CUSTOMARY RULES OF WATER MANAGEMENT FOR SMALL IRRIGATION RESERVOIRS IN KOREA*

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I. Introduction

One of the underlying basic assumptions in planning and financing irrigation systems is that farmers get water in the right volume at the needed plots at the right time. This assumption, however, frequently fails at the operational level. Failures of irrigation systems management result in decreased crop production, decreased farm income and often capital disinvestment of the irrigation facilities. Failures of the irrigation systems as opposed to the initial assumptions stem from largely improper institutional settings around decision making systems such as rules or customary methods of water and cost distribution among the irrigators. It has been known that dependability of reservoir systems is significantly decreased due to mismanagement and irrational decision systems.

There are over 18,000 reservoir irrigation systems for rice production in Korea. Of 1,082,000 hectars of irrigated paddy, which comprises 84 percent of the total rice paddies, more than 40 percent is irrigated by reservoir systems and 13 percent by weir systems. Reservoirs have remained as the most important irrigation source. Small reservoirs (tanks) which have less than 50 hectars of service area number more than 15,000 systems. They are located at foot hills or small valleys where large irrigation systems are not suitable.

There are two channels of agricultural water resource development in Korea. Larger irrigation systems which have more than 50 hectars of service area are planned and constructed by the Ministry of Agriculture and Fisheries through the Agricultural Development Corporation (ADC). After the completion of the projects they are handed over to the Farm Land Improvement Associations (FLIA) for their operation and management. FLIA is a legal person supervised by the Ministry of Agriculture and

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Fisheries. Members of FLIA consist of irrigators within the service area but managing staffs of FLIA units are appointed by local governments.

Small irrigation systems which have less than 50 hectars of service area are planned and constructed by city and counties with public funds. After the completion of the projects they are handed over to the farmers for operation. No repayment for the construction costs is necessary whereas FLIA members are required to pay a portion of project costs.

Small reservoirs are managed by autonomous organizations of farmers. Irrigators set up various rules and regulations to manage the small irrigation systems. However the rules and regulations to manage the system are deeply influenced by traditional customary rules of water management of the region or of the nearby irrigation systems.

The history of reservoir irrigation for rice crops goes back more than a thousand years in Korea. There had been numerrous constructions of irrigation projects throughout history. A few of them are still in use even today. Skeletons of management institutions of the old days at the operation level are alive and evolve around the customary rules and regulations of water management of the small reservoirs.

To identify and classify the customary rules of water management and evaluate their economic implications, 64 small reservoirs in Ichon, Gochang, Jinan, and Kyunsan Counties are surveyed. Water and cost distribution methods and economic incentives of the system managers were among the major items surveyed.

II. Customary Rules of Water and Cost Distribution of Small Reservoirs

1. Organization of Soori-Ke

Small reservoirs depend largely on the occurence of runoff from their watersheds. The average service area per small reservoir is about 24 hectars. When there is an excess rainfall in watersheds, reservoir water is discharged over a fixed spillway. Water is distributed by opening one or two sluices by hand. Reservoir sites are located higher than paddies. Water runs along the main canal ditches by natural gravity. Forty-seven percent of the small reservoirs were built after 1945 and the remaining were built during the 1900–1945 period although a few of them appear to have been built about 300 years ago.

The general maintenance condition of the small reservoirs was so poor that approximately 64 percent of the sample reservoirs would not have a dependable water supply in case of a drought which may occur once in ten years.[1] Water holding capacities of the reservoirs have been significantly

[1] Oh Ho-Sung, "Dependability Test of Small Irrigation Reservoirs", NAERI Research Report No. 78, National Agricultural Economics Research Institute, Seoul, 1976 (Written in Korean). pp. 85–86

decreased due to sedimentation and erosion in all samples.

"Soori-Ke" is a non-formal grass root organization by rice farmers who have land within the service area of a confined irrigation system. Soori-Kes have been developed historically by the necessity of the farmers collective work to develop and utilize water resources for their mutual benefit. The prime objective of the organization is to maximize rice production by utilizing the irrigation facilities. Main functions lie in the assessment of necessary costs and the distribution of water to the members.

The Soori-Ke has exclusive rights to use its own source of water against other "Soori-Kes" or other rice farmers. However, members of a Soori-Ke have co-equal rights to share water from their own irrigation system. Water in a reservoir may be considered as a common property of the members.

