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The Contribution of Farmers to Irrigation Management for Agricultural Production in The Red River Delta Vietnam

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Abstract: In the Red River delta Vietnam, farm performance is dependent on the availability of water provided by public irrigation. With a well constructed irrigation system, farmers can increase their income by cultivating three crops per year. Hence participating in irrigation system management is necessary to improve their living. The aims of this paper are to examine the contribution of farmers to irrigation control for sustainable agricultural production. By analyzing primary data which is collected from the survey of 60 farm households, we discovered that irrigation management in this delta consists of several activities such as canals dredging, damaged canals repairing, checking the flow of water in canals and water pumping. In general, farmers contribute to these activities in two ways either in cash or working days. Around 70 percent of farmers contribute money to canal dredging and repairing annually, the rest are poorer so they support by their working days. Our regression model indicates that household income, the contribution of their neighbors, and frequency of attending social events in the community are main factors which statistically significant affect on farmers' contribution. Therefore, promoting the contribution of farmers to irrigation management is an appropriate policy that needs to be implemented.

Keywords: Contribution of Farmers, Irrigation Management, Agricultural Production, Red River delta, Vietnam

Introduction

"Water first, fertilizer second, diligence third, seed fourth" is an old Vietnamese proverb telling us the importance of irrigation in agricultural production. Being aware of that, the Government has invested in building and maintaining irrigation systems in order to support agricultural production. However, many old systems lacking of maintenance have been so degraded that they can not afford to water as well as to prevent flooding. Generally, just about 60% to 65% of designed capacity of the irrigation systems is used; meanwhile the required efficiency need to be 85% (Dao Huyen, 2012).

One of the main reasons leading to such a low effieciency is that irrigation system is a public product which every farm holders can use without paying maintenance fee, especially after the Government's policy of free, irrigation became effective. All maintenance and reparing works are performed by Government's budget. That is why producers do not have witting to maintain and repair irrigation systems. Besides, budget for maintenance is not always provided in time, especially for 3rd and 4th levels irrigation systems.

The Red River delta of Vietnam is characterized by high population density rates of around 1000 inhabitants per square kilometer, heavy agricultural intensity with almost three crops a year, and huge water control infrastructures with around 3000 kilometers of dykes (Binnie et al., 1995) and around 1700 irrigation and drainage

pumping stations (George et al., 2004) scattered along thousands of kilometers of irrigation/drainage canals. Irrigation systems in Red river Delta of Vietnam rely heavily on pumping (80% of 850000 ha) for the provision of irrigation and drainage services.

Yen Gia is a commune of Que Vo district which presents a typical irrigation system in the Red River region. This commune is located on a junction of three 1st order canals managed by North Duong River Irrigation Exploitation Company Limited. Yen Gia is in a trough area of Red River delta and has lowest elevation among the communes of Que Vo district. That is why irrigation is extremely important for agricultural production here. However, the irrigation systems have been built with very limited budget leading to low capacity and low efficiency of the systems.

While the maintenance budget from the governmental levels is very limited, contribution of farmers in repairing and upgrading the irrigation systems in Yen Gia commune is very necessary. This essential contribution raises several questions are: How much money farmers ready to contribute in terms of cash? How many days they willing to contribute in terms of working days? And, what factors impact on their contribution decision? The aims of this paper are to answer these questions, and to shed the light on policy recommendations which encourage farmers to share the Government's budget load for better managing and repairing the irrigation systems in the future.

Materials and Method

Materials: Review of irrigation systems in Vietnam

Criterion of irrigation system

Intra-field irrigation system is a small-scale infrastructure contruction in the last level of an irrigation system to exploit advantage aspects, to prevent disadvantage aspects, and to keep ecological balance. This system directly supplying water to plots includes sluice-gates, pump stations, water pipes, canals, constructions on the canals, and edges.

The main function of intra-field irrigation systems is to regulate water on plots. They decide the way of water regulation and efficiency of water use, especially when optimized watering is applied in intensive farming (La Thi Phuong Thuy, 2013).

