INSTITUTIONAL ASPECTS FOR WATER MANAGEMENT IN SMALL-SCALE WATER SECTOR DEVELOPMENT SCHEMES

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Abstract

It is a fundamental question for the future productivity and sustainability of irrigated agriculture in many developing countries that which institutional aspects are most conducive to achieving and sustaining high performance in water sector development schemes. In Bangladesh, most of these schemes are designed for flood control, drainage and/or irrigation (FCD/I) purposes. Previously, a large proportion of the total irrigated area receives its water through systems constructed, owned, and administered by government agency such as Bangladesh Water Development Board (BWDB). In Upazila Parishad Act (1998), a clear and formal institutional link has been made between the Upazilla Parishad and the technical capability at local level, as represented by LGED (Local Government Engineering Department), which itself is a statutory organization under the Local Government Division of the Central Government. The LGED has already been given power to plan, design and implement small-scale (≤ 1000 ha) FCD/I schemes. These schemes are later transferred to the local Water Management Co-operative Association (WMCA) for operation and maintenance (O & M). Two such schemes (one FCD and one Irrigation) were considered as the study areas and the institutional aspects of these schemes were investigated. Primary data were collected interviewing different stakeholders in the scheme area using prescribed questionnaire and the secondary data were collected from different government agencies in the study areas. These data were further analyzed to evaluate the agro-socio-economic performance of the schemes and thus to identify the institutional aspects for the water management in small-scale FCD/I schemes. The results revealed that the rural leaders and the articulate people representing the elite, dominant and wealthy groups of the area largely control the local water management and the rate of participation of the overall beneficiaries in the field level.

***Keywords**: Water management, Small-scale, Institutional settings, Performance evaluation*

1 INTRODUCTION

With increasing population and demand for food, sustainable water management systems and irrigated agriculture must be achieved. With limited freshwater and land resources, and increasing competition for these resources, irrigated and water-managed agriculture must improve its utilization of these resources. Water can no longer be considered a totally free resource, and plans must be developed for its efficient use through better management and rules that preserve everybody's access to it and interest in its development especially in case of flood control, drainage and irrigation (FCDI) systems (Faruque and Choudhry, 1996). The management of FCDI is, therefore, one of the prime objectives in a land like Bangladesh where agriculture consists of about 60% of the land use and the majority of the population lives near or on floodplains (Datta et al., 1999; Wester and Bron, 1998).

Bangladesh Water Development Board (BWDB) categorizes water schemes based on the size of its area such as, small-scale projects ≤1000 ha, medium scale projects: 1000-5000 ha, and large-

scale projects >5000 ha (GPWM, 2001). In 1998, Union Parishad Act (1998) was passed in the Parliament, where the power has been given to the Local Government Engineering Department (LGED) to plan, design and implement the water resources schemes up to 1000 ha (Datta et al., 1999). It is also suggested in the National Water Policy (NWPo, 1999) to hand over the water schemes up to 5000 ha to LGED in the coming years.

Small Scale Water Resources Development Sector Projects (SSWRDSP), under implementation by LGED, aims at sustainable agricultural growth and poverty alleviation by developing water resources, with much emphasis on people's participation. Thirty-seven districts in western half of Bangladesh have been covered with these kinds of water schemes. About 400 small-scale water resources subprojects will be developed to benefit about 190,000 hectares of cultivated lands. Implementation of the SSWRDSP started in 1996 and to date about 300 subprojects have been initiated. It has now been widely acknowledged that the one common factor behind the inefficient output of the main projects in the water sector is the lack of people's participation. The SSWRDSP therefore, aims at involving the people at all stages of subproject development in planning, design, implementation and post project operation and maintenance. The beneficiary contribution amounting to 3% of earthworks and 1.5% for the water control structures of the investment cost has been made mandatory. The charge of the SSWRDSP is then handed over to the local Water Management Co-operative Association (WMCA) after one-year operation and maintenance (O & M) by LGED (SSWRDSP, 2000). Among the beneficiaries (i. e. general members), 12 members are democratically elected to form executive committee of WMCA for 3 years. The institutional framework for O & M of small-scale subprojects of LGED is shown in Fig. 1.