Indigenous Soori-Kes rarely have written articles of organization. There are many types of organization. Organizations may be reduced to three basic types according to a formula; simple ones with one or two executive managers with a few assistants, organizations with executive and audit bodies and organizations with executive, audit and temporary legislative organs. Simple organizations with executive bodies under the general meeting comprise 75 percent of the samples. Legislative and audit bodies generally play no active role even if a Soori-Ke has them.

Managers play the most important roles in operating a reservoir system. Although there are no explicitly defined ranges or duty and rights of a manager he is in charge of the general management works. Managers' functions are intake and distribution water gates operation, water distribution, collection of water fees, and book keeping, assessment of labor, supervision of works, and information of general and special meetings to the members.

The qualification of a manager is strong leadership among the irirgators. Next are large landowners and irrigators whose house is nearby the water gate of the reservoir, and elder irrigators respectively. The small Soori-Ke which have a small service area tend to select a large farmer as its manager. This is because the large farmer derives more benefit than others. There are two cases in which managers must be selected from the non members. This institutional device is to ensure against unequitable water distribution during short water periods. Managers are generally selected by the majority voting at the general meeting which is held once a year after harvest. The majority of organizations allow concecutive terms of service for a specific manager if he has performed his job satisfactorily.

2. Water Distribution Rules

Seed Bed Nursery Water Supply

Water supply to prepare seed bed nurseries is the first step in rice cultivation. The seed bed must be irrigated about forty days until rice transplanting day. The average size of the seed bed nursery is about 1/20 of

the expected rice planting area. The amount of water to prepare the seed bed is relatively small. Nevertheless many reservoir systems which have experienced chronic water shortage due to their limited capacities to hold water adopt various regulative measures to save water for future use, particulary for rice transplanting. Twenty-two reservoirs which is 34 percent of the total, take restrictive measures to supply seed beddling water. The First method is the complete cut off of seed beddling water supply. This measure is possible when there are alternative places nearby with service area to prepare the seed bed nursery without the use of reservoir water. Second is establishment of a joint nursery just in front of the water gate of the reservoir to minimize conveyance water loss along the canals. Last is manual bucketing of water without opening the water gate. Bucketing of water is a laborous job so that irrigators do not have any incentive to waste water. He may stop bucketing at the level that equate his opportunity cost of labor to marginal value product of the water.

Distributor

The water distribution operation is conducted either by the manager or individual farmers at the time of rice transplanting. The advantage of manager control methods lies in economizing water. The manager supplies water one plot by one plot and irrigators have nothing to do with the water supply. Of the total samples, 40 percent has adopted the manager control method. The other method of operation is giving complete free hand to individual irrigators. Any one of the irrigators can use water at any time if he wants. This method tends to use too much water and the conveyance loss by not properly operating the water gate may be significant. Thus the private cost of the water use and the social cost may not coincide. About 60 percent of the sample reservoirs utilize this measure.

Distribution Order

Four types of distribution order are found. The majority of the reservoirs distribute water by top down order by natural gravity flow. Rice paddies nearby the water gate get the water first and the plot at the end of the ditch gets it last. There are chances some down stream parcels of paddy may not receive water in the case of a shortage. To lessen the chances of unequal distribution of water some reservoirs start water distribution from a bottom-up order and some reservoirs adopt rotation of top-down and bottom-up methods on a yearly base. The last measure has no specific distribution order. Any irrigator can get water anytime if we wants since water runs from higher to lower, along the course of the water ditch, up stream farmers may divert water for their use. Consequently this method tends to open the water gate all the time until the confined water has run out.

Volume of Water Distributed

Those reservoirs adapting restrictive measures of water distribution also regulate the volume of water distrbuted to the paddy. There are four methods of regulating volume of water received. The most common way is

that the manager decides the volume of water to be distributed by his subjective judgement.

Once every other day distribution, or once every three days distribution methods are found in water scarce areas. Dang Hyun Reservoir gives water only to dried paddies once in every three days. Wet paddies do not get water until they are dry.

Water distribution methods on an hourly base and water level base also exist. Water level distribution means the manager floods a parcel of paddy until the water level reaches 5 cm hight and then moves to the next paddy for every day. The hourly base allows water to flow for 30 minutes per unit of land size.