Components of an irrigation system

An irrigation system consists of a series of irrigation constructions supporting each other in a wide area:

- *Junction construction:* is a sluice-gate taking water from water source to plots or draining water from plots to drainage receiver. Junction construction is very important and decides working capacity of the whole system.
- *Canal system:* is to conduct water from main channel to branch canals and from sluice-gates to plots or from plots to drainage receivers.
- *Temporary storage and temporary drainage canals:* during agricultural production when some disadvantage factors occur such as soil contaminated by salt water and high hydrated soil, or elevation variation among plots, temporary canals may be built to conduct or drain water. After use, they can be abandoned without affecting surrounding constructions (Nguyen Van Hieu, 2005).

Classification of irrigation construction systems

In agriculture, irrigation constructions may appear in different types with different structures as well as functions such as source (lake, dam), distribution (channel, canal), dynamics (pump station). Depending on purposes and characteristics of using water, irrigation constructions can be classified into different levels.

For purpose aspect, they can be divided into junction construction, water obstruction construction, and storage construction, conduct construction, watering and draining constructions. For investment level, capacity, flowrate, watering and draining capacities, they can be divided into 1st, 2nd, 3rd and 4th level constructions, primary and secondary constructions, big and small constructions. For management level, they can be divided into constructions managed

by Government and local authorities. However, the classification may vary depending on concepts of each country, each region or each period of time. In whatever manner, classification of irrigation constructions helps to apply management methods suitable for each type of constructions (Nguyen Van Hieu, 2005).

Farmers' contributions in managing irrigation constructions

Local contribution in irrigation management is recently seen as a crucial prerequisite for the conservation and sustainable use of scarce water resources. Since the late 1990's, participatory and integrated water management has been high on the agenda of national governments and international donors in the Southeast Asian region (Heyd and Neef, 2004). It is argued that a key driver of increased efficiency in irrigation management is the involvement of all stakeholders, especially at the local level where resources originate (Barron et al., 2008).

Farmers' contributions can be understood as an asset expressed by money, kinds or labor that people contribute to perform community's mutual purposes. Farmers' contributions in managing irrigation constructions are the share of people with authorities and management organizations by supporting money, kinds or manpower for activities such as maintaining, repairing, dredging, and building new canals. Besides, the contribution can be evaluation opinions of community about timing of water supplying, water quality and quantity in order to help managers to adjust their management.

Research methodology

Data collection

The survey was performed in 60 farm holders whose plots wide spread over the whole canal system of the commune and are at different elevations. Besides, to analyze factors affecting community contribution in managing irrigation system, the authors classified farm households by income level into: better-off, intermediate and poor households. The poor group has average income of less than $25.00/person/month; the intermediate group has average income from $25.00 to $50.00/person/month; the better-off group has average income of over $50.00/person/month.

The survey content includes: General information of farmholds such as name, age, gender, educational level of farmholders, number of family members, number of laborers, attendance of the farmholds in society organizations (farmers' union, women's union...). Agricultural production situation such as farming area, water demand, budget for repairing intra-field canals. Contribution of farmholds for managing irrigation constructions: by money, kinds, labor, and opinions.

Surveying method: Primary data were collected by surveying each farmholder using a questionnaire with the above-mentioned contents. Besides, to analyze the contributions and factors that affect the contributions of the community in managing irrigation system in Yen Gia commune, the authors organized a game relating to a public product for the 60 farm households to join. To play, we selected 60 players who are farmholders (N=60) and assumed to provide each player $5.00 (E=5.00). Each player would decide by himself to contribut a part (x_i) of their amount to repair, maintain and build new canals. This decision may be affected by surrounding players.

Data analysis

Economical statistic method: It is a method to study socio-economic events by describing collected data. Calculations such as average number, percentage, comparison of data in every group are used. Such indices support integrating and describing actual situation of management of irrigation system, analyzing and comparing contributions of each group of farmholds in the management in certain conditions.