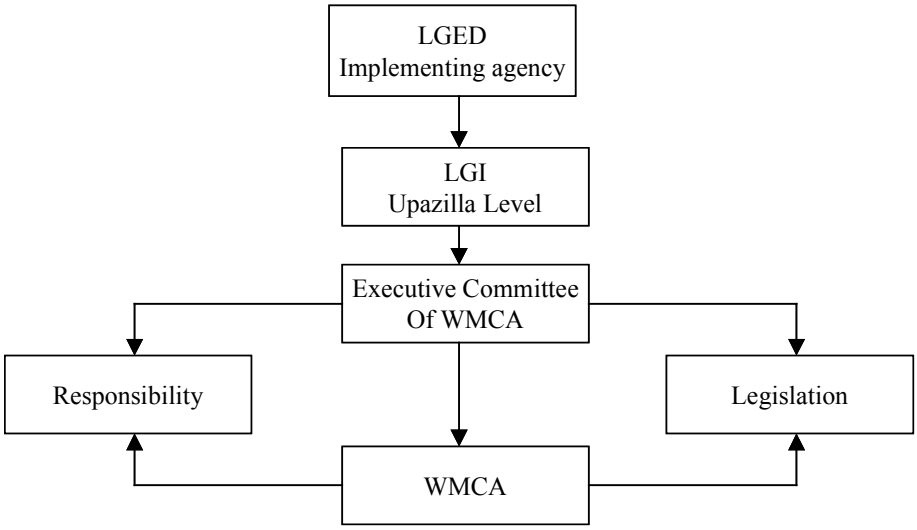

Fig. 1. The institutional framework for O&M of small-scale projects of LGED

Post-construction project monitoring and evaluation is the most neglected aspect of overall project management in most developing countries. If the institutional setting of small-scale water sector scheme is strong then the scheme will perform well in order to achieve its sustainable goal by periodical monitoring and evaluation. But still there has been no study to monitor or evaluate the performance of these small-scale schemes of LGED. Performance of irrigated agriculture is a complex subject. Irrigation systems often have a number of competing objectives and are assessed by interest groups with different values and perspectives (Lamaddalena and Sagardoy, 2000). There are many variables influencing the overall performance of FCDI systems, such as infrastructure design, management, climatic conditions, price and availability of inputs, and socioeconomic settings (Molden et al., 1998). This research focuses on the evaluation of agro-socio-economic performance of the schemes and thus to identify the institutional aspects for the water management in small-scale FCD/I systems. The

results from the analysis would make it possible to compare the different small-scale areas, facilitate to conclude about the areas and give insight into the weaknesses and strengths of the management and other features of the sub-project areas.

2 STUDY AREA

Two sites of SSWRDSPs were selected as the study areas to investigate the institutional aspects for water management. One is located at Rajbari district, which is a flood control and drainage (FCD) scheme known as Brazamul Banagram Subproject (BBS) and another one is located at Chapai Nawabganj district - an Irrigation scheme (I) known as Agrani Command Area Developemnt (ACAD) subprojects. These areas were selected because of their accessibility, availability of data and relatively older age. The scheme at Rajbari is about 200 km west of Dhaka city and the gross area is about 550 ha. The other scheme at Chapai Nawabganj is about 320 km northeast of Dhaka city close to the Indian border and the gross area is about 685 ha.

3 DATA COLLECTION

Two broad categories of data from both primary and secondary sources were collected in this study. Primary data (such as, agro-socio-economic data) were collected interviewing different stakeholders in the study area using structured questionnaire and the secondary data (such as, technical and environmental data) were collected from different government agencies such as, Local and Head office of LGED, Department of Public Health Engineering (DPHE), Bangladesh Agricultural Research Council (BARC), Soil Resources Development Institute (SRDI), Local Pouroshova, etc.

4 PERFORMANCE EVALUATION

In order to investigate the contribution of institutional settings for water management in a small-scale water sector scheme, it is first needed to evaluate the agro-socio-economic performance of the scheme. Several indicators for different aspects were considered:

4.1 Agricultural Effects

The agricultural indicators most commonly used are the area indicators and production indicators (BWDB, 1998):

4.1.1 Area indicators

Area Indicators area as follows:

(i) Cultivated Area Index (CAI) = (Actual cultivated area) / (Target cultivated area) (1)

(ii) Cropping Intensity Performance = (Actual Cropping Intensity) / (Target Cropping Intensity) (2)

4.1.2 Agricultural Production indicators

The following are ratio-based indicators of performance applies to measure the production (tons) and yield (tons/ha).

(i) Yield Performance = Actual Yeild/Target Yeild (3)

(ii) Production Performance = Total Production / Target Production (4)

4.2 Socio-Economic Effects

4.2.1 Financial and Economic Impact Assessment

The economic indicators usually used in the performance evaluation are:

(i) *Profitability to the farmer*: This system may be checked using Farm Budget Analysis, which illustrates the project impact in financial terms (Gittinger, 1982). Farm Budget Analysis provides the indication for assessing the trend in agricultural employment and agricultural per capita income.