Emergency Period Water Distribution

During the normal period with regular rain and wind, water distribution is generally generous except for some of the reservoirs which have very restrictive rules due to their small capacity to hold water. However once there is a drought, competition for water among each individual farmer within the service area becomes very serious. The failure of his rice crop means a disaster for his household economy for the next year. Down stream farmers ask the manager for rationing of water. In case of Suhsung Reservoir, down stream farmers ask the manager to ration water when the remaining water is about 1/3 of the reservoir capacity. Then the manager calls for a general meeting of the irrigators. If the request is approved they wait 5 days for rains. If there is no rain they start to organize a water rationing task force. The rationing task force may be organized by the manager, ditch tenders, and irrigators. In certain cases the rationing manager and his assistants are hired on a daily wage basis among the non-irrigators of the service area for the emergency period. This method is to minimize possible complains of unequal water distribution by excecutives of the Soori-Ke.

Emergency water rationing is called "Patmool". Once Patmool operation starts the operation continues day and night until the reservoir water runs out. If it rains during the operation, the rationing stops. The rationing committee spreads or rolls the water just enough to soak the rice crop roots and move to the next plot of paddy. Some reservoirs do not supply water for a specially designated "sacrifice paddy" during the emergency period. The "sacrifice paddy" is a supplementary service area not originally covered by the irrigation authority, which receives water on the condition that their paddy will not get water in an emergency period.

The third method is rotational water supply by main canals. The method is used by reservoirs with a large service area in which labor intensive Patmool rationing is not economically feasible. Paddy owners along the main canal freely take water into his paddy when water runs through their canal. About 22 percent of the reservoirs do not have any regulative measures even if it is a drought. Consequently up stream farmers derive most of the benefits whereas down stream paddies are wide open to drought

damage.

3. Cost Distribution

Water Fees

Since irrigators within the serive area of a reservoir manage the system autonomously, the Soori-Kes have to rely upon members expenses for operation and maintenance of the systems. There is no general guide line of cost distribution by government. Communities of irrigators have their own assessment methods of costs to the members. About 52 percent of the sample reservoirs collect water tolls annually but the remaining 48 do not collect tolls regularly. They assess costs only in case of emergency repairs once every few years.

The survey revealed three types of management in terms of revenue acquisition for systems management; revenues from regular or irregular water fees, revenues from miscellaneous sources, and no revenues at all. Reservoir systems also require members to contribute labor to repair systems damaged by floods or regular use. Labor assessment also can be classified as an annual labor contribution, emergency labor contribution and no labor assessment at all. Micellaneous revenue sources are the interest from irrigators common fund, rice from reservoir site cultivation, revenue from fish cultivation in the reservoir, lease of the reservoir for game fishing. Revenues are from various combinations of the sources in certain reservoirs.

The assessment of regular water tolls are either in cash or in kind. The assessment criteria most often used is the unit of land system.Given amounts of toll per 200 Pyongs of land are levied for all land regardless of its productivity or volume of water used. The next criteria often used is volume of water system. The service area is classified according to its soil and drainage characteristics. Some land with better drainage because of more sand components in paddy soil is considered to use more water and thus is charged a higher fee. Land with more clay components and poor drainage is levied a lower fee.

There is a reservoir that levies more water tolls to the up stream paddy and less to the down stream paddy. They consider that the up stream land uses more water while down stream paddies use less water. Some reservoirs in Jinan adopt a differential price system. Toll payment by small land owners in the service area are excempted but farmers with more than a certain land size pay all the costs depending upon the size of holding. These methods may be considered as an implicit water volume charge. Water toll is assessed by the number of water inlet holes of a farmers paddy in a reservoir located in Ichon. The more water inlet holes he has the more he pays regardless of the acrage he has.

Eight reservoirs in Gochang and Ichon do not collect water fees in any circumstances. Maintenance of the reservoir was so poor that the site of the reservoirs converted to paddy for rice cultivation after rice replanting.

There is little cooparation among the farmers to maintain the reservoir in good shape.

Labor Assessment

Before rice cultivation season starts earth ditches and other irrigation works have to be repaired. Grass cutting for canals is also necessary to have a smooth water distribution during the summer. For these purposes, about 75 percent of the surveyed reservoirs assess labor to the members once or twice in a year. The most widly used labor assessment criteria was a person per farm household system whereas the water fee was based upon land size. This is perhaps due to the ralatively small amount of work to do and the low costs of labor in the past. It is interesting that the old custom ramains unchanged in many reservoirs depite of soaring farm wage rates these days.

There are sevearl reservoirs of which managers employ laborers to do the job. Members are required to deposit a given amount of rice or cash instead of labor works before rice season starts. The manager employs laborers and pays wages. The efficiency of hired laborers is higher than the members collective work. This method is found in the vicinities of cities.

