

Article

Costly Barriers to Sustainable Institutions: Empirical Evidence from State-Reinforced Management of a Communal Irrigation System in the Philippines

Doreen Ingosan Allasiw *, Toshinori Tanaka and Takashi Mino

Graduate Program in Sustainability Science-Global Leadership Initiative (GPSS-GLI),
Graduate School of Frontier Sciences, the University of Tokyo, Environmental Studies Building,
5-1-5 Kashiwanoha, Kashiwa City, Chiba 277-8563, Japan; ttanaka@k.u-tokyo.ac.jp (T.T.);
mino@mw.k.u-tokyo.ac.jp (T.M.)

* Correspondence: doreen@sustainability.k.u-tokyo.ac.jp

Academic Editor: Vincenzo Torretta

Received: 30 December 2016; Accepted: 3 May 2017; Published: 5 May 2017

Abstract: This study examines the process and outcome of institutional change from a self-governing common-pool resources (CPR) model into state-reinforced self-governance. Empirical evidence is drawn from the Philippines' experience in decentralizing the management of communal irrigation systems (CIS) to local farmers through Irrigators Associations (IAs). The field data were collected through archival research, a review of secondary documents, and key informant interviews in Sagada, Philippines. Through institutional analysis, the study confirms earlier empirical findings that self-governing bodies can work well with the state provided they do not impinge on the autonomy of resource users. However, user expectations regarding the costs and benefits of state-reinforced self-governance affect its likelihood of success. Drawing from the case study, changes in the value and distribution of transaction costs are the two biggest challenges to sustaining state-reinforced IAs. The first challenge is the introduction of membership and irrigation fees, a huge shift from the non-monetary contribution that farmers were accustomed to. The second challenge is the change in the allocation and distribution of transaction costs or, simply, who bears what cost. Further research is recommended to expand the current discourse on state-reinforced self-governance to include more in-depth transaction cost analysis.

Keywords: institutions; transaction cost; state-reinforced self-governance; community-based irrigation system; institutional analysis

1. Introduction

Studies that investigate the interactions of the state with local, informal organizations are still lacking [1]. To address this gap, the present study examines the process and outcome of changing the institutional arrangement of a communal irrigation system from self-governance to state-reinforced self-governance.

In lieu of privatization and centralized government control, self-governance is widely accepted to be a powerful policy alternative to avert the tragedy of the commons [2–9]. Often, due to the fixation on the superiority of self-governance over privatization and centralization, the state is inadvertently portrayed as coercive, and at times even destructive to self-governing systems [10,11].

Recently, however, an increasing number of studies have shown that the state is moving away from its traditional role of top-down hierarchical control. In a study of Japanese irrigation commons, an alternative regime called state-reinforced self-governance is described as a policy situation whereby the state employs a strategic non-coercive approach to reinforce self-governing institutions [12].

A similar trend has been observed in the field of environmental protection and natural resource management. The emerging literature on ‘new governance’ recognizes that a substantial change in the role of the state from a top-down command and control regulation to a more decentralized and consensual approach is taking place in the world [13,14]. This new mode of governance is characterized by some or all of the following dimensions: participation and power-sharing, diversity and decentralization, deliberation, flexibility, and knowledge creation [15]. From a normative stance, ‘new governance’ is argued to be more responsive, legitimate, and effective than top-down approaches since it builds on local knowledge and capacities, resulting in greater stakeholder ownership and ‘buy-in’ [16].

Despite its promise, many cases of collaborative environmental governance are failing, but the data to explain the failure are still limited [17], hence much remains to be done in identifying which types of institutional and governance arrangements work and which do not and why [16].

Existing case studies on repetitive failed attempts to bring about institutional change suggest that the process is neither simple nor spontaneous [18]. One prominent theory to explain why some institutional arrangements fail while others persist is the transaction cost theory [19]. In institutional economics, transaction costs generally refers to costs expended for the development, improvement, and implementation of institutions [20]. Transaction costs are incurred as a result of collecting information, decision-making, formulating rules, monitoring compliance, and enforcing rules [21].

A high transaction cost can impede the persistence of institutions, defined as “the rules of the game in the society or, more formally . . . the humanly devised constraints that shape human interaction” [19]. In the case of community-based irrigation, the literature on the effectiveness of institutions is vast [22–30], but empirical studies on the role and impact of transaction costs are still limited [25,30,31]. Accordingly, this lag in empirical research despite considerable theoretical advancement is due to the difficulty in identifying quantifiable, objective transaction costs [25].

The main objective of this article, however, is not to quantify transaction costs but to contribute in providing empirical data on transaction costs associated with the institutional change of community-based irrigation from self-governance to state-reinforced self-governance. Based on the theory of transaction cost economics, if given a choice, individuals will choose an institution that minimizes transaction costs [32]. Therefore, transaction costs should be examined when evaluating the potential of new institutions as alternatives to existing ones [33]. Adhikari & Lovett [34] similarly suggested that the comparison of transaction costs associated with different forms of property regimes is important in examining their significance in managing local commons.

The costs for sustaining self-governing institutions were traditionally kept low by strong social capital [9]. Social capital here refers to trust, norms, and networks, which are features of a social organization that improves the efficiency of the society by facilitating coordinated actions [35]. Hence, another contribution of the paper is to examine how institutional change is affected by the crowding out of social capital due to socioeconomic changes in the community. Based on the concept of embeddedness, institutions do not exist in a vacuum, after all; their formation cannot be removed from the social, cultural, and economic context within which they exist [36].

The empirical work on this article is based on the examination of institutional challenges to the sustainability of rice terraces in northern Philippines. While many studies on rice terrace management have mainly focused on exogenous threats [37–39], this study shifts attention to the endogenous threats to rice farming, specifically the breakdown of institutions supporting the construction, operation, and maintenance of the rice terraces. Araral [40] highlighted the importance of institutions in ensuring the resilience of rice terraces and recommends that future research investigate the emerging patterns of institutions to address the contemporary challenges facing local rice farming communities.

2. Emergence of State-Reinforced Self-Governance in the Philippines

In line with the increasing trend towards decentralized resource management, the Philippines’ irrigation commons has also undergone institutional change in recent years. In the past,

local farmers built their own irrigation systems, which they managed through self-organized institutional arrangements [41]. Since no external support was available from the state, the cost of developing, improving, and implementing self-governing institutional arrangements was borne by the users themselves.

Starting in the 1960s, however, the government initiated a nationwide rehabilitation of community-based irrigation systems. Following this, the self-governing farmer groups managing the irrigation systems were formalized into Irrigators Association (IA), through which financial aid and technical assistance from the state were channeled. In effect, user self-governance was transformed into state-reinforced self-governance.

By the 1980s, the Philippines case had been hailed as a model for participatory irrigation management in the developing world [42–45]. However, more recent studies claim that many of the rehabilitated irrigation infrastructures have deteriorated due to a lack of maintenance and that farmer associations have also ceased to be functional [46].

In theory, the improvement in the physical conditions of the irrigation system and the enhancement of local farmers' associations should increase the benefits of participation, and ensure that collective action for infrastructure maintenance is sustained through time. Collective action is defined as the situation when a group of people take coordinated and distributed action in pursuit of a common interest [47].

However, since sustaining institutions entails certain costs, institutional change can be challenging because not only can it result in increased costs but also new types of costs. Hence, the likelihood of a successful institutional change depends on how much of the cost the participants are willing and able to bear.

The present study attempts to draw a connection between changing institutional arrangements and the decline in collective action for irrigation maintenance. In doing so, this paper examines empirical evidence to support the proposition that “if the transaction costs are too high for those who implement them, institutional arrangements are unlikely to persist.” Previous studies suggest that an increase in the number of bargaining partners and routine interactions will likely lead to an increase in transaction costs [48].

Drawing on a case study of an irrigated rice farming community in Sagada, Philippines, this study investigates the role of institutional change in the decline of farmers' collective action, as evidenced by the deterioration of irrigation infrastructure. The paper addresses the following questions: (1) How did farmers ensure collective maintenance of communal irrigation under self-governing institutional arrangements? (2) What is the difference between communal irrigation management under self-governing and state-reinforced institutional arrangements? (3) What are the associated costs for maintaining the different institutional arrangements, and how did farmers deal with these costs?

The paper is divided into seven parts. The next section outlines the theoretical framework of the study, followed by the methodology section. The main findings are described in Section 5. Section 6 presents the discussion and analysis. Finally, Section 7 concludes the study.

3. Theoretical Framework

3.1. Collective Action and Institutional Approach

Collective action is essential to the maintenance of irrigation infrastructure. However, because of the nature of irrigation as a public good, collective action may fail when farmers are unable to deal with the public goods dilemma. Since resource users can benefit regardless of whether they have helped provide it, the individual farmer is faced with the dilemma of choosing whether to contribute to its maintenance or not [30,49].