Game theory: Since the second half of 20^{th} century, the game theory called *"silent economic revolution"* has taken place strongly but silently. It has stepped out of the border of pure mathematics to the potential field of economic and policy analyses. It has quickly become an incomparable tool in social sciences to

provide logic and in-depth analysis of human behaviors.

First of all, game theory can be described as a system studying mathematic models which describe the conflict and cooperation between ***"individuals who make wise decisions"***. It is called theory because it provides mathematic techniques to analyze a situation when two or more individuals make decisions that impact on the interests of other ones present in the situation (game). Thus, game theory provides essential comprehending that researchers need to study human behaviors (Grootaert et al, 2004). The term "game" here is just language consent to indicate any social situation relating to at least two people. With this consent, all individuals relating to a "game" are called "players" even though they do not actually play any game in the studied situations. Exactly, they just make serious and wise decisions but not play at all. The study needs assumption thatplayers are rational and intelligent.

Applying game theory in studying the decision-making process of people to contribute to the management of irrigation systems: The system of irrigation constructions is a kind of public goods that all farmers can use. Therefore, the decision each individual makes may depend much on decisions of the others. In this study, the authors applied a game about public goods to find out factors that may affect the community contribution in managing irrigation system in Yen Gia commune.

In the game, when the total amount of contributed money exceeds a given limit T, such repairing, maintaining or building will be performed. In the study, we assumed T = \$150.00 corresponding to the average contribution of each player of \$2.50.

When the total contribution of the players is beyond the limit T and management activities of the irrigation system is performed, the benefit of the players will be:

$$\pi_i = \{E - x_i + G_i + (\sum_j^N x_j - T)\frac{x_i}{\sum x_j} \; when \sum_j^N x_j > T$$

When the total contribution is below the limit T, the management activities are not performed and the benefit of the players will be:

$$\pi_i = E \; when \sum_j^N x_j < T$$

Quantitative economic model: A linear regression function is used to give a more detailed view of the factors that affect the farmers' contribution. Such factors are socio-economical characteristics of each farmhold (age, educational level, and gender of the holder, income, farming area, etc) and factors from outside of the farmholds such as contribution level of the other households, encouragement from the other households, etc.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + ... + \beta_v X_n$$

Where:

Y : Dependent variable representing the contribution level of each farmhold (in thousand VND)

X1 : Variable representing community's effect to the contribution level. It is the contribution decision of each farmholder if he knows the highest contribution the others did.

X2 : Variable representing community's effect to the contribution level. It is the contribution decision of each farmholder if he knows the lowest contribution the others did.

X3 : Variable representing socio-economic characteristics of a farmhold such as income, age, gender of the holder, educational level, number of family members, etc.

Results and Discussion

Overview of irrigation system in research site

In agricultural production, the management of irrigation systems as well as the irrigation systems themselves must be mentioned. They are the first priority that the Government and Yen Gia authorities concern about in order to accelerate agricultural development. Recently, agricultural production is the main part of economic structure of the commune where

natural conditions are very suitable for farming wet rice. Therefore, the irrigation system here has been invested early by both the Government and the local authorities for building, using and managing them.

The 1st level canals connect to Tao Khe river; the 2nd level canals include Hien Luong 12, Hien Luong 18, Hien Luong 20, Nam 23 and Thai Hoa 3; the end of the system is the 3rd level canals of 2650m long which are intra-field canals, constructions on the canals such as gates, pump stations and small ditches managed and used by the agriculture cooperative (Table 1).

Table 1. Main canals of the commune.