(ii) *Profitability to the system:* Profitability is checked by the Economic Internal Rate of Return (EIRR).

(iii) *Sustainability of the FCDI system:* Sustainability is checked by: (a) Financial viability = (Revenue from beneficiaries) / (Total O & M requirements) and (b) Fee Collection Performance = (Beneficiary contribution collected) / (Beneficiary contribution due).

4.2.2 Performance of FCDI Social System

Two types of indicators are broadly used here, "social capacity", and "social impacts".

Social capacity: This refers to the social (as distinguished from physical, biological, or economic) capacity of the people and organizations for managing and sustaining the FCDI supported-agriculture system. The suggested indicators are: (i) Response capacity, (ii) Degree of farmer involvement in system management and (iii) Effectiveness and legitimacy of farmer organizations.

Social Impacts: This refers to the effects on people, their well-being, social organization, and livelihoods of irrigation. Most of them are qualitative rather than quantitative include: (i) Farmer satisfaction, (ii) Employment generation, (iii) Quality of housing, ownership of basic consumer items, (iv) Nutritional and health status, (v) Migration patterns (vi) Gender relations or women aspects and (vii) Access to resources.

4.3 Environmental Effects

Continued irrigation is bringing both favorable and unfavorable changes in the irrigated areas. While the favorable changes consist of increased crop production, better soil moisture conditions conducive toward establishment of vegetation and availability of water for other uses, several environmental hazards in irrigated areas are identified. The major items of concern are as follows: (i) Soil degradation, salinity and alkalinity, (ii) Deterioration of ground water quality, (iii) Deterioration of surface water quality, (iv) Water logging, (v) Stagnant drainage channels with aquatic weeds, (vi) Changing in cropping patterns resulting in cropping systems injurious to health, (vii) Uptake of undesirable elements by plants causing long term health problems, (viii) Irrigation return flows causing water quality problems for aquatic habitat and (ix) Contamination of irrigation water with urban wastes.

5 RESULTS AND DISCUSSION

5.1 Subproject Performance

The overall performance of a small-scale FCD/I system depends on the performances of several factors include: Agricultural, Socio-economic and Environmental aspects:

5.1.1 Agricultural Effects

Cultivated Area Index

The calculated value for Cultivated Area Index (CAI) is presented in Fig. 2. The results revealed that the net cultivated area of BBS has increased quite significantly, whereas the value for ACAD project has failed to attain the target or goal in most of the seasons. Results of the field survey revealed that the inadequate O & M by WMCA in ACAD subproject is prevailing. This was because of the internal conflict (i.e. institutional weaknesses) between the WMCA members.

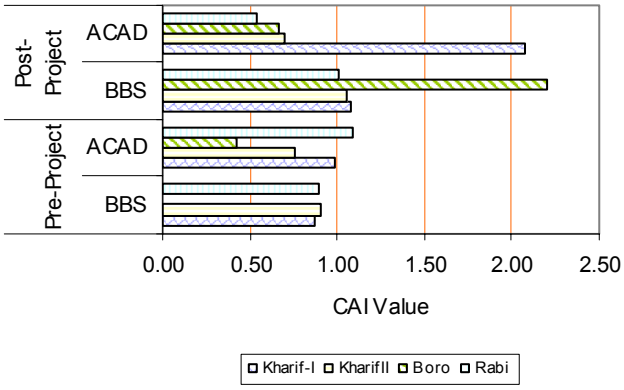

Fig. 2. Cultivate Area Index for BBS and ACAD sub-project

Cropping Intensity Performance

The cropping intensity performance is calculated throughout the year in both pre-project and post -project condition. It was seen from the results that the cropping pattern have changed quite significantly in the BBS area with the implementation of the project, where as it remained almost same and failed to attain the target in ACAD. The shift in cropping pattern and agricultural practices in BBS have been reflected the increase in cropping intensity to 294% against the pre-project cropping intensity of 235%.

Yield Index

Crop yield is a real indicator for assessing the change in fertility and trend in production in any agriculture related water project. The indicator was calculated for "pre-project" and post-project" conditions. The results revealed that the yield of cereals have decreased both in BBS and ACAD during post-project time.

