Formation of Social Capital for Common Pool Resource Management

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ABSTRACT

A standard optimal investment model is used to analyze farmers' decision to accumulate social capital in terms of participating in collective activities for irrigation management. Several predictions borne out by the data are presented in this study. Social capital investment in small irrigation groups 1) decreases when the farmer's field is located at the downstream area where water is scarce; 2) increases when farmers have larger ricefields; 3) decreases when farmers pay the irrigation service dues; and 4) increases when the farmer belongs to a heterogeneous group which facilitates collective action when pooling resources to reduce the risks involved in rice farming. Moreover, the farmers' social capital investment in other small irrigation groups in the irrigation system 1) increases when farmers have larger rice-growing areas; 2) increases when there is a high level of trust among the farmers; but 3) declines as the opportunity cost of time increases due to coordination and participation in collective activities with farmers from other areas of the system.

INTRODUCTION

Resource management practice indicates a great diversity of ways in which individual choices and action are coordinated to balance the needs and interests of users with the capacity of the resource system. Through time, as the uses of the resources change, the resource system consequently changes, and so do the human needs and interests. One of the significant changes that have been introduced by the policymakers and scholars is the recognition of the ability of the rural community to manage and to conserve common pool resources like irrigation (Bardhan 1993; Baland and Platteau 1999; Hayami and Kikuchi 2000; Vermillion 2001). Local users who live and work in the area are seen to have a comparative advantage over government agents in monitoring the resource use. This new paradigm is reflected in many empirical studies. Scholars of common property have pointed out the many cases in which local communities have successfully created institutions for managing forests, pastures, fisheries, irrigation systems, and other shared natural resources, often with limited or no government intervention. Case studies have shown that the most successful communities have developed their own rules for the use of common resources (Castillo and Kerem Saysel 2005).

The behavior of the individual towards investing in social capital is worth exploring under the context of local participatory management. Social capital defines the internal social and cultural coherence of local groups that manage the resource. Cultural beliefs are basic determinants of the institutional structure in the community. Attention to culture is related to institutional development and in turn, to effective governance and its consequence for economic growth. On the other hand, it is also important to observe the frequency of interaction among community members. Intense interaction lowers the cost and raises the benefits associated when transacting with other members of the community. Moreover, through interaction, information is easily acquired and widely dispersed, which gives community members an incentive to act in ways that result in collectively beneficial outcomes (Bowles and Gintis 2002).

This paper presents evidences of social capital formation using a model of optimal individual investment decisions. Given the physical and socioeconomic environment, the study attempts to identify the conditions under which farmers are likely to participate in a local organization's collective activities for irrigation management. Empirically, the study examines the extent of farmer participation in the activities of the Balanac River Irrigation System Irrigators Association (BRISIA), an irrigators' association (IA) that manages the Balanac River Irrigation System (RIS) in Laguna, Philippines. The Balanac RIS is a gravity-type system that draws water from the Balanac River. It has 1,200 hectares designed area and a firmed-up service area of 1,056 hectares. The system covers four municipalities of Laguna, namely: Magdalena, Pagsanjan, Lumban, and Sta. Cruz. Information regarding the local organizations and the households are mainly gathered through a household survey administered in these four municipalities towards the end of the rainy season (September-October) of 2006. There are 32 turned-out service areas (TSA) in the whole irrigation system. Members of BRISIA are grouped according to their TSA; there are a total of 32 TSAs, each of which has at least 20 farmer-members. Out of the 928 BRISIA members, 20 percent from each TSA groups (211 members) are surveyed through random sampling. The respondents are also grouped according to their TSA in the irrigation system, for the purposes of the study.

Two models are constructed to investigate the factors affecting the farmers' social capital investment decisions: Model 1 deals with how such factors affect behavior within the farmers' TSA groups, while Model 2 is concerned with the behavior towards other TSA groups. Several predictions are confirmed from the data gathered and processed in this study. Model 1 shows that: a) water scarcity drives down the perceived benefits from the common pool resource, hence reduces social capital investment; b) those who cultivate a relatively larger area tend to be active in the local organization to secure the water requirements of their respective fields; c) there is low participation level when members pay their irrigation service dues because their payment serves as substitute for their active participation in collective activities; and d) differences in terms of socioeconomic background attract the members to work collectively in order to pool resources and reduce the risks involved in rice farming. Moreover, the findings based on Model 2 show that the trust that prevails among the farmers increases their participation in collective activities, while the higher opportunity cost of time dampens the farmers willingness to invest their time and effort to do collective work.

All of the above-mentioned conditioning variables account for the social capital investment behavior of the farmers involved in a local irrigation association. However, some parameters included in the economic model do not do as well empirically. The study is not able to show that the access of farmers to nonfarm market activities lowers their participation in collective action within the farming community, nor that social capital rises and then declines with age, as the life cycle predicts. Such patterns are not validated by the data but the study provides several reasons for such behavior.

THEORIES AND CONCEPTS

Before proceeding to the empirics, the connection between the concepts of individual social capital and the aggregate social capital should first be established. Individual social capital is defined as a person's social characteristics, which include one's social skills, charisma, and the size of one's networks. Compared with other forms of capital, social capital is a unique resource embedded in a social structure; it is invested in social relations for expected returns (Lin 2005). Normally, people engage in social interactions and networking in order to produce profits and access information that the organization provides (Coleman 1988; JBIC 2004). However, unlike the kind of capital that benefits individuals who are directly utilizing the resource, social capital is expected to produce goods that are more collective rather than just for the individual (Uphoff and Wijayaratna 2000). For the purposes of the study, it is assumed that individual social capital includes both intrinsic abilities (e.g., being extrovert or charismatic, etc.) and the result of social capital investment. This definition of social capital is not an original concept, having been tackled in many studies in the past like Loury (1977) and Glaeser et al. (2002). These forms of individual social capital are aggregated because these forms are indistinguishable from one another. For instance, it is hard to differentiate if one's being active and becoming a leader in organization or group emanates from one's good relation with the members of the group or from one's innate leadership skill. However, in constructing the empirical models, the variables are grouped according to individual factors (physical and socioeconomic factors that are unique to an individual), and the more aggregate factors (stock of social capital) that are affected by their interaction and the composition of the group they belong to. In this way, the aggregation of the two forms of social capital is made possible.