Canal level	No	Canal Name	Duty	Canal Length (m)	Canal Average Width (m)	Required Coverage Area (ha)
1st level	1	Tao Khe	Drainage	2500	15.0	323.4
2nd level	2	Hien Luong 12	Drainage	130	1.7	109.2
	3	Hien Luong 18	Drainage	3000	4.0	240.0
	4	Hien Luong 20	Drainage	2300	4.5	137.3
	5	Nam 23	Watering	1800	1.5	356.9
	6	Thai Hoa 3	Watering	100	1.5	123.1
3rd level	7		Drainage	2000	0.8	165.3
	8		Watering	650	0.8	78.5

Source: Yen Gia commune annual report

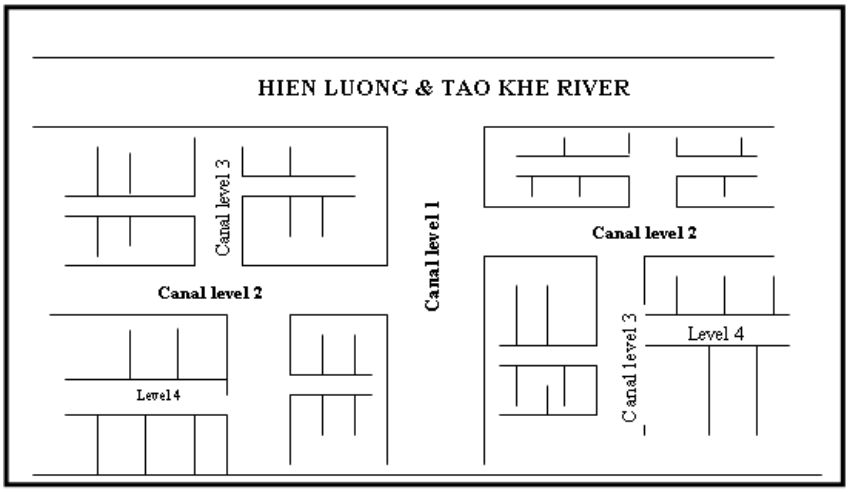

Figure 1. A Description of canal system in study site

Watering and draining capacity of irrigation systems

Before constructing and using any irrigation system or construction, regulation ability is a prior factor must be considered during design process. This criterion needs to satisfy long-term plan and be adaptable to the whole project (governmental, provincial or districal levels) in order to meet the increasing water demand of agricultural production.

Regulation ability of an irrigation construction or system, especially intra-field one, in almost locales reduces gradually during using period. The subjective reasons of that are: the lack of comprehending of farmers about the importance of irrigation and focusing on building but not on managing. The objective reasons of that are: severe climate conditions causing damages and changing regulation capacity of irrigation constructions. Notably, almost irrigation constructions have been built in

hard economic condition, limited budget and spreading investment. Therefore, they have normally been designed with capacity lower than actual need.

The above-mentioned reasons also cause the Yen Gia irrigation system to be able to regulate water for just 60% – 70% of the required area (Table 2).

The irrigation system of the commune has been degraded for a long time. The bottom of the drainage canals is equal or even higher than plot surface in many locations (in La Miet and Nga Hoang villages). In the 2nd level Nam 23 canal, water fern grows so strongly and fast that obstructs water flow. The pump system cannot serve the farmers' demand of watering and draining especially during and after tropical hurricanes because it has not been frequently maintained and, therefore, it cannot work with full capacity. The specific reasons for such degradations are:

Table 2. Actual water regulated area of Yen Gia irrigation.

Canal	No	Canal Name	Duty	Actual Area (ha)	Required Area (ha)
1st level	1	Tao Khe	Drainage	226.4	323.4
2nd level	2	Hien Luong 12	Drainage	71.0	109.2
	3	Hien Luong 18	Drainage	156.0	240.0
	4	Hien Luong 20	Drainage	96.1	137.3
	5	Nam 23	Watering	250.0	356.9
	6	Thai Hoa 3	Watering	73.8	123.1
3rd level	7		Drainage	107.5	165.3
	8		Watering	55.0	78.5

Source: Yen Gia commune annual report

- The irrigation constructions were been built long time ago but budget for maintainance and reparation is limited. Therefore, their service ability reduces.
- Quality of constructing process is poor because it did not totally comply with regulations for designing and building irrigation constructions.
- Technical instructions for managing and using irrigation constructions are not seriously followed. That indicates limited level of management and using of the irrigation staffs.
- It is lacking of community contribution in conserving irrigation constructions. Sometimes, some individuals blithely cause degradation or damage of the constructions for their own demands.