Production Performance

Agricultural Production is the combined effect of cultivated area and production yield. The indicator "Production Performance" is calculated in assessing the field variation of output under 'pre-project' and 'post-project' conditions. Rabi seasonal crop production is very significant in BBS due to dominating contribution of spices production in the micro level. Spices production has increased over 400% in the project area than pre-project period in BBS. But in ACAD the production of Rabi crops are not satisfactory except than that of vegetables. This result reflects the weaknesses in institutional settings in the ACAD subprojects.

5.1.2 Socio-Economic Effects

FCDI agricultural economic system

Profitability to the farmer (Farm Budget Analysis): Representative cropping pattern and crop yields in project area have been used in the farm budget analysis. Inputs and outputs have been valued at 2001 market prices. Farm budget analyses were carried out both for tenant farmer and owner farmer. The result obtained from the Farm Budget Analysis has been carried out to illustrate the indicator "Agricultural employment". This indicator has applied to evaluate the actual agricultural employment generation by the provision of FCD/I in the project area under pre and post-project condition. Results revealed that the agricultural employment opportunity has substantially increased in BBS. Shifting to more profitable HYV seeds and spices cultivation practice is one of the main reasons for increased employment opportunity in BBS, which is four times higher than ACAD. Conflict within WMCA and relatively lack of participation in day-to-day management in ACAD is responsible for this.

Profitability to the system: (Economic Internal Rate of Return (EIRR)): To calculate the EIRR the capital costs, O&M costs and the incremental economic benefit of crop production was first collected and determined. The project life was estimated as 35 years. In BBS, it was found that the EIRR value for "post-project" years is 21% (target was 32%). On the other hand, in ACAD it was found that the EIRR value for "post-project" years is 30% (target was 38.9 %).

Sustainability of the FCDI system.

In recent years, there has been increasing concern over the level of recurrent costs required to keep FCDI system functioning and substantial efforts have been made to raise revenues from water users to bear O&M costs and often some percentage of structural components of FCDI system. From the result of *Financial Viability and Fee Collection Performance***,** it has been seen that the fee collection performance is poor in ACAD, but the *Financial Viability* index is satisfactory. On the other hand, both *Fee Collection Performance* and the *Financial Viability* index are quite satisfactory in BBS. In ACAD, local conflict for leadership within the executive committee of WMCA hinders the fee collection performance, whereas the local peoples in BBS are very willing to pay the contribution and other charges due to relatively strong institutional settings in the micro level.

Performance of FCDI Social System

Social capacity: The data for the indicators for social capacity was obtained from careful field surveys. The results of the indicators are as follows:

Response capacity: Response capacity refers to the social capacity of people and organizations for managing and sustaining the FCDI system. Social capacity of the people can also be seen through the quantitative indicators "financial viability" along with "fee collection performance". In BBS the response capacity and the rate of beneficiary participation is much higher than ACAD. This was because in ACAD, faulty design of the canal structure, local conflict within WMCA, inefficient management practices sense unprovoked them to do their respective job in the day-to-day management.

Degree of farmer involvement in system management: The degree of farmer involvement in day-to-day management is assessed by the indicator: "Farmers Participation Index", which is the percentage of local beneficiaries attending the monthly and weekly meetings. It was found from the questionnaire survey that the participation in the meeting in BBS is higher than ACAD.

Effectiveness and legitimacy of farmer organizations: The WMCA members are democratically elected, they take monthly salary or monitory benefits for their respective jobs and responsible for record keeping and other activities for day-to-day management. But there is an essence of some internal conflict between the members of WMCA, which in the long run, may affect the effectiveness of WMCA. The objective of calculating the rate of monitoring or authenticity is to

find out how the well functioning of the FCDI-system is protected by legislation. Since it is very difficult to give a quantitative value to the content of regulations and laws it is easier to calculate the rate of monitoring by summing the amount of regulations controlling the FCDI system. Legislation was found weaker in both the study areas because of the lacking in inter agency coordination in the higher level of the institutional settings.

Social Impacts: The qualitative factors for social impacts are presented in Table 1. The overall positive social impact is moderate and low in BBS and ACAD respectively. This reflects the relative weaknesses in institutional settings in case of ACAD. To obtain high positive impact in FCDI system, the full decentralization is necessary with strong institutional settings.

Table 1: Social Impact Assessment

Indicator	ACAD	BBS
Farmer satisfaction	-	++
Employment generation	+	++
Quality of housing	+	+
Nutritional and health status	+	+
Migration patterns	**nil**	++
Gender relations or women aspects	**nil**	++
Access to resources	+	+

Scoring: Positive Impact: High +++, Moderate ++, Low +; Negative Impact: High ---, Moderate --, Low -

5.1.3 Environmental Effects

There is an urgent need for giving due attention to the environmental impact of water development projects because of increasing threat of environmental degradation and ecological imbalances. The impact of different environmental parameters due to sub-project development for both the study areas are given in Table 2. Though the institutional setting is relatively stronger in BBS, some negative environmental impact was found because of the increase in agricultural practices in the area.

