RESEARCH REPORT

186

PERFORMANCE OF SMALL-SCALE WATER PROJECTS: AN EVALUATION OF LGED'S PARTICIPATORY INTERVENTIONS

K. M. Nabiul Islam

May 2014

BANGLADESH INSTITUTE OF DEVELOPMENT STUDIES
Dhaka, Bangladesh

RESEARCH REPORT

PERFORMANCE OF SMALL-SCALE WATER PROJECTS: AN EVALUATION OF LGED'S PARTICIPATORY INTERVENTIONS

K M Nabiul Islam [1]

May 2014

BANGLADESH INSTITUTE OF DEVELOPMENT STUDIES

[1]Senior Research Fellow, Bangladesh institute of Development Studies. This article draws on a Benefit Monitoring Study of LGED's Small Scale Water Resources Development Sector Project (SSWRD) where the author was involved as the Team Leader (Islam et al 2008: Impact Evaluation Study Report, BIDS). He was also individually responsible for, among others, this part of the analysis and the study report, as a whole. The author wishes to acknowledge the contribution of the Team Members, particularly Dr Quazi Shahabuddin and Mirza M Shafiqur Rahman for their valuable feedback on an earlier draft of this paper. The author also wishes to acknowledge the valuable comments of anonymous referee on an earlier version of this paper. However, the author is fully responsible for the views expressed and for any remaining errors or shortcomings in the paper.

Research Report No. 186

K. M. Nabiul Islam
Senior Research Fellow
Bangladesh Institute of Development Studies
Dhaka

Published by

Bangladesh Institute of Development Studies
E-17, Agargaon, Sher-e-Bangla Nagar
G.P.O. Box No. 3854, Dhaka-1207, Bangladesh
Phone: 9143441-8
FAX: 880-2-8141722
Website: www.bids.org.bd
E-mail: publication@bids.org.bd

Price: Inland Tk. 80.00 Foreign US$ 10.00

This Research Report has been set in Times New Roman by Ms. Amena Khatun, Steno-Typist-cum-Computer Operator BIDS, Printed in Bangladesh at Dot Printing & Packaging

CONTENTS

LIST OF TABLES, FIGURES, MAP AND APPENDIX TABLES

Page No.

Figures

Map

Appendix A: Appendix Tables

CHAPTER 1
INTRODUCTION

1.1 Introduction

Common property resources (e.g. open access water bodies) and public infrastructure (e.g. polders, embankments and regulators to control water flows) are often used generously by people in Bangladesh. However, not only the operation and maintenance of such infrastructures has largely been ignored, but also the facilities created have most often been uneven and problematic. One way to resolve the problem is to create property rights on such resources and facilities. In other words, establishing property rights and ownership on them for the community is a possible means to operate and maintain them so as to put them to proper use and they do not degrade as usually the case with unrestrained use of common property resources. The important question is how to create such property rights and ownership. Formation of water management associations is one option towards this end. Operation and maintenance, a crucial element of project cycle, is considered to be properly addressed through formation of such associations.

Since the early 1980s, both the Government of Bangladesh and the donor community recognised the need for mobilisation and promotion of beneficiary participation in water management to enhance potential benefits of investment in water resources projects through sustainable operation and maintenance. Since then, various forms of beneficiary participation models were suggested and experimented by experts and institutions from home and abroad. One can mention some as the participatory water management approach of the Early Implementation Project (EIP), Command Area Development (CAD) Project and its on-farm water management activities, and BWDB activities in the GK Irrigation Project and other projects. Under the Flood Action Programme (FAP), the components FAP12 and FAP13 evaluated the operation and maintenance of 13 flood control and drainage improvement projects. The Compartmentalisation Pilot Project (CPP), also under FAP, devoted substantial effort to the introduction of participatory water management. The Systems Rehabilitation Project was implemented in the early 1990s by BWDB aiming at sustainable O&M in rehabilitated projects.

Over the years, participatory water management received further emphasis under the water sector reform programme and National Water Management Plan with major focus on institutional arrangements aiming at improving capacities and efficiencies of water sector institutions and facilitating participation of stakeholders and water management associations (WMAs). Success of the models for enhancing participatory water management, however, was limited and results could not be adequately sustained and replicated. Rather, when the O&M model proved inadequate, rehabilitation of projects used to be the practice.

In this backdrop, and following learning through experience, the Local Government Engineering Department (LGED) suggests that the community needs to be involved in the process from the very beginning of project cycle, up to the actual project implementation. Thus, LGED initiated a model with small scale water interventions (Phase 1) in the late 1990s, focusing on a participatory project framework (log frame) ensuring sustainable operation and maintenance through forming Water Management Cooperative Associations (WMCAs). The model is designed such that participation of beneficiaries is ensured from the very inception stage through planning, designing, construction and O & M of the project cycle. Under the model, the WMCAs receive the project infrastructure, which includes the actual water bodies and other LGED-constructed infrastructure on lease for a 20-year period. After the hand over, the WMCAs have the sole legal right to use, operate and maintain the infrastructure for day-to-day management of water for various kinds of water-using activities including cultivation and fisheries. The WMCAs are registered under the Registrar of Co-operatives with certain amendments to the usual co-operative laws and regulations[1] .

The LGED initiated this model and implemented 280 small water resources management subprojects under its Small Scale Water Resources Development Sector Project (SSWRDSP-1) during 1996-2002. The main purpose of the subprojects was to improve water management, flood management, drainage improvement, water conservation and command area development. The Project was designed to SSWRDSP benefiting a net area of up to 1,000 hectares in each subproject with a view to increasing production in agriculture and fishery and generating more income and employment, thereby contributing to overall reduction poverty. The subprojects are basically designed as participatory, which means that local beneficiaries participate in the project cycles starting from project identification, planning and designing to its implementation phase. After the subprojects are constructed, they are handed over to local water management committees, known as WMCAs, for their operation and maintenance.

In 2008, BIDS carried out a Benefit Monitoring and Evaluation (BME) Study to examine the performance of the subprojects, through covering 10 subprojects (SP) of SSWRDSP-1, for which a baseline study was carried out by LGED in 2002[2] (BIDS 2008). The study assessed impacts of the subprojects on socio-economic, agriculture, water management, fisheries and gender aspects and the present report is based on that study (Table 1.1).

[1] For a discussion of the alternative institutional arrangements that have been considered for day-to-day water resources management, see Aide Memoire of the Joint Appraisal Mission of the ADB, IFAD and the Government of Netherlands, 2-20 April, 1995.

[2] For a detailed discussion on the benchmark study, see Islam et al (2008).

Table 1.1
LGED Water Intervention Subprojects under Study

Name of Subproject (SP)	Location	Type of SP
1. Jetua-Kanaidia	Satkhira	Flood Control & Drainage (FCD)
2 Rajapur Patilapara	Patuakhali	Flood Control & Drainage (FCD)
3. Raufkhali	Chuadanga	Flood Control & Drainage (FCD)
4. Puthia-Falia	Sirajganj	Flood Control & Drainage (FCD)
5. Char Bhurungamari	Kurigram	Flood Control & Drainage (FCD)
6. Ramkrishnapur	Gopalganj	Drainage (DR)
7. Rajapur	Jhalakathi	Drainage (DR)
8. Banderpara Chatra Beel	Rangpur	Water Conservation (WC)
9. Barung River	Panchagarh	Water Conservation (WC)
10.Akhaira-Saidpur Khal	Noagaon	Drainage (DR) & Water Conservation (WC)

1.2 Study Methodology, Approach and Data Limitations

The study, on which this report is based, is an impact study, which encountered a number of data problems. A major problem was related to the benchmark study conducted nearly six years ago by a private firm. The major limitation of the benchmark study was that it did not adopt any control area approach.

But the ideal methodology for this study could be to carry out some comparisons between the "before and after" situations for both the project and the control areas ("with-without") to (a) dissociate autonomous changes that occurred over time and (b) identify possible differences between the project and control areas before the intervention. Consequentially, there was no alternative but to assess the effects of the project by comparing the two sets of areas during the time of evaluation at one point of time.

In each subproject, one "control" village was, thus, picked up from around the adjacent locations but outside the command areas, such that they were maximally similar to the sample project villages, in terms of, among others, socio-economic, hydrological and environmental characteristics. The selection of the control villages was finalised in consultation with the local LGED and WMCA officials.

Survey Methodology and Sampling Procedures

In consultation with the WMCA officials and other key informants, two villages were purposively selected from the "project" area and one village was selected from the "control" area for each of the ten subprojects. The selection of villages from the project areas was made such that one from the high impact and one from the medium impact areas were included. The sample consisted of 40 households from the project villages and 30 from control villages for each subproject. Using a pre-tested structured questionnaire, the selected households were interviewed to generate data on the impact indicators. This gave a total of 700 households for interviews in 10 SPs. A systematic sampling procedure was adopted for the selection of the households. This involved choosing every k-th subsequent unit after the first sample was chosen at

random, where k= N/n, N = population size and n = sample size. The procedure with a random start was adopted for all the individual categories of households, without replacement.

The Study Households and Landholding Stratum

The survey was carried out by categorizing the households according to the following land-holding groups (according to land ownership):

LL = Landless (owning 0 - 49 decimal of cultivated land)

MRF = Marginal Farmer (owning 50 - 99 decimal of cultivated land)

SF = Small Farmer (owning 100 - 249 decimal of cultivated land)

MF = Medium Farmer (owning 250 - 749 decimal of cultivated land)

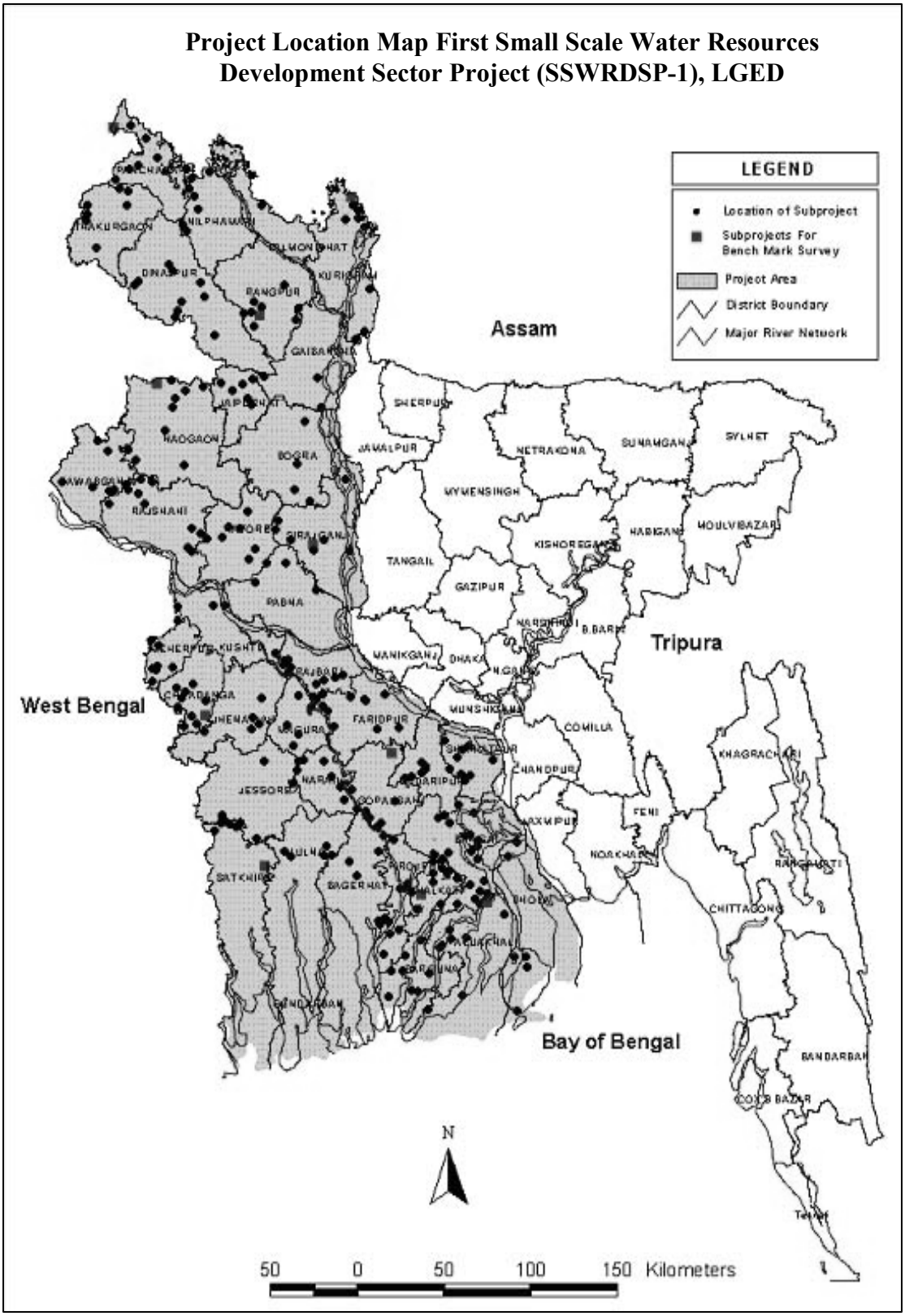
LF = Large Farmer (owning 750 decimal of cultivated land and above)

Econometric Modeling of Household Incomes

The provision of water management facilities in rural areas was one of the major features of LGED's water management infrastructure development. Finally, therefore, econometric analysis was carried out to determine the likely impact of water management interventions on household incomes, assets and poverty, by using the information available from the household surveys. Multivariate regression model was also estimated to determine what could be the impact of the subprojects on different groups of household, classified by poverty levels. Finally, multi-criteria analysis was carried out to assess the overall performance of both the subprojects and WMCAs, which also allowed to testing whether the performance of the former depended on that of the latter.

This report has been organised into four chapters. Starting with an introduction outlining evolution of participatory water intervention projects and study methodology in Chapter 1, Chapter 2 presents an analysis based on perceptions of the beneficiaries of impact on water and flood management due to LGED water interventions. The performance of the subprojects in respect to changes in water and flood management including status of the subprojects and operation and maintenance has also been discussed in this chapter. Chapter 3 presents analyses on institutional issues, particularly examining how effectively the institutional procedures were put into practice. Finally, Chapter 4 provides analysis on economic effects of LGED water interventions through carrying out econometric modeling. In order to determine how far the poor farmers were able to reap benefits from the SSWRD-I subprojects, an analysis of differential impacts by income levels was also carried out in this chapter. Moreover, this chapter assesses the overall performance of the subprojects and WMCAs through multi-criteria analyses.

Project Location Map First Small Scale Water Resources Development Sector Project (SSWRDSP-1), LGED



CHAPTER 2

IMPACT ON WATER AND FLOOD MANAGEMENT DUE TO LGED INTERVENTIONS

Before undertaking a rigorous econometric analysis on the performance of the small-scale participatory water projects, we first discuss performance in respect to changes in water and flood management due to LGED's SSWRD-1 interventions. A few institutional issues are also highlighted in this section (To get fuller insights on the institutional aspects relating to the subprojects, see Chapter 3).