The public goods dilemma is also characterized by tension between short-term individual interests and the general public interest [50]. In the absence of strong collective action institutions, farmers tend

to shirk their responsibilities, even though they all would be better off in the long run if everybody chose to cooperate [30].

In terms of their short-term interests, farmers receive higher benefit from freeloading on the efforts of others in the maintenance of the irrigation system [50]. However, in the long term, freeloading can undermine the cooperative behavior of otherwise willing participants, due to fear that there will not be enough others who will cooperate. They might defect, ultimately resulting in a negative effect on the public good [51,52].

Ostrom identified three main categories of factors related to participation in collective action: resource characteristics, characteristics of the user group, and attributes of institutional arrangements [53]. Numerous case studies have established that the physical characteristics of an irrigation system affect the way farmers cooperate in its maintenance [54]. As for user characteristics, it has been argued that small, socially and economically homogenous communities are more likely to have successful collective action [55,56].

Nevertheless, it was found that even without facilitating conditions such as size and homogeneity of user groups, collective action participation has a higher likelihood of success when institutions exist [30]. Woodhill suggests that institutions influence cooperative action by providing incentives (positive and negative) for resource users to behave in particular ways [57].

The lack of appropriate institutions could lead to a lot of uncertainty about the behavior of other users, making it difficult to sustain collective action [9]. Thus, an institutional approach that combines the theory of institutions and transaction cost theory was established to understand the existence of institutions, and why some fail and others succeed [19].

In the past, transaction cost economics discourse was limited to the business literature. More recently, however, it has also been used for development policy analysis and assessment of institutional arrangements for resource management [58]. Over the years, the works of various scholars on transaction costs have led to the development of the school of institutional economics, which argues that societies can only endure if they create institutions that effectively reduce transaction costs [19,32,59,60]. For institutions to work in the context of community-based resource management, enforcing, monitoring, and improving them are necessary. These efforts entail human action, which in turn has corresponding costs. Hence, transaction cost analysis can be used as an indicator to show the superiority of institutions and institutional arrangements [20].

3.2. Institutional Choice Framework

To examine the process and outcome of institutional change, the present study adopts the institutional choice framework of Ostrom [2]. An institutional choice situation refers to the situation where an individual is faced with the decision of whether to retain or change the status quo operational rules. Kiser and Ostrom defined operational rules as those that affect daily operation decisions concerning when, where, and how to withdraw resource units, monitoring and enforcement, sanctioning, and information to be shared among users [61].

The institutional choice framework enables the researcher to focus on individual level strategies in institutional choice situations. Although institutional change often affects constitutional choice and collective choice rules, the individuals who have to choose whether to retain or change the status quo rules remain the same. Collective choice rules are used in deciding operational rules. On the other hand, constitutional rules indirectly affect operational rules by limiting the types of decisions that can be made, and by influencing the choice of which can be represented and in what capacity in the collective choice sphere. Hence, to analyze the failure or success of institutional change, one must view it from the perspective of individuals who can make choices about future operational rules [2].

As shown in Figure 1, the decision of individual users about whether or not to support change in status quo rules is influenced externally by information about the costs involved and internally by the expected benefits.

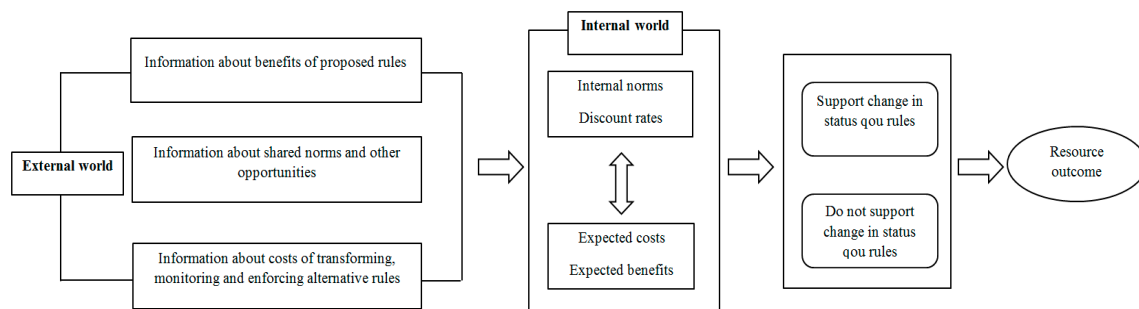


Figure 1. Framework for analyzing institutional choice. Adapted from Ostrom [2].

4. Methodology

4.1. Research Design

The study was designed as a qualitative research following the case study method. This methodological choice is aimed at capturing social reality through fieldwork in natural settings. A case study is defined as an “empirical inquiry that investigates any contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” [62]. The case study approach aims for analytic generalization, where the intention is to generalize at a conceptual level, in contrast to quantitative research designs, which aim for statistical generalization [63].

To gather the most relevant data and to be able to make generalizations about a case, obtaining a “representative characterization” of whichever aspect of the population one is interested in is highly important [64]. Since the objective of the study is to analyze the nature of changing institutional arrangements for governing the irrigation system, purposive sampling was used to select the informants in the community who have the longest farming experience. Since they have utilized the irrigation system for a long time, it is presumed that they are the most knowledgeable about changes in institutional arrangements over the years.

However, one common criticism of using interviews to ask people to remember and explain historical experiences that the researcher cannot directly observe is the questionable validity [65]. In order to compensate for this, the study included multiple perspectives and referred to secondary documents such as National Irrigation Administration (NIA) project reports, municipal documents, and barangay files including minutes of meetings and project records.

NIA is a government-owned and controlled corporation that is responsible for developing and managing irrigation in the country. A barangay is the smallest political sub-division of municipalities and cities in the Philippines. As a local unit of governance, the barangay serves as the main channel through which the national government implements plans and policies for national development.

The interviews were conducted using purposeful snowball sampling, wherein each person interviewed was asked to recommend the next person to be interviewed. The first informant, unanimously recommended by local farmers during the initial exploratory field visit, is considered to be the most authoritative figure in irrigation management. The interviews ended when the same information started to be repeated by the informants. Two main categories of interviewees were considered in the study, namely, traditional community leaders and barangay officials, to account for any contrasting perspectives about institutional change and its impact on collective action. Barangay officials are the local government representatives, elected every three years by the community to govern the barangay. A barangay official can be elected thrice. In contrast to traditional community leaders, barangay officials usually have higher educational attainment.

In total 18 people were interviewed, 10 of whom currently serve or have previously served as *barangay* officials. Each interview session was recorded, transcribed, translated into the English language, and coded for themes.

Finally, a two-step research process was undertaken to analyze the empirical data. The first process is the triangulation of data from different sources. The second process is matching theory and reality. This process entails an iterative process of comparison and adjustment between theory and reality, which provides the researcher with a refined understanding of the real situation [66]. The main goal of the analysis is not to present reality as it is, but to create a representation by using the subjective viewpoints of the different stakeholders. This provides an opportunity to gain a deeper understanding of how people experience and interpret reality.

4.2. Research Setting

The research reported here is from a case study of communal irrigation in the municipality of Sagada, Philippines. The study area was chosen for two reasons. First, the case presents both successful self-governance [67,68] and failed state-reinforced self-governance, which allows for a meaningful comparison of the transaction costs between different resource regimes in a single case. Second, issues about declining collective action for irrigation maintenance were found to be persistent and critical to the sustainability of the rice terraces in the region.

Since local-level institutional arrangements for communal irrigation are the empirical focus of this study, it was important to select a suitable community-managed irrigation system with participants who were accessible to the researcher, possess relevant knowledge about irrigation management, and were willing to share their experiences to provide primary data.

The study area is located in the northernmost part of the municipality and supplies irrigation water to four *barangays*, namely Aguid, Pide, Banga-an, and Fidelisan, comprising 303 households. The location of Sagada municipality and the boundaries of its different *barangays* are shown in Figure 2. Table 1 shows that the area has a total irrigable area of 120 hectares, with an average farmer landholding of 0.25 hectares.

An earlier case study of the Ifugao Rice Terraces (IRT), a UNESCO World Heritage Site located in the same region, stated exogenous factors such as urbanization and the availability of alternative livelihood threaten the sustainability of rice farming [40]. It has been argued that the decline in maintenance activities for rice terraces is a result of the increasing number of farmers leaving rice farming. A survey conducted in one of the heritage sites revealed that local farmers do not identify rice farming as a main source of livelihood [69].

In contrast, a baseline survey for the present study shows that 51 percent of the households in Northern Sagada still identify rice farming as their main source of livelihood (see Table 2). This underscores the fact that the maintenance of the irrigation system remains important for the sustainability of the rice terraces.