Table 2: Environmental Impact Assessment

Indicator	Environmental Impact	
	BBS	ACAD
Incidence of flood	--	nil
Drainage and water logging	--	+
Sedimentation in the project area	--	-
Deforestation	++	+
River bank erosion	nil	nil
Level of groundwater use and depletion	++	+
Effect on navigation	nil	nil
Changes in soil properties and land fertility	--	--
Effect on public health and sanitation	++	+
Effect on fisheries and live stock	-	-
Blocking of fish pass	--	nil
Level of use of pesticides and fertilizers	--	--

Scoring: same as Table 1

5.2 Role of Institutional Settings for Water Management

Various researchers have documented their experiences with water managed schemes and suggested that FCDI systems managed by financially and organizationally autonomous systems specific organizations that are accountable to their customers or beneficiaries perform better and are more sustainable than systems managed by agencies dependent on the government (Kloezen and Garces-Restrepo, 1998; Merry, 1996). It can be said that accountability is the key to success in any water sector projects. Both evidence and theory suggested that financially autonomous

public agencies, which depend for a substantial portion of their funding on farmers paying fees, provide better service.

Monitoring performance and ensuring accountability for achieving defined performance objective is a daunting task for these projects. The main objective of this study is to find out what institutional conditions and principles are most conducive to achieving and sustaining high performance in the FCD/I supported agricultural systems and what is the present scenario within the LGED's SSWRDSP. There are variations in what task and responsibilities are shared, turned over to farmers, or retained by the government. The most frequent pattern in Bangladesh is one in which the government retains overall ownership and financial responsibility in the macro (national) and meso (regional) level for the system and control over the water resources, reservoir and main canals. O & M in the micro (local) level canals and other supporting structures are turned over to WMCA or Water Users Association (WUA).

The fundamental problem is that while public organizations under various forms of pressure, have agreed to share many of the responsibilities - especially the expenses and hard work of system management with WMCA, there is no significant change in the power relations between officials and farmers. Mutual accountability is absent. Officials have no incentives to foster independent WMCA. Thus the farmer organizations such as, WMCA remain dependent on the public organization legally, financially and psychologically. 'Joint Management' as currently practiced is often business as usual with cosmetic changes.

Various types of Government agencies are involved including centralized departments usually dominated by the civil engineers, area or river basin development authorities, and agricultural agencies. Most of the agencies structured hierarchically, with officials primary accountability upward to their supervisors and to the political level. Stakeholders of a large government department include politicians, the civil service hierarchy, the users of the services, and ministries, private farms, and donors. Even where corruption and other such related problems are minimal, it is difficult for politicians or senior officials to the central level to effectively understand and represent the interest of users. Hence decentralization may be a partial solution, but that doesn't solve the problems of accountability upward. Temporary decentralization and local organization established as part of the construction or rehabilitation projects often do not have a significant long - term impact because the basic institutional framework is not changed. Long-term decentralization for water management can be performed when the institutional settings meet the following (Kloezen and Garces-Restrepo, 1998; Merry, 1996):

1. A supportive policy, regulatory and legal environment, which recognizes the irrigation community's water rights.

2. Capacity to mobilize resources adequate to meet the costs of O&M including emergency repairs.

3. Benefits exceed cost of participation, with proportional equivalence between benefits and cost for each irrigator- that is, those with larger benefits pay a larger share of the costs.

4. Effective collective choice arrangements or "organizational control of water" by users which will normally have the following characteristics:

    - Organizational Autonomy, with clearly defined boundaries (area and membership), in which the users control the allocation of water, and officials derive their legitimacy and authority from users and are accountable to users.

    - Financial autonomy, i.e., an institutional arrangements in which the irrigation management organization relies on direct methods to raise most or all of the resources needed for O&M as well as capital investments.

6 CONCLUSION

From the results of agro-socio-economic performance of two SSWRDSPs revealed that BBS performs better than ACAD to some extent. But still BBS failed to attain the total target or goal of the subproject development. This is only because of partial decentralization of water management in the micro level. On the other hand, in ACAD, local conflict within WMCA and less participation of beneficiaries in system management is solely responsible for the inefficient output. Total objective of small-scale water sector schemes can only be fulfilled when the system is managed financially and organizationally autonomous in the micro level.

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