Aggregate social capital is defined as the sum of individual social capitals, adjusting for all of the relevant externalities. Joining a social network may be one of the most common forms of social capital investment, where aggregate social capital is created. These networks are usually in the form of organizations. Network membership often has strong positive externalities but in some instances it also has negative externalities. For instance, a particular activity can have positive benefits but there can be also negative externalities toward the group as a whole. Generally, aggregate social capital incorporates all the cross-person externalities generated by the different types of individual social capital and it is quite close to the definition of the usual social capital.

Social capital is very much evident in the irrigation system. Considering the nature of the irrigation as a common-pool resource, investment in a collective effort is necessary in order to have an efficient water allocation. Although water from the irrigation is limited and relatively prone to overexploitation, cooperative action is found to be effective in mitigating inefficiency. Statistically, institutional innovations have been shown to be the main factor in increasing the irrigated area and water productivity (Uphoff and Widjayaratna 2000).

The recognition of the ability of the rural community to manage and conserve common pool resources had been the theoretical support for the implementation of the Irrigation Management Transfer (IMT) policy. Local users who live and work in the area are seen to have an intimate knowledge of the resource compared with the government agencies that used to manage the irrigation system (Fujiie et al. 2005). By allowing the local communities to operate and manage irrigation facilities, social capital is being formed. The networks of trust and collaboration bind the state and the civil society together. It is perceived, therefore, that farmers are better off if they can organize themselves and do more collective works (Evans 1996).

Different studies have identified several factors that affect the farmers' cooperation in the irrigation management. The level of participation can be affected by the physical, socioeconomic, and political environment where the system is located. To account for the specific factors affecting the farmers' decision to actively participate in the collective activities of the irrigators' group in Balanac RIS, the study adopted the individual social capital model developed by Glaeser et al. (2002). This model is almost identical to the standard models of investment in physical and human capital. However, the treatment of social capital as an individual characteristic is very much different from the bulk of the modern literature on social capital, which treats social capital as the characteristic of a community.

The succeeding discussions about the investment model, including the notations and comparative statics results are adapted from Glaeser et al. (2002).

Given the individual approach to social capital, individual social capital is represented as a stock variable S and aggregate per-capita social capital is represented as a stock variable $\hat{S}$. Each individual receives a per-period utility flow, $SR(\hat{S})$, where $R(\hat{S})$ is a differentiable function with aggregate per-capita social capital as its argument. The flow of pay-off to the individual $SR(\hat{S})$ includes the market and non-market returns to social capital. Market returns can be higher wages or profit, in the case of the farmers being serviced by the irrigation. Non-market returns may include improvements in the quality of the farmer's relationships, improvements in irrigation services, or even direct happiness. The literature on social capital strongly argues that there are positive complementarities in the accumulation of social capital across individuals; nothing is gained by belonging to a group that has no other members. To capture these effects the model assumes $R'(\hat{S}) > 0$.

The social capital stock follows the dynamic budget constraint $S_{t=1} = \delta S_t + I_t$. Due to depreciation, the stock of social capital falls to proportion $\delta < 1$ of its previous value. Hence $1 - \delta$ is the depreciation rate. Social capital might depreciate through time reflecting the effects of changes in the mortality rates of the other members in a group, and changes in one's physical and mental ability. The level of investment I_t has a time cost $C(I_t)$, where $C(\cdot)$ is increasing and convex. The opportunity cost of time is w, representing the wage rate or the value of income foregone when participating in the activities of the group. It is assumed that individuals have a known lifespan of T periods and that they discount the future with discount factor β. It also assumes that with probability θ, the individual leaves his community. When people move, the value of their social capital depreciates, falling to proportion $\lambda < 1$ of its previous value. This decline is meant to capture the idea that much of social capital investment is community-specific. Let $\phi = (1 - \theta) + \theta\lambda$. Hence, θ represents the depreciation factor arising from mobility. The individual's maximization problem can now be expressed as:

$$\max_{I_0, I_1, \ldots I_T,} \sum_{t=0}^{T} \beta^t \left[S_t R(\hat{S}) - wC(I_t) \right],$$
$$\text{s.t. } S_{t+1} = \delta\phi S_t + I_t, \quad \forall t$$

The equation that describes the evolution of the capital stock incorporates the expected depreciation that arises from mobility. Like firm-specific human capital, which depreciates when individuals leave their current job, social capital depreciates when an individual leaves the group. The individual maximizes his objective function, taking aggregate per-capita social capital $\hat{S}$ as fixed.

The first-order condition associated with this investment problem is given by:

$$wC'(I_t) = \frac{1-(\beta\delta\phi)^{T-t+1}}{1-\beta\delta\phi} R(\hat{S})$$

This first-order condition implies the following comparative static results. Social capital investment (1) rises with the discount factor, β; (2) declines with the opportunity cost of time, w, (3) increases with more homogenous groups, $R(\cdot)$; (4) declines with the rate of social capital depreciation, $1-\delta$; (5) rises in an organization with more aggregate social capital, $\hat{S}$; (6) declines with mobility due to market activities, ϕ, and; (7) declines with age, t. Theoretically, based on the economic model developed, being active in a group is influenced by the perceived benefits of cooperation derived from a particular group. The benefits of investing in the activities of the group should outweigh the costs involved.

ANALYTICAL TOOLS AND PROCEDURES

A binary logit regression is used to predict the probability of being active in the IA given the physical, socioeconomic conditions, and accumulated social capital in the IA. The dependent variable in the binary logistic regression takes the value of 1 if the member is active and the value of 0 if the member is inactive.

