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Report on

Multi-Purpose Cyclone Shelter: *Institutional and Economic Evaluation*

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Prepared by

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List of Acronyms and Abbreviations

ABC	Ashray Babasthapana Committees
AF	Ashray Foundation
BCR	Benefit Cost Ratio
BDPC	Bangladesh Disaster Preparedness Center
BWDB	Bangladesh Water Development Board
3Cs	consciousness, capacity and collective actions
CBA	Cost Benefit Analysis
CBDRR	Community Based Disaster Risk Reduction
CBFM	Community Based Fisheries Management
CBO	community based organizations
CEA	Cost Effectiveness Analysis
CHF	Swiss Franc (Switzerland Currency)
CNRS	Center for Natural Resource Studies
CPP	Cyclone Preparedness Program
CS	Cyclone Shelter
DDMC	District disaster management committees
DRRO	District Relief and Rehabilitation Officer
DRR	Disaster Risk Reduction
EC	Executive Committee
ECD	Early Childhood Development
EWS	Early Warning System
FD	Forest Department
FEMA	Federal Emergency Management Agency
FGD	Focused group discussion
GB	general body
HH	Household
IFRC	International Federation of Red Cross
IRR	Internal Rate of Return
ISET	Institute for Social and Environmental Transition
JICA	Japan International Cooperation Agency
KII	Key Informant Interview
LEAF	Livelihoods, Empowerment and Agro Forestry Project
LGED	Local Government Engineering Department
MACH	Management of Aquatic Resources through Community Husbandry
MCA	Multi-criteria analysis
MCS	Multipurpose Cyclone Shelter
NGO	Non Government Organization
NPV	Net Present Value
O&M	operation and maintenance
PIO	Project Implementation Officer
PNGO	Partner NGO
PTA	Parent Teacher Association
RCS	Red Crescent Society
RCV	Red Crescent Volunteer
SDC	Swiss Agency for Development Cooperation
SHAU	Swiss Humanitarian Aid Unit
SMC	School management committees
SMRC	SAARC Meteorological Research Centre
SoD	Standing order for disaster management
SWOT	strengths, weaknesses, opportunities and threats
UNO	Upazila Nirbahi Officer
UP	Union Parishad

UzDMCs	upazila disaster management committees
VDC	village development committee

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Executive Summary

This study did evaluations on the institutional and economic aspects of the SDC aided cyclone shelters. Though typically such kind of establishments are built to protect human lives - but the SDC initiative added new dimension by establishing multi-purpose cyclone shelters (MCS) that safeguards both lives and livelihoods. With establishment of 12 MCSs under "Community Based Disaster Risk Reduction (CBDRR)" program in two coastal *upazilas* (sub districts) in Bangladesh SDC exemplified the efficacy of MCS in fostering social and economic purposes other than savings of human lives. Field study carried out in the beneficiary areas of the shelters and a survey of 360 households from that area revealed optimistic scenarios: i) a shelter based community driven disaster risk management capacity is on the making due to the institution building efforts put by SDC; and ii) the MCSs bear a economically beneficial results as the financial benefit and return figures for all the shelters are positive.

In looking at the institutional arrangement of the MCSs the study found that ABC (*Asroy Bebosthapona Committee* – meaning Shelter Management Committee) is playing the pivotal role in managing the shelters. ABC is composed of the members and stakeholders from within the communities thus making the shelter based risk reduction or development efforts a community driven one. In the conventional management arrangements direct engagement and role of local communities in CS management is not properly ensured but is reflected through their representatives (viz. UPs, SMCs and PTA). But the approach of SDC is atypical as it emphasized community engagement from planning to construction and management to maintenance of these facilities – thus the authority has been nested to the communities where the concerned local communities have taken up the role of "owners and managers" of these facilities. Community ownership is further ensured as the villagers contribute monthly subscription for the maintenance of these facilities which is lacking in all other shelters in Bangladesh. Employment of women as treasurer of ABCs in Sharonkhola indicates a step towards empowering women.