Table 1. Characteristics of the study area.

| Sagada, Philippines | |
|----------------------------|---|
| Production system | Irrigated rice farming |
| Irrigable area | 120 ha |
| Topography | Terraced |
| Water storage | None/river run-off |
| Average landholding/farmer | 0.25 ha |
| Property rights system | |
| Rice paddies | Privately owned |
| Irrigation | Common property |
| Institutions | Informal rules for operation and maintenance of irrigation system |

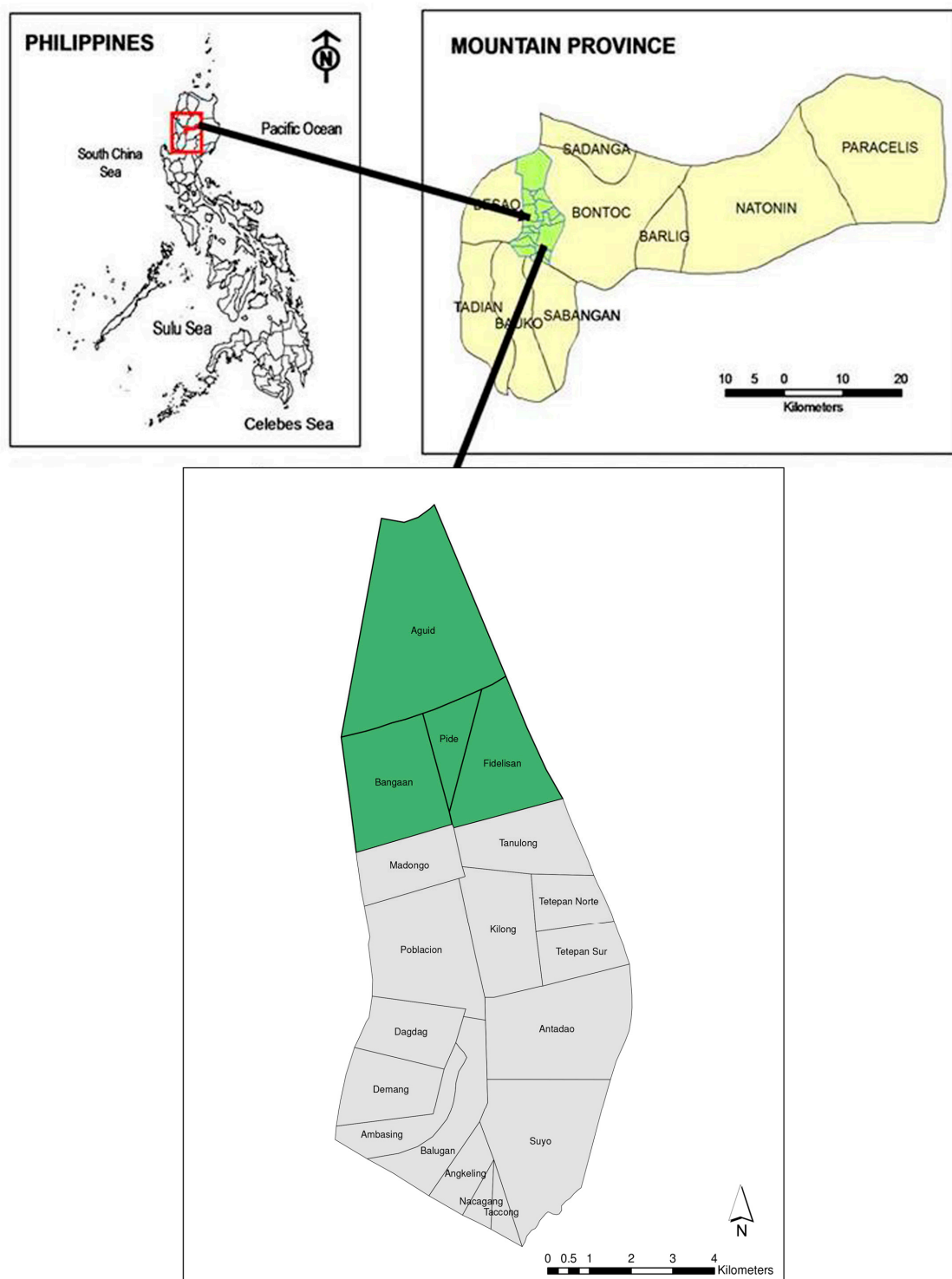


Figure 2. Map showing the location of the four northern *barangays* of Sagada covered in the study.

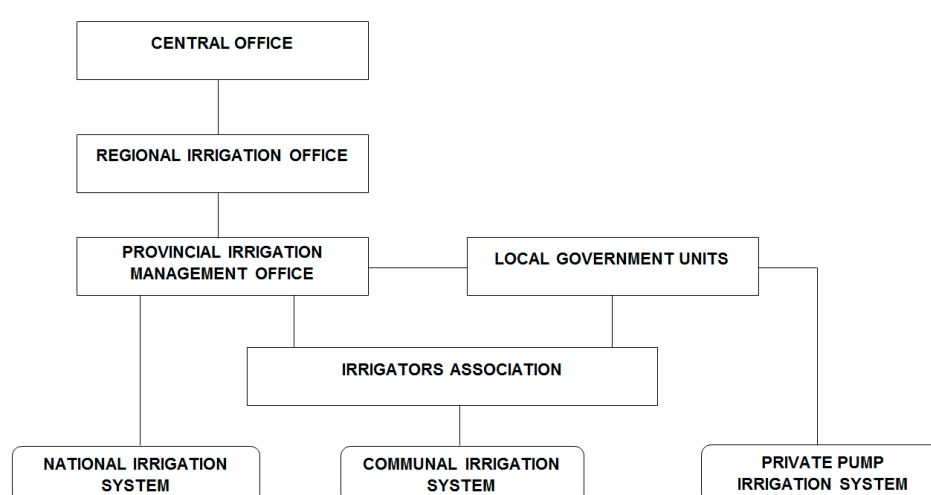
Table 2. Main sources of livelihood, Northern Sagada (2016), $n = 120$.

| Livelihood Activity | Frequency | % |
|---------------------|-----------|----|
| Rice farming | 61 | 51 |
| Logging | 7 | 6 |
| Mining | 9 | 7 |
| Barangay official | 16 | 13 |
| Hog raising | 10 | 8 |
| Tour guide | 6 | 5 |
| Carabao rental | 1 | 1 |
| Sugar cane growing | 1 | 1 |
| Coffee growing | 4 | 3 |
| Buy and sell | 1 | 1 |
| Teaching | 1 | 1 |
| Storekeeper | 1 | 1 |
| Poultry raising | 1 | 1 |
| Weaving | 1 | 1 |

4.3. Case Study Description

In the 1960s, the national government embarked on the construction of public irrigation systems as well as the rehabilitation of existing indigenous irrigation systems to increase rice productivity to meet the food demand of a burgeoning population. At the time, the population of the country was about 62 million, with a growth rate of 2.4% [70].

In 1963, the NIA was created to oversee irrigation development and management. Three categories of irrigation system were placed under the agency: 79 National Irrigation Systems (NIS), 771 Communal Irrigation Systems (CIS) and 2450 privately owned pumps/tube wells [71]. Communal Irrigation Systems (CIS), which are mostly self-organized, are mainly small-scale systems irrigating 100–200 hectares. In contrast, medium and large National Irrigation Systems (NIS) irrigating areas of more than 1000 hectares are usually built by public funds and managed by the state through NIA. Although the financial flow of NIA is top-down, the actual management of irrigation systems in the country is in fact bottom-up. The communal irrigation systems, as well as the privately-owned pump system, are managed at the local level by the municipal government, while the provincial government manages the national irrigation system. Figure 3 shows the organizational structure of NIA.

**Figure 3.** Organizational structure of the National Irrigation Administration (NIA).

In the mid-1970s, the NIA launched a pioneering program called the Participatory Irrigation Management (PIM) Program, which aimed to decentralize the construction and the operation and

maintenance O&M of both small and large-scale irrigation systems. Apart from investing in the improvement of infrastructure, local farmers were also organized into Irrigator Associations (IAs) with the goal of improving institutional support for irrigation development.

The participatory model implemented by NIA was hailed a success and attracted widespread attention from both practitioners and scholars. World Bank representatives as well as independent researchers conducted extensive evaluations of irrigation performance after the reform [42–45]. From the 1980s to the 1990s, the NIA gained international recognition due to the positive results of PIM, including better yield, more equitable water distribution, and better financial management [72–74].

In the early 1990s, one of the communal irrigation systems selected for rehabilitation was the Mabileng-Oliwek Communal Irrigation System (CIS) in northern Sagada. The gravity-flow irrigation system is the biggest in the municipality with a total length of 9.24 km and width of 3 m. Originally constructed in 1952, it used to be a rudimentary canal made from local materials, including hollowed logs and a compacted mixture of grass and mud. During the rehabilitation of the irrigation system, the earthen canal was replaced by a concrete-lined structure. Figure 4 shows a typical view of the irrigation canal traversing the mountain.