The regression makes use of TSA location parameters for the physical condition variable. For the socioeconomic factor, the rice field area, age, and percent of non-farm income are added as explanatory variables. For the social capital aspect, the degree of heterogeneity, and the degree of trust are considered. Moreover, to measure the degree of willingness of the respondents to be active in the IA activities, the foregone income due to participation in collective actions is included. Also, the willingness to pay the irrigation service fee (ISF) is added to measure their commitment to help maintain the irrigation system. Applying the binary logistic regression using the foregoing variables gives the equation:

$$Y = f(X_1, X_2, X_3)$$

$$Y = X'\beta = X_1'\beta_1 + X_2'\beta_2 + X_3'\beta_3$$

where:

y = vector of dependent variables,

X = vector of the independent variables,

β = coefficient of the predictor variables,

X_1 = vector of physical environment variables and 1st column is a vector of 1,

X_2 = vector of socioeconomic environment variables,

X_3 = vector of stock of social capital variables,

β_1 = coefficient of the physical environment variables,

β_2 = coefficient of the socioeconomic environment variables, and

β_3 = coefficient of stock of social capital variables,

Rate of Participation in Collective Activities

Social capital is formed and continues to accumulate as people constantly join together and engage in collective activities. To examine empirically the behavior of individuals with regards to social capital investment, the frequency of collective activities done within one's TSA group and with other TSA groups was analyzed. Two models were developed to assess the level of participation within the TSA group (Model 1) and with other TSA groups (Model 2). The farmers' level of participation served as the dependent variable for the binary logistic regression for these models.

To gather data on the dependent variable, the respondents were asked about the following collective activities:

Item 1: In the past year how often have members of the TSA gotten together and jointly petitioned government officials or political leaders with TSA development as their goal?

Item 2: How often in the past year have you joined together with others in the TSA to address a common issue?

The purpose of asking the respondents these questions is to determine their rate of activity within their TSA groups, and the extent of their participation in activities done in coordination with other TSA groups. Being active within the TSA group would not have as much impact on the management of the whole system when there is no active participation in the collective activities with other TSA groups. Coordination among TSA groups is much needed in a gravity-type irrigation system since they are drawing from one main source of water flowing from the upstream down to the lower stream area of the system.

Factors Affecting the Level of Participation

It is important to assess whether the member is active or inactive in the group to effectively measure the extent of the individual's investment in social capital. Equally important is identifying what factors significantly affect the level of their participation in collective activities. We therefore came up with several hypotheses, each of which proposes a single primary cause to account for the membership status of a member in an IA. These factors, as discussed below, were chosen based on the review of the literature.

Physical environment. To incorporate the level of participation of the members, given the extent of the water scarcity they face, the respondents were divided according to the TSA location, namely; upper stream, midstream, and downstream area of the irrigation system. The upper stream is designated as the base (0, 0), indicated by the variable TSALOC. Two dummy variables represent the two other locations: TSALOC1 represents the middle stream (1; otherwise: 0), while TSALOC2 indicates the lower stream (1; otherwise: 0).

Socioeconomic environment. The capacity and willingness of an individual to actively participate in collective activities is largely dependent on his/her socioeconomic condition. Different parameters were examined such as:

- Rice area: the area of the respondent's rice farm that is being irrigated by the system; in hectares.
- Age of respondent
- Age squared: included in the regression analysis to determine the life-cycle effect
- Percent of non-farm income of the respondent: serves as a measure of the degree of the "exit option" of the respondent. (The respondent is likely to concentrate on non-farm activities if the expected return from these activities, in terms of income or profit, is higher compared with what could be earned from rice farming; this eventually leads to lower participation in collective action.)

Forgone income was used as a proxy to measure the opportunity cost of time spent by the farmer in participating in collective activities. To come up with the equivalent wage given up by the farmer to attend to collective activities, the agricultural income per hour was first determined. It was estimated that the average time consumed by the farmers in attending meetings and collective activities per month amounted to three hours. Thus, the income per hour was multiplied by three hours per month times the number of months for the two cropping seasons, to arrive at the forgone income for the whole year. For the farmer operators, an imputed value was used, based on the prevailing agricultural wage in the area. It was assumed that the increase in forgone income had a negative effect on the farmers' participation. The net benefit would be perceived to be lower due to an increase in forgone income brought about by continuously participating in the activities of the IA.

On the other hand, it is also important to take a look at the farmers' behavior towards the payment of the ISF. Paying the ISF after every cropping season is an obligation of every member of the IA. However, a farmer has the option to pay or not to pay the ISF depending on his perceived benefits from the irrigation system. This means that they can be exempted from payment if their fields are not irrigated by the system. Active payment of their ISF dues therefore indicates that they are benefiting from the irrigation system. They are also aware that the ISF payment serves as a mobilization fund for the cleaning, maintenance, and minor repairs of their irrigation system. Consequently, the ISF payment can serve as substitute for participation in collective activities. Instead of engaging in collective endeavors, some would opt to pay their ISF dues. The hypothesized effect of the ISF payment on the investment in social capital is negative because non-participation in collective activities will eventually result in lower investment in social capital.

Stock of social capital. To determine the stock of social capital of the farmer, the trust and the heterogeneity indices were used as substitute measures. The selection of these components of social capital was based on the definition of the individual stock of social capital and aggregate social capital. The trust index serves as a proxy variable to estimate the individual stock of social capital. The increase in the trust index inarguably has a positive effect on investment in social capital. On the other hand, it is not immediately obvious whether a high degree of internal heterogeneity has a positive or negative impact on social capital. Heterogeneity could be a sign of inclusiveness since the presence of members with different backgrounds opens up more opportunities for exchanging information and knowledge. On the other hand, an internally homogeneous association might make it easier for members to trust each other and to reach decisions.