2.1 Water Management Problems and Their Solution: Perception of Beneficiaries

The major reasons for constructing the subprojects, in most cases, have been perceived by local people to be the incidence of crop losses (73.6 per cent), drainage congestion, flooding (52.6 per cent), waterlogging (56.2 per cent) and lack of irrigation facilities (38.0 per cent) (BIDS 2008). Irrigation has been pointed out as a major issue by comparatively few respondents. Only 9.1 per cent of respondents mentioned of property losses. The distribution of the responses made by the WMCA members and non-members tended to be more or less similar.

Regarding whether the problems have been resolved, very few respondents (3.3 per cent) mentioned that the problems have been slightly solved or not solved at all, while over half (52.4 per cent) of them mentioned that the problems were only partially solved (Table 2.1). However, around 44.3 per cent of the respondents thought that the problems have largely been solved or have been solved as expected. All these imply that there were some problems that still remained.

Field investigations generally indicate that the formation of WMCAs or the hand over of the subprojects has been delayed due to, among others, the delay in construction (not shown here). In such cases, the problems are unlikely to be resolved satisfactorily in some places. Two issues can be mentioned here. The performance of the WMCAs was found to be not satisfactory in a number of cases. As would be observed later, in quite a number of cases the subprojects were found not to be maintained properly. The distribution of the WMCA members by subproject types on the question of problem solution shows that 61.8 per cent of the respondents in the case of FCD subprojects, 51.6 per cent in the case of WC and only 7.7 per cent in the case of DR subprojects reported that their problems were largely solved (Table 2.1). More importantly, in the case of DR & WC subprojects, none mentioned that the major problem of project area was largely solved with these projects. Most of the respondents (around 91 to 92 per cent) mentioned that the problems were only partially solved in the case of DR and DR & WC subprojects. Thus, it appeared that FCD and WC types were relatively more successful than the DR, and DR and WC types.

Table 2.1

Respondents' Perception on whether the Major Problems of Project Area were Solved by Constructed Subprojects

Perception on solution	Distribution of households										
	WMCA Members (%)					WMCA Non-members (%)					All
	FCD	DR	WC	DR & WC	ALL	FCD	DR	WC	DR &WC	ALL	%
Solved as expected	10.3	-	29.0	-	10.9	8.5	1.9	10.2	-	6.8	8.3
Largely solved	61.8	7.7	51.6	-	40.8	41.9	9.3	49.0	-	33.2	36.0
Partially solved	27.9	92.3	19.4	90.9	46.9	45.0	81.5	38.8	100.0	55.6	52.4
Slightly solved	-	-	0.0	4.5	0.7	3.1	7.4	2.0	-	3.6	2.5
Could not solve	-	-	0.0	4.5	0.7	0.8	-	-	-	0.4	0.5
Not sure	-	-	-	-	-	0.8	-	-	-	0.4	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Waterlogging and Drainage

Improved drainage, water conservation and increased irrigation facilities are the major objectives of the DR & WC type of subprojects. However, the siltation of khals was the most common problem reported to be largely unresolved, which caused drainage problem in their low pockets as mentioned by 40.9 per cent of the respondent households (Table 2.2). About half of the respondents (48 per cent) put forward suggestions to solve this problem through excavation/re-excavation. Some of the other problems that remained to be addressed were frequent breach of embankments (21.7 per cent), non-operation of sluice gates (15.9 per cent) and water-logging due to drainage congestion (14.1 per cent).

The findings, according to subproject types, show that the siltation was the pressing problem in the case of DR & WC, as reported by all the WMCA members and non-members. Frequent breach of embankments and non-operation of sluice gates were among the most pressing problems facing the FCD subprojects, as mentioned by a little less than two-fifths of the WMCA members/non-members. Crop loss or property damage appeared to be no longer a general problem as only 1.3 percent of the respondents mentioned it to remain unaddressed.

Table 2.2

Respondents Suggesting Problems Still Unsolved by SP

Existing problems/ problems still unsolved	% of households								
	WMCA Members				WMCA Non-members				All
	FCD	DR	WC	DR & WC	FCD	DR	WC	DR &WC	%
Waterlogging due to embankment	2.0	-	-	-	1.0	-	-	-	0.7
Water logging due to congestion	13.0	35.0	-	-	16.4	25.0	-	-	14.1
Frequent break/breach of embankment	41.0	-	-	-	38.5	1.5	-	-	21.7
Non-operation of sluice gates	22.0	-	6.9	-	21.0	-	30.4	-	15.9
Siltation	13.0	60.0	75.9	100.0	15.9	70.6	63.8	100.0	40.9
Crop loss/damage to property	-	2.5	-	-	2.1	2.9	-	-	1.3
Others	9.0	2.5	17.2	-	5.1	-	5.8	-	5.4
Total	52.6	21.1	15.3	11.1	55.7	19.4	19.7	5.1	100.0

2.2 Changes in Inundation Levels and Drainage System

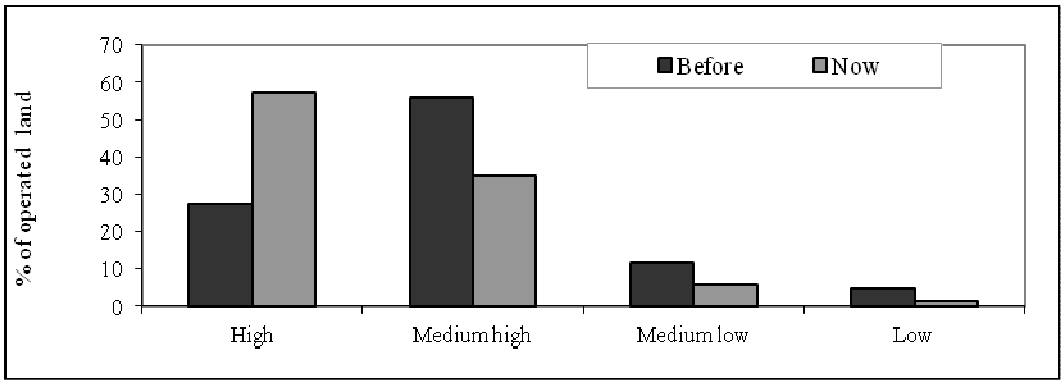
There have been changes in flood levels of operated land in the subproject areas in the pre- and post-project situations (Tables 2.3 and 2.4 and Figure 2.1). The changes by landholding size (not shown here) indicate that the landless category (ownership) of households has 60.0 per cent flood-free (operated) land, which was around 24.5 per cent before. Large farmers had 27.9 per cent of flood-free (operated) land before, which has been reported to have increased to 52.1 per cent after the implementation of the subprojects. Similarly, for other land categories such as marginal, small and medium, flood-free lands have nearly doubled compared to that in the past. Overall, in the post-project periods the situation in respect to inundation and land levels had considerably improved. On the whole, 27.6 per cent of the operated land was flood-free in the pre-project situation, which increased to 57.5 per cent, in the post project situation.

Table 2.3

Operated Land by Flood Level by Subproject

Type of SPs	% of operated land in subproject area					Average operated area (in acre)
	High (Flood-free, 0-1ft)	Medium high (Flooded, 1-3ft)	Medium low (Flooded, 3-6ft)	Low (Flooded, >6ft)	Total	
	Before					
FCD	21.1	53.7	18.0	7.1	100.0	1.7
DR	5.8	78.2	11.5	4.6	100.0	1.7
WC	48.7	41.1	6.5	3.7	100.0	1.7
DR & WC	47.2	52.8	-	-	100.0	3.0
All	27.6	55.9	11.7	4.8	100.0	1.8
	Now					
FCD	61.1	31.5	6.3	1.1	100.0	1.9
DR	35.3	53.3	9.0	2.4	100.0	2.1
WC	53.1	38.0	6.4	2.5	100.0	1.7
DR & WC	81.1	18.9	-	-	100.0	3.1
All	57.5	35.1	5.9	1.4	100.0	2.0

Figure 2.1: Changes in % of Operated Land by Flood Level in the Project Area



The percentages of operated land were much higher for the FCD and DR subprojects, about 61 and 35 per cent in the post-project situation, as against 21 and 5.8 per cent in the pre-project situation respectively (Table 2.3). In terms of flood intensity, the incidence of shallow flooding was reduced to 34.4 per cent from 41.8

per cent in the past, and moderate flooding was reduced to 6.9 per cent from 26.3 per cent before (Appendix Table A.1). The incidence of deep flooding declined from 5.5 per cent to 1.5 per cent over time.[3] Similarly, the drainage system generally improved even though there has been the persistent problem of siltation. For example, the overall well-drainage category of land nearly doubled, from 20.3 per cent to 39.5 per cent. Naturally, for DR and DR & WC subprojects, the extent of improvement was significant, from 0.6 and 35.5 per cent to 29.8 and 69 per cent respectively.

As mentioned earlier, an important component of the subprojects was the provision of flood protection and drainage. A distribution of land cultivated by beneficiaries (both inside and outside the project areas)[4] by flood levels during the pre-project and post-project situations shows that in the project area the overall flood-free area increased to the extent of as high as 178 per cent, while flooded area has decreased to the extent of 49 per cent (Table 2.4, See also Appendix Table A.2 for the distribution by SP type). In contrast, in areas outside the project, the flood-free area has remained more or less the same, while flooded area has increased by 120 per cent. Obviously, the proportion of flood-free area for FCD-type subprojects has increased largely within the project areas (286 per cent), while flooded areas have declined considerably in this type of subproject (76 per cent). In contrast, flooded areas increased in outside the project locations to as high as 211 per cent of their cultivated lands (Appendix Table A.2). The question can be raised whether all these changes (positive or negative) could be attributed to the projects. Nearly 73 per cent households perceived major or large influence of the subprojects in effecting the improvement in terms of flood-free areas (having a good drainage), while around 16 per cent of the households reported a slight or no influence in effecting the improvement (Appendix Table A.3). Flood protection and drainage subprojects appeared to have improved these conditions on such lands. Nevertheless, whether the deteriorating conditions outside the project areas were due to the project interventions could not be ascertained.

Table 2.4
Distribution of Cultivated Land Within and Outside the Project Areas

Type of area	Cultivated land (decimal)		% Change
	Before	Now	
Within project area			
Flood-free area	40.9	113.6	177.8
Flooded area	120.1	60.8	- 49.4
Outside project area			
Flood-free area	6.1	6.4	4.9
Flooded area	11.9	26.2	120.2
Total	179.0	207.0	15.6

[3] The benchmark information collected nearly six years ago indicated that flood-free land constituted 9.3 per cent, shallow 29.1 per cent, moderately 49.2 per cent and deep flooded cultivated land 12.4 per cent respectively.
[4] Outside areas here may serve as sort of "control" areas.

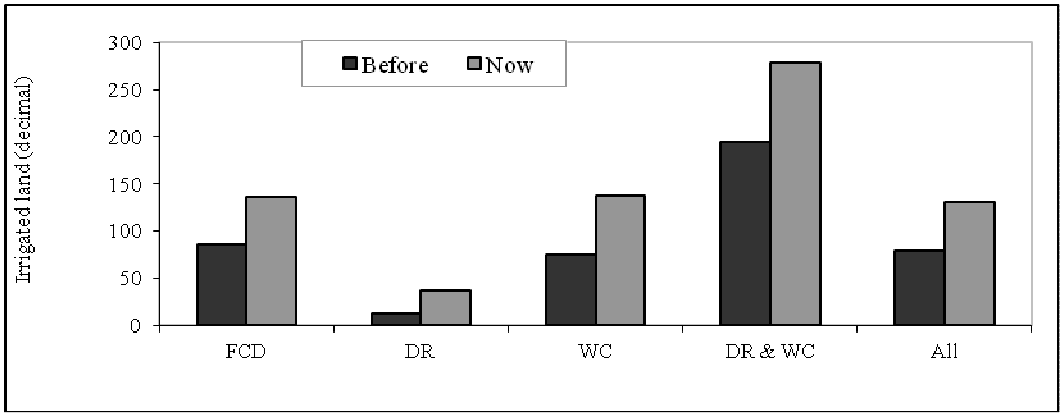
2.3 Changes in Irrigated Areas and Irrigation Methods

The situation with respect to irrigation coverage appears to have improved substantially. In some subprojects even without irrigation component, surface water provision generally becomes available for irrigation facilities (e.g., Char Bhuringamari FCD Subproject). In the past, about 45 per cent of the operated land were irrigated, which increased to 64 per cent over time (Appendix Table A.1). Across subproject types, the highest increase (197%) was found to have taken place in the DR subprojects, followed by WC (86 per cent), FCD (59 per cent) and, the lowest, DR& WC projects (43 per cent) (Table 2.5 and Figure 2.2). The overall growth in irrigated land was around 64.3 per cent, demonstrating a growth of approximately 10.7 per cent per annum over nearly the last six years following the implementation of the projects.

Table 2.5
Land Irrigated per Household in Pre- and Post-Project Situation by SP

Type of SPs	Per household irrigated land (in decimal)		
	Before	Now	% changes
FCD	85.3	135.54	+ 58.9
DR	12.24	36.4	+ 197.4
WC	74.34	137.99	+ 85.6
DR & WC	194.27	278.02	+ 43.1
All	79.39	130.45	+ 64.3

Figure 2.2: Land Irrigated per Household in Pre- and Post-project Situation by Project Type



There has been a change in the use of irrigation methods over the last few years in the project areas. For example, the use of LLP (in terms of number of households using it) increased by 135 per cent, followed by an increase by 50 per cent for DTW and 36 per cent for STW (Table 2.6). Consequently, the use of traditional methods declined to about 55 per cent. Nevertheless, how much of these changes occurred due to the project interventions could not be explored. In terms of amount of land under irrigation, LLP accounted for an increase by 129 per cent, DTW 71 per cent and STW 61 per cent (Not shown here).

Table 2.6
Changes in Irrigation Methods

Situation	No. of households using irrigation methods				All
	LLP	DTW	STW	Traditional methods	
Before	23	24	165	11	208
Now	54	36	225	5	227
% change	134.8	50.0	36.4	-54.5	33.2

2.4 Present Condition of Infrastructure and Its Maintenance

People had different opinions regarding the adequacy of establishing sustainable management of operation and maintenance. So far as the condition of khals and canals is concerned, 51 per cent reported to be "bad" or "deplorable," around 38.5 per cent reported to be "good" or "excellent" and around 10.6 per cent not sure (Table 2.7). As regards embankments, a majority of the respondents (55 per cent) perceived the condition to be "good" or "excellent," nearly 17 per cent perceived the condition reporting as "bad"/"deplorable" and a considerable number of the respondents was not sure about the condition (28.2 per cent). Regarding structures or sluice gates, the status was perceived to have been in a better condition, as a large majority of the respondents (78.3 per cent) mentioned this to be in a "good" or "excellent" state.