Based on project documentation from NIA, the original construction of Mabileng CIS was initiated by the traditional leaders of the community, also known as *dap-ay* elders, to address the shortage of water for irrigation purposes. The *dap-ay* was the traditional sociopolitical unit of governance in Sagada prior to the establishment of the *barangay* system. Soon after construction, the appropriation and provision rules were agreed upon by the users themselves and enforced by the *dap-ay*.

Each farming household is represented in the *dap-ay* by the male head. The elderly and more experienced members are elected by other members to become part of the council of elders who serve as leaders of the *dap-ay*. Besides age, members of the council are also selected based on their expertise in performing traditional rituals as well as a good reputation for resolving conflicts. Each *dap-ay* unit can make decisions on its own. However, major decisions that affect the entire village have to be deliberated upon by all the concerned *dap-ay*.



Figure 4. Canal cross section of Mabileng Oliwek CIS taken in January 2000.

5. Main Findings

5.1. Decline in the Collective Maintenance of Irrigation System

Despite huge investments in the development of Mabileng Oliwek CIS (see Table 3), all key informants claim that the irrigation system is not as well maintained as it used to be. It was reported

in the interviews that farmer participation in the annual cleaning and maintenance as well as other periodic activities necessary for the functioning of the system has decreased. The lack of canal maintenance often results in water shortages, especially during the summer months, when water discharge from the source is low. Consequently, very little or almost no water reach the paddies located at the lower end of the irrigation system.

Table 3. List of projects implemented for Mabileng Oliwek CIS. Based on NIA Annual Reports 1990–2016.

| Year | Project Name | Project Cost | Project Details |
|-----------------------------|---|--------------------------------------|---------------------------------------|
| 1990 | Communal Irrigation Development Program (CIDP II) | Php 5,912,420.00 | Canalization of 3.7 km of the canal |
| 1999 | Cordillera Highland Resource Management (CHARM) | Php 12,311,944.00 | Canalization of 5.334 km of the canal |
| 2012 | NIA Calamity Fund CY 2012 for those affected by a super-typhoon | Php 1,500,000.00 | Repair and rehabilitation of canal |
| Total government investment | | Php 19,724,364.00 50 Php = 1 US\$ | |

As a typical gravity-flow irrigation system, Mabileng-Oliwek CIS is highly reliant on collective effort to ensure that water is equitably distributed to the paddy fields in the upper, middle, and lower reaches of the mountain. Since there is no metering device to measure the water intake by individual paddy fields, each farmer has to cooperate in ensuring the equitable distribution of water by self-policing.

Also, because of its size and the ruggedness of the terrain traversed by the irrigation system, the maintenance of the irrigation canal is highly labor-intensive. In the past, farmer irrigators were organized into ad hoc groups based on the location of their paddies and assigned to maintain a specific section of the canal. In recent years, labor is simply divided among the *barangays* supplied by the irrigation system.

The annual cleaning and maintenance officially starts as soon as the farmers from *barangay* Fidelisan, whose paddy fields are located in the lower stream, initiate the clearing of the canal section starting from the water source. Afterwards, the remaining *barangays* proceed to clean their assigned section, one after the other, until the water reaches the tail end of the irrigation system. Maintenance tasks include weeding, stonewalling, and clearing the canal of debris.

Paddy fields located at the lowest reaches of the mountain are most vulnerable to water shortage because of the distance the water needs to travel and the many disturbances it could encounter, both natural such as seepage and human-induced including water diversion by farmers in the upper reaches. Key informants from *barangay* Fidelisan specifically complained that, although they try their best to keep up with the maintenance work, they often suffer from water shortages because of the declining cooperation of upstream *barangays* including Aguid and Pide.

We always do our part in the maintenance [of] the irrigation because it is our obligation as good members of the community. It is also to ensure our supply of water. But when farmers from other *barangays* do not do their part then our effort is useless. (Farmer from Fidelisan, field interview, March 2015)

The water source of our irrigation system is a stable one. In the past, even during [the] summer months, the water discharge from the canals was enough to irrigate the last paddies. But now farmers in the upper *barangays* do not let the water flow to us anymore. (Farmer from Fidelisan, field interview, March 2015)

The shortage of irrigation water often forces farmers to abandon their paddy fields, which not only poses a livelihood problem, but is also a serious environmental threat. It has severe consequences

not only for soil quality and erosion, but for sedimentation processes as well [75]. Since agricultural terraces were built to retain water and soil to reduce erosion and hydrological connectivity, a lack of maintenance can cause the terraces to collapse, resulting in increased erosion [76].

In early 2016, a strong typhoon swept across the country, bringing a lot of rain. Since many of the terraced paddies were left fallow and unmaintained due to a lack of irrigation water, the absorption capacity of the soil was very weak. With this situation, it was not able to hold much water, causing a big slide. Figure 5 shows the eroded portion of the rice terraces during the field visit in March 2016.



Figure 5. Eroded portion of rice terraces in Northern Sagada, Philippines in March 2016 (Photo by Doreen Allasiw).

5.2. Rule Enforcement and the Changing Role of the Dap-Ay System

The *dap-ay* plays an important role in enforcing the rules for the operation and maintenance of irrigation systems in northern Sagada. In the past, *dap-ay* was a central part of everyday life in the community, which made it effective in its role as a rule enforcer.

The *dap-ay* is the center of community life. So, if you always violate rules of *dap-ay*, you will get [a] bad reputation in the community. This situation is difficult because if you need help then people may be hesitant to give it. (Farmer from Pide, field interview, March 2015)

Non-participation in the annual maintenance of the irrigation system is subject to a penalty either in the form of cash or an equivalent amount in food, which is usually served to others who participate in the cleaning. Reportedly, the amount varies per *barangay*, but it is usually between 50 and 100 Philippine pesos. The *dap-ay* elders themselves monitor farmer participation. After every maintenance activity, assigned members of the *dap-ay* go around the community to collect a penalty from the households that did not send any representative for the maintenance work. According to the informants, however, even if a non-participating farmer is able to pay the penalty, the damage to his reputation of being branded as non-cooperative is a heavier price to pay, especially if he does it repeatedly.

Apart from the enforcement of the rule on annual maintenance, the *dap-ay* also ensures that irrigation water is properly appropriated. Ideally, each paddy field is given two hours' worth of water. Afterwards, water is directed to the next paddy field. Farmers caught stealing more than their fair share pay a fine decided upon by the *dap-ay* elders.

First-time violators simply get a warning, but repeat offenders are subject to a counseling session. At the same time, the offender is also usually asked to pay a fine in the form of food for the *dap-ay* elders who take part in counseling. However, if water stealing results in an altercation with another

farmer, the offending farmer may also be asked to compensate the aggrieved party by providing food not only for the elders but for the whole community. According to key informants, the main objective of conflict resolution is to restore a good relationship between farmers. Hence, fines are usually in the form of animal sacrifice so that it can be used for the ritual of restoring order in the community. All those involved in resolving the conflict share the meal provided from the animal sacrifice.

For first-time offenders, we only give a warning. But if you repeat it, then we [*dap-ay* elders] have to decide on the nature of the fine, depending on the circumstances of your offense. There was one farmer before who was caught stealing the water share of other farmers and directing it to the river. So a group of elders went to his house to counsel him, and he provided food for us as his punishment. (Farmer from Aguid, field interview, March 2015)

Recently, however, the authority of *dap-ay* elders is said to be declining because of sociocultural and political changes in the community. One major change is the introduction of the *barangay* system. In the past, being a *dap-ay* elder was a symbol of power and prestige, and a proof of good reputation in the community. Improving one's reputation can be done by rendering services to the community including resolving conflicts, performing rituals, and enforcing irrigation rules. Although they do not receive any monetary compensation, the *dap-ay* elders willingly bore the cost of enforcing and monitoring irrigation rules with the incentive of gaining prestige and higher status.

In the late 1960s, the *barangay* system of governance was adopted in Sagada. The *barangay* system introduced the concept of honoraria and salaries for elected *barangay* officials. This resulted in a shift in the perception of community leadership as an employment opportunity. Although several informants claim that some *dap-ay* elders continue to be motivated to render services because of a genuine interest in serving their community, others pointed out that it should be the responsibility of *barangay* officials to enforce rules because they are getting paid.

Nowadays we wait for the *barangay* officials to call for the annual cleaning and maintenance. In the past, *barangay* officials consulted *dap-ay* elders on the schedule of maintenance because they also had to consider a good day to perform rituals. But *dap-ay* elders are less involved now since there is no incentive for them. (Farmer from Pide, field interview, March 2015)

Apart from the introduction of the *barangay* system, which usurped the leadership authority of the *dap-ay* elders in the community, the social and cultural changes in community dynamics also threaten the social relevance of the *dap-ay*. The *dap-ay* was traditionally the center of the religious and cultural beliefs of the community. However, this has been challenged recently by the entry of new religious sects and the diminishing commitment of the younger generation to cultural practices and traditions.