The participating members of communities (men and women) mentioned various aspects of strengths of ABCs and MCSs that they observe. Communities think that these newly constructed MCSs as boon for them. They also appraised the MCSs as they are large in size, have capacity to accommodate good numbers of people during disaster time, spacious rooms and corridors, enough ventilation, adequate toilet and water facilities, electricity with solar power back-up and generators. The most noteworthy feature of the shelters as mentioned by the communities is the separate protection facilities for their livestock. It (livestock protection) is very important for most of their livelihoods and has been a matter of great concern to the communities for long. Besides, these shelters are built on donated land in close locations with good approach roads – making it easy and quick for them to come to the shelters during disaster time.

Institutional linkages, rapports and working relationships of ABCs with other relevant DRR and non – DRR service providing agencies, local institutions (*union* and *upazila*) is still in a nascent stage as the age of the ABCs spans 14-24 months only. The study finds that the state of ABCs' institutional linkages and relationships with other relevant organizations including catchment communities is not ideally optimal, and therefore, needs to improve significantly in this area. ABCs also needs to strengthen their capacities in planning, documentation, dissemination and organization. Political influence, groupings and dominance of land donors' families in ABCs seem crucial weaknesses that ABCs are to overcome. ABCs also lack fund management skills - funds are often not deposited in the bank in time, more money (cash) remains at hands of treasurers that has high risk of being mismanaged.

As far as the direct benefit concerns, apart from sheltering facility for both people and livestock, these MCSs opened up avenues for multiple socio-economic facilities. In remote coastal areas of Bangladesh there is hardly any suitable physical community facility. Now, the SDC-MCS spaces can be used for community purposes (social, economic, cultural) as well. These shelters will generate

revenue for ABC as there is a high potential that the shelter space could be rented to individuals and institutions for organizing various events (viz. wedding receptions, training venue, office, handcrafts production, fishing nets repairing, and other social and cultural event. Most cyclone shelters (CSs) have already started renting out shelter spaces and earning money to be used for operation, maintenance and bear other management expenses of the shelters.

The study had economic evaluation of the SDC intervention with cost benefit analysis (CBA) being the major analytical tool. As part of economic evaluation of a DRR scheme, the study initially looked at the characteristics of hazards and associated risks, vulnerability, and effects of disasters in general in the study area as opposed to the exposure of economically valuable assets and properties to the disasters. The study found that apart from human fatalities, the area suffers from different kinds of economic losses, such as: productivity loss (e.g. human injury), production loss (e.g. death of livestock) capital loss and loss of stocks. Among these losses SDC-MCSs are most effective in addressing human loss or saving human lives, saving livestock, and avoiding human injuries.

With a back-ward looking or ex-post evaluation procedure the study factorized past damage on livestock and human injuries into present benefit. Along with the business income of the shelters the following financial results has been found for the overall SDC CBDRR scheme:

Benefit Cost Ratio	1.27
Internal Rate of Return IRR	31.7
Net Present Value (NPV)	BDT 46.8 million or CHF 0.72 million

The study also found that the SDC had an investment cost per life secured from disaster risk is CHF 1.15/Person or BDT 75.00 per person in annual premium equivalent (APE). Similarly, the investment cost in keeping both live and livestock free from disaster risk is CHF 51.6 or BDT 3,351.7 for 60 years period which is APE 0.86 CHF or BDT 55.86.

As viewed by the participants and reflected from survey results and FGDs, economic implications of these shelters are immense as they will increase resilience and decrease loss of productive days resulting increased productivity in the communities. Looking at the past trend in livestock production function the study found that the livestock possession per household were 12 in 1968, 7 in 1988 and 4 in 2007 respectively. Though there are various socio-environmental factors responsible for the declining trend but the most influencing factor has always been the threat of cyclone and associated storm surge. Now as this threat is reduced or largely diminished- a steady growth in the livestock production function is predicted.

1.0 Background and Objectives

This study evaluated contributions of Multipurpose Cyclone Shelters (MCS) and related community works implemented by the Swiss Humanitarian Aid Unit (SHAU) of Swiss Development Cooperation (SDC). With an overall development goal to reduce disaster risk at community level, the SDC intervention was programmatic and was launched in 2009 under "Community Based Disaster Risk Reduction (CBDRR)" program. As part of its main component the program successfully established 12 MCS in the study area i.e. coastal communities in Morrelganj and Sharankhola *upazila* (sub districts) at Bagherhat district in Khulna Division, Bangladesh.