Table 2.7
Present Condition of Subprojects

Present condition of SPs	Condition of SP components		
	% of households		
	Khal/Channel/ Irrigation canals/pipe	Embankment	Structures/sluice gate/ culvert
Excellent	24.9	26.1	51.5
Good	13.6	28.9	26.8
Bad	31.7	8.2	10.7
Deplorable	19.3	8.6	3.7
Not sure	10.6	28.2	7.3
All	100.0	100.0	100.0

Obviously, operation and maintenance has a large bearing on the conditions of the project infrastructures. Over half of the respondents (52 per cent) reported that there had been hardly any maintenance, while around 39 per cent reported of regular maintenance of the projects; the remaining 10 per cent reported that they were not sure about that (Table 2.8). There were large variations with regard to maintenance activities across the ten projects under study. Regular maintenance activities were carried out as mentioned by about 99 per cent of the respondents for the WC projects, followed by 36 per cent for the FCD, 2.5 per cent for the DR and none for the DR & WC projects. Likewise, there was hardly any maintenance, as reported by 92 per cent of the respondents, in the case of DR & WC projects, followed by 90 per

cent in the case of DR, 49 per cent in the case of FCD and none in the case of WC projects.

Field investigations clearly show that O&M had not developed to its desired level of performance due to many reasons.[5] The reasons in most cases are not easy to explain. In general, lack of motivation of the local beneficiaries can be considered to be the main cause of its under-performance. Some of the projects were found utterly dysfunctional reportedly due to erroneous design or construction fault (e.g., Barung River WC in Panchagar). In some cases, the projects were nearly dysfunctional due to lack of maintenance (e.g., Char Buringamari FCD).[6]

The siltation was the most commonly found problem which needs to be addressed through re-excavation of khals. However, it appeared that the WMCAs were reluctant in this regard presumably because of their understanding that at some later stage, the government or the LGED would take up the job of rehabilitation. In most cases, beneficiaries also showed little interest in assuming responsibility for maintenance.

Table 2.8

Respondents' Opinions about Maintenance of the Major Components by SPs (Canal/Embankment/Regulators)

Opinion	% of opinions				
	FCD	DR	WC	DR & WC	All
Maintained regularly	36.4	2.5	98.8	-	38.5
Few maintenance	49.0	90.0	0.0	92.3	51.6
Don't know/not sure	14.6	7.5	1.3	7.7	9.8
All	100.0	100.0	100.0	100.0	100.0

Problems of Maintenance

WMCAs were specifically established to (a) conduct routine operation of the structures and necessary maintenance works, with resources generated from among the members, and (b) plan for O & M for the future.

Most projects encountered some maintenance problems most of which were not difficult to have been addressed. Some common problems in relation to the maintenance of the projects were identified (Appendix Table A.7). Over two-fifths of the perceived problems (42.8 per cent) were related to either O&M fund inadequacy or O&M group being non-functioning, while over one third (35.3 per cent) were related to lack of dynamism on the part of the WMCA or lack of unity/common interest on the part of the beneficiaries. Some of the problems (9.4 per cent), however, were perceived to be related to project design or its defective construction. Some of the project designs lacked long-term planning associated with potential changes in the future water regime (e.g., Barung River WC, Panchagarh and Akhira-Siadpur WC, Noagaon).

[5]This was also a common observation made by BUET-BIDS-delft hydraulics (2003): External Evaluation of SSWRD-I Project, June, Dhaka.

[6] This was also due to the 2007 flood that caused a number of major breaches, which remained still unattended.

CHAPTER 3

INSTITUTIONAL ISSUES

While most of the preceding discussion was directly related to the impacts of the projects' intervention, this chapter specifically examines how effectively the institutional procedures were put into practice, particularly in relation to the project identification and implementation process, participation of beneficiaries, operation and maintenance activities, training, employment generation and so on. These insights are useful in the context of highlighting indirect role on impacts, and also in identifying the factors that constrained the performance and gaining lessons towards its improvement.[7]

3.1 Involvement of Beneficiaries in the Participatory Process

The basic approach of the LGED subprojects was that the initiation, identification, designing, construction and O & M activities should be participatory with the local beneficiaries involved in various capacities. By and large, the beneficiaries had participated in a moderate way in the activities of the WMCAs, but largely during the identification phase only. To some extent, they initially participated as wage labourers during construction and also during the O&M phase. They have contributed to the initial fund for the construction but occasionally to the O&M fund.[8] Moreover, they appear to have participated to some extent in the microcredit and training activities.

The process of initiation and identification appeared to be more participatory as reflected through the involvement of 78 per cent of the beneficiaries in the initial stage, 12.4 per cent in the construction stage, 6.2 per cent in the O & M activities and only 3.7 per cent in the planning and designing stage (Table 3.1).

Table 3.1

Distribution of Respondents by Involvement in Different Stages of Subproject

Stages of SP	Distribution of responses *	
	No.	%
Initial stages of SP	125	77.6
Planning and design stages of SP	6	3.7
Construction stage of SP	20	12.4
O & M stage	10	6.2
All	161	100.0

Note: * Multiple responses.

However, field investigations generally reveal that the participation of the beneficiaries in the O & M and post-construction phases has been constrained by two

[7]The issues discussed in this section have also been taken up later in the assessment of the overall performance of both the projects and WMCAs. The insights in this regard are also expected to contribute to gaining lessons for the ongoing SSWRDSP-II and upcoming SSWRDSP-III projects.

[8]Informal discussion with general people, however, revealed that the initial fund, on behalf of the beneficiaries, was largely arranged by sole contribution of the local elites, often happened to be UP Chairmen/Members. As will be seen later, this had some implications in the exertion of control by them over the WMCAs.

factors. First, not all of them could benefit equally, as many lacked land in the project areas to directly derive the benefit. Second, the WMCAs being largely operated by the rural affluent people seemed to have prevented fuller participation of the general people. It was gathered that the rules for general membership and managing committee membership were largely not broad-based.

Nearly half reported that discussions on identification were made with influential persons only and one-third opined that the views of the villagers were largely overlooked. With regard to project implementation five out of ten WMCAs responded. Two-thirds of them mentioned of lack of supervision or low construction quality, while the remaining one-third mentioned of corruption or flaws in SP designs (e.g., Barung River WC project).

3.2 Coverage and Membership

The ten WMCAs had on an average 421 members (Appendix Table A.4). A large majority of the WMCAs (7 out of 10) had members less than 400, while a few had more than 500, and in some cases up to 848 members. A Project on average covered 7.4 villages, while the average number of beneficiary households was estimated at 959 per project. In other words, the WMCA members constituted 44 per cent of the beneficiaries of the locality, according to the WMCA officials.

3.3 Women Participation

According to records maintained by the WMCAs, average women members in the WMCAs were found to be 109 per WMCA.[9] In other words, more than one fourth (25.9 per cent) of the total members were female. In all, 4 out of 10 WMCAs had up to 100 female members. Only one WMCA has more than 200 female members (Appendix Table A.4).

3.4 Trend of Membership and Savings

As the WMCA comprised the core of the project from institutional perspective, the trend of membership and savings activities over the years (since its inception) is considered to be two good performance indicators.

The overall annual trend growth was 1.9 per cent, 2.2 per cent for male and 0.9 percent for female, during the 2002-07 period. As regards savings level, the annual growth was 9.7 per cent during the same period (Appendix Table A.8).[10]

There was no fixed rule on savings practices. Savings used to be collected on both monthly and weekly basis. The amount to be saved each time was not uniform across the WMCAs. A savings of TK 10 per installment was the general norm, as observed in most WMCAs.

3.5 Profile of Managing Committee Leaders

A WMCA had on average 8.7 male and 3.3 female members in its Executive Committee (Appendix Table A.4). On an average, there were 0.5 salaried and 4

[9] Informal discussion, however, reveals that the involvement of a substantial proportion of the female members were rather passive.

[10] The overall trend in savings showed a large value because of some extreme values.

voluntary employees in a WMCA. Each of the WMCAs had one president, one secretary and one treasurer in their executive committee. All of the 30 key leaders (office bearers) in 10 projects were male. It is interesting to note that more than three-fourths (77 per cent) had an education level equivalent to SSC or above (Table 3.2).

Nearly half (47 per cent) of the key leaders in WMCAs claimed to be agriculturist (medium or large farmers), while over one-fourth (27 per cent) were businessmen (Table 3.3). Small or marginal farming was reported to be the occupation of only 6 per cent of the WMCA leaders.

Thus, the occupational pattern of the WMCA leaders indicates that most of them were non-poor. The main leaders were relatively affluent having an average of nearly 5.9 acres of land, which was much above the national average for Bangladesh and over three times larger than that for an average WMCA member (Not shown here). More than two-thirds of the presidents, half of the secretaries and one-fourth of the treasurers had land above 4 acres. More than one-fourth of such leaders had landholding between 7 and 28 acres. Overall, the landholding pattern indicates that the leadership of the WMCAs was vested in the hands of the comparatively rich and influential people in the locality.[11] The presidents of the WMCAs had an average of 8.2 acres of land, the treasurers had 5.2 acres and the secretaries had 14.3 acres. On the other hand, a WMCA member had, on an average, 1.9 acres of land.

Table 3.2
Educational Level of WMCA Leaders

Years of education	% distribution of WMCAs with			
	President	Secretary	Treasurer	All
1-5	10	-	-	3
6-10	30	-	30	20
11-12	50	60	40	50
Above 12	10	40	30	27
All	100	100	100	100

Table 3.3
Occupational Pattern of WMCA Leaders

Major occupation	% of WMCAs with			
	President	Secretary	Treasurer	All
Agriculture (medium /large farmer)	50.0	50.0	40.0	47.0
Agriculture (small /marginal farmer)	10.0	-	10.0	6.0
Business	30.0	20.0	30.0	27.0
Others	10.0	30.0	20.0	20.0
Total	100.0	100.0	100.0	100.0

3.6 Profile of WMCA Members

The landholding pattern of the WMCA members shows that at the time of the survey, around 40.7 per cent were landless, 24.0 per cent were small, 19.7 per cent were marginal, 12.1 per cent were medium and the remaining 3.5 per cent were large

[11] This was also observed by the External Evaluation Study (BUET-BIDS-delft hydraulics 2003).

farmers (Appendix Table A.5). Almost a similar distribution of landholdings can be observed among sample respondents, with 40.5, 22.5, 18.5, 11.8 and 6.8 per cent for landless, small, marginal, medium and large categories of farms respectively (Appendix Table A.9).[12]

3.7 Savings and Micro-credit Activities

WMCAs, as cooperative associations, have the mandate to carry out all normal activities of a cooperative. One of these activities was credit operation. Indeed, as reported by the WMCA officials, 8 out of 10 or 80 per cent of the WMCAs had some kind of microcredit programme. The members of the WMCAs who were poor and undertake regular savings were eligible to get the loans.[13]

At the earlier phases, microcredit programme was not envisaged as a major component of the project. Over time, however, this had become an important component. However, the microcredit facilities had not been developed equally in all the projects observed during this survey. In a few cases, this programme was not developed at all (in 2 of the 10 WMCAs). In general, the WMCAs had a separate sub-committee to look after credit operations.

The number of credit beneficiaries varied significantly among the WMCAs, ranging from 19 (in Ramkrishnapur DR) to 293 (in Bandarpara Chira Beel WC) (Appendix Table A.6). On an average, 102 beneficiaries (per WMCA) used to be provided with microcredit, amounting to an average sum of nearly Tk. 147 thousands during the last few years since its inception. The older WMCAs had generally higher amount of savings, micro credit and O&M funds. Just about half of the WMCAs provided microcredit between Tk. 1.0 and 3.5 lakhs up to the period of the survey. A quarter of the WMCAs provided microcredit between Tk. 38,000 and Tk. 84,000.

Overall, the state of the savings activities was found to be not much encouraging, as only one out of the ten SPs reported that the WMCA members deposited savings regularly, four reported of irregularity and five did not deposit at all. Among the respondents, only 17 per cent so far deposited savings regularly, with 60 per cent irregular and 23 per cent defaulters in savings deposits. The fund for the microcredit programme was generated from shares and savings of the members of the WMCAs. Obviously, savings and microcredit activities indirectly played an important role in the ultimate performance of WMCAs regarding the sustainability of the projects.[14]

Some of the WMCAs experienced withdrawals of shares by some members who dropped out. Similarly, there were many members who failed to regularly save the money they were supposed to. Around 60 per cent of the members were irregular in savings deposits. It was also reported that a considerable number of members never deposited their savings after being members of the WMCAs. Lack of appropriate collection system was the most widely reported reason for the irregularity or default of savings installments, which may also be due to management problems in the

[12]This also indicated that sampling was carried out in a fairly representative way.

[13]The positive role of credit in income generation has been demonstrated in regression models presented later.

[14]See Chapter 4 of this report on the overall performance of the subprojects and WMCAs.

WMCA or credit committees, lack of awareness of the members and lack of willingness of the managing committee to collect the savings.

The purposes for which the credit was taken were largely purchase of agricultural inputs (41.9 per cent), small business (32.3 per cent) and meeting general expenditure (16.1 per cent) (Table 3.4). Irrigation water received low priority in the use of the credit. In other words, the crop-related activities got higher priority, while small business was the second most important category.

Table 3.4
Distribution of Households by Purpose of Loan Received

Purpose	Distribution of households by purpose of loan received	
	No.	%
Small business/shop-keeping	10	32.3
Buying of agricultural equipment/inputs	13	41.9
Buying of cattle	-	-
Buying land/leasing in	1	3.2
Vegetables production	-	-
Poultry farming	-	-
Meeting expenditure	5	16.1
Marriage	-	-
Religious purpose	-	-
Others	2	6.5
All	31	100.0

3.8 Training

The members of the WMCAs and project beneficiaries received various types of training such as management training for the executive committee members, O&M training for the members of the O&M subcommittee, and training in fishery, livestock, integrated pest management and so on. In all, 525 beneficiaries received training so far (2002-07) since its inception in ten projects. Out of this, executive committee members received highest number of training, 40 per cent, followed by general members (38.5 per cent), O & M committee members (10.7 per cent) and so on (Appendix Table A.10). Among those who received training, the male members constituted 73 per cent, while the female members constituted the remaining 27 per cent. On an average, a WMCA had training for its 52.5 members.

In contrast, the respondent members of the WMCAs received training in agriculture (39 per cent), fisheries (22 per cent), cooperatives/management aspects (20 per cent), livestock (14 per cent) and other areas (6 per cent) such as home gardening and integrated pest management (Table 3.5). It is interacting to note that more than 62.5 per cent of the respondents opined that quality-wise the trainings were quite good, while 37.5 per cent assessed these to be of only average quality. However, it is interacting to note that none reported of poor quality (Not shown here). In terms of relevance, again, almost all (93.8 per cent) viewed that trainings were relevant and fruitful.