Farmers' contribution to irrigation management in Yen Gia commune

Contribution in annual canal dredging

Dredging is organized and directed annually in November and December by the Agriculture and Rural Development Department of Que Vo district in association with the People's Committees of the communes. The work is performed directly by agriculture cooperatives. Dredging is mainly deployed on 3rd and 4th levels intra-field canals because they are not concreted and usually filled up. This work is a kind of movement that uses volunteers from all farmholds in the communes. However, many households' laborers are working off-farm. Therefore, the households are not devoted to join. That is why the cooperatives proposed money contribution of $2.50 for each household who cannot contribute manpower for dredging. For the others, man-day contribution is encouraged because it represents the witting of households to participate in public works. The surveyed results show that 100% of better-off households contribute money because most of them have only one agricultural laborer. The other laborers are working in Que Vo industrial zones and cannot participate in dredging. Resersely, 100% of poor households contribute manpower (Table 3). The communes stipulate that each households contribute one day. However, the poor households usually wittingly participate in 2 to 3 days until the dredging finishes because they are aware that water

flow stuck in the canals will directly affect the farming of everyone.

Table 3. Contributions of farmholds in canal dredging.

Description	Unit	Better-off	Intermediate	Poor
1. Number of household contributing to dredging		20	20	20
2. Contributing by money				
Average contribution amount/household	USD/household	2.5	2.5	0
Percentage of households contributing money	%	100	40	0
3. Contributing by man-day				
Man-day/household	Man-day/household	0	2.5	3.0
Percentage of household contributing by man-day	%	0	60	100

Source: Surveyed data

Contribution in canal reparation and maintenance

Besides annual dredging, the agriculture cooperative of Yen Gia also performs reparation and maintenance for the damaged 3rd and 4th level canals. Reparation of the 1st and 2nd level canals is performed by Que Vo Irrigation Exploitation Company because it directly manages those canals. As mentioned earlier, the 3rd and 4th level canals are not concreted and require inconsiderable budget for reparation. The reparation budget is mostly from irrigation fee contributed by the households ($0.60/household/crop that equals to price of 2kg of rice). Therefore, the cooperative does not force the households to contribute either by man-day or by money. It just encourages households to voluntary contribute. Being aware of the importance of intra-field canals in farming, the households actively participate in canal reparation. The surveyed data show that the better-off group contributes money the most with 70% of households contributing $5.00; the intermediate and poor groups mostly contribute by manpower with man-day about 2 to 3 days (Table 4).

Table 4. Contribution of farm households in canal reparation and maintenance.

Description	Unit	Better-off	Intermediate	Poor
1. Number of households contributing to reparation and maintenance works		20	20	20
2. Contributing by money				
Average contribution amount/household	USD/household	5.00	3.50	0
Percentage of household contributing by money	%	70	50	0
3. Contributing by man-day				
Man-day/household	Man-day/household	2.0	2.0	3.5
Percentage of household contributing by man-day	%	30	50	100

Source: Surveyed data

Contributing in using irrigation constructions

The farm households of Yen Gia commune not only participate actively in repairing and maintaining the canal system but also are responsible users. Even though the irrigation team of the cooperative is in charge of watering and draining, every time

when water is pumped in or out the farmers usually goes and checks water level in their own plots. Table 5 shows that 80% of the intermediate and 90% of the poor groups do that frequently. The better-off group normally does not have adequate labor and does not spend much time for water checking. After checking water level in the plots, the farmers can inform the irrigation team if water level is high or low. Some do not want to wait for the irrigation team and regulate water in their own plots by themselves (about 85% of the surveyed households). The active concern about watering and draining of especially the intermediate and poor households indicates that the households have important contributions in managing and using irrigation system.

Table 5. Contribution of households in using irrigation system.

