social-dimensions-of-adaptation-of-climate-change-in-Vietnam

Poverty Task Force. 2002. *Reducing Vulnerability and Providing Social Protection: Localizing MDGs for Poverty Reduction in Vietnam.* Hanoi: Poverty Task Force.

Pretty, J., and H. Ward. 2001. "Social Capital and the Environment." *World Development* 29 (2): 209–227.

Scoones, I. 1998. "Sustainable Rural Livelihoods: A Framework for Analysis." *Discussion Paper 72.* Brighton: Institute for Development Studies, University of Sussex.

Sen, A. 1981. *Poverty and Famines: An Essay on Entitlement and Deprivation.* Oxford: Clarendon Press.

UNEP (United Nations Environment Programme). 2011. *Guidebook on National Legislation for Adaptation to Climate Change.* http://hdl.handle.net/20.500.11822/9709

Wassmann, R., N.X. Hien, C.T. Hoanh, and T.P. Tuong. 2004. "Sea Level Rise Affecting the Vietnamese Mekong Delta: Water Elevation in the Flood Season and Implications for Rice Production." *Climate Change* 66: 89–107.