Table 3.5

Distribution of Respondents by Type of Training Received from WMCA by Sex

Broad subject of training	Distribution of beneficiaries by type of trainings received					
	Male		Female		All	
	No.	%	No.	%	No.	%
Agriculture	19	39.6	1	33.3	20	39.2
Fisheries	10	20.8	1	33.3	11	21.6
Livestock	6	12.5	1	33.3	7	13.7
Cooperatives/Management	10	20.6	-	-	10	19.6
Tailoring/cottage industries	-		-	-	-	-
Others	3	6.3	-	-	3	5.9
All	48	100.0	100.0	100.0	51	100.0
Total respondents receiving training	24	-	1	-	25	-

3.9 Role of WMCA in Operation and Maintenance

As mentioned earlier, the sustainability of the subprojects was largely dependent on the satisfactory performance of the WMCAs and the performance of the WMCAs largely depended on proper operation and maintenance of the projects. The responsibilities of the WMCAs were to conduct routine operation of the structures and necessary maintenance works, with resources generated from among the beneficiaries. In general, WMCA members have not shown adequate interest in assuming responsibility for maintenance. According to WMCA officials themselves, there were hardly any canal re-excavation activities either in the current or in the previous year, as reported by 85.7 per cent of the officials (Appendix Table A.11). There were, however, small-scale repairs, siltation removal or embankment re-sectioning activities, reported by 42.9 per cent of WMCA officials.

Field survey reveals that some of the projects had become dysfunctional due to reportedly erroneous construction fault (e.g., height of sluice gates) or dysfunctional state of the WMCAs. In most cases, the projects appeared to be dysfunctional largely due to lack of maintenance as well as lack of interest on the part of the beneficiaries.[15] The WMCAs appeared to have utterly failed to properly discharge the responsibility of maintenance. The factors such as construction or design faults or lack of funds were frequently mentioned as excuses, which were not always appropriate.

Nearly 86 per cent of the WMCA officials reported that the operation of sluice gates (where applicable) was undertaken properly, while 14 to 71 per cent of them mentioned that the activities such as re-sectioning, cleaning hyacinth and small repairs were undertaken in the past two years. Most of the WMCAs opined that works such as replacing of gate seal and repair of embankment breaches needed some additional support as if these were not their responsibility.[16]

[15]This was a common observation made by BUET-BIDS-delft hydraulics 2003: SSWRD-I External Evaluation, June, Dhaka, where some of the members of the current study team were involved. It was discouraging to observe that since then the situation did not seem to have much improved.

[16]Similar observation was also made by BUET-BIDS-delft hydraulics (2003).

In a few cases, embankments were found unattended due to, again, lack of proper initiative, even in front of the houses of WMCA leaders (e.g., Char Bhurngamari FCD Project) where rain-cuts, rat-holes, etc. were growing in sizes leading to major failures of the embankments in a short span of time.[17] There had been severe conflicts on the issue of LCS job allocation by WMCA leaders in this project. Seedbed practice was very common for most of the khals, which needed preparing a flat plot onto the khal slopes, as was observed in Barung River WC Project.

Within a few years of implementation, the siltation problem became most common in khals which remained mostly unaddressed. The problem got compounded over the years. Unfortunately, WMCAs were found to be reluctant in this regard because of their common perception that at some later stage, the government or the LGED may agree to carry out the job.

In contrast, the O&M fund, collected in some cases, appeared to have been substantial (e.g., an average of over 53,000 Taka) compared to annual O&M requirements (Appendix Table A.6). Despite this, the expenditures appeared to be relatively insignificant and O&M were not found up to its desired level of performance due to many reasons. The reasons in most cases were not that easy to explain. However, in general, the lack of motivation on the part of local beneficiaries could be identified as one of the main causes for its under-performance. Lack of proper planning and understanding of O&M requirements, and perhaps indifference on the part of the WMCAs might have resulted in deferred maintenance which has made some projects unsustainable.[18]

Sub-committee, Office Space and Staff

The WMCAs were mandated to form sub-committees to carry out all activities properly. All the ten WMCAs were reported to have one or more sub-committees. There were many types of sub-committees, namely the O&M subcommittee, the credit sub-committee and similar other categories (e.g., village subcommittee, agriculture sub-committee and fisheries subcommittee). On an average, a WMCA had as many as more than seven sub-committees. However, informal discussion reveals that the process of formation of the sub-committees was not much democratic. In most cases, these committees were reported to have been selected by the managing committees. A related issue was that of the office space for the WMCAs. Six out of 10 WMCAs had formal offices, one on rental basis and 5 on own premises, with the remaining 4 WMCAs having no office at all.

It is somewhat encouraging to note that in 5 out of the 10 WMCAs there were salaried staff (Appendix Table A.4). The major duties of the staff were to collect the installments of savings and loans, and maintain the official records. In nine out of 10 WMCAs annual general meetings were reported to have been held regularly, while in 8 out of 10 WMCAs managing committee meetings were claimed to be held regularly. In 7 out of 10 WMCAs, the maintenance of accounts as a requirement of

[17]A major breach of the embankment (occurred in 2007 flood) was also lying without attention at the time of this survey, which appeared to be beyond financial and physical capacity of the concerned WMCA.

[18]Similar observation was also made by BUET-BIDS-delft hydraulics 2003: SSWRD-I External Evaluation, June, Dhaka.

cooperatives audits were said to be carried out regularly. Election and annual meetings (along with recording of minutes) were claimed to be held regularly in 6 out of 10 WMCAs (Not shown here).

In fact, the lack of a proper space for keeping books and records often hampered the activity of the 4 WMCAs having no office. It was informally gathered that the WMCAs that had salaried staff were generally in a better position in terms of savings collection and loan repayment than others. As the field investigations suggested, despite some financial implications, provisions for salaried staff for maintaining records and carrying out the normal office responsibilities were essential for better functioning of the WMCAs. The employment of salaried staff was particularly important for the better performance of savings activities.

3.10 LCS Formation

Earthwork carried out through formation of labour contracting societies (LCSs) was a major component in many projects. The landless, widows and destitutes were expected to get priority in the formation of the LCSs and their employment. Unfortunately, proper formation of LCS did not happen in most cases. The formation of LCS was somewhat faulty and there were conflicts of interest among the leaders on their formation. In some cases, the WMCA leaders and traditional Sardars formed LCS with their own people, thereby depriving some genuine destitute labourers (e.g., in Char Buringamari FCD Project). On an average, a WMCA was reported to have formed nearly 14 LCSs during the project implementation stage, while only, on average, 2.3 LCSs were formed during the project maintenance stage. In all, about 640 members were involved in these LCSs during the implementation and maintenance stages. Some members of the WMCAs had left the associations after having failed to get a job in earthwork (e.g. in Char Buringamari FCD Project).[19] It was also a common complaint that the women labourers of LCSs were exploited in respect of wages.

3.11 Direct Employment Generation

In general, the projects have generated direct employment opportunities for the disadvantaged groups of people, especially during its construction. Moreover, in a few projects, where repair and maintenance works have been carried out, some more direct employment opportunities were created.

According to the concerned WMCA officials, total person-days generated during construction works (excluding the work of structures) in the projects, on which information were available, estimated at 189, 813 (Table 3.6). On an average, an FCD project employed highest number of person-days (33,290), followed by a DR (14,380 person-days) and a WC project (4,492 person-days). In other words, FCD projects have created 63.8 per cent of the total person-days of direct employment,

[19] During our field survey of Char Buringamari FCD Project, a group of disadvantaged labourers who previously formed LCSs gave a representation to BIDS research team to urge their demands for inclusion in the repair works of the embankment in the presence of WMCA Chairman. They also handed over a formal application to take up the matter with the headquarters.

DR projects have created 27.6 per cent and WC projects have created 8.6 per cent of the total person days of employment. The information on the DR & WC projects were not readily available. However, the direct employment effects appeared to be not substantial because of the small size of the projects and inadequate O&M activities.

Table 3.6
Employment Generated through LCSs during Implementation and O&M Stages by SP

Name of projects	Type of project	Total employment* generated (person-days)		
		Male	Female	Total
1. Jetua-Kanaidia	FCD	250	-	250
2. Rajapur Patilapara	FCD	18000	2400	20400
3. Raufkhali	FCD	6000	3900	9900
4. Puthia-Falia	FCD	81900	-	81900
5. Char Bhurungamari	FCD	35100	18900	54000
6. Ramkrishnapur	DR	13500	880	14380
7. Rajapur	DR	-	-	-
8. Banderpara Chatra Beel	WC	3960	1150	5110
9. Barung River	WC	2039	1834	3873
10. Akhira-Saidpur	DR & WC	-	-	-
All	-	160749	29064	189813

Note: * Employment generated during the implementation of SP and its O&M during the period 2002-2007.
- = Not available

3.12 Indirect Employment Generation

Apart from the direct employment opportunities created during the project construction, some additional employment was generated due to increased cropping activities in individual localities, which has been analysed in this section.

Average yield of crops in general and rice crops in particular has increased due to increased irrigation and crop security. The cropping intensity in the project areas was 169 per cent in the pre-project situation, which increased to 198 per cent after the project intervention, indicating an overall increase of nearly 29 percentage points. This resulted in the increase of cultivated area by 3,830 acres (See Main Report: BIDS 2008: Agriculture Section).[20]

Annual employment generated by increased agricultural activities, disaggregated by crops and hired/family labours, has been estimated and presented in Table 3.7. It can be seen from the table that the gross area for all the crops has not increased; in fact, the areas for some crops have declined (e.g., local rice, wheat and oilseeds). Person-days used in the cultivation of various crops were compiled from various studies conducted by BIDS (e.g. BIDS 2008).[21] Thus, the extra indirect employment generated annually due to increased agricultural activities in the study areas was in

[20]Considering total net area under the 10 subprojects as 5,329 ha (13,167 acres), increase of cropping intensity by 28.3 per cent estimated a similar figure, an increase in gross areas by 3,724 acres.

[21]BIDS (2008). [M Asaduzzaman and K M Nabiul Islam**:** Adequacy and Effectiveness of Fuel Subsidies to the Poor Bangladeshi Farmers, The World Bank, Dhaka]

the range of 365,098 person-days. This implies that, on an average, a project generated additional employment of 36,510 person days annually due to increased agricultural activities. Of this incremental agricultural employment, 195,601 (or 53.4 per cent) person-days were due to family and 169,497 (or 46.6 per cent) person-days due to hired labours. As regards women participation in the total employment generated, it was estimated that wage employment to the extent of approximately 85,068 person-days were likely to have been accounted for by female labourers.[22]

Of the annually generated 365,098 person-days in agricultural employment, HYV rice cultivation alone accounted for 73.5 per cent, followed by spices (8.0 per cent), maize (6.8 per cent), potato and other crops including vegetables (4.8 per cent) and pulses (2.0 per cent).

Table 3.7
Annual Employment Generated by Increased Agricultural Activities in 10 Projects

Major crops	% of gross area in post-project situation	Increased area cultivated under crop (acres)	Employment generated (person-days)			
			Family	Hired	Total	(%)
Local rice	26.9	- 215	-6,880	-5,375	-12,255	-
HYV rice	47.1	2,679	144,666	136,629	281,295	73.5
Wheat	0.7	- 106	-1,590	-3,286	-4,876	
Maize	3.4	502	8,534	17,570	26,104	6.8
Pulses	3.7	141	3,102	4,653	7,755	2.0
Oilseeds	4.4	- 13	-143	-468	-611	
Potato	2.8	402	6,030	12,462	18,492	4.8
Spices	1.7	131	29,213	1,441	30,654	8.0
Others (incl. jute, vegetables)	9.3	309	12,669	5,871	18,540	4.8
All	100.0	3,830	195,601 (53.4)	169,497 (46.6)	365,098 (100.0)	100.0
Women participation in employment	-	-	-	-	85,068	0.18

Note: For column 2, Main Report: BIDS 2008: Agriculture Section.

The employment thus generated was expected to have some positive role in poverty reduction. However, not all the generation was due to the project interventions following some autonomous growth resulting from other contributing factors such as a switch to HYV varieties and increased use of inputs due to lower perceived risk of crop failure or reduced losses due to flooding.

[22]According to Labor Force Survey (2010), the coefficient for women participation to total labour force in 2010 was 0.233. This coefficient has been used to estimate women's employment.

3.13 Benefits to Landless and Marginal Farmers[23]

It was earlier argued that a high proportion of higher landholding beneficiaries have reaped relatively higher output benefits. Even then, considerable benefits seem to have been accrued to the marginal and small farmers in the form of increased agricultural production. The respondents, by and large, perceived that the landless, marginal and small farmers had benefited from the projects in terms of agricultural production. In terms of direct employment from construction, particularly earthwork, the poor were benefited more. More importantly, a larger part of the indirect employment was perceived to have gone to the hired agricultural labourers, small and marginal farmers through increased cropping activities. Obviously, this has appeared to have contributed to reducing the severity of poverty, if not its incidence.

According to the perception of the respondent households, more than half (50.7 per cent) of the responses were related to benefits in terms of agricultural production, followed by increased employment opportunity (22.2 per cent), increased income (15.6 per cent) and improved quality of livelihood (11.1 per cent) (Appendix Table A.12). As considerable maintenance works did not take place, it was not clear whether the projects have generated substantial direct employment opportunities for landless people in such activities.