There are also cases which adopt a responsible area system to repair facilities by designating certain areas to each of the irrigators. Combinations of two or more methods are also available. Emergency labor assessments generally follow similar lines.

Absentee Penalty

An absentee penalty system is widly used where labor contributions of the irrigators are required. Penalties are assessed in the form of fines. Collected fines are generally used for buying liquor and meals for participating members.

However enforcement of fines on the absentees is difficult. Of 49 reservoirs which have absentee fine systems, about 50 percent can actually implement the system. This is because of a lack of cooperation among the members and poor leadership by the managers.

The amount of the fine is less than the market wage rate in most of the systems but some reservoirs, collect fines which are 50 percent more than the market wage rate to ensure full participation of the irrigators.

4. Compensations for Managers

A Manager has to spend much of his time to operate intake and outlet sluices, distribute water, collect water fees, and to do many other miscellaneous functions. It is natural to give him pay. Nevertheless, only 65 percent of the sample reservoirs pay annual compensation after harvest and the remaining 35 percent do not pay at all. Compensations are paid general in the form of rice. In some cases, however, the compensation is made in the form of rights to cultivate the land inside the reservoir created by eroded soil and sediments. There are other forms of payment that allow managers to have the reeds and grass which grow inside the shallow parts of

the reservoir. The reed is used for fuel. Various combined forms of the above compensation also exist. Cultivators of the filled up land inside of the reservoir tend to foster sedimentation in order to expand the land and manipulate the water gate not to flood his cultivated land. To harvest reeds grown inside the reservoir, the water has to be drained. This may cause a shortage of water for the next crop year and mining of investment to protect his own interest.

The average payment level of the managers was low at about one-third of market wage rate when their annual pay is converted to an hourly basis assuming half time service for the reservoir management. There will be little incentive for sound management in the case of no economic compensation or nominal payment for the managers service.

III. The Theoretical Framework and Evaluation of the Customary Rules of Water Management

1. The Theoretical Framework

Price mechanism plays a minor role in water resources development and managementity due to the natural characteristics of water and the significant external problems involved. Instead, institutions act like a price mechanism in the field of natural resources. Designs of water resource systems requires the existence of an institutional framework. Appropriate institutional structures are a necessary condition for its efficient functioning.[2] This is because water resources are less concerned with market mechanism and more with laws, regulations and administrative structures under which individual farmers and non-profit organizations make decisions. For these reasons the study of water institutions and their effects on development, allocation, and use of water resources becomes important.[3]

Korea has neither general water laws nor a well defined system of water rights. It is a custom that members of a community of irrigators have exclusive rights to use their own source of water without concern to other farmers or organizations. However members of an organization have coequal rights to use water from their own irrigation systems. Each has its own customary rules of water management which have evolved historically. And they are the main framework within which important

[2] S. V. Ciriacy-Wantrup, "Water Policy and Economic Optimizing: Some Conceptual-Problems in Water Research", *American Economic Review*, Vol. LVII, No. 2 (May, 1967), p. 180

[3] In Western Countries where water laws and rights are well defined, the second level decisions systems (institutional level) in the hierachy of decision system play a more important role in water resource allocation than first level decision systems (operating level) do. For more information refer Ciriacy-Wantrup, Ibid, pp. 179–189, Hiroshi Yamauchi, "Hierachy of Decision Systems; An Analytical Framework for the Study of Water Institutions in Hawaii", WRRC Contribution Paper No. 79, Water Resources Research Center, University of Hawaii, 1975, pp. 2–4.

decision making is based on at the operating level in Korea. Therefore Wantrupian methods of the second level analysis may be applied to the operating level of small reservoirs in Korea.

The customary rules of reservoir management may be evaluated in terms of allocational efficiency, performance, and protection of investments. Allocational functions of the customary rules of reservoir management can be evaluated by analyzing its impacts on intertemporal decisions of resource allocation and incidence structures of benefits and costs among the competing users.

Individual decisions or group decisions to save water at the present time mean more water that can be used at a future time for service areas of a resevoir. Conversely the abundant use of water at the present time means less available water in the future. Since natural rainfall varies greatly, weekly or seasonally, the marginal value product of stored water in a reservoir also varies. Seasonable smooth rain and wind will lessen the value of the water stored in reservoirs. Lack of rain will decrease the water table of the reservoirs and increase the value of the water confined. There is, at all times, the probability of drought during any time in a rice growing season.