Nowadays, the younger generations who have higher education feel like they do not need to follow *dap-ay* rituals and practices anymore. They say it is too expensive and not practical. The price of pigs, which are the main component of *dap-ay* rituals, has rapidly increased in recent years. (Farmer from Pide, field interview, March 2015)

The new religious sects that entered the community say *dap-ay* practices are paganistic. They tell their followers not to join anymore and some people do obey. (Farmer from Fidelisan, field interview, March 2015)

One of the main tasks of the *dap-ay* elders in the management of communal irrigation system is the appointment of water distributors called *lampisa*. This function is critical to the sustainability of the irrigation system because it serves as a coping mechanism during seasonal water scarcity. Even though water is generally abundant throughout the year, it becomes scarce during the dry months and water stealing and fighting among farmers become problematic. The placement of *lampisa* therefore is necessary to ensure that water is equitably distributed between the users.

The work of the *lampisa*, the water distributor, typically commences after the transplanting season: starting from early March to April, when the water level is at its lowest. The services rendered by the water distributor include weekly inspection of the main irrigation canal to ensure the smooth flow of water from the source to the rice fields. On a daily basis, he distributes the irrigation water evenly between the upstream, middle stream, and downstream fields. A *lampisa* water distributor gets a five-percent share of the total harvest as compensation. Since 2012, however, there have been no *lampisa* volunteers.

Lately it has become difficult to convince people to serve as *lampisa*. One reason is that the elders are now losing their ability to convince. (Former *barangay* captain and *lampisa* form Pide, field interview, March 2015)

Despite acknowledging that the legitimacy of the *dap-ay* has been declining because of the changing political and social dynamics of the community, all key informants claim that the *dap-ay* elders still hold considerable authority in the community. One example often mentioned in the interviews was about conflict resolution. Currently, conflicts in the community are usually first brought to the *dap-ay* for resolution. It is only when the parties are not satisfied with the *dap-ay*'s decision that it is taken to the *barangay* level. Setting the tempo of the agricultural cycle also remains in the hands of the *dap-ay* elders.

5.3. State-Reinforced Self-Governance through the IA

Despite the financial and technical support provided by the national government for the rehabilitation of Mabileng-Oliwek CIS, the state maintained a non-authoritarian approach in dealing with local farmers. Though certain requirements were made of the project beneficiaries, the process was done in a bottom-up participatory process. One of the main requirements was the formalization of farmer groups into registered Irrigators Association (IAs). To meet these requirements, local farmers organized themselves into a general assembly and elected board members to serve as leaders of the IA. Although organizational positions specified in the IA were pre-determined positions standard for all IAs in the country, the locals were given the freedom to create their own committee for operating and managing the system.

Consequently, institutional change took place only at the formal level, through the organization of farmer groups. In reality, local farmers continued to comply with existing rules that were long established under the *dap-ay* system. This was only possible because of the high degree of autonomy granted to the local farmers by the government.

The participatory and consultative process of organizing the Mabileng IA and the transfer of ownership of the newly rehabilitated canal from the state to the IA allowed the users to retain autonomy in managing their resource. Furthermore, the positioning of *dap-ay* elders and *barangay* as IA officials ensured the legitimacy of the rules enforced by the IA. Notably, besides coercion, self-interest and legitimacy are important factors in encouraging compliance with rules [77].

Local farmers supported the establishment of IA in the beginning because it was the main requirement needed to receive funding support from the government. However, it was reported in the interviews that *dap-ay* elders and *barangay* officials were expected to remain responsible for enforcing irrigation rules.

During project implementation, the *barangay* served as the implementing partner of the national government. The *barangay* officials received honoraria and travel allowances for attending activities related to the project. After the completion of the project, however, the official responsibility of the *barangay* also ended since irrigation management is not part of the official mandate of *barangay* officials. As a result, there was tension between *dap-ay* elders and *barangay* officials but also confusion among the farmers. The majority of those interviewed expressed the opinion that the *barangay* officials who had gained monetary incentives from the project should be more active in maintaining the system.

A former *lampisa* volunteer claimed that, although some people want to serve as *lampisa*, the lack of follow-up from *barangay* officials discouraged them from doing so.

In 2011, I was a *lampisa* volunteer. At that time the *barangay* officials gathered us in the *barangay* hall and formally requested our services. In the following year, I wanted to be a volunteer again. However, the *barangay* officials did not bother to contact us so we felt like we were not recognized and so we did not do it. (Farmer from Aguid, field interview, March 2015)

The state-reinforced IA system was found to have stopped functioning after the project completion. In 2012, almost a decade after the establishment of the Mabileng IA, the local farmers registered a new IA covering the same irrigation system when it was found that the Mabileng IA registration had expired due to unpaid annual fees. This situation came to light when the farmers requested new funding from the government to rehabilitate a portion of the canal destroyed by a typhoon.

Results of key informant interviews suggest that local farmers had difficulty sustaining IA organizations after the project completion. A review of the meeting minutes of the *barangay* assembly in 2012 revealed that the IA was not able to implement its by-laws on the collection of required membership and irrigation fees. Based on Article VII of the Constitution and By-Laws of Mabileng Oliwek Irrigators Association (1990–2012), the fees that were supposed to be collected were to be utilized for the yearly renewal of IA registration and other administrative expenses.

As reported by key informants, local farmers could not afford to pay membership fees in cash. Most do not earn cash from rice production since it is mainly for subsistence because of the limited planting area of on average 0.25 hectares per farmer.

Prior to the establishment of the formal IA organization, membership was legitimized simply through labor contributions provided during the annual cleaning and maintenance activity, whenever required by the *dap-ay*, as well as attendance at meetings. With the establishment of IA organization, however, farmer members were also required to contribute an annual membership fee and an irrigator's fee in order to pay for the annual registration of the organization as well as finance its operation.

During project implementation, the budget for the registration fee was included in the project cost. After the project completion, however, IA members needed to raise funds on their own. Unfortunately, local farmers indicated that they could not afford to pay the membership fee for Irrigators Association (IA) on a regular basis.

To elucidate this situation, Table 4 shows the amount of contributions needed from the farmers for the rehabilitation of the irrigation system in 1999. According to government regulations, project beneficiaries through the IA were required to provide 30% of the total project cost. However, because IA members could not afford such a huge amount in cash, the farmers instead provided its equivalent value in the form of labor force. Based on the computation, each household that benefited from the project was expected to contribute Php 12,190.04, which is equivalent to 38 days of labor per household.

Table 4. IA member contribution for rehabilitation of irrigation system as of 1999.

| Total Project Cost (Php) | 30% Counterpart (Php) | No. of Household Beneficiaries | Expected Cash Contribution per Household (Php) | Equivalent Contribution in Labor (No of Days) |
|--------------------------|-----------------------|--------------------------------|---|--|
| 15,765,121.00 | 3,693,583.42 | 303 | $3,693,583.42 / 303 = 12,190.04 / \text{household}$ | $12,190.04 / 317.84 = 38 \text{ days/household}$ |

Daily rate for unskilled labor = 317.84/day; 50 Php = 1 US\$.

To get a sense of how costly this was for the local farmers, the amount is compared with the average per capita income of the *four barangays* in Northern Sagada as shown in Table 5. The data were obtained from a survey conducted by the Department of Social Welfare and Development (DSWD) in 2009–2010. The comparison shows that the expected amount of contribution is almost 40–50% of the average per capita income.

Table 5. Average income per household in Sagada.

| Barangay | No. of Assessed Household | Estimated Average Income per Household (Php) | Comparison with Expected IA Contribution (%) |
|-----------|---------------------------|--|--|
| Aguid | 152 | 27,807.94 | 43.84 |
| Bangaan | 171 | 32,519.39 | 37.49 |
| Fidelisan | 99 | 25,740.29 | 47.36 |
| Pide | 91 | 27,521.06 | 44.29 |

Similar to the change in membership cost, a change in participation cost was also observed. Prior to the rehabilitation of the canals and the establishment of IA, member contribution for the maintenance of the system was provided in the form of time and labor. During that time, this contribution was enough since the irrigation canal was made from rudimentary materials that could be easily and freely outsourced in the locality such as rocks, muds, grass, and hollow logs. Although the concreting of the canals has in fact made them easier to clean, it also resulted in the introduction of monetary costs for purchasing concrete materials such as cement, gravel, and sand whenever repairs had to be done.

Unexpectedly, the decrease in labor requirements for maintenance work resulted in a decline in the internal motivation for people to cooperate. In the past, the rudimentary condition of the irrigation canals made them very fragile and vulnerable to landslides and erosion, and thus regular maintenance work was highly necessary. Consequently, local farmers were motivated by the moral responsibility of knowing that their participation was important to ensure water provision for the community.