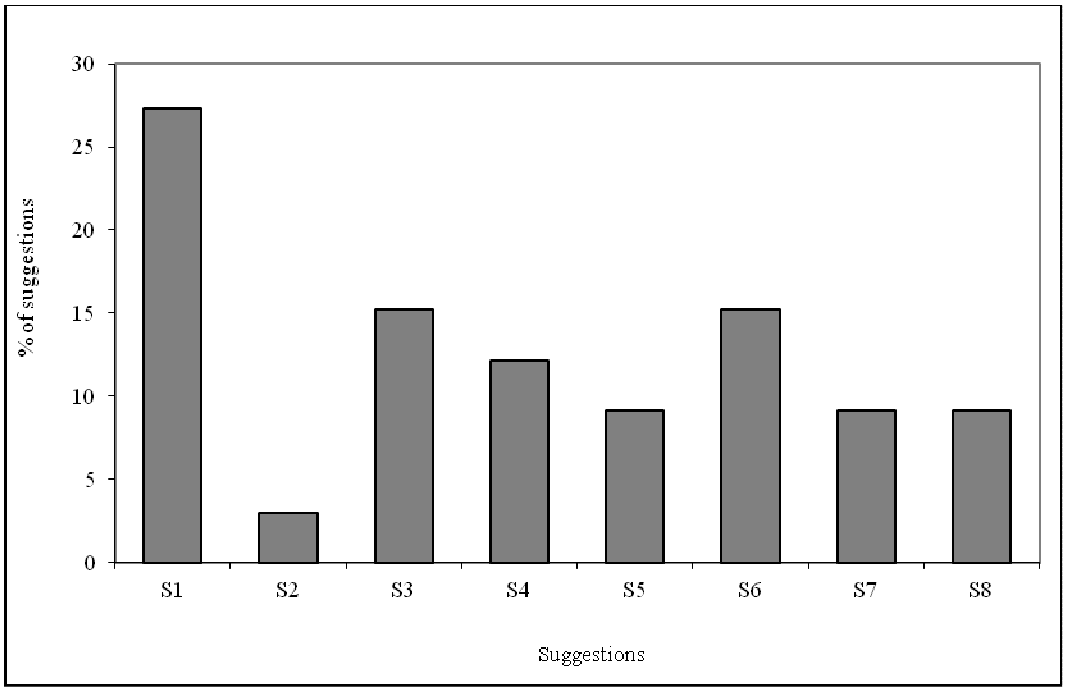
3.14 Suggestions Towards Better Functioning of WMCAs and the Projects

The WMCA officials were asked to make suggestions towards better functioning of the WMCAs and the projects under study. Most suggestions made in regard to WMCAs functioning were related to O & M and WMCA leaders themselves. As the O&M had not yet developed up to its desired level of performance, naturally, most suggestions made (27.3 per cent) (based on multiple responses) were related to ensuring adequate fund for O& M activities, followed by making the WMCA officials more dynamic/active (15.2 per cent), making the WMCA officials more committed (15.2 per cent) and introducing some incentive mechanism for the officials (12.1 per cent). Other suggestions made were, among others, asking support for technical assistance from LGED (9.1 per cent), enhancing manpower skill within WMCAs (9.1 per cent) and reducing local political pressures on WMCA activities (9.1 per cent) (Appendix Table A.13) (Figure 3.1).

Likewise, in relation to projects functioning, most (78.5 per cent) suggestions made were related to steps towards regular maintenance of the projects, followed by making WMCAs more effective (71.4 per cent), making WMCA management more responsible (50.1 per cent), ensuring transparency of accounts (34.4 per cent), holding regular meetings (management and general) (33.2 per cent) and so on.

[23] For a more concrete assessment, made through econometric models in this regard, see Chapter 4 of this report.

Figure 3.1: Suggestions Made by WMCA Officials for Better Functioning of WMCAs



S1	Ensure adequate fund for O&M
S2	Mobilise fund from large & medium farmers
S3	WMCA leaders should be more dynamic/active
S4	Introduce incentive mechanism for leaders
S5	Ensure technical assistance from LGED
S6	WMCA officials should be more committed
S7	Increase skilled manpower within WMCA
S8	Reduce political pressure

3.15 Paired Samples Test for Selected Variables

Before undertaking a rigorous econometric analysis on the performance of the small-scale participatory water projects, it is important to work out some descriptive statistics of the key socio-economic variables, especially which are later included in regression models, to compare values for before and after situations. Table 3.8 presents paired samples test for selected variables for pre- and post- interventions for project households while Table 3.9 presents paired samples test for selected variables for control households. In particular, the observed mean difference in respect to changes in socio-economic variables and those related to water and flood management (due to LGED's interventions) is worked out. Interestingly, for almost all the variables the mean differences are significant at more than 99 per cent level, indicating that difference between two means for the two periods is highly significant. Such results lay importance of undertaking some regression analyses that are presented in next chapter.

Table 3.8

Paired Samples Test for Selected Variables before and after Interventions (Project Households)

	Mean	95% Confidence Interval of the Difference		Sig. (2-tailed)
		Lower	Upper	
Credit received (TK)	7856	4206	11506	.00
Flood free land (dec)	113	87	140	.00
Total irrigated land (dec)	69.7	57.2	82.1	.00
Total household income (TK)	163146	126894	199399	.00
Total owned land (dec)	4.47	2.17	6.76	.00
HYV rice area (acre)	0.67	0.56	0.78	.00
Total non-irrigated land (dec)	-28.4	-45.5	-11.3	.001
Value of household assets (TK)	838789	690558	987020	.00
Non-flooded land (dec)	.6916	.5667	.8165	.00
Shallow flooded land (dec)	-.0468	-.1844	.0908	.50
Moderately flooded land (dec)	-.3299	-.4454	-.2143	.00
Deep flooded land (dec)	-.0669	-.0911	-.0427	.00
Early drainage land (dec)	.4809	.3318	.6301	.00
Slow drainage land (dec)	-.5100	-.6201	-.3998	.00
Late drainage land (dec)	-.1371	-.1875	-.0868	.00
Well drainage land (dec)	.4475	.3494	.5457	.00

Table 3.9

Paired Samples Test for Selected Variables (Control Households)

	Mean	95% Confidence Interval of the Difference		Sig. (2-tailed)
		Lower	Upper	
Credit received (TK)	7028	4756	9299	.00
Total household income (TK)	145814	97767	193862	.00
Total owned land (dec)	2.96	1.26	4.66	.001
HYV rice area (acre)	0.20	0.10	0.29	.00
Value of household assets (TK)	627999	495427	760572	.00

CHAPTER 4

ECONOMIC EFFECTS OF SSWRDSP-I INTERVENTION

The findings in the preceding chapters give a mixed story about the performance of the LGED's small-scale water sector projects. There were diverse impacts, both positive and negative, on various counts. In fact, the impact assessment of SSWRDSP-I interventions on economic variables is a formidable task because of multiple ongoing programmes along with those of water management infrastructures in a particular area. Segregating the impacts poses a particular challenge in that the SSWRDSP-I interventions involve a small area (comprising only up to 1,000 hectares) in the local economy. Attempts have, however, been made to capture the impact of water interventions by carrying out an econometric modeling exercise. The primary project objective of ensuring benefits to poor farmers has been kept in perspective while carrying out the analysis. The economic variables considered are income and asset of the project beneficiaries.

4.1 Impact on Household Income and Assets: A Multi-variate Econometric Analysis

The Analytical Framework

The provision of water management facilities in rural areas is one of the major features of LGED's infrastructure development in recent years. The villagers' access to this facility has grown rapidly over the last decade. The question is what we can infer about the likely impact of such water management interventions on household income and assets.

In rural Bangladesh, where agriculture is still the pre-dominant activity, the impact of water infrastructure such as flood protection, drainage and irrigation development may immediately lead to higher adoption of modern high yielding variety (HYV) technology through the provision of increased irrigation facilities, and thereby enhance production and income. However, the increased adoption of modern technology is likely to result in unequal income distribution among the poor and non-poor, as these are relatively cash intensive in nature, compared to traditional varieties. The interventions such as embankments to prevent crop losses generally lead to expanded non-farm activities (e.g., processing industries and small enterprises). As was evident from the preceding chapters, the management of small-scale water infrastructures under study was generally dominated by local elites and affluent farmers. Hence, it is likely to have greater economic impacts on those with higher incomes (having access to such facilities) than on the average poor who might not be able to reap the full advantage of the created water facilities. All these aspects discussed above would be kept in perspective in the analysis that follows.

The analysis is carried out to capture the aggregate impact on household income and asset using the information available from the household surveys carried out under the present study.

Household income and asset

As was reported elsewhere in the study report (Islam et al 2008) (Socio-economic), the average household income (farm income) and value of assets in the project area (with interventions) were respectively 22.3 and 30.6 per cent higher than those in the control villages (having no such interventions).[24] Not all of these differences, however, were attributable to the effect of the concerned projects. Considerable differences were evident among the households, located in two different study villages, in terms of initial resource endowment as well as the level of development due to other infrastructures. In order to segregate the influence of the "other" factors, a household income (or asset) determination model has been estimated, using household level data, to analyse the determinants of income and assets.[25]

4.2 The Household Income (assets) Determination Model [26]

The income (or asset) determination model is described as follows. Two models have been estimated using two sets of data (Table 4.1). First, the farm income of a household is expected to primarily depend on land owned (LAND), asset endowment (ASSET), credit/loans received (CREDIT), cropping intensity (INTNSTY) and the number of earning members (proxied here by the number of agriculture earners) (ERNER). The income of households is also likely to be positively correlated with the productivity of land, proxied by the proportion of area allocated to the cultivation of high yielding varieties of crops (HYV). The productivity of land and occupation choice may also vary according to the level of education (proxied here by years of education of household head) (EDUC). The first model (Model 1) along with the corresponding set of results refers to entire samples comprising both the project and control areas (combined), while the second model (Model 2) along with the corresponding set of results refers to that of the project area only; the only major difference was that the second model incorporates an additional set of variables, called intervention variables (Table 4.1). Such variables include proportion of flood-free land (FLDFREE), proportion of irrigated land (IRRIG), proportion of well-drainage type of land (DRAIN) and WMCA membership (WMCA) (taken as dummy variable, with members assigned as 1 and 0 otherwise). It may be recalled that the projects under study were of several types (e.g., flood control, irrigation and drainage) in disproportionately unequal numbers, and hence benefits of the households from flood protection, irrigation and drainage in the entire sample have a skewed distribution.[27] However, it would be important to control for different types

[24] See Section 2.3, Islam et al (2008) : Impact Evaluation Study Report, BIDS (Chapter 2).

[25]These effects may be applicable over a short period. The long-term effects of these infrastructures may not be captured with the cross-sectional data. This can probably be assessed from panel data on a same set of households.

[26] The model specification follows Hossain and Sen (1992), and Sen (1998).

[27]Ideally, this could be incorporated if the models were run on the households of individual projects separately. In contrast, as would be seen later, independent income effects of all such variables (e.g., irrigation, flood

of SPs such as FCD, DR, WC and DR & WC to capture the heterogeneity in interventions. Thus, the regression models have used three SP dummies to account for this.

Finally, an important variable is the "Project intervention" variable, a dummy variable defined as beneficiary households living in project area as 1, and control areas as zero. The project intervention is likely to make positive difference to the overall income-earning environment.

4.3 Discussion of Results

Two sets of information were considered for the two models: the former including the entire sample (combining project and control areas households), and the latter considering only the project area households, which, of course, included, as already mentioned, a number of additional intervention variables, such as those related to irrigation, flood protection, drainage and WMCA membership (Table 4.1).[28] It can be seen that both the models fitted extremely well, indicated by high value of R^2s (adjusted), 0.61 and 0.65 respectively, which were found to be highly significant.[29] Interestingly, almost all the independent variables have shown statistical significance, at more than 99 per cent level for all but two variables. In the first model, the variable CREDIT was significant at more than 95 per cent level. As expected, the variable of landownership (LAND) was an important determinant of income in the study areas. Its independent effect was quite substantial as reflected in the relatively high elasticity of income with respect to landownership. Thus, a doubling of the landownership size for an average household was expected to increase income by about 53 per cent. The variable asset endowment (ASSET) had relatively low elasticity as doubling of the assets for a household would increase income by 17 per cent. The coefficient for the variable credit (CREDIT) is statistically significant but has a low elasticity (5 percent).

The variable of HYV technology (HYV) was found to be highly significant and the regression coefficient was estimated as 0.34, implying that the contribution made by the new rice technology to farm income was 34 per cent higher than that for land cultivated under traditional rice varieties. The contribution of agricultural labour (ERNER) to household farm income was also found to be higher than that for

protection) were not found to be statistically significant. Besides, the variables for both the models were beset with the problem of multicollinearity; however, these were assumed to be balancing such effects.

[28]The regression equations were estimated in log linear forms. Natural logarithms were taken for the dependent variable, income, and for the independent variables, land owned, assets endowment and credit were taken. The HYV technology variable was measured in ratio form, i.e., by the proportion of total cultivated area under high-yielding paddy varieties. Similarly, the variable earner was measured in ratio form, i.e., in terms of the proportion of agricultural to total earners in the households. The level of education considered years of education of the household head. In the first model, the project intervention variable has been measured in dummy form: households in the project area assigned a value "1" and those in the control area assigned a value "0." In the second model, intervention variables (flood-free land, irrigated land and well-drainage land) were measured in terms of proportions to total cultivated land. The variable WMCA membership was measured as a dummy variable, members assigned a value "1" and non-members assigned a value of "0."

[29]Such high correlations were not much expected from a cross sectional data, the aspect of which might raise questions about the unbiasedness of the control area selection. Hence, one should be careful in using the absolute values of the income effects.

the non-agricultural workers by 63 per cent. The education variable (EDUC) was found to be positive but significant only at 9 per cent level.

Thus, controlling for the variation in initial resource endowment of the household (e.g., land, non-land capital, labour, modern technology and education), one can observe a significant positive income effect of the SSWRDSP-I investments. In general, households in the project area (with intervention) had, on average, 32 per cent higher income than those in the control area (without intervention).

Similar results were obtained for the second model comprising households of only the project area, representing interventions in water management. The only major difference that can be observed was related to income effect of HYV rice technology. Such coefficient in this model was 8 per cent (but not statistically significant) compared to 34 per cent in the first model.[30] As regards project intervention variables, the independent income effects of WMCA membership[31] and well-drainage land variables were found to be statistically significant: the former at more than 95 per cent and the latter at more than 90 per cent level. This implies that the WMCA members had higher income than that of the non-members by about 18 per cent, while well-drainage type of land had higher returns, by more than one third (34 per cent), compared to land with poor drainage conditions. The variables such as flood-free land and irrigated land were not found to be significant at any acceptable level of significance, presumably because the sample households comprised not a single type of project but various types such as irrigation, flood protection and drainage improvement so that benefits from these varied substantially. In order to control for different types of SPs (e.g. FCD, DR, WC and DR & WC) three SP dummies were used to capture the heterogeneity in interventions. It can be seen that compared to WC subprojects, DR & WC subprojects performed very well and FCD subprojects performed worst, in terms of providing benefits to farmers. [32]

Almost similar findings are found to be true for the models (Model 1 and Model 2) with total assets as dependent variable (See Appendix Table A.14).

[30]To look into which of the HYV paddy productivity was more contributing, a separate model was run with the HYV (Aman) and HYV (Boro) included as two independent variables, instead of the HYV rice as a whole. It shows that Aman productivity had a higher income contributing effects by about 3%, the coefficient being 0.026. The coefficient for Boro was found to be not statistically significant (See Appendix Table B.16).

[31]The variable considered as dummy, with WMCA members assigned value 1 and 0 otherwise. The respondent beneficiaries included a considerable number of non-members.

[32] It can be recalled that the FCD subprojects under investigation largely comprised embankments, which had been under severe threats due to, among others, unattended breaches, non-operation of sluice gates and lack of maintenance since the 2004 and 2007 floods.