Heterogeneity index: To determine the internal diversity among the members of the association, the heterogeneity index was rated according to seven criteria, namely: kinship, religion, gender, political affiliation, occupation, age, and education. A diversity score was calculated for each category wherein a value of one indicated that the members of the organization were from a different kin group, religious group, and so on. These scores were added, and the average score computed. For ease of comparison, the score was rescaled from 0 to 100, with the latter corresponding to the highest possible value of the index.

The heterogeneity index measures (on a scale from 0 to 100) the extent to which the membership of the group (TSA) is internally diversified. When the heterogeneity index is low which means that the group is relatively more homogenous, then there is more likely to be an increase in the social capital as a result of more cooperation by the members of the group. On the other hand, a high heterogeneity index could lead to either a positive or negative effect on the level of investment in social capital, as previously argued.

Trust Index. Trust is the most widely used indicator of social capital. To trust someone or something means to have belief or confidence in the honesty, goodness, skill, or security of a person or an organization. Trust is the basis of all social institutions.

In the context of collective activities done by the IA, there are two types of trust included in the analysis: trust toward other farmers within the TSA groups (TSACA), and trust towards other farmers in other TSA groups(WTSACA). Trusting other farmers from other TSA groups is important for the collective action of the whole irrigators' association work.

All factors from each item were computed to come up with the trust index, one pertaining to co-members in the TSA groups (TSACA), and another to farmers in other groups (WTSACA). The scores per variable were added, and the total score rescaled from 0 to 100, following the same procedure to compute the heterogeneity index. A high trust index means that a high level of trust exists between the fellow members of the group.

SOCIOECONOMIC CHARACTERISTICS OF THE SAMPLE AREA

Out of the 211 respondents covered by the analysis, 82 respondents come from the upstream area, 48 from the midstream area, and 81 from the downstream area of the system. Given that the irrigation system is mainly located in the municipalities of Pagsanjan, almost 60 percent of the respondents are residents of this area (Table 1).

All of the household respondents are considered rice farmers (Table 2). Respondents' ages range from 54–56 on the average, which is a relatively old age bracket. As to their educational attainment, most of them have acquired only a primary education (47%), while 28 percent reached the secondary level, and the remaining 25 percent have had vocational and university schooling. The farmers in the lower system have the highest income per year. They earn Php 98,668 on the average which is relatively higher than the income of the farmers in the upper and middle parts of the system, who earn Php 881,278 and Php 79,954 respectively.

It is very remarkable that though the respondents are considered rice farmers, more than half (61%) of their household income is derived from non-agricultural resources, largely coming from the remittances of their relatives abroad. On the average, only 39 percent of their income comes from agricultural resources, mostly from rice farming. In the downstream area, only 32 percent of the respondents' income is sourced from agriculture because rice farming is not suitable in their area. They have insufficient water during the dry season but experience flooding during the wet season. Though they are not very productive when it comes to farming, they surprisingly have the highest income. The high income of the downstream farmers is attributed to non-agricultural sources which contribute around 68 percent, which in turn is made up mostly of remittances from their relatives (47%).

Looking at the characteristics of the farms in the sample (Table 3), most of the cultivated areas are planted with rice (1.5 ha.) and a small portion of the land is dedicated to non-rice crops

Table 1. Number of respondents by municipality and TSA Location, Balanac RIS, Laguna, Philippines, 2006.

Municipality	Number of respondents			Total
	Upstream	Midstream	Downstream	
Magdalena	46	0	0	46
Pagsanjan	36	47	40	123
Lumban	0	1	24	25
Sta. Cruz	0	0	17	17
Total	82	48	81	211

Table 2. Selected socioeconomic indicators by TSA Location, Balanac RIS, Laguna, Philippines, 2006.

Socioeconomic indicators	TSA Location			Total
	Upper	Middle	Lower	
Number of households	*82*	*48*	*81*	*211*
Average household size	*5*	*5*	*5*	*5*
Average age of household head	*56*	*56*	*54*	*55*
Education of respondents (%)				
Primary	45	50	48	47
Secondary	26	25	32	28
Tertiary	29	25	20	25
Average household income (2005–2006), (Philippine peso/yr)	81,278	79,954	98,668	87,653
% of Income from agriculture:	46	43	32	39
Rice farming	66	81	63	68
Non-rice farming	12	14	9	11
Livestock	13	2	19	13
Income from hired labor	5	3	1	3
Income from capital rental	4	0	8	5
% of Income from non-agriculture	54	57	68	61
Non-farm employment	17	33	20	22
Other sources	32	36	33	33
Remittances from relatives	51	31	47	45

Table 3. Farm characteristics of the sample systems by TSA Location, Balanac RIS, Laguna, Philippines, 2006.

Farm characteristics	TSA location			Total
	Upper	Middle	Lower	
Average area cultivated	1.4	1.6	1.9	1.7
Area cultivated by size classification (%)				
0.5–1.0	43.9	50.0	28.4	39.4
1.5–2.0	47.6	37.5	58.0	49.3
2.5–3.0	7.3	8.3	6.2	7.1
< 3.5	1.2	4.2	7.4	4.3
Average rice area	1.1	1.3	1.8	1.5
Average non-rice area	0.4	0.3	0.1	0.2
% of farmers with sufficient water in dry season	100.0	87.5	8.6	62.1
% of farmers who paid irrigation fees in 2005-2006	56.1	56.3	25.9	44.6

Note: other includes: permanent laborer, pawnee, agricultural laborer, right, borrowed land, unknown owner

(0.20 ha.). Though 4.3 percent of the sampled farmers cultivate relatively larger tracts of land (i.e., greater than 3.5 ha.), much of it lies idle during the wet season. Given the water shortage problem, some of them have opted to plant only during the dry season while others resorted to the use of pumps as alternative water source. Few of them are into livestock farming like hog-raising, and some of them run other businesses like small variety stores to compensate for the loss of income during the said period.