Before the canal was cemented, the maintenance work took at least 3–5 days' worth of work, but now it only takes 1–2 days. (Barangay captain from Aguid, field interview, March 2015)

The collection of fines is important to motivate people to come. But in reality what is more important is you show your cooperation with the community. In the past, some people from one *barangay* did not join the cleaning and simply send food contribution. So the community got angry and left their part unmaintained so they had to come do it themselves. (Farmer from Aguid, field interview, March 2015)

6. Discussion

Two main challenges are found to pose the greatest threat to the sustainability of a state-reinforced IA institution. First is the change in the form of transaction costs needed to maintain institutions, and second is the change in the distribution of costs.

6.1. Change in the Form of Contributions from Non-Monetary to Monetary

The change of institutional arrangement from self-governing *dap-ay* system into a state-reinforced IA system entailed transaction costs that local farmers could not afford. At the onset of the rehabilitation project, local farmers willingly invested time and effort for the establishment of an IA association because of the knowledge that they could not access government funding without a registered IA. However, after the completion of the project, sustaining the IA institution became too costly for the farmers.

One reason for the increased cost is the change in the form of member contributions from non-monetary to monetary. The establishment of IA inadvertently introduced bureaucratic procedures that required cash contributions from resource users for administrative and operational purposes. Tang [78] suggested that, although bureaucratic arrangements can play an important role in the construction, production, and distribution of common-pool resources, they are sometimes less sensitive to the local context of resource users, making them less effective than communal systems. Since rice farming in Sagada is mainly for subsistence, a monetary contribution is burdensome for farmers. Apart from the fact that the required cash contribution is too high for farmers, the emphasis

on monetary contribution for the maintenance of the irrigation system crowded out the intrinsic motivation of farmers to cooperate. It is well documented in the conservation literature that the crowding out of intrinsic motivations, such as the need for internal satisfaction or the moral commitment to the common good, can undermine the long-term success of such initiatives [79–81].

This study shows that the farmers were motivated to cooperate for at least two reasons: the desire for a good image, and moral responsibility. In the past, the labor provided by each farmer was very important given the fragile nature of the irrigation system. Contributing labor allowed each farmer to show that they were cooperative and cared about the common good of the community, which in turn helped build their good image. By reducing participation to monetary contributions, however, farmers are denied the chance to build a good public image. Gneezy et al. [82] refer to such a crowding out phenomenon as reduced image motivation.

Irrigation water is an indispensable resource for food security; hence, each farmer was internally driven by the moral responsibility to contribute to ensuring that the water needs of the community were met. The improved conditions of the canal lowered the labor requirement for maintenance, which released farmers from feeling morally responsible, resulting in a decreased commitment to participate in maintenance activities.

6.2. Change in the Allocation and Distribution of Costs

Based on the institutional choice framework, it can be argued that, at the beginning, the change from a self-governing *dap-ay* system to the state-reinforced IA organization was successful, because the benefits outweighed the costs from a farmer's perspective. The local farmers were highly cooperative because the benefits were immediate, in this case the concreting of the irrigation canals. This is consistent with the concept of discount rate introduced earlier. According to this concept, individuals discount future benefits, attributing less value to the benefits that they expect to receive in the distant future, and more value to the immediate ones [83].

Farmer compliance with irrigation rules remained consistent in the early stages of the change from an informal to a formal system, since the locals continued to comply with the social norms under the *dap-ay* system. However, concurrent with the change in institutional arrangements for irrigation management, the social relevance of *dap-ay* was also found to be declining due to changes in religious and cultural beliefs. The decline in the social relevance of *dap-ay* changed the incentive structure for the *dap-ay* elders, which significantly impacted their role in internalizing the cost of maintaining the system. With the decline in the social relevance of elders, they had no incentive to internalize the cost of enforcing and monitoring irrigation rules.

Also, the monitoring costs were kept low in the *dap-ay* system due to the entwining of personal and economic relationships. Since the *dap-ay* elders themselves were farmers, they were easily accessible to the community whenever there were issues to discuss or conflicts to settle.

In contrast, in a state-reinforced IA system where the *barangay* officials are the de facto IA officers and implementers, it was reported that commitment to managing the irrigation system is lower. A former *lampisa* volunteer claimed that, although some people wanted to serve as *lampisa*, the lack of follow-up from *barangay* officials discouraged them from doing so.

Two possible reasons have been identified. Firstly, most of the currently serving *barangay* officials are non-farmers. In fact, only one out of the four *barangay* captains interviewed is a full-time rice farmer. The *barangay* captain is the highest position to which one can be elected. Secondly, managing the irrigation system is not part of their official function. The lack of commitment on the part of the *barangay* to enforce irrigation rules, coupled with the declining authority of the *dap-ay*, weakened the enforcement of rules and monitoring of compliance.

One of the indications, as reported in the interviews, that *dap-ay* elders are losing their power in the community is their inability to convince locals to serve as *lampisa* water distributors. The decline in the power of *dap-ay* elders has compromised their authority to enforce rules in the community.

Although the *barangay* is equally important in giving legal stature to the operational rules for irrigation management, social norms dictated by *dap-ay* are necessary to ensure the legitimacy of institutions.

This is consistent with the case of Taiwan, which is often mentioned in the literature as having one of the most effective irrigation institutions in the world. Lam [84] claims that the secret to its success lies not only in its well-designed bureaucratic arrangement, but in the fact that the rules are strongly supported by norms and sanctions.

Similarly, Hurd [77] noted that, besides coercion, legitimacy is an important factor in enforcing compliance with rules. The decline in the authority of *dap-ay* created a sense of uncertainty in other members of the group. From a farmer's point of view, the lack of a stable, legitimate source of authority creates uncertainty about other farmers' behavior. The legitimacy of *dap-ay* authority can be attributed to the high social status accorded to them. Besides actual group contribution, the impression given by an individual of being concerned with group welfare can affect an individual's status in a group [85].

The legitimacy of *dap-ay* elders as leaders of the community makes people more willing to participate in collective action. Several studies have highlighted the importance of community leaders in ensuring community participation [25,86], since members of a group will only cooperate towards a collective goal when they expect other members to contribute as well [51].

Hence, the decline of *dap-ay* authority, coupled with the weak commitment of the *barangay* officials, increased the level of distrust among farmers, which subsequently increased the cost of bargaining and negotiation. This is consistent with the argument that the involvement of trusted leaders is necessary for reducing the costs of organizing collective action [25].

7. Conclusions

Building on the earlier studies of Sarker [12] on state-reinforced self-governance, this study sought to provide empirical evidence that state intervention does not necessarily diminish the autonomy of users or suppress their ability to self-govern. Results show that the state was able to encourage the participation of local resource users in formalizing traditional institutional arrangements by employing a consultative and non-coercive process. However, the case presented also highlights that user expectations regarding the costs and benefits of new institutional arrangements affect the likelihood that it will persist.

Using the institutional approach for analysis, two main challenges to sustaining state-reinforced IA system were identified from the case study. First is the change in membership and participation costs from non-monetary value (time and labor) into a monetary value, through the introduction of membership and contribution fees. This is burdensome for subsistence farmers in Sagada. Also, the monetization of contributions to irrigation maintenance crowded out the intrinsic motivation of farmers to cooperate based on their desire to build a good reputation and their feeling of being morally responsible for the irrigation needs of the community.

The second challenge is the change in the allocation of transaction costs. The strength of traditional self-governing institutions such as the *dap-ay* over formal, state-organized IA institutions lies in its ability to internalize transaction costs because of the significant personal relationships between the users. Since the *dap-ay* hinges upon the social structure of the community, social norms and obligations can effectively incentivize users to behave cooperatively. In contrast, the IA system was highly reliant on government funding; thus, when funding ended at the project completion, the IA also ceased to be functional.

One possible way to ensure the sustainability of IA therefore is to institutionalize it within the *barangay* system. Currently, the management and operation of the communal irrigation system are not part of the official duties and functions of the *barangay* officials, hence they have neither the obligation nor the incentive to enforce irrigation rules.

Moreover, the IA system can also benefit from formalizing the role of the *dap-ay* elders within the *barangay* system to incentivize managing a communal irrigation system. Although the authority of the *dap-ay* in the community is said to be on the decline due to societal and cultural changes,

the study found that local farmers still hold the *dap-ay* elders in high regard. By integrating the IA organization with the barangay system and formalizing the role of the *dap-ay* elders in the management of a communal irrigation system, there should be more opportunity for state-reinforced self-governance to be successful in Sagada.

In conclusion, the findings of the study highlight the need for more empirical studies on comparing the transaction costs between different institutional arrangements in order to improve the institutional design for state-reinforced management of community-based irrigation.