Table 4.1

Multiple Regression Results- Dependent Variable: Log of Farm Income (TK)

Independent variables	MODEL 1 (Project + Control) Area Households			MODEL 2 Project Area Households		
	Regression coefficients	't' value	Signifi-cance	Regression coefficients	't' value	Signifi-cance
Constant	3.386	7.718	.000	3.399	5.82	.00
LAND-Log owned land (dec.)	.530	19.699	.000	.507	14.32	.00
ASSET-Log total assets (Tk.)	.166	4.402	.000	.233	4.70	.00
CREDIT-Log of credit received (Tk.)	.046	2.557	.011	.036	1.54	.12
HYV-Proportion of cultivated land under HYV rice variety	.335	3.593	.000	.076	.42	.66
INTNSTY-Cropping intensity (%)	.006	7.063	.000	.005	4.89	.00
ERNER-Proportion of agri. earner	.630	7.240	.000	.629	5.45	.00
EDUC-Years of schooling of household head	.014	1.702	.089	.006	.56	.57
PROJ- Project/control (Dummy) *	.318	4.876	.000	-	-	-
FLDFREE -Proportion of flood-free land	-	-	-	-.003	-1.71	.08
IRRIG -Proportion of irrigated land	-	-	-	-.002	-.87	.38
DRAIN -Proportion of well-drainage land	-	-	-	.002	1.74	.08
WMCA -Membership of WMCA**	-	-	-	.176	2.34	.02
DR & WC-Type of subproject***	-	-	-	.484	2.47	.01
WC-Type of subproject****	-	-	-	.076	.46	.64
FCD-Type of subproject *****	-	-	-	.001	.01	.99
R^2 (Adjusted)	.61	F	.000	.65	F	.00
No. of cases	553	-	-	322	-	-

Note: * Dummy variable, assigned value 1 for the project and 0 for the control area.
** Dummy variable, assigned value 1 for the WMCA members and 0 for the non-members.
*** Dummy variable, assigned value 1 for the DR &WC and 0 for other SPs.
**** Dummy variable, assigned value 1 for the WC and 0 for other SPs.
***** Dummy variable, assigned value 1 for the FCD and 0 for other SPs.

4.4 Differential Impact of SSWRDSP-I Projects by Income Status

The preceding analysis has demonstrated significant positive impact of SSWRDSP-I projects on income and assets at household level. Now the question is what would be the impact of the projects on different groups of households, classified by poor and non-poor categories. To address this question, the same econometric model, referred to in the previous sub-section, is estimated through considering poor and non-poor households taken separately.[33] The results are presented in Table 4.2.

Both the models, Model 3 and Model 4, considered the entire samples of project and control areas; the former for poor sample households only, and the latter for non-poor households only. The following observations are made from the two models (Figure 4.1).

- Poor households in the project area earned 24 per cent higher income than that of poor households in the control area
- Non-poor households in the project area earned 22 per cent higher income than that of non-poor households in the control area.

[33] TK 11,220 (annual per capita), based on annual per capita expenditure, has been taken as (upper) poverty line for the year 2007; the estimate is made on the basis of HIES expenditure data (BBS-*Household Income and Expenditure Survey Report 2005)*.

Table 4.2

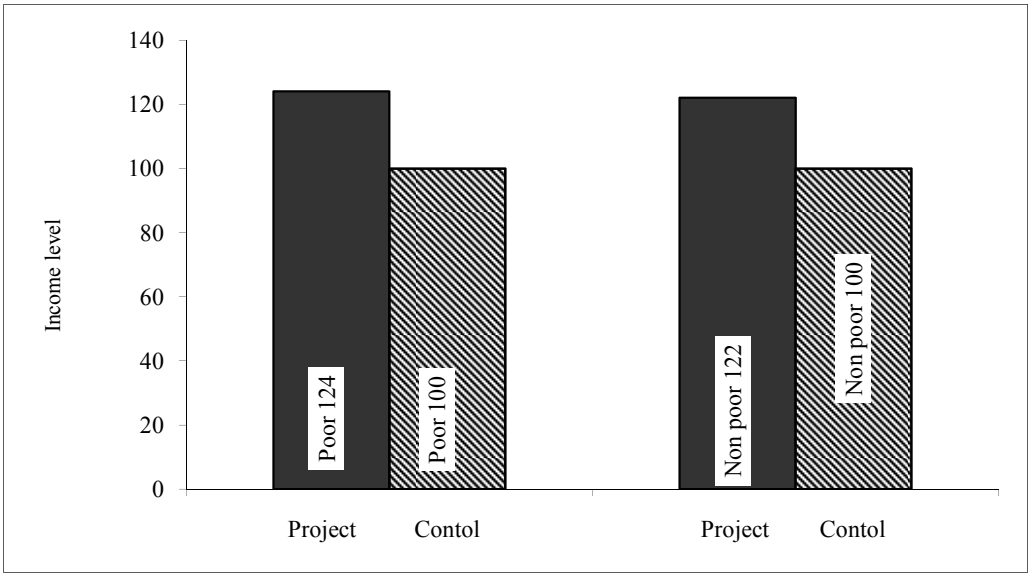
Multiple Regression Results- Dependent Variable: Log of Farm Income (TK) after Intervention

Model	Model 3 (Project + Control) Area Poor Households			Model 4 (Project + Control) Area Non-Poor Households		
	Regression coefficients	't' value	Signi-ficance	Regression coefficients	't' value	Signi-ficance
(Constant)	2.074	1.620	0.11	2.062	2.384	0.02
Log owned land (dec.)	0.444	4.687	0.00	0.470	7.559	0.00
Log total assets (Tk.)	0.366	3.102	0.00	0.281	3.503	0.00
Log loan received (Tk.)	-0.048	-1.774	0.08	0.053	2.863	0.00
Proportion of cropped land under HYV (dec)	0.216	1.469	0.14	0.304	2.914	0.00
Cropping intensity (%)	0.005	3.082	0.00	0.006	6.937	0.00
Proportion of agri earner	0.235	1.603	0.11	0.454	5.094	0.00
Year of schooling of household head	0.018	1.375	0.17	0.005	0.537	0.59
PROJ Project/control *	0.235	2.346	0.02	0.221	3.037	0.00
R^2 (Adjusted)	.569	F	0.00	.690	F	0.00
No. of cases	143	-	-	350	-	-

Note: * Dummy variable, assigned value 1 for the project area and 0 for the control areas.

On the whole, available evidence leads us to conclude that the SSWRDSP-I projects had considerable positive impacts on the income of both the poor and non-poor households. Nevertheless, one should be careful in using the absolute figures as the survey was likely to have suffered from limitations in that the data collected on pre- and post-project situations for both the project and control areas at one point of time were subjected to recall problem.

Figure 4.1: Income Level (after intervention) between Poor and Non-poor in the Project and Control Areas



4.5 Overall Performance Evaluation of SPs and WMCAs

The projects under SSWRDSP-I have been implemented with a view to undertaking improvement on water management, drainage and irrigation in order to increase production in agriculture and fisheries and generate increased income and employment, thereby contributing to overall reduction in poverty in the project areas. The projects were based on a community based participatory model aiming to promote participation at all stages of the project cycle, thereby ensure sustainability of the projects through proper operation and maintenance.

The very SSWRDSP model hypothesises that the sustainability of the projects is largely dependent on the satisfactory performance of the WMCAs and the performance of the WMCAs depends on their operation and maintenance activities. In other words, the Water Management Co-operative Association (WMCA), a key component of this model, is responsible for the operation and maintenance, through participation by its member-beneficiaries. Some ancillary activities of the WMCAs consist of activities such as savings, micro credit and employment generating activities.

This section aims to (1) assess the overall performance of the projects, (2) assess the overall performance of the WMCAs, and (3) test the hypothesis that the success and sustainability of the projects depend on the satisfactory performance of the WMCAs.

Performance Criteria

The criteria used for evaluating the performance of the sample projects and WMCAs are presented in Tables 4.3 and 4.4 respectively. A total of 13 criteria in both cases were used in the evaluation. The major evaluation indicators for the projects are employment, income, land ownership, irrigation, flood protection, cropping intensity and crop productivity. Percentage change over the intervention period for each of the indicators is considered. The major evaluation indicators for the WMCAs are trend in membership, savings, micro credit, condition of infrastructures, O&M activities, training and leadership.

Table 4.3

Performance Criteria for Projects

Performance criteria of SPs	Labels
1. EMPLOYMENT	% change for full time employment of main earner
2. INOCME	% change in average annual income per household
3. SURPLUS	% change in rice surplus situation of sampled households
4. LAND 1	% change in amount of flood-free land per household
5. LAND 2	% change in amount of operating land per household
6. LAND 3	% change in size of own land per household
7 LAND 4	% change in irrigated land per household
8. DRAINAGE	% change in well-drainage lands in the SP area
9. CROPPING INTENSITY	% change in cropping intensity
10. EMPOWERMENT	% change in women empowerment (%)
11. YIELD-1	% change in yield (Aman HYV) (kg/per acre)
12.YIELD-2	% change in crop yield (Boro HYV) (kg/per acre)
13. SOLUTION	% respondents perceived their problem as (almost) solved

Table 4.4
Performance Criteria for WMCAs

WMCA performance criteria	Labels
1 MEMBERSHIP 1	Trends in total membership (% of increase/decrease)
2. MEMBERSHIP 2	Trends in women membership (% of increase/decrease)
3. SAVINGS	Trends in savings (% of increase/decrease)
4. MICRO CREDIT 1	Micro credit amount (% of increase/decrease)
5. MICRO CREDIT 2	Beneficiaries (as % of total members)
6. MICRO CREDIT 3	Micro credit members (% of increase/decrease)
7. O & M STATUS	Operation & Maintenance (regular? "yes"=1; "no"=2)
8. O & M GROUP	Functioning/non-functioning of O & M Group
9 INFRASTRUCTURE 1	River/canals conditions (very good = 10, good=8, fair=6, bad=4, very bad=2).
10. INFRASTRUCTURE 2	Embankments/regulators condition (good, fair, bad, very bad)
11. TRAINING	Training activities (no. of trainers)
12. LEADERSHIP	WMCA key leaders occupation (% of agriculture)
13. OFFICE	(Own/rented/other/no office)

Method of Evaluation

Each of the 13 evaluation criteria has been assigned a score on a scale from 0 to 10, based on quantitative information collected from the field for each of the project (see Appendix Tables A.17 and A.18. In general, a score 5 represents the minimally required score. Most of the performance criteria were used based on quantitative values, representing the changes over the intervention period. Average ranks were assigned to a few missing values for which data were not available. Highest score of 10 was given to those with highest positive change. A lowest score 1 was given to the criterion with lowest value of change. The exercise has ignored multicolinearity, if any, among variables. There were a few negative criteria (e.g., non-functioning of O & M group) to which scores were assigned in a reverse way. The overall purpose of the projects, that is the wellbeing of people, was kept in perspective in the performance evaluation. Thus, the best performing project was expected to be able to provide the maximum benefits to project beneficiaries. The relative importance of the performance indicators, that is, the individual weights were predetermined based on subjective assessments of the research team. Thus, for each of the indicators, the composite index (overall scores) was estimated by applying the individual weights, the total of which was equal to one.

4.6 Discussion of Results on Overall Performance

Distinction was made among the projects with varying scores (shown in percentage terms) – scoring more than 70 per cent was regarded as "excellent," the projects/WMCAs scoring between 60 and 70 per cent were regarded as "good," those with a score between 50 and 60 per cent as "poor," and those with a score below 50 per cent were considered as "very poor." As mentioned earlier, the valuation of the different criteria has been based on a quantitative analysis of the responses to the questionnaires in the field surveys, in addition to the professional judgment of the members of the evaluation team.

Table 4.5 presents the performance of the ten projects under study. Although the figures presented should not be interpreted as absolute scores for each of the evaluation criteria, it allowed a comparative ranking of the ten subprojects based on some distinctive criteria. The following observations can be made:

- None of the projects showed "excellent" (above 70 per cent) performance. Three of the sample projects showed a "good" score on the composite index (60-70 per cent), a score limit which may be considered to be minimum for the sustainability of the projects. The projects were SP8 (Banderpara Chatra Beel WC, Rangpur), SP3 (Roufkhali FCD, Chuadanga) and SP5 (Char Bhuringamari FCD, Kurigram). These three projects may be considered as more or less sustainable.
- Four projects, namely SP2 (Rajapur Patilapara FCD, Patuakhali)), SP7 (Rajapur DR, Jhalakathi), SP1 (Jetua-Kanaidia FCD, Satkhira) and SP10 (Akhira-Saidpur DR and WC, Noagaon), with scores between 50 and 60 per cent, showed "poor" performance.
- Three out of ten projects had "very poor" score, below 50 per cent. These are SP9 (Barung River WC, Panchagarh), SP4 (Puthia-Falia FCD, Sirajganj) and SP6 (Ramkrishnapur DR, Gopalganj). These projects demand some urgent actions to improve their performance, especially in terms of operation and maintenance.

Performance with regard to WMCAs

- As regards WMCA performance, one of the ten WMCAs, SP 8 (Banderpara Chatra Beel WC, Rangpur), scored as high as 89 per cent, which was considered as "excellent" (above 70 per cent) (Table 4.5). Three WMCAs of SP5 (Char Bhurungamari FCD, Kurigram), SP2 (Rajapur Patilapara, Patuakhali), and SP4 (Puthia-Falia, Sirajganj) scored between 60 and 70 per cent. These WMCAs showed "good" performance.
- The remaining six WMCAs, showing 50 to 60 per cent scores, had "poor" performance. These were SP1 (Jetua-Kanaidia FCD, Satkhira), SP3 (Roufkhali FCD, Chuadanga), SP9 (Barung River WC, Panchagarh), SP7 (Rajapur DR, Jhalakathi), SP10 (Akhira-Saidpur DR & WC, Noagaon) and SP6 (Ramkrishnapur DR, Gopalganj). None of the WMCAs scored "very poor" (<50 per cent) performance.

4.7 Correlation of Performances between Projects and WMCAs

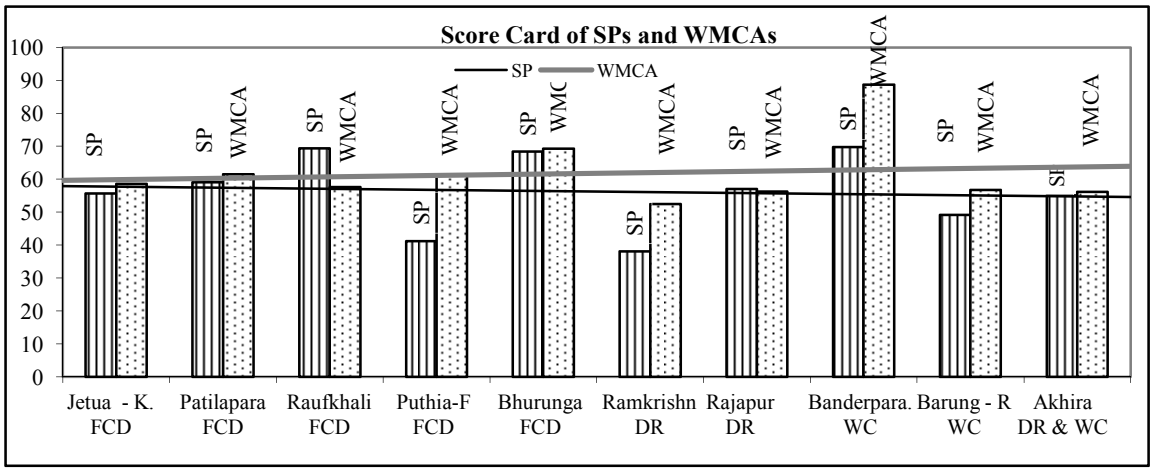
Detailed ranking of the SPs and WMCAs is shown in Table 4.5. The rank correlation of the performances between the projects and the WMCAs was estimated at 0.65, which was statistically significant at 95 per cent confidence level (2-tailed). This leads to the conclusion that the performance of the SPs is highly dependent on the performance of the WMCAs (Figure 4.2).