Integrated with the risk reduction SDC tried to address both lives and livelihoods of the people exposed to severe cyclone and storm surge. Therefore the MCSs with their main purpose to shelter people are also designed to protect their major livelihood asset (livestock) and to facilitate income generation by working as business hubs. Therefore, multiple benefits are aimed by the SDC-CBDRR scheme. A substantial investment of CHF 3.5 million was made to implement the program. The study report, therefore, tries to delineate whether the investment of SDC through establishment of these MCS has been sound and effective.
Aid flow and financing are made by development agencies (e.g. SDC) from public and private sources where myriad of other potential development investment opportunities prevail; it therefore, needs to be proven that investments in Disaster Risk Reduction (DRR) yields comparative benefit. Therefore, unless the economic and financial case for such investments can be demonstrated, efficacy for such program would be in question. SDC therefore, commissioned this study with a view to evaluate the overall CBDRR program. The focus of evaluation primarily entails the following study objectives:

- to look at the institutional arrangement and sustainability aspects of the CBDRR scheme implemented by SDC
- to evaluate and analyze the SDC investment through CBDRR program with economic tools

Therefore, a comprehensive approach to investigate the nature and complexities underlying in MCS management has been looked in terms of their cross scale institutional linkages, SWOT (strengths, weaknesses, opportunities and threats) and sustainability. On the other hand, to justify the investment Cost Benefit Analysis (CBA) approach has been adopted to compare the benefits against the costs of this SDC-CBDRR. Therefore this report is organized into two major thematic sections, which are: institutional and economic evaluations.

1.1 Methodology

The methods adopted to carry out the study were focused to delve out institutional and economic aspects of the SDC intervention. We collected data from both the primary and secondary sources relevant to institutional arrangements of MCS management as well as costs and benefits of MCSs. Before developing the study tools, we conducted a reconnaissance field visit, interviewed shelter management committee members, catchment villagers and consulted with the relevant partner NGO personnel and reviewed relevant reports and documents. We also collected CSs construction and NGO engagement costs data from SDC head quarters.

We applied various qualitative and quantitative survey tools to gather data from primary sources. Household survey was conducted in the catchment villages using a pre-tested questionnaire comprising of institutional and cost-benefit related attributes covering 360 HHs (based on a formula drawn sample size of 358) from the study area. All 12 shelters were evenly covered as we interviewed 30 HH from the catchment area of each shelter. An age wise sorting of the catchment households were done in selecting these 30 HHs. A short list of the households having 60 years or older members was done so that they can provide or recall historical data. A simple random sampling was then conducted with those short listed households.

As the total household number in the study area is around 3,400 and we need to draw samples from all the catchment communities objectively, a simplified statistical formula for proportion was to calculate the sample size.

$$n = \frac{N}{1+N\,(e)^2}$$

n = 3400/{1+3400 (.05) ^{2}} = **358**

Where, n is the sample size;
N is the Population Size – 3400;
e is the level of precision at 95% confidence level i.e. .05.

Focused group discussions (FGDs) were conducted at each CS site with the shelter management committee members on loss and damages due to disaster in the past with special focus on livestock and human casualty using checklists. The FGD checklists also comprised of institutional arrangements of CSs management. Historical trend analysis and KII (key informants interview) were also done on disaster loss aspects. Besides, we also conducted SWOT (strength, weakness, opportunity and threat) analysis with shelter management committee members for each of the 12 sites (with men and women members). We interviewed local UP Chairmen and members on their roles in CS management.

1.1.1 Valuation methods

The study followed an ex-post evaluation procedure. For CBA with ex-post procedure we relied on past damage data as the MCS establishment offsets such damages and thereby render benefits to the beneficiary communities. A Direct Market Based Methods were used to estimate the values of loss, damage, and benefit forgone. As the study considered only the benefit in terms of avoided loss of livestock and human injury, the current average market price for livestock was calculated. Similarly, average current wage rate has been calculated for productivity loss avoided due to injury of a productive individual. Again yearly market price was estimated for the benefit forgone. As we did not consider valuing any other indirect or intangible benefits, non-market valuation techniques were not used for the sake of robustness and simplicity of the study.