Acknowledgments: Our heartfelt gratitude to the tribal elders of the Pidlisan tribe and barangay officials of Northern Sagada, Philippines who have willingly shared their time for interviews and narrative walks. We are also grateful for the financial support provided by the Graduate Program in Sustainability Science Global Leadership Initiative in the collection of field data.

Author Contributions: Doreen Ingosan Allasiw conducted the field data collection, analyzed the data, and wrote the research article. Tanaka Toshinori supervised the data analysis and writing of the research article. Takashi Mino supervised the design and implementation of the study. All the authors revised and approved the publication.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Agrawal, A.; Brown, D.G.; Rao, G.; Riolo, R.; Robinson, D.T.; Bommarito, M. Interactions between organizations and networks in common-pool resource governance. *Environ. Sci. Policy* **2013**, *25*, 138–146. [[CrossRef](#)]
2. Ostrom, E. *Governing the Commons. The Evolution of Institutions for Collective Action*; Cambridge University Press: Cambridge, MA, USA, 1990.
3. Bromley, D.W. (Ed.) *Making the Commons Work: Theory, Practice and Policy*; ICS Press: San Francisco, CA, USA, 1992.
4. Hanna, S.; Folke, C.; Mäler, K.G. Property rights and environmental resources. In *Property Rights and the Environment: Social and Ecological Issues*; Hanna, S., Munasinghe, M., Eds.; The World Bank: Washington, DC, USA, 1995; pp. 15–29.
5. Pinkerton, E.; Weinstein, M. *Fisheries That Work: Sustainability through Community-Based Management*; The David Suzuki Foundation: Vancouver, BC, Canada, 1995.
6. Dyer, C.L.; McGoodwin, J.R. *Folk Management in the World's Fisheries: Lessons for Modern Fisheries Management*; University Press of Colorado: Denver, CO, USA, 1994.
7. McCay, B.J.; Acheson, J.M. (Eds.) *The Question of the Commons: The Culture of Ecology of Communal Resources*; University of Arizona Press: Tucson, AZ, USA, 1990.
8. Berkes, F.; Folke, C.; Colding, J. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*; Cambridge University Press: Cambridge, MA, USA, 2000.
9. Acheson, J.M. Institutional Failure in Resource Management. *Annu. Rev. Anthropol.* **2006**, *35*, 117–134. [[CrossRef](#)]
10. Wunsch, J.S. Institutional analysis and decentralization: Developing an analytical framework for effective Third World administrative reform. *Public Adm. Dev.* **1991**, *11*, 431. [[CrossRef](#)]
11. Durrenberger, E.P.; King, T.D. *State and Community in Fisheries Management: Power, Policy, and Practice*; Greenwood Publishing Group: Westport, CT, USA, 2000.
12. Sarker, A. The role of state-reinforced self-governance in averting the tragedy of the irrigation commons in Japan. *Public Adm.* **2013**, *91*, 727–743. [[CrossRef](#)]
13. Gunningham, N. Environment law, regulation and governance: Shifting architectures. *J. Environ. Law* **2009**, *21*, 179–212. [[CrossRef](#)]
14. Trubek, D.M.; Trubek, L.G. New governance & legal regulation: Complementarity, rivalry, and transformation. *Columbia J. Eur. Law* **2014**, *1*, 539.
15. Scott, J.; Trubek, D.M. Mind the Gap: Law and New Approaches to Governance in the European Union. *Eur. Law J.* **2002**, *8*, 1–18. [[CrossRef](#)]
16. Gunningham, N. The new collaborative environmental governance: The localization of regulation. *J. Law Soc.* **2009**, *36*, 145–166. [[CrossRef](#)]
17. Abel, T.D.; Stephan, M. Limits of civic environmentalism. *Am. Behav. Sci.* **2000**, *44*, 614–628. [[CrossRef](#)]

18. Florensa, M.C. Institutional Stability and Change. A Logic Sequence for Studying institutional dynamics. In Proceedings of the Tenth Biennial Conference of the International Association for the Study of Common Property (IASCP), Oaxaca, Mexico, 9–13 August 2004.
19. North, D.C. *Institutions, Institutional Change and Economic Performance*; Cambridge University Press: Cambridge, MA, USA, 1990.
20. Marinescu, C. Transaction Costs and Institutions' Efficiency: A Critical Approach. *Am. J. Econ. Sociol.* **2012**, *71*, 254–276. [[CrossRef](#)]
21. Paavola, J.; Adger, W.N. Institutional ecological economics. *Ecol. Econ.* **2005**, *53*, 353–368. [[CrossRef](#)]
22. Martin, E.D.; Yoder, R. A comparative description of two farmer-managed irrigation systems in Nepal. *Irrig. Drain. Syst.* **1988**, *2*, 147–172. [[CrossRef](#)]
23. Ostrom, E. Design principles in long-enduring irrigation institutions. *Water Resour. Res.* **1993**, *29*, 1907–1912. [[CrossRef](#)]
24. Lam, W. Improving the performance of small-scale irrigation systems: The effects of technological investments and governance structure on irrigation performance in Nepal. *World Dev.* **1996**, *24*, 1301–1315. [[CrossRef](#)]
25. Meinzen-Dick, R.; Raju, K.V.; Gulati, A. What affects organization and collective action for managing resources? Evidence from canal irrigation systems in India. *World Dev.* **2002**, *30*, 649–666. [[CrossRef](#)]
26. Lam, W.F. Coping with change: A study of local irrigation institutions in Taiwan. *World Dev.* **2001**, *29*, 1569–1592. [[CrossRef](#)]
27. Tanaka, Y.; Sato, Y. An institutional case study of Japanese Water Users Association: Towards successful participatory irrigation management. *Paddy Water Environ.* **2003**, *1*, 85–90. [[CrossRef](#)]
28. Bastakoti, R.C.; Shivakoti, G.P. Rules and collective action: An institutional analysis of the performance of irrigation systems in Nepal. *J. Inst. Econ.* **2012**, *8*, 225–246. [[CrossRef](#)]
29. Finger, R.; Borer, A. Cooperative Management of a Traditional Irrigation System in the Swiss Alps. *Soc. Sci.* **2013**, *2*, 1–19. [[CrossRef](#)]
30. Totin, E.; Leeuwis, C.; van Mierlo, B.; Mongbo, R.L.; Stroosnijder, L.; Kossou, D.K. Drivers of cooperative choice: Canal maintenance in smallholder irrigated rice production in Benin. *Int. J. Agric. Sustain.* **2014**, *12*, 334–354. [[CrossRef](#)]
31. Cox, M. Modern disturbances to a long-lasting community-based resource management system: The Taos Valley acequias. *Glob. Environ. Chang.* **2014**, *24*, 213–222. [[CrossRef](#)]
32. Coase, R.H. The nature of the firm. *Economica* **1937**, *4*, 386–405. [[CrossRef](#)]
33. Kuperan, K.; Abdullah, N.M.; Pomeroy, R.S.; Genion, E.; Salamanca, A. Measuring transaction costs of fisheries co-management. In Proceedings of the Seventh Biennial Conference of the International Association for the Study of Common Property (IASCP), Vancouver, BC, Canada, 10–14 June 1998; pp. 9–14.
34. Adhikari, B.; Lovett, J.C. Transaction costs and community-based natural resource management in Nepal. *J. Environ. Manag.* **2006**, *78*, 5–15. [[CrossRef](#)] [[PubMed](#)]
35. Putnam, R.D. Social capital and institutional success. *Mak. Democr. Work. Civ. Tradit. Mod. Italy* **1993**, *163*, 185.
36. Granovetter, M. Economic action and social structure: The problem of embeddedness. *Am. J. Sociol.* **1985**, *91*, 481–510. [[CrossRef](#)]
37. Lorenzen, R.P.; Lorenzen, S. Changing Realities-Perspectives on Balinese Rice Cultivation. *Hum. Ecol.* **2011**, *39*, 29–42. [[CrossRef](#)]
38. Charette-Castonguay, A. *Assessment of Resilience and Adaptability of Social-Ecological System: A Case Study of the Banaue Rice Terraces*; University of Kiel: Kiel, Germany, 2014.
39. Yuan, Z.; Lun, F.; He, L.; Cao, Z.; Min, Q.; Bai, Y.; Liu, M.; Cheng, S.; Li, W.; Fuller, A.M. Exploring the State of Retention of Traditional Ecological Knowledge (TEK) in a Hani Rice Terrace Village, Southwest China. *Sustainability* **2014**, *6*, 4497–4513. [[CrossRef](#)]
40. Araral, E. What Makes Socio-ecological Systems Robust? An Institutional Analysis of the 2000 Year-Old Ifugao Society. *Hum. Ecol.* **2013**, *41*, 859–870. [[CrossRef](#)]
41. Araral, E. Decentralization Puzzles: A Political Economy Analysis of Irrigation Reform in the Philippines. Ph.D. Thesis, University of Indiana, Bloomington, IN, USA, 2006.
42. Briscoe, J. *The World Bank's Role in Water Resources Management in the Philippines: Results of a Consultation*; The World Bank: Washington, DC, USA, 2000.