Table 4.5
Performance of SPs and WMCAs and their Ranks

Name of SP	Location	Score on SP	Rank	Score on WMCA	Rank
1. Jetua-Kanaidia FCD	Satkhira	5.56	6	5.85	5
2 Rajapur Patilapara FCD	Patuakhali	5.90	4	6.14	3
3. Raufkhali FCD	Chuadanga	6.93	2	5.75	6
4. Puthia-Falia FCD	Sirajganj	4.11	9	6.11	4
5. Char Bhurungamari FCD	Kurigram	6.83	3	6.92	2
6. Ramkrishnapur DR	Gopalganj	3.80	10	5.24	10
7. Rajapur DR	Jhalakathi	5.69	5	5.62	8
8. Banderpara Chatra Beel WC	Rangpur	6.97	1	8.87	1
9. Barung River WC	Panchagarh	4.91	8	5.67	7
10.Akhaira-Saidpur Khal DR & WC	Noagaon	5.50	7	5.61	9

Note: Rank=1 for highest value, and so on.

Figure 4.2: Performance of SPs and WMCAs and their Ranks



4.8 Concluding Remarks

The LGED model for small-scale water resources development with the WMCA as the cornerstone is innovative. Besides, WMCAs have, to some extent, developed facilities towards community development at local levels, through provision of microcredit, training and other activities. However, the sustainability of the projects is largely dependent on the performance of the WMCAs through satisfactory operation and maintenance.

Nevertheless, O&M has not developed up to its desired level of performance due to many reasons. In general, lack of motivation on the part of local beneficiaries and lack of commitment on the part of the WMCAs can be singled out as the main reasons for under-performance of the projects. Some of the projects were found to be dysfunctional reportedly due to flawed design or construction, and due to lack of maintenance. Almost all the projects encountered some maintenance problems, most

of which could have been addressed by the WMCAs. Within a few years of its implementation, the siltation problem became most common in khals and canals, which remained largely unaddressed. The problem had worsened over time. Frequent breach of embankments and non-operation of sluice gates were among other pressing problems for the FCD projects.

Even then, the situation in the post-project periods with respect to inundation, flood levels and irrigation appeared to have improved substantially. The drainage system also generally improved even though there has been the persistent problem of siltation. Surprisingly though, despite many limitations of the WMCAs (e.g., malfunction of WMCAs, lack of O&M activities, inadequate funds and participation), an overwhelming proportion of the respondents perceived the water management facilities to have largely improved. The formation of Labour Contracting Society (LCS) was somewhat faulty and there were conflicts of interest among leaders on their formation. In some cases, the WMCA leaders and traditional Sardars (Labour leaders) formed LCS with their own people depriving some genuine destitute labourers. Despite that, considerable benefits appeared to have accrued to the marginal and small farmers in the form of increased agricultural production. Besides, a larger part of the indirect employment was perceived to have gone to the hired agricultural labourers through increased cropping activities. Obviously, this is likely to have contributed to reduction of poverty.

As already mentioned, one should not rely too much on the absolute figures relating to the performance of the projects and WMCAs. Nevertheless, subject to limitations of the survey and survey data, described in Appendix A, it can be concluded that the SSWRDSP-I projects have had substantial positive impacts on income and asset for the beneficiary households, although the non-poor households have benefited more. Moreover, not all the incremental benefits can be attributed directly to the project interventions; some autonomous growth such as switch to HYV varieties and increased use of inputs due to lower perceived risk of crop failure or reduced losses due to flooding may also have contributed to these incremental benefits.

The significant positive rank correlation of the performance between the projects and the WMCAs leads to the conclusion that the performance of the SPs is highly dependent on the performance of the WMCAs. Hence, efforts should be made to improve the performance of the WMCAs through improved operation and maintenance in order to ensure the sustainability of the projects and avoid their costly rehabilitation in the future.

REFERENCES

Asaduzzaman, M and K M Nabiul Islam (2008). Adequacy and Effectiveness of Fuel Subsidies to the Poor Bangladeshi Farmers, BIDS, The World Bank, Dhaka.

BUET-BIDS-delft Hydraulies (2003). External Evaluation of SSWRD-1, Project, June, Dhaka.

Islam, K M N et al (2008). Impact Evaluation Study Report – Selected 10 Subprojects, SSWRDSP-1, BIDS, December.

Appendix A : Appendix Tables

Table A.1

Operated Land by Flooding/Drainage Characteristics by Project

Land characteristics	Before					
	% of operated land of households by landholding size					
	FCD	DR	WC	DR & WC	ALL	Average operated land (in acre)
Flood						
No flooding	20.8	1.2	49.5	45.1	27.6	0.47
Shallow flooded	46.9	24.3	40.3	49.3	41.8	0.75
Moderately flooded	23.6	70.2	6.5	5.7	26.3	0.47
Deep flooded	8.7	4.4	3.7	-	5.5	0.10
Drainage						
Early drainage	28.3	9.3	36.5	45.5	29.5	0.52
Slow drainage	43.8	87.2	11.3	19.0	41.0	0.73
Late drainage	17.0	2.9	4.1	-	9.3	0.16
Well drainage	10.8	0.6	48.1	35.5	20.3	0.37
Irrigation						
Irrigated	52.9	6.6	45.1	64.6	44.6	0.80
Non-irrigated	47.1	93.4	54.9	35.4	55.4	1.00
	Now					
Flood						
No flooding	63.3	30.9	53.2	77.9	57.5	1.20
Shallow flooded	28.3	55.3	37.9	21.1	34.4	0.74
Moderately flooded	7.0	11.3	6.6	1.0	6.9	0.14
Deep flooded	1.3	2.5	2.3	-	1.5	0.03
Drainage						
Early drainage	56.8	53.7	39.4	30.0	49.1	1.00
Slow drainage	12.8	14.8	5.9	1.0	10.2	0.23
Late drainage	1.2	1.7	1.9	-	1.2	0.03
Well drainage	29.2	29.8	52.8	69.0	39.5	0.81
Irrigation						
Irrigated	71.3	15.7	79.7	87.9	64.0	1.34
Non-irrigated	28.7	84.3	20.3	12.1	36.0	0.73

Table A.2

Distribution of Cultivated Land Within and Outside the Project Areas by Pre-Project and Post-Project Situations

Type of area	Cultivated land (decimal)		% Change in cultivated land
	Now	Before	
FCD			
Within project area			
Flood-free area	0.31	1.18	286.1
Flooded area	1.17	0.28	-75.8
Outside project area			
Flood-free area	0.03	0.03	-12.1
Flooded area	0.13	0.42	210.7
DR & WC			
Within project area			
Flood-free area	1.34	2.44	82.1
Flooded area	1.56	0.53	-65.7
Outside project area			
Flood-free area	0.00	0.00	
Flooded area	0.07	0.16	110.0
WC			
Within project area			
Flood-free area	0.62	0.71	14.9
Flooded area	0.74	0.59	-21.0
Outside project area			
Flood-free area	0.20	0.21	4.0
Flooded area	0.10	0.22	131.8
DR			
Within project area			
Flood-free area	0.01	0.65	-
Flooded area	1.54	1.20	-22.4
Outside project area			
Flood-free area	-	-	-
Flooded area	0.14	0.25	82.9

Table A.3

Influence of the Projects in Effecting Changes in Flood/Drainage Characteristics (as Perceived by Respondents)

Influence	Distribution of household's perception about project's impact	
	Flood-free area	
	No. of households	% of households
Major influence	164	51.1
Large influence	69	21.5
Slight influence	25	7.8
Hardly any influence	27	8.4
Not sure	36	11.2
All	321	100.0

Table A.4

Coverage and WMCA Members of Selected SPs: At a Glance

Subproject name	Type of subproject	Total villages covered	Total beneficiary households	WMCA members			Members of Ex. Committee		No. of WMCA employee	
				Male	Female	Total	Male	Female	Salaried	Voluntary
1 Jetua-Kanaidia	FCD	5	2,800	630	218	848	9	3	-	1
2.Rajapur Patilapara	FCD	4	450	182	98	280	9	3	1	12
3. Raufkhali	FCD	4	1,000	147	102	249	9	3	-	2
4. Puthia-Falia	FCD	12	782	511	158	649	9	3	-	-
5. Char Bhurungamari	FCD	5	767	328	172	500	9	3	1	0
6. Ramkrishnapur	DR	10	490	333	57	390	8	4	-	4
7. Rajapur	DR	6	1,200	255	69	324	9	3	1	10
8. Banderpara Chtra Beel	WC	4	300	235	90	325	8	4	1	12
9. Barung River	WC	14	800	246	94	340	9	3	1	0
10. Akhira-Saidpur	DR&WC	10	1,000	248	32	280	8	4	-	-
All		74	9,589	3,115	1090	4,205	87	33	5	41
Average		7.4	959	312	109	421	8.7	3.3	0.5	4.1

Source: Impact Evaluation Survey (2007-08).

Table A.5

Landholding (Ownership) Categories of WMCA Members by SP

Name of SP	Type of subproject	% of general members by landholding category					Average landholding (owned) (acres)
		Landless	Marginal	Small	Medium	Large	
1 Jetua-Kanaidia	FCD	50.0	15.0	30.0	5.0	-	1.0
2.Rajapur Patilapara	FCD	48.0	27.0	17.0	8.0	-	1.0
3. Raufkhali	FCD	9.0	7.0	32.0	40.0	12.0	4.0
4. Puthia-Falia	FCD	60.0	20.0	12.0	5.0	3.0	1.1
5. Char Bhurungamari	FCD	35.0	20.0	25.0	15.0	5.0	2.0
6. Ramkrishnapur	DR	42.0	19.0	28.0	7.0	4.0	1.5
7. Rajapur	DR	46.0	22.0	15.0	13.0	4.0	1.6
8. Banderpara Chtra Beel	WC	12.0	25.0	40.0	21.0	2.0	2.2
9. Barung River	WC	46.0	20.0	22.0	9.0	3.0	1.4
10.Akhira-Saidpur	DR & WC	15.0	30.0	20.0	25.0	10.0	3.0
All	-	40.7	19.7	24.0	12.1	3.5	1.9

Source: Impact Evaluation Survey (2007-08).

Table A.6

Micro-credit and Fund Situation of Selected SPs

Subproject name	Type of subproject	Location	Yr of starting micro credit	Loan benefi-ciarries so far	Amount distributed	Amount of savings so far	Amount of O&M fund so far
1 Jetua-Kanaidia	FCD	Satkhira	2003	21	44,000	18,000	117,000
2.Rajapur Patilapara	FCD	Patuakhali	2003	225	300,000	150,000	44,000
3. Raufkhali	FCD	Chuadanga	2003	110	110,000	86,000	27,561
4. Puthia-Falia	FCD	Sirajganj	-	-	-	36,200	266,000
5. Char Bhurungamari	FCD	Kurigram	2001	145	304,638	110360	34,713
6. Ramkrishnapur	DR	Gopalganj	2003	19	38,000	51,045	5,420
7. Rajapur	DR	Jhalakathi	2006	21	84,000	98,600	-
8. Banderpara Chtra Beel	WC	Rangpur	2001	293	354,000	122,204	24,786
9. Barung River	WC	Panchagar	2001	183	233500	77,763	12,144
10.Akhira-Saidpur	DR & WC	Noagaon	-	-	-	33,000	-
Total	-	-	-	1017	1468,138	783,172	531,624
Average	-	-	-	101.7	146814	78,317	53,162

Note: Not available.

Table A.7

Respondents' Perception about Maintenance Problems with SPs

Perception about maintenance problems	Distribution of responses*	
	No.	%
Inadequacy of O&M fund	256	23.9
O&M group not properly functioning	202	18.9
Flawed design of SP	55	5.1
Defective construction of SP	46	4.3
Lack of unity among beneficiaries	181	16.9
No. common interest	131	12.2
Lack of LGED interest	107	10.0
Lack of dynamism	66	6.2
Not sure	7	0.7
Don't know	15	1.4
Others	5	0.5
All	1071	100.0
No. of respondents mentioning maintenance problem	398	99.5

Note: * Multiple responses

Table A.8

Trend in Membership and Savings with WMCA by Selected SPs

Name of SP	Type of project	Regression Trend (exponential)			
		Membership (%)			Savings (%)
		Male	Female	Total	
1 Jetua-Kanaidia	FCD	0.9	0.7	0.9	-35.9
2.Rajapur Patilapara	FCD	-1.0	-1.0	-0.9	29.4
3. Raufkhali	FCD	-8.3	-12.8	-10.3	-1.3
4. Puthia-Falia	FCD	19.0	28.1	20.0	-
5. Char Bhurungamari	FCD	1.4	0.4	0.9	13.0
6. Ramkrishnapur	DR	-	-	-	-
7. Rajapur	DR	-	-	-	-
8. Banderpara Chatra Beel	WC	2.8	2.2	2.6	21.5
9. Barung River	WC	-7.4	-2.3	-6.0	-0.7
10. Akhira-Saidpur	DR & WC	0.3	0.6	0.3	-
All	-	2.2	0.9	1.9	9.7

Note: Not available; Trend refers to exponential trend of membership or savings (%). Information based on interviews from WMCA Officials.

Table A.9

Landholding (Ownership) Categories of Respondents by SP

Name of SP	Type of subproject	% of respondents by landholding category					Average landholding (owned) (acres)
		Landless	Marginal	Small	Medium	Large	
1 Jetua-Kanaidia	FCD	55.0	12.5	27.5	5.0	0.0	0.80
2.Rajapur Patilapara	FCD	25.0	22.5	40.0	7.5	5.0	1.54
3. Raufkhali	FCD	30.0	15.0	25.0	17.5	12.5	2.27
4. Puthia-Falia	FCD	42.5	22.5	17.5	10.0	7.5	2.02
5. Char Bhurungamari	FCD	35.0	25.0	20.0	12.5	7.5	1.76
6. Ramkrishnapur	DR	52.5	25.0	10.0	5.0	7.5	1.41
7. Rajapur	DR	50.0	15.0	20.0	10.0	5.0	1.65
8. Banderpara Chtra Beel	WC	40.0	12.5	22.5	17.5	7.5	1.78
9. Barung River	WC	37.5	15.0	22.5	17.5	7.5	2.31
10.Akhira-Saidpur	DR & WC	37.5	20.0	20.0	15.0	7.5	2.08
All	-	40.5	18.5	22.5	11.8	6.8	1.76

Source: Impact Evaluation Survey (2007-08).