2.0 Institutional Arrangements for Shelter Management

2.1 Conventional CS Management Structure and Systems

Having cyclone shelters (CSs) in a coastal zone exposed to cyclones and storm surges is one of the key risk reduction measures aiming to reduce human casualties, loss of livestock and other assets. Theoretically, a CS by itself is a physical facility or a "hardware" that has potential to safe people's lives, livestock animals and other valuable assets from deadly cyclones and storm surges. However, it is proven that only a hardware facility (viz. CS) is not enough to realizing the maximum benefits of a CS in a given area unless having an enabling institutional structure & systems in operation that govern and facilitate in a way that ensure fuller utilization of the facility not only during disaster times but also during normal times.

There are nearly 4,000 CSs in the coastal areas of Bangladesh constructed over the last 30 years in phases with assistance of various donors. Apart from providing shelters during disaster times, most of these CSs are used as primary schools during normal times. Therefore, the management responsibilities of these CSs lay with the primary education department and more precisely the school management committees (SMCs) shoulder the key management responsibilities in their respective areas. The CS-cum-primary schools are also used by local communities for various other social, cultural and economic purposes (social & religious gathering, training venue, daily markets and so forth). Union Parishads (UPs), as per the SoD (standing order for disaster management), are given the

major role to play in disaster risk reduction (DRR) activities. The UP Chairmen and members are thus by default, get involved in CS management mainly during disaster times. In addition, the Red Crescent Volunteers in the coastal area also play important role in CS management particularly during disaster times in facilitating communities to come to the CSs for taking shelter. The UNOs as the Chairs of the upazila disaster management committees (UzDMCs) also have management and coordination roles in all DRR activities including CS management. The CSs being physical facilities need regular maintenance works to keep them usable for the people. The LGED (Local Government Engineering Department) usually take the major responsibilities of maintenance works for the CSs jointly with the SMCs and primary education department at the upazila level. Besides LGED, primary education department also undertake maintenance works for CSs through its facilities department. The SMCs also undertake some small maintenance works of CSs from time to time.

The management of CS is thus not a job of a single entity rather being managed by multiple organizations/ agencies under an overarching management framework of disaster management as suggested in the SoD (Figure 1& 2). In this conventional management arrangements direct engagement and role of local communities in CS management is not properly ensured but is reflected through their representatives (viz. UPs, SMCs and PTA). SDC in their efforts of construction and management of CSs have taken up an alternative approach and emphasized community engagement from planning to construction and management to maintenance of these facilities through adopting community based approaches.

2.2 SDC's Community-based CS management Approaches

Following the disaster caused by the super cyclone Sidr in the southwestern coastal zone of Bangladesh in November 2009, SDC constructed 12 CSs in Sharonkhola (8) and Morrelgonj (4) upazilas of Bagerhat district in 2010-2012. Unlike other CSs in Bangladesh, SDC adopted community-based approaches in planning, construction, management and maintenance of CSs where the concerned local communities have taken up the role of "owners and managers" of these facilities. The SDC assisted CSs are unique in several aspects. Firstly, apart from being human shelters, all these CSs have provisions for providing shelters for livestock animals which most of other donor supported CSs lack.

Secondly, all these shelters have adequate toilets, water, and light (electric) facilities backed up by generators and solar systems such arrangements do not exist in most of other donor supported shelters. Thirdly, unlike other donor supported CSs, the SDC assisted CSs are not used as primary schools during normal times rather kept open for various community uses viz. socio-cultural, religious and economic purposes aiming to make these as center points for overall village development.

Finally, the overall management responsibilities of these shelters are given to local communities as opposed to SMCs or other entities that are common in other donor assisted CSs in the country. SDC focuses on transforming these shelters in to community-led village development center points in each of the respective village clusters.

Keeping this in mind, SDC engaged two NGOs, one in each upazila, in community mobilization and capacity building activities. A national NGO named BDPC was given the responsibility of community mobilization for 4 CSs in Morrelgonj upazila and Ashray Foundation (AF), a Khulna based NGO for 8 CSs in Sharonkhola upazila. The scope of works for NGOs included identifying villages, sensitizing communities to donate lands for CS construction and mobilizing communities to participate in CS planning, construction, management and outreach activities. The key focus of SDC has been to establish a community based CS management system where the communities' take up the full ownership with sole responsibility of operation and maintenance of CSs as their own facilities that protect their lives and assets from devastating cyclonic events. Thus the approach adopted can be termed as "community planned, community managed and community owned CSs".