Most of the respondents are tenants (66.4%) who cultivate a relatively small portion of land. The average size of land cultivated by a household with five members is only about 1.74 hectares. Tenants constitute 89 percent of farmers in the downstream area, 62.5 percent in the midstream area, and 46.4 percent in the upstream area. Most of the owner-cultivators are in the upstream area (48.8%) and only 9.9% are in the downstream area. The respondents who are neither owners nor tenants are classified as either permanent laborers, or temporary landowners, i.e., their land had been either pawned to them, or loaned from other landowners for a certain length of time. Only about 3 percent of the respondents fall into these "other" categories of tenure status.

A large part of the lower stream area is not being served by the irrigation system. Out of the 91.4 percent with water distribution issue in the lower system, 7.1 percent of it is not being served. In this case, farmers are not required to pay their irrigation fees. Anticipating the possible failure of the irrigation system to reach certain areas, the National Irrigation Administration (NIA) had been helping some farmers amortize pumps for their fields. However, the cost incurred in using pumps is much higher compared with the irrigation fee to be paid every season. The cost of ISF is P1,500/ha during the dry season and P1,000/ha during the wet season. On the other hand, the expenses for pumps come up to an average of P5,000/ha per season just for the fuel cost alone (P30.00/liter), plus the fee for the operator, and the amortization for the pump.

EMPIRICAL RESULTS

To further examine the behavior of the member when it comes to the level of active participation in collective activities, this study uses two models to see the effect of selected predictors on two different collective activities, as shown in Table 4. Participation in collective activities serves as a proxy for the active membership status of the respondents. Being active in collective activities reflects their overall membership status. For Model 1, the participation in collective activities is the dependent variable. It is found that the location in the irrigation system, the size of the rice area being cultivated, the degree of heterogeneity, and the ISF payment are significant factors that affect their participation in collective activities within their TSA. Other variables turn out to be insignificant which means that there is no sufficient evidence to say that age, non-farm income, and trust among farmers within the TSA of the respondent influence the decision to participate in collective activities. Model 2 represents the response of the farmers to collective activities with other farmers in other TSA groups. Given the same parameters as Model 1, only the foregone income, area cultivated, and the trust variable explain the behavior of the members given the collective activity specified. Other variables such as the TSA location, degree of heterogeneity, and ISF payment are found insignificant factors for Model 2. In contrast, these factors effectively influence the decision of the farmers in Model 1. Moreover, the percent of non-farm income, and the age do not influence the decision of the farmers to do collective activities with other TSA groups.

The models presented in Table 4 significantly fit the data as indicated by χ^2=5.716 for Model

Table 4. Summary of binary logistic regression, Balanac RIS, Laguna, Philippines, 2006.

Variables	Model 1		Model 2	
	Coefficient	S.E	Coefficient	S.E
TSA Location dummy	-.902**	.340	.226	.329
Rice area	.271*	.140	.252*	.143
Percent of non-farm income	-.003	.004	-.006	.004
Age	-.026	.094	-.077	.095
Age squared	.000	.001	.001	.001
Trust with farmers within TSA	.001	.008	-	-
Trust with farmers from other TSA	-	-	.020**	.007
Degree of heterogeneity	.010*	.005	.003	.005
Forgone income	-.001	.002	-.004**	.002
ISF payment dummy	-.958**	.354	-.264	.340
Constant	.062	2.646	1.300	2.615
-2 Log likelihood	262.729		263.346	
Cox and Snell R square	.091		.099	
Nagelkerke R square	.121		.132	
Chi-Square	5.716		15.156	

Note: **-significant at 0.05 probability level.
*-significant at 0.10 probability level.

1, and χ^2=15.156 for Model 2. However, the pseudo R-squares of the models are relatively small, which means that the models poorly account for the variation in the specified dependent variables. Model 1 only accounts for 9 to 12 percent of the variance in the level of participation in collective activities within the TSA, while Model 2 accounts for only 10 to 13 percent of the variance in their common participation with other groups.

Social Capital and Water Supply Availability

The water supply available for irrigation is determined by the location of the system, the alternative water sources, and the cropping pattern. It is assumed that farmers with plentiful water supply are less active, and those who expect little water from the irrigation have no incentive to be involved in collective action (Meizen-Dick et al. 2000). Such behavior appears to be manifested in the study area. Farmers in the upstream and downstream areas have lower participation rates of 46.3 and 37 percent, respectively, compared to the participation of the middle stream farmers at 50 percent (Table 5). Furthermore, the low participation of the downstream farmers in collective activities within TSA groups is mainly caused by the unfavorable rice farming condition in their area, as reflected in Model 1 of Table 4. Extreme stresses are experienced by these farmers in the two cropping seasons, to wit, water scarcity during the dry season, and flooding during the wet season. Because of floodwaters coming from the nearby lake, some of them opt not to plant during the wet season. This leads to the reduction of their participation in collective activities within their TSA group. As mentioned in the previous discussion, these farmers rely more on non-farm activities as their source of income especially during the wet season when their fields cease to be productive. In contrast, farmers from the

Table 5. Percent of active members in collective activities with the TSA groups and with other TSA group by TSA location, Balanac RIS, Laguna, Philippines, 2006.

Location	N	Percent of active members in collective action within TSA	Percent of active members in collective action with other TSA group
Upper	82	46.3	50.0
Middle	48	47.9	47.9
Lower	81	37.0	56.8
Total	211	43.1	52.1

upper and midstream areas can be expected to participate in collective activities because the benefits they get from the irrigation system are relatively higher compared to the farmers from the downstream area of the irrigation system.