Description	Better-off	Intermediate	Poor
1. Repairing canal edges	20	20	20
2. Checking water level			
- Usually	20	80	90
- Sometimes	65	20	10
- Not at all	15	0	0
3. Informing the irrigation team	30	85	90
4. Self watering, draining	20	60	70
5. Self pumping	85	100	100
6. Cooperating with other households to pump	15	10	30

Source: Surveyed data

Table 6. Opinion contribution of farm households in managing irrigation system.

Description	Better-off (%)	Intermediate (%)	Poor (%)
1. Plan of watering/draining	30	50	60
2. Timing of watering/draining			
- In time	90	85	70
- Too early	5	0	0
- Too late	5	15	30
3. Amount of water			
- Adequate	80	75	70
- Sometimes not enough	20	25	30
4. Water quality			
- Good for farming	100	100	100
- Polluted	0	0	0

Source: Surveyed data

Contributing by giving opinions for better management of irrigation constructions

In Yen Gia, every 6 months the cooperative organizes a general meeting where farmers can contribute their opinions especially for irrigation activities. The Agriculture and Rural Development Department of the district in cooperation with the Que Vo Irrigation Exploitation Company already plans the watering/draining schedule at the beginning of every crop. Therefore, farmers rarely have opinion about it. About timing of watering/draining, 70% of the farm households proposes that water is conducted to their plots in time. Only 30% of households (in the poor group) says that water comes to their plots lately because their plots are quite far from the water source. Most households (over 70%) thinks that water amount and quality are adequate for farming. The cooperative takes note of the opinions given in the general meeting and adjusts the irrigation activities for better suitability.

Quantitative economic model to analyze factors impacting on contribution decision of farmers

In the irrigation system of Yen Gia commune, few canals degraded seriously and need be concreted for better service. However, the commune authority and the cooperative do not have enough budgets for such reparation. We assume that the commune authority will call for community contribution. Each farmhold is provided $5.00 and decides to contribute a part of their money for concreting 100 m canal. There are 5 cases when a player has to make decision:

- *Case 1*: ask a player how much money among his $5.00 he will contribute.
- *Case 2*: Let him know that the others contributed $3.75, ask him how much he will contribute.
- *Case 3*: Let him know that the others contributed $1.25, ask him how much he will contribute.
- *Case 4*: Give him a series of contribution levels from 0 to $5.00, ask him to select a level.
- *Case 5*: Give him a series of contribution levels from $5.00 to 0, ask him to select a level.

The game revealed that the farmholds tended to contribute more than the average level of $2.50. Thus, the households understood that the 100 m canal just can be concreted if their contributions are considerable. That expresses the willing to cooperate of farmers in Yen Gia in building public constructions. The average contribution level in 5 cases was quite high with 4/5 cases higher than standard level of $2.50. The better-off group tended to contribute higher than the intermediate and poor groups. When a farm household knew that the contributions of the others were high, it tended to give higher contribution ($3.41 in case 2). When a household knew that the contributions of the others were low, it tended to give lower contribution ($2.21 in case 3). We observed that there is a close correlation (r=0.65) the between the contribution level of a farm household and a level the other households are predicted to contribute. The predicted level is usually lower than the actual contribution but not too different (less than $0.50).

Table 7. Result of regression model.

	Coefficients	P-value
Intercept	4.444	0.730
Low reference	-6.550***	0.000
High reference	3.348	0.217
Predicted contribution	0.199***	0.005
Number of family members	1.776	0.167
Age	0.122	0.517
Gender	1.440	0.674
Income	1.335***	0.001
Farming area	-0.188	0.471
Member	5.559**	0.012
Event	5.009*	0.059
Educational level (high school)	-1.705	0.598
Educational level (Secondary school)	-3.974	0.185
Observation: 60; R^2: 0.564; Sig F: 0.000		

*Note: dependent variable is contribution in thousand Vietnam dong, 1USD= 20 thousands Vietnam dong; * significance at 10% level, ** significance at 5% level, *** significance at 1% level*

The regression results show that the factors relating to community have high impact on the contribution level of the households. They are, the lowest contribution level of the other households (low reference), the predicted contribution level of the other farmholders, participation of the households in social organizations, active joining of the households in public events. Besides, income is the only factor from the households themselves having impact on the contribution level.