43. Vermillion, D. Irrigation sector reform in Asia: From participation with patronage to empowerment with accountability. In Proceedings of the Asian Irrigation in Transition Workshop, Wuhan, China, 23–25 March 2002.
44. Easter, K.W.; Feder, G.; Le Moigne, G.; Duda, A.M.; Forsyth, E. *Water Resources Management. World Bank Policy Paper (PB-94-144813/XAB)*; International Bank for Reconstruction and Development: Washington, DC, USA, 1993.
45. Whitford, P.; Mathur, K. *The Effectiveness of World Bank Support for Community Based and Driven Development; Background Paper, Safeguard Policy Review*; World Bank: Washington, DC, USA, 2005.
46. Araral, E. Bureaucratic incentives, path dependence, and foreign aid: An empirical institutional analysis of irrigation in the Philippines. *Policy Sci.* **2005**, *38*, 131–157. [[CrossRef](#)]
47. Ostrom, E. How types of goods and property rights jointly affect collective action. *J. Theor. Polit.* **2003**, *15*, 239–270. [[CrossRef](#)]
48. Levi, M. *A Logic of Institutional Change. The Limits of Rationality*; University of Chicago Press: Chicago, IL, USA, 1990.
49. Brewer, M.B.; Kramer, R.M. Choice behavior in social dilemmas: Effects of social identity, group size, and decision framing. *J. Pers. Soc. Psychol.* **1986**, *50*, 543. [[CrossRef](#)]
50. Leeuwis, C. *Communication for Rural Innovation: Rethinking Agricultural Extension*; John Wiley & Sons: Wageningen, The Netherlands, 2013.
51. Eek, D.; Biel, A. The interplay between greed, efficiency, and fairness in public-goods dilemmas. *Soc. Justice Res.* **2003**, *16*, 195–215. [[CrossRef](#)]
52. Holzinger, K. *Transnational Common Goods: Strategic Constellations, Collective Action Problems, and Multi-Level Provision*; Palgrave Macmillan: New York, NY, USA, 2008.
53. Ostrom, E. A general framework for analyzing sustainability of social-ecological systems. *Science* **2009**, *325*, 419–422. [[CrossRef](#)] [[PubMed](#)]
54. Wade, R. *Village Republics*; Cambridge University Press: Cambridge MA, USA, 1988.
55. Bardhan, P.; Dayton-Johnson, J. Unequal irrigators: Heterogeneity and commons management in large-scale multivariate research. In *The Drama of the Commons*; National Academy of Sciences: Washington, DC, USA, 2002; pp. 87–112.
56. Poteete, A.R.; Janssen, M.A.; Ostrom, E. *Working Together: Collective Action, the Commons, and Multiple Methods in Practice*; Princeton University Press: Princeton, NJ, USA, 2010.
57. Woodhill, J. *Capacities for Institutional Innovation: A Complexity Perspective*; Institute of Development Studies: Brighton, UK, 2010; pp. 47–59.
58. Mburu, J.; Birner, R.; Zeller, M. Relative importance and determinants of landowners' transaction costs in collaborative wildlife management in Kenya: An empirical analysis. *Ecol. Econ.* **2003**, *45*, 59–73. [[CrossRef](#)]
59. Cheung, S.N. Transaction costs, risk aversion, and the choice of contractual arrangements. *J. Law Econ.* **1969**, *12*, 23–42.
60. Alchian, A.A.; Demsetz, H. Production, information costs, and economic organization. *Am. Econ. Rev.* **1972**, *62*, 777–795.
61. Kiser, L.; Ostrom, E. *The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches*; Sage: Beverly Hills, CA, USA, 1982.
62. Yin, R.K. *Case Study Research: Design and Methods*, 5th ed.; Sage: Beverly Hills, CA, USA, 2013.
63. Vij, S.; Narain, V. Land, water & power: The demise of common property resources in periurban Gurgaon, India. *Land Use Policy* **2016**, *50*, 59–66.
64. Rice, S. *Key Methods in Geography*; Clifford, G., Valentine, N.J., Eds.; Sage: London, UK, 2010; pp. 230–252.
65. Sanjek, R. *Fieldnotes: The Makings of Anthropology*; Cornell University Press: Ithaca, NY, USA, 1990.
66. Alrajeh, A.; Fearful, A.; Monk, E. Qualitative Research Process Using Abductive Approach. *SSRN Electron. J.* **2013**. [[CrossRef](#)]
67. Voss, J.H. *Capitalist Penetration and Local Resistance: Continuity and Transformations in the Social Relations of Production of the Sagada Igorots of Northern Luzon*; University of Toronto: Toronto, ON, Canada, 1985.
68. Scott, W.H. Sagada Rice Growing. *Philipp. Econ. J.* **1963**, *2*, 87–105.
69. Bulayo, Z. Tinawon Production among the Namulditan Farmers in Hingyon, Ifugao. Master's Thesis, The University of the Philippines Baguio, Baguio, Philippines, 1998.

70. World Bank. *Philippines: Environment and Natural Resource Management Study (PUB7388)*; World Bank: Washington, DC, USA, 1989.
71. Panella, T. Irrigation Development and Management Reform in the Philippines: Stakeholder Interests and Implementation. In Proceedings of the International Researcher's Conference on Irrigation Management Reform, Hyderabad, India, 11–14 December 1999; pp. 11–14.
72. Bagadion, B. Case Study on Farmers Participation in Philippines National Irrigation Systems. In Proceedings of the Workshop on Participatory Development, Chatham, UK, 6–7 September 1994.
73. Bagadion, B. Sustaining Irrigation Management Transfer and Privatized Management of Organizations. In *Irrigation Management Transfer in Asia*; FAO: Bangkok, Thailand, 1995.
74. Meinzen-Dick, R.; Reidinger, R.; Manzardo, A. *Irrigation Participation Sourcebook Technical Paper*; World Bank: Washington, DC, USA, 1995.
75. Luppi, L.; Rinaldi, M.; Teruggi, L.B.; Darby, S.E.; Nardi, L. Monitoring and numerical modelling of riverbank erosion processes: A case study along the Cecina River (central Italy). *Earth Surf. Processes Landf.* **2009**, *1584*, 1574–1584. [[CrossRef](#)]
76. Gallart, F.; Llorens, P.; Latron, J. Studying the role of old agricultural terraces on runoff generation in a small Mediterranean mountainous basin. *J. Hydrol.* **1994**, *159*, 291–303. [[CrossRef](#)]
77. Hurd, I. Legitimacy and Authority in International Politics. *Int. Organ.* **1999**, *53*, 379–408. [[CrossRef](#)]
78. Tang, S.Y. Institutional arrangements and the management of common-pool resources. *Public Adm. Rev.* **1991**, *51*, 42–51. [[CrossRef](#)]
79. Frey, B.S.; Oberholzer-Gee, F. The Cost of Price Incentives: An Empirical Analysis of Motivation Crowding-Out. *Am. Econ. Rev.* **1997**, *87*, 746–755.
80. Rode, J.; Gómez-Baggethun, E.; Krause, T. Motivation crowding by economic incentives in conservation policy: A review of the empirical evidence. *Ecol. Econ.* **2015**, *117*, 270–282. [[CrossRef](#)]
81. Lopez, M.C.; Murphy, J.J.; Spraggon, J.M.; Stranlund, J.K. Comparing the effectiveness of regulation and pro-social emotions to enhance cooperation: Experimental evidence from fishing communities in Colombia. *Econ. Inq.* **2012**, *50*, 131–142. [[CrossRef](#)]
82. Gneezy, U.; Meier, S.; Rey-Biel, P. When and Why Incentives (Don't) Work to Modify Behavior. *J. Econ. Perspect.* **2011**, *25*, 191–210. [[CrossRef](#)]
83. Simon, H.A. A Behavioral Model of Rational Choice. *Q. J. Econ.* **1955**, *69*, 99–118. [[CrossRef](#)]
84. Lam, W.F. Institutional design of public agencies and coproduction: A study of irrigation associations in Taiwan. *World Dev.* **1996**, *24*, 1039–1054. [[CrossRef](#)]
85. Ridgeway, C.L. Conformity, Group-Oriented Motivation, and Status Attainment in Small Groups. *Soc. Psychol.* **1978**, *41*, 175–188. [[CrossRef](#)]
86. Baland, J.M.; Platteau, J. *Halting the Degradation of Natural Resources: Is There a Role for Communities?* Food & Agriculture Organization: Rome, Italy, 1996.