On the other hand, Kähkönen (1999) has argued that if all farmers experience water scarcity, they are likely to act collectively in order to have a sufficient and fair water supply. This explains the increased participation rate (56.8%) of the downstream farmers when it comes to doing collective activities with other TSA groups. Since they experience water scarcity especially during the dry season, they are more obliged to coordinate with other TSA groups just to ensure that water will reach their area. Collective activity such as the clearing and cleaning of the irrigation canal is very important and requires the joint efforts of the different TSA groups. The awareness for such need for cooperation is consistent with Model 2 (Table 4) results which show that participation in collective action with other TSA groups is high among farmers whose fields are located in the downstream areas. However, there is no sufficient evidence to claim that water scarcity due to being in a downstream location increases the level of investment in social capital. Some other factors might have affected the level of their participation in collective activities with other TSA groups. For one, the presence of an alternative source of irrigation could have diminished their participation in collective activities. This is true in the case of the downstream farmers who are receiving government subsidy for the use of irrigation pumps as an alternative source of irrigation during the dry season. Therefore, since Model 2 was not able to establish the effect of the location dummy, some other factor like the presence of an alternative resource could indeed have affected the level of their participation in collective activities with other farmers from other TSA groups.

Social Capital and Perceived Benefits from Irrigation

The farmers' decision to do collective work is largely influenced by the perceived benefits that can be derived from the irrigation system. As shown in Table 4, regardless of the location of their field in the irrigation system, farmers who have larger rice areas tend to be more active in collective activities. As the rice area of the farmers increases, so does the probability of being active both within the TSA group and with other TSA groups. Compared to farmers with small rice areas, farmers with large rice areas face greater risks when their fields are not well irrigated. The possible risk of crop loss could have instigated the farmers to overcome the obstacles to collective action (Kähkönen 1999). They need to guarantee that there will be sufficient water flowing into their fields to maintain the land's productivity. These farmers are expected, therefore, to actively support the association to ensure that there will be an efficient irrigation management. They are aware that having a better irrigation system will be more beneficial to them. Moreover, because the system is a common pool resource, the association still needs to have an irrigation schedule to efficiently distribute the water to its beneficiaries. As expected, priorities are given to those active members when it comes to irrigation scheduling. Problems in their fields, particularly in matters of irrigation, are better addressed because they are recognized as members of the association.

Social Capital and Mobility

It has become a common trend in farming communities for farm households to be engaged in non-farm activities. As earlier mentioned (see Table 2), 61 percent of the farmer-respondents' income comes from non-agricultural sources. Such trend has an implication for the accumulation of social capital within the association. Non-farm activities serve as an "exit option" for farmers to disengage themselves from the association's collective activities (Glaeser et al. 2002). The respondent is likely to concentrate on non-farm activities if the expected return in terms of income or profit is higher compared with rice farming; this eventually leads to inactivity in the association. Though our data showed that the percentage of non-agriculture sources was relatively higher, we were not able to establish that participation was inversely affected by the high percentage of non-farm income (Table 4). Since the data used to estimate the percent of non-farm income was a proxy variable, bias was inherited when it was used for the logistic regression.

Social Capital and the Life-cycle Effect

Among the members' characteristics considered in the analysis, age appears to exercise a negative effect on a member's active participation in the association's collective activities. As predicted by the economic model, there is an inverted U-shaped profile of social capital over the life cycle (Glaeser et al. 2002). As shown in Table 6, the extent of active participation in collective activities within the TSA (45.5%) and with other TSA groups (59.2%) is at its highest among farmers aged 40–59 years old, and exhibits a declining trend at age groups <40 and ≥ 60. Usually, farmers in their early years are not so active in their participation, but their level of participation picks up at midlife, and eventually wanes as they grow in age. The patterns of age group and rate of participation, as shown in Table 6, seem to conform with the predicted relationship of the economic model. However, the majority of the farmers (68%) are in their fifties and older. This has an implication for the model as the life cycle effect is found statistically insignificant as a predictor of the level of active participation in collective activities within and with other TSA groups.

Table 6. Percent of active participation in collective activities within and with other TSA groups by age group, Balanac RIS, Laguna, Philippines, 2006.

Activities	Age group			
	<40 N=20	40-49 N=49	50-59 N=66	>60 N=76
Collective action within TSA	40	44.9	45.45	40.8
Collective action with other TSA	50	59.2	54.54	46.1

Social Capital and Stock of Social Capital

The effectiveness of a water users' group is mainly dependent on the degree of solidarity between its members (Kalshoven 1998). BRISIA has been consistently active as an irrigation association since it was organized in 1990. The members have collectively made an effort to finally transfer the Balanac RIS under their management. Since collective actions had been done in the past, it is expected that trust and reciprocity have accumulated and developed into a stock of social capital. As indicated in Table 7, the trust level among the farmers within the association is quite high. Farmers who belong to the same TSA groups are more trusting of each other, with 94.4 percent of them having a ≥50 trust index. Based on their responses pertaining to the trust level within the TSA groups (Table 8), most of them confirm that they trust each other in the matter of lending and borrowing (60.7%), and that they agree that people in their group are honest and can be trusted (75.9%). Farmers were also asked to compare the trust level within their TSA group, relative to their trust towards farmers in other TSA groups. More than half of them responded they "did not know", which was not among the choices offered for this question. Among the valid responses, 33 percent stated that the trust level within and without the TSA groups were the same. On the other hand, 70.4 percent disagreed with the statement that people within the TSA are always more trustworthy than those in the other TSAs (Table 8). This shows that, somehow, their perceptions of trust are not confined to members of their TSA group, and that they also consider other farmers as trustworthy. This conclusion is furthered strengthen by the results of the regression. Though trust is found to be insignificant in facilitating collective action within their respective groups, trust towards farmers from other TSA groups is found to be crucial in the farmers' decision to engage in the collective activities of the association (Table 4).

Since the irrigation system covers a relatively large area, there are few chances of interaction among farmers from the different TSAs, aside from the regular cleaning and clearing of the main canal. Furthermore, the monthly meeting of the whole BRISIA association is attended only by TSA leaders. Consequently, there is less solidarity among farmers in larger groups (Bardhan 2000), as in the case of BRISIA, compared to smaller community-based ones. Doing collective activities with other TSA groups is relatively challenging and is harder to coordinate. Given the physical distance and the varying characteristics and circumstances that separate the members from each other, an increase in the level of trust among them will

Table 7. Trust Index of farmers within TSA and with other TSA groups, Balanac RIS, Laguna, Philippines, 2006.