Impact of the low reference: contribution of a household will reduce $0.33 in average if they know the lowest contribution level of the other households in comparing to the case they do not know about that level.

Impact of a household's expectation about contribution level of the others: each $1.00 increase of their predicted level results in $0.20 increase in their contribution.

Impact of socio-political organizations: the households who participate in organizations such as the Farmers' Union and the Women's Union normally contribute $0.28 more than the households who do not participate such organizations do.

Impact of joining public events: expenditure for public events expresses the relationship between the households and the

community. The households having higher expenditure for public events tend to contribute more. In average, each $1.00 increase of the expenditure results in about $5.00 increase in their contribution.

Impact of the households' income: farholds having higher income tend to contribute more. With each $1.00 increase of the income, the contribution increases $1.34.

Conclusion

The households can contribute by participating in annual dredging, repairing and maintaining damaged canals, by self building edges and self watering/draining when necessary, and by giving opinion to enhance the management of the cooperative's irigation team. Annual dredging is organized in November and December every year by the cooperative following direction of local authority. All farm households have to participate and contribute by either money or man-power. 100% of the better-off households participate by money contribution (stipulated $2.50/household). Meanwhile, all poor households participate by voluntary contributing man-day (3 man-day/household).

In canal reparation and maintenance activities which are organized by the cooperative, the households are encouraged to contribute by either money or manpower. The better-off households contribute the most with 70% of the households contributing $5.00; the intermediate and poor groups mainly contribute manpower (2 to 3 man-day/household). Checking water level, building edges are performed by over 80% of the intermediate and poor households. They spend time to frequently check water and inform to the irigation team. Almost farmholds have to pump water by themselves, especially for high-elevation plots (85% of the better-off group and 100% of the intermediate and poor groups). The farm households can contribute their opinions for activities of the irigation team. The opinions are collected and reported at a general meeting of all cooperative members organized every months. Over 70% of the farm households suppose that the irrgation activities of the irrigation team are good, and water quality and amount are enough for farming.

In summary, there are several factors come from the community such as reference of the other farm households' contributions, prediction of the other farm households' contribution, influence of socio-political organizations and public events that considerably impact on the contribution decision of the farm households. Except the income, the other characteristics of the households such as age, gender, and educational level of the farmholders do not influence the contribution lelvel.

Recommendations

In the condition of inadequate budget for building public constructions as well as for rural development programs, the use of resources from the community is a necessary means. In order to well use farmholders' contributions, it needs to increase their roles and their awareness in the community as well as to encourage contribution by letting them know about the contribution of the other farm households rather than just asking contribution with a stipulated level. The socio-political organizations need to encourage their members to contribute by suitable means.

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APPENDICE

A1. Definition of independent variables.

No	Variable	Definition	Average value	St.dev
1	Number of family memer	Total number of family members	4.47	(0.85)
2	Age	Age of the farmholder, equals to 1 if he is older than 50	48.20	(5.89)
3	Gender	Gender of the farmholder, equals to 1 for male	0.88	(0.32)
4	Education level	1 = primary school and lower; 2 = secondary school; 3 = high school and higher	2.43	(0.67)
5	Income	Monthly income of the farhold (million VND)	5.97	(3.74)
6	Expenditure	Spent for public events such as funeral, wedding... (million VND)	1.84	(0.56)
7	Social organization	Equals to 1 if the farmhold has at least 1 member participating in a social-political organization	0.75	(0.44)
8	Farming area	Total farming area ("sao", 1 sao = 360m^2)	4.84	(4.09)
9	Low reference	Contribution when knowing the lowest level the other farmholds contributed	41.25	(39.72)
10	High reference	Contribution when knowing the highest level the other farmholds contributed	71.25	(69.23)
11	Predicted contribution	Level a farmhold predicts the others contribute	51.25	(49.57)

Source: Surveyed data