Individual decisions of intertemporal water resource allocation are affected by the security of water rights. Security of water rights is a protection ability against the physical uncertainty of the water supply, particularly at the time of water shortage or drought.

If a down stream irrigator has experienced a water supply shortage because of the waste of water by an upstream irrigation and if he has not been guaranteed a supply of water in a drought period. he will not have an incentive to save water in normal times for emergency use. In other words, if a group of farmers think their share of water is not guaranteed during a drought they tend to use reservoir water more abundantly during the normal time. Depletion of confined water resources in a reservoir means degredation of physical protection capability against possible droughts and consequently less production for all users in the service area.

Physical uncertainty of a reservoir system may be reduced by dredging or enlarging its capacity to hold water. However, if a group of irrigators feel that benefits of the system improvement will not be shared equitably among the users, they will be reluctant to bear the costs, and will not cooperate in improving the system's facilities. The imbalance of the incidence of costs and benefits exist with respect to the use of water resources. This is largely the result of imperfections at the institutional level. The customary rules of reservoir management may foster efficient resource allocation and equitable costs distribution over a time period if they are carefully designed in such a way that guarantees equitable water and cost distribution in any climatic conditions.

The performance of decision rules can be appraised by viewing it as it functions over a time period under varying economic, social, and natural

conditions. Maximization of profits or production of all the irrigators may serve as the evaluation criteria. But it is difficult to be used for dynamic analysis in the world of a highly uncertain future. Ciriacy-Wantrup suggests to use the simple concept of survival over time as an evaluation criterion for the performance of water institutions.[4] Just as the most adaptable and the strongest species survive and flourish in the physical world, so do the most adaptable and secure institutions survive in the economic world. The proper function of economic institutions is not to maximize economic difficiency for particular conditions and points in time, but rather to provide a framework within which decision makers at the operating level can operate and which will withstand the rigors of varying conditions while providing long run economic growth and general welfare.

Another important aspect in reservoir management is that of protection of investment of physical facilities of irrigation systems. Generally, greater security of water rights of individual irrigators will promote greater investment in development of water resources and better maintenance of invested facilities for long lasting use. However, it should br remembered that increases in security for some irrigators only, for example up stream irrigators, may mean reduced security for others and resulting external problems arise. The practical goal of management policy should be to provide the minimum security guarantees necessary to induce cooperation of all irrigators in system maintenance and water resource conservation.

To implement decisions made within the framework of customary management rules the manager must have strong leadership and a will to do a better job. He is also the man who can change the customary rules if they turn out to be irrational by exercising his influence. Since he devotes much of his time to the management of the system, economic compensation must be given at least to the level covering his labor costs. Enough economic incentives in the form of cash or in kind will bring him a greater sense of responsibility. This is another way to promote better management and greater protection of the investments.

2. Economic Evaluation of the Customary Rules

Over one hundred different customary rules on organization, water distribution, cost allocation, labor assessment, compensations for manager and other management rules were found through the survey. It was difficult to classify them systematically by management unit because many different combinations of rules exist. Quantification of such important variables as volume of water distributed, rice production, and physical condition and value of the investment facilities were not possible Qualitative and relative evaluations are attempted for some of the important customary rules and methods in forms of intertemporal allocation of resources,

[4] S. V. Ciriacy-Wantrup, "Concepts Used as Economic Criteria for a System of Water Rmghts", *Water Resources Development* (ed. by Castle and et al), Iwoa State Univ. Press 1964, pp. 251–257.

security of eater rights, equity of water distribution, incidence structure, working efficiency, and incentives to protect physical investments. The relative evaluations are summarized in the following tables.

Water Distribution at Normal Time

a. *Distributor*

Evaluation Criteria Methods	Intertemporal Distribution of Water Use Rate	Security of Water Rights
Manager	Conservation	Increase
Irrigator	Depletion	Decrease

b. *Distribution Order*

Evaluation Criteria Methods	Intertemporal Distribution of Water Use Rate	Security of Water Right
Top Down	Depletion	Decrease
Bottom up	Conservation	Increase
Top down, Bottom—up Shift	Conservation	Increase
Unrestricted	Depletion	Decrease

c. *Volume of Water Distributed*

Evaluation Criteria Methods	Intertemporal Distribution of Water Use Rate	Security of Water Rights
Continuous Irrigation Controled by Manager	Conservation	Increase
Daily Shift by Main Canal	Conservation	Increase
Hourly Shift	Conservation	Increase
Unrestricted Continuous Irrigation	Depletion	Decrease