Trust index	N	Percent
Trust index within TSA		
< 50	12	5.7
≥ 50	199	94.4
Trust index with other TSA groups		
< 50	84	39.8
≥ 50	127	60.2

Note: The missing cases replied "do not know" or had no answer to the question.

Table 8. Percent distribution of indicators of trust, Balanac RIS, Laguna, Philippines, 2006.

Question/ Statement	N	Percent
Trust level within TSA group		
Q1A. Do you think that in this TSA people generally trust one another in matters of lending and borrowing?		
Do not trust	42	20.4
Do trust	125	60.7
Q2.A Most people in this TSA are basically honest and can be trusted.		
*Strongly **disagree***	2	0.9
Disagree	49	23.2
Agree	147	69.7
Strongly agree	13	6.2
Trust level with other TSA group		
Q1B. Compared with other TSA, how much do people of this village/ neighborhood trust each other in matters of lending and borrowing?		
Less than the other TSA	21	10.8
Same with other TSA	64	33.0
More than the other TSA	25	12.9
Q2B. Members in this TSA are always more trustworthy than others.		
Strongly disagree	9	4.4
Disagree	145	70.4
Agree	45	21.8
Strongly agree	1	0.5

Note: The missing cases replied "do not know" or had no answer to the question.

definitely facilitate the collective activities of the irrigators association.

Social Capital and Heterogeneous Groups

Generally, past studies (Bardhan 2000; Kähkönen 1999; Meinzen-Dick et al. 2000) contend that homogeneous groups are able to facilitate collective action better compared to groups of different orientations, cultures, beliefs, and economic backgrounds. Differences among members deter trust, as well as the level of collective action, because cultural diversity can decrease the likelihood of finding shared interests and understandings (Ostrom et al. 1999). But in cases where the users are a socially cohesive group, institutional arrangements are more successful (Uphoff 1992). Ironically, members from different backgrounds may learn more from each other because they have different stock knowledge to start with. Having different backgrounds can also be an advantage in term of pooling resources and reducing risk that the members of the group might face. Such characteristic and its attendant benefit seem to be manifested in the case of the members of BRISIA. Table 9 indicates that most farmers in the association believe that they are very much different from each other. In terms of the seven indicators of heterogeneity, the farmer-members are highly different when it comes to age (88%), followed by education (84.6%), and

Table 9. Percent distribution of indicators of heterogeneity, Balanac RIS, Laguna, Philippines, 2006.

Indicators	N	Percent (%)
Mostly of different extended family	208	76.9
Mostly of different religion	208	75.5
Mostly of different gender	208	65.4
Mostly of different political party	207	79.2
Mostly of different age	208	88.5
Mostly of different occupation	208	52.9
Mostly of different education	207	84.6

Note: The missing cases replied "do not know" or had no answer to the question.

lowest in terms of occupation (52.9%). Though they are expected to be a homogeneous group as far as occupation is concerned, this does not appear to be so since some of them indicated that farming was not their sole occupation. Some have secondary occupations in carpentry, construction work, factory work, transport, and other nonfarm activities which they engage in while waiting for the harvest season.

Their differences in terms of the selected indicators were summed up to estimate the heterogeneity index. A relatively high heterogeneity index is seen to increase the probability of the farmers to be active in collective activities (Table 4). The positive effect of the degree of heterogeneity can be explained by the tendency of the TSA members to coordinate more with each other because of the different information they have which can be shared within the group. Members from different backgrounds can generate more ideas which are also beneficial for the group. At the same time, a group whose members have different backgrounds may be less likely to be at risk because they possess different resources that would help to address their problems more effectively. This pattern, though , appears valid only in the case of the collective action being done within the TSA. Heterogeneity among the members shows no effect on the rate of collective activities with other TSA groups. This means that factors other than the heterogeneity index might be largely influencing the decision of farmers to do collective activities with other TSA groups.

Social Capital and the Opportunity Cost of Time

Forgone income was considered as an important factor that could influence the level of participation of farmers in collective activities. The study estimated the average length of time a farmer consumed in doing collective activities like canal maintenance. The hours spent on these activities were converted into an equivalent income forgone. Based on the regression results (Table 4), the income forgone has a negative effect on the decision of the farmers to participate in collective activities. Physical distance has something to do with the farmers' response to a change in their forgone income. Their transaction cost increases with the size of the system since it is more difficult to organize if there are more farmers involved. Having a larger numbers of users also increases the difficulty of agreeing on rules and enforcing rules (Ostrom et al. 1999). Moreover, it is more difficult and more costly to monitor over a wider area whether the rules of collective actions such as planting schedules and water rotation are duly observed (Fujiie et al. 2005). As indicated by the results in Table 4, farmers seem unaffected by a change in their forgone income when doing collective work within their TSA but appear to react negatively when doing collective activities with other TSA. This is because, the perceived forgone income in doing collective activities within their area is relatively lower compared to the possible income loss when engaging in activities with other TSA groups. Since TSA groups are far apart from each other, doing collective action with other TSA groups would entail a lot of coordination activities, which will be costly in terms of time and effort. Moreover, the perceived benefits of doing other activities like their secondary jobs, and chores like taking care of their children, may be more valuable than doing collective activities for the whole association.

Social Capital and Irrigation Service Fee Payment

Members of the irrigators' association are expected to pay their ISF dues every after cropping season. The collected ISF serves as source of funds of the association for irrigation management. As shown in Table 3, less than half (44%) of the farmer- respondents paid their ISF and the lowest percentage of paying members (25.9%) was from the downstream area. These figures may be interpreted to mean that these farmers were no longer benefiting from the irrigation system and were consequently discouraged to pay their ISF dues. However, there were also cases wherein some farmers in the upstream area did not pay their ISF dues. Though these farmers enjoyed 100 percent sufficiency in water supply, only 56.1 percent of them paid their ISF dues. These show that the farmers' compliance with the payment of their ISF dues is not solely based on their perceived benefits from the irrigation system. Recall that the ISF payment was treated as one of the variables affecting social capital investment. Based on the Model 1 regression results (Table 4), the farmers seem to be of the view that the act of paying the ISF gives them the option of not participating in the collective activities. This indicates that the ISF payment is more likely to be treated as a substitute to participation in collective activities within the TSA groups.