Table A.10

Training Received So Far by Type of Stakeholders by Sex

Stakeholders group	Distribution of training recipients so far (Nos)			
	Male	Female	All	%
General members	138	64	202	38.5
Executive committee members	150	60	210	40.0
O&M committee members	46	10	56	10.7
Micro-credit committee members	7	1	8	1.5
Agriculture committee members	26	3	29	5.5
Fisheries committee members	14	2	16	3.0
Salaried employee of WMCA	4	0	4	0.8
All	385	140	525	100.0
Average per WMCA	38.5	14.0	52.5	-

Note: Information based on interviews from WMCA Officials.

Table A.11

Canal/Embankment Maintenance Activities of 10 SPs during Last Two Years

Type of maintenance activities	Last two years			
	Current year (1413)		Last year (1412)	
	Yes %	No %	Yes %	No %
Canal re-excavation	14.3	85.7	14.3	85.7
Small-scale repair/siltation removal	42.9	57.1	28.6	71.4
Cleaning hyacinth/unnecessary bushes	28.6	71.4	14.3	85.7
Embankment repair re-sectioning	42.9	57.1	42.9	57.1
Operation of sluice gates	85.7	14.3	85.7	14.3
Small repairs/coloring/greasing of sluice gates door	71.4	28.6	71.4	28.6
All	-	-	-	-

Source: Impact Evaluation Survey (2007-08).

Table A.12

Perception of Respondents about Benefits to Landless, Marginal and Small Farmers from the Project

Benefits Perceived	% of responses*	
	No. of responses	% of responses
Increased agricultural production	361	50.7
Improved quality of livelihood	79	11.1
Increased employment opportunity	158	22.2
Increased income	111	15.6
Others	3	0.4
All	712	100.0
No. of respondents suggesting benefits to landless, marginal & small farmers	389	98.0
Respondents suggesting no benefits	8	2.0
Reasons for no benefits		
Small ownership/operation of land	3	37.5
Dominating attitude of large farmers	1	12.5
Project design made in favor of large farmers	1	12.5
Lack of irrigation/agricultural equipment/inputs	2	25.0
Others	1	12.5
All	8	100.0

Note: * Multiple responses.

Table A.13

Suggestions Made by WMCA Officials for Better Functioning of WMCAs

Suggestions	Distribution of responses over 10 SPs *	
	No.	%
Ensure adequate fund for O&M activities	9	27.3
Mobilise fund raising through more contribution from large & medium farmers	1	3.0
WMCA & its leaders should be more dynamic and active	5	15.2
Introduce some incentive mechanisms so that leaders can give more time and efforts	4	12.1
Ensure technical assistance from LGED even after hand over of the SPs	3	9.1
Ensure improved monitoring method and facilitation through LGED & other organizations	-	-
WMCA officials should be more committed	5	15.2
Increase skilled manpower within WMCA	3	9.1
Make cooperative rules & regulation easy and relaxed	-	-
Reduce political pressure	3	9.1
All	10	100.0
Total no. of responses	33	100.0

Note: * Multiple responses.
Information based on interviews from WMCA Officials.

Table A.14

Multiple Regression Results- Dependent Variable: Log of Total Assets

Independent variables	MODEL 1 (Project + Control) Area Households			MODEL 2 Project Area Households		
	Regression coefficients	't' value	Signifi-cance	Regression coefficients	't' value	Signifi-cance
Constant	8.899	54.67	.000	8.760	42.52	.000
LAND-Log owned land (dec.)	.646	37.34	.000	.645	31.59	.000
ASSET- Log of Farm Income (Tk.)	.141	6.79	.000	.153	6.21	.000
CREDIT-Log of credit received (Tk.)	.005	.586	.558	.032	3.18	.002
HYV-Proportion of cultivated land under HYV rice variety	-.151	-3.24	.001	-.243	-3.04	.003
INTNSTY-Cropping intensity (%)	-.002	-4.32	.000	-.002	-3.66	.000
ERNER-Proportion of agric. earner	-.059	-1.39	.162	-.087	-1.717	.087
EDUC-Years of schooling of household head	.015	3.87	.000	.010	2.09	.037
PROJ- Project/control (Dummy) *	.206	6.29	.000	-	-	-
FLDFREE -Proportion of flood-free land	-	-	-	-.002	-1.96	.051
IRRIG -Proportion of irrigated land	-	-	-	.002	1.45	.147
DRAIN -Proportion of well-drainage land	-	-	-	.001	2.08	.038
WMCA -Membership of WMCA**	-	-	-	-.071	-1.14	.254
DR & WC-Type of sub-project***	-	-	-	-.079	-.911	.363
WC-Type of sub-project****	-	-	-	-.298	-4.04	.000
FCD-Type of sub-project *****	-	-	-	.132	2.06	.041
R^2 (Adjusted)	.89	-	-	.92		
No. of cases	553	-	-	322		

Note: * Dummy variable, assigned value 1 for the project and 0 for the control area.; ** Dummy variable, assigned value 1 for the WMCA members and 0 for the non-members; *** Dummy variable, assigned value 1 for the DR &WC and 0 for other SPs; **** Dummy variable, assigned value 1 for the WC and 0 for other SPs; ***** Dummy variable, assigned value 1 for the FCD and 0 for other SPs.

Table A.15

Multiple Regression Results - Dependent Variable: Log of Farm Income

Model	Model 3 Project Area Poor Households			Model 4 Project Area Non-poor Households		
	Regression coefficients	't' value	Signi-ficance	Regression coefficients	't' value	Signi-ficance
(Constant)	1.367	0.755	0.45	0.831	0.705	0.48
Log owned land (dec.)	0.352	2.341	0.02	0.370	4.094	0.00
Log total assets (Tk.)	0.419	2.381	0.02	0.383	3.411	0.00
Log loan received (Tk.)	-0.015	-0.384	0.70	0.055	2.411	0.02
Proportion of cropped land under HYV rice (dec.)	0.706	2.389	0.02	0.262	1.459	0.15
Cropping intensity (%)	.005	2.367	0.02	0.006	5.633	0.00
Proportion of agri. Earner	0.365	1.893	0.06	0.311	2.713	0.01
Year of schooling of household head	0.019	1.017	0.31	0.003	0.278	0.78
Proportion of flood-free land	0.115	0.171	0.87	0.345	1.557	0.12
Proportion of irrigated land	-0.151	-0.592	0.56	-0.007	-0.052	0.96
Proportion of well-drainage land	-0.088	-0.134	0.89	0.424	2.039	0.04
Membership of WMCA (Dummy) *	0.243	1.716	0.09	0.150	1.697	0.09
R^2 (Adjusted)	.603	F	0.00	.684	F	0.00
No. of cases	69			212		

Note: * Dummy variable, assigned a value 1 for WMCA members and 0 for non-members.

Table A.16

Multiple Regression Results-Dependent Variable: Log of Farm Income (TK) after Intervention

Model	Mode l 5 Project Area Households		
	Regression coefficients	't' value	Significance
Constant	2.700	1.861	.065
Log owned land (dec.)	.634	6.548	.000
Log total assets (Tk.)	.149	1.204	.230
Log loan received (Tk.)	-.005	-.272	.786
Cropping intensity (%)	.004	3.813	.000
Proportion of agri earner	.271	2.683	.008
Years of education of household head	-.005	-.569	.570
Proportion of flood-free land	.112	.406	.685
Proportion of flood-free land	.112	.406	.685
Proportion of irrigated land	.457	2.363	.020
Proportion of well-drainage land	.385	1.737	.085
HYV Aman yield (md/acre)	.026	3.391	.001
HYV Boro yield (md/acre)	-.006	-.712	.477
Membership of WMCA*	.131	1.750	.082
Non-poor income group (>TK 11220/year)**	.236	2.409	.017
R^2 (Adjusted)	.63	F	.00
No. of cases	151	-	-

Note: *Dummy variable, assigned a value 1 for WMCA members and 0 for non-members.
**Dummy variable, assigned a value 1 for non-poor (TK 11,220/year) and 0 for poor.

Table A.17

Multi-criteria Analysis: Performance Variables for SPs

Performance variables of SP	SP-1 (Jetua) (Satkhira)	SP-2 (Patilapara) (Patuakhali	SP-3 (Raufkhali) (Chuadanga)	SP-4 (Puthia) (Sirajganj)	SP-5 (Bhurunga) (Kurigram)	SP-6 (Ramkrishna) (Gopalganj)	SP-7 (Rajapur) (Jhalakathi)	SP-8 (Bander) (Rangpur)	SP-9 (Barung) (Pachagar)	SP-10 (Akhira) (Noagaon)
Full time Employment Main earner (%)										
% Change	72.5	67.5	85	25	95	52.5	89.8	87.5	84.7	97.5
Score	4	3	6	1	9	2	8	7	5	10
weights	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
Average annual Income per HH TK.										
% Change	65.8	89.7	142.4	62.8	71.6	37.5	110.5	104.8	96.3	80.3
Score	3	6	10	2	4	1	9	8	7	5
weights	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20
Rice Surplus (%)										
% Change	28.2	65.0	70.0	5.0	30.0	15.0	57.5	45.0	30.0	52.5
Score	4	9	10	2	5	3	8	6	5	7
weights	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
Flood-free land situation										
% Change	168.8	560.0	154.5	310.5	516.7	25.0	0 ?	17.2	6.5	82.1
Score	7	10	6	8	9	3	1	4	2	5
Weights	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06
Drainage(well) situation										
% Change	105.3	271.4	10.9	251.6	516.7	17.2	-?	17.2	11.0	105.7
Score	6	9	3	8	10	5	1	5	4	7
weights	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
Operated land per HH acre										
% Change	12.8	13.1	35.1	6.7	4.1	-5.4	37.1	4	5.1	5.7
Score	7	8	9	6	3	1	10	2	4	5
weights	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
Own land per HH dec.										
% Change	2.6	5.6	3.0	1.0	5.7	- 4.0	2.9	4.0	0.5	1.3
Score	5	9	7	3	10	1	6	8	2	4
weights	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
Irrigated land per HH acre										
% Change	1240	0	85.8	12.2	33.3	204.2	0	40.3	375	43.3
Score	10	2	7	3	4	8	2	5	9	6
weights	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
Cropping intensity (%)										
% Change	70.1	24.2	38.8	14.8	34.1	-4.5	8.5	76.6	-7.5	31
Score	9	5	8	4	7	2	3	10	1	6
weights	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
Women empowerment (%)										
% Change	8	3.3	3.0	5.0	7.0	4.0	9.5	9.3	8.7	5.0
Score	7	3	2	5	6	4	10	9	8	5
weights	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
Yield (per acre kg.) (Aman HYV)										
% Change	21	-	9.6	38.9	29.0	50.0	-	17.1	-	13.2
Score	7	3	4	9	8	10	3	6	3	5
weights	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06
Yield (per acre kg.) (Boro HYV)										
% Change	-	-	14.0	10.5	19.6	33.9	-	18.3	16.0	2.6
Score	3	3	6	5	9	10	3	8	7	4
weights	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06
Perception-problem solution(Almost/most problems solved)										
%of respondents	51.3	43.6	7.5	51.3	97.5	43.6	7.5	92.5	42.5	0.0
Score	7	6	2	7	10	6	2	9	5	1
Weights	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05

Table A.18

Multi-criteria Analysis: Performance Variables for WMCAs

WMCA performance variables	SP-1 (Jetua) (Satkhira)	SP-2 Patilapara) Patuakhali	SP-3 (Raufkhali) Chuadanga	SP-4 (Puthia) (Sirajganj)	SP-5 Bhurunga) Kurigram)	SP-6 Ramkrishn Gopalganj)	SP-7 (Rajapur) Jhalakathi)	SP-8 (Bander) (Rangpur)	SP-9 (Barung) (Pachagar)	SP-10 (Akhira) (Noagaon)
Trends-Membership (% increase)	0.9	-0.9	- 10.3	20.0	0.9	0	0	2.6	-6.0	0.3
Score	8	5	3	10	8	6	6	9	4	7
weights	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
Trends-womenmember (%increase)	0.7	- 1.0	- 12.8	28.1	0.4	0	0	2.2	- 2.3	0.6
Score	8	3	1	10	6	5	4	9	2	7
weights	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
Trends- savings (%f increase)	-35.9	29.4	- 1.3	0	13.0	0	0	21.5	- 0.7	0
Score/Rank	1	10	2	5	8	7	6	9	3	4
weights	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
Micro credit (% increase)	- 79.2	200.0	33.3	0	87.5	- 41.7	10.0	660.0	- 99.9	0
Score/Rank	2	9	7	5	8	3	6	10	1	4
weights	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
Loan beneficiaries (% of members)	2.5	80.4	44.2	0	29.0	4.9	6.5	90.2	53.8	0
Score/Rank	3	9	7	2	6	4	5	10	8	1
weights	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
Micro credit (% inc. of member)	- 92.9	150.0	33.3 *	0	- 44.4	- 41.7	10.0	446.7	- 98.6	-
Score/Rank	3	9	8	6	4	5	7	10	2	1
weights	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
O&M (regularly=yes, otherwise no)	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Score/Rank	9	3	6	4	10	5	5	10	10	10
weights	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
Non-functioning O&M (% said)	0.1	18.3	11.4	17.3	10.9	17.3	16.3	0.0	0.0	7.4
Score/Rank	9	3	6	4	7	4	5	10	10	8
weights	.15	.15	.15	.15	.15	.15	.15	.15	.15	.15
Current situation of SP										
- River/ Canal	Bad	Very bad	bad	Good	Very bad	Good	good	Fair	Very bad	Bad
Score/Rank	4	2	4	8	2	8	8	6	2	4
weights	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
- Embankment/ - regulators	Bad	Fair	Good	Very bad	Bad	Good	Bad	Fair	V bad	Bad
Score/Rank	4	6	8	2	4	8	4	6	2	4
Weights	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
Training activities (no. of trainer)	13	115	19	27	32	18	20	100	161	20
Score/Rank	2	9	4	6	7	3	5	8	10	5
weights	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
WMCA leadership occup. Agri %)	66.7	33.3	66.7	33.3	100	0	33.3	100	-	100
Score/Rank	9	8	9	8	10	7	8	10	5**	10
weights	.04	.05	.05	.05	.05	.05	.05	.05	.05	.05
Office (Own=1, Rent=2 ,other=3, no =4	4	1	1	4	1	4	2	1	1	4
Score/Rank	4	10	10	4	10	4	8	10	10	4
weights	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08

Note: Not applicable * = start in 2003 and continued up to 2006 and stopped in 2007. ** Average ranks given to blanks Very good = 1; Good = 2; Fair = 3; Bad = 4; Very bad = 5. Highest = 10 Lowest = 1.