Water Distribution at Emergency Time

a. *Distributor*

Evaluation Criteria Methods	Equity of Water Distribution	Security of Water Rights
Manager	Increase	Increase
Rationing Committee	Increase	Increase
Irrigators Under the Supervision by Manager	Decrease	Decrease

b. *Controlling Methods*

Evaluation Criteria / Methods	Equity of Water Distribution	Security of Water Rights
Patmool Rationing	Increase	Increase
Canal Shift	Decrease	Decrease
Sacrifice Paddy	Decrease	Increase
Uncontrolled	Decrease	Decrease

c. *Volume of Water by Rationing*

Evaluation Criteria / Methods	Equity of Water Distribution	Security of Water Rights
Soaking Roots	Increase	Increase
Rationing by Time	Increase	Decrease
Rationing by Water Table	Decrease	Decrease
Managers Option	Decrease	Decrease

Cost Distribution (in cash or in kind)

a. *Periodic Cost Assessment*

Evaluation Criteria / Assessment Principles	Direction of Incidence Between Benefit and Cost	Protection Abiltiy for Physical Investments
Unit Land Area	Unbalanced Direction	Decrease
Volume of Water Used	Balanced Direction	Increase
Differential Price	Balanced Direction	Increase
No. of Water Holes	Unbalanced Direction	Decrease

b. *Emergency Costs Assessment*

Evaluation Criteria / Assessment Principles	Direction of Incidence Between Benefit and Cost	Protection Ability for Physical Investments
Unit Land Area	Unbalanced Direction	Decrease
Flat Assessment by Household	Unbalanced Direction	Decrease
Differential Price by Land Size	Balanced Direction	Increase
Volume of Water Used	Balanced Direction	Increase

c. *Periodic labor Assessment*

Assessment Principle / Evaluation Criteria	Direction of Incidence Between Benefit and Costs	Labor Efficiency	Protection Ability for Physical Investments
Unit Land Area	Balanced Direction	Low	Increase
Flat Assessment by Household	Unbalanced Direction	Low	Decrease
Employment	Balanced Direction	High	Increase
Flat Household + Responsible Area	Unbalanced Direction	Low	Decrease
Flat Household + Unit Land Area	Balanced Direction	Low	Increase

d. *Emergency Labor Assessment*

Assessment Principle / Evaluation Criteria	Direction of Incidence Between Benefit and Costs	Labor Efficiency	Protection Ability for Physical Investments
Unit Land Area	Balanced Direction	Low	Increase
Unit Land Area of Up Stream Paddy	Balanced Direction	Low	Decrease
Flat Assessment by Household	Unbalanced Direction	Low	Decrease
Responsible Area	Unbalanced Direction	Low	Decrease
Increasing Land Block System	Balanced Direction	Low	Increase
Employment	Balanced Direction	High	Increase

e. *Absentee Penalty Assessment*

Assessment Principle / Evaluation Criteria	Incentives for Work Participation
Fine Less Than Market Wage Rate	Low
Fine Equal to Market Wage Rate	Neutral
Fine Higher Than Wage Rate	High

Compensations for Manager

a. *Methods of Payment*

Methods / Evaluation Criteria	Security of Water Rights	Protection Ability for Physical Investment
In Cash	Neutral	Neutral
In Kind	Neutral	Neutral
Right to Cultivate Filled Up Reservoir Site	Decrease	Decrease
Right to Have Reed and Grass	Decrease	Decrease

IV. Conclusion

Public funded small irrigation reservoirs are managed by autonomous organizations of benefited farmers. Each organization has its own customary rules and regulations of management. The context of rules and regulations within which operating decisions are made vary greatly and are complex in nature. These rules and regulations are deeply influenced by traditional customs of water management of the region or of the nearby old irrigation systems.

Most of the small reservoir systems have failed to meet their basic management goal which is that the farmers get water in the right volume at the needed paddy parcel at the right time. Also physical maintenance of the irrigation systems is poor. The failure of the irrigation systems management as opposed to the basic goal largely stems from improper low level institutional settings such as customary rules and regulations of water management.

The lack of security measures for water rights, the imbalanced nature of the incidence structure of benefits and costs among the competing water users, and less economic incentives for the system manager were important factors leading to depletion of water resources and degredation of investment facilities.

The customary rules of water management may be esaily changed in such a way that gurantees security of water rights and equitable water and cost distribution to induce full cooperarion of all irrigators. This is possible because the decision systems have a great flexibility in nature.

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