Therefore, although farmers may regularly pay the ISF, it cannot be assumed that they are willing to participate in the TSA activities. In fact, paying their ISF dues somehow seems to discourage them to work collectively. As earlier mentioned, one logical explanation for this effect is the perception of these farmers that their compliance with this obligation is their way of contributing to the irrigation management. In the same vein, these farmers believe that their fulfillment of this financial obligation compensates for their absence in collective activities. This way of thinking of course does not apply to all the members since there are those who are very active in the activities of the association and at the same time paying their ISF dues regularly. As indicated by the regression, the negative influence of the ISF variable is only valid within the TSA group activities. On the other hand, Model 2 indicates that the decision of the farmers to do collective work with other TSA groups is unrelated to their ISF payment status. Some other relevant factors are influencing their behavior, other than the ISF payment.

DISCUSSIONS AND CONCLUSIONS

The analysis of the data showed that the individual social capital investment generally adhered to the standard economic investment model. The farmers have been shown to be encouraged to participate in collective activities that translated into social capital accumulation, in the face of their perceived positive benefits of such collective activities. However, we had noted the important consideration that the social capital investment behavior we had observed exhibited some complications that veered from the usual expectations. As shown by the patterns of behavior of the farmers in the association, their responses to the demand for collective action were being influenced by the physical and socioeconomic environment, the stock of social capital, as well as by the externalities generated by each member and concerned agencies around them.

One particular example of this complication in the social capital investment behavior was the interaction of the effect of the physical environment and the introduction of a substitute source of water. Theoretically, farmers from the downstream area where water was most scarce were more expected to act collectively. Arising from the perceived greater risk due to their unfavorable location, they were expected to have been more encouraged to engage in collective efforts to irrigate their fields. However, a solution that was introduced to solve their seasonal problem of water scarcity has somehow influenced events to go in another direction. In response to the water shortage problem, the Department of Agriculture (DA) and the NIA had helped the farmers to amortize irrigation pumps that were acquired to mitigate the water shortage particularly during the dry season. A good number of farmers availed of this assistance and shifted to pumps to irrigate their fields. This new reliance on an alternative source of water wielded an adverse effect on the collective action of the association because the farmers reduced their participation in collective activities. This implied that the benefit of having an irrigation pump was perceived to be weightier than the benefit of relying on the irrigation association. This was evident in the shift in interest from doing collective work for the irrigation association, to availing of the subsidized irrigation pumps. If this condition persists, social capital investment might decrease in the long run.

The same pattern was evident with regards to the farmers' response to heterogeneity within the group. Based on the economic model presented, social capital investment would rise with more homogeneous groups. However, the results of the study showed an opposite response. The greater degree of heterogeneity promoted social capital investment. There was a complementation of resources and needs among the members of the groups which encouraged them to continuously work together. As highlighted by the previous discussion, social capital investment is unique in that the aggregation process taking place within the group is a crucial factor in an individual's social capital investment.

Aside from some complications brought about by the nature of social capital, farmers' responses towards social capital accumulation were consistent with the economic investment model. Farmers with relatively bigger portions of land to cultivate were more likely to be active in a group because the perceived benefit of having a good irrigation system was great. Thus, these farmers were more likely to participate in collective activities that could further enhance the irrigation management. Individuals were also concerned not just with the benefits derived from the resource but also the cost involved in investing on social capital. Since the irrigation system under study covered a relatively large area, coordination among members and collective efforts were costly. As presented in the study, the opportunity cost of time due to participation in collective actions significantly affected their participation. Due to a perceived increase in forgone income, individuals appeared to be discouraged to involve themselves in the collective activities of the association. Therefore, if the constraints to the investment in collective efforts and participation in local association can be overcome, more farmers would be encouraged to continuously support their local organization.

The stock of social capital within the association enhanced the participation in collective action. Since trust had already been established, the possibility of joining the collective activities in the future was expected. Even though members of the association were different from each other, as indicated by the heterogeneity index, still their differences encouraged participation in collective action. This was explained by the prevalence of the implicit view among the members that they could share their divergent interests and resources for the good of their group. By doing so, they increased the level of social capital in their association.

The study highlighted the fact that some farmers were somehow participating in the activities of the association through their monetary contribution. As evidenced by the data, some farmers who were religiously paying their dues were less likely to participate in collective efforts like canal maintenance and cleaning. Since the ISF served as a fund for the irrigation system's improvement and rehabilitation, the farmers' continuous payment could thus also help in sustaining the association's operations. However, if farmers were to assume all the responsibilities of managing the irrigation system as indicated by the IMT program, participating in collective activities would have an even greater impact on long-term irrigation performance than the cash contributions would indicate. The farmers' participation was clearly critical in order to have a successful participatory irrigation management.

It is clear that being a member of a group takes time, effort, and resources. To further enhance the level of coordination and collective action, and therefore the level of social capital within the association, the perceived benefits should outweigh the costs of investing in such capital. The perceived benefits of having good social relations and a smoothly running irrigation system must be high to continuously encourage participation in collective activities. Amid current trends in policies and programs to devolve natural resource management from governments to user groups, it is important to take a look at the situation beyond the simplistic and optimistic view that users can manage the resources. It is essential to recognize that the users' willingness and ability to take on additional responsibilities will vary across locations, as well as over time. Identifying the factors that will contribute to social capital accumulation is essential to the effective resource management by user groups. Therefore, interventions and programs by the government should complement and not impede the smooth coordination system taking place within the organization. On top of that, programs that may promote farmers' participation are necessary to productively harness the social capital existing within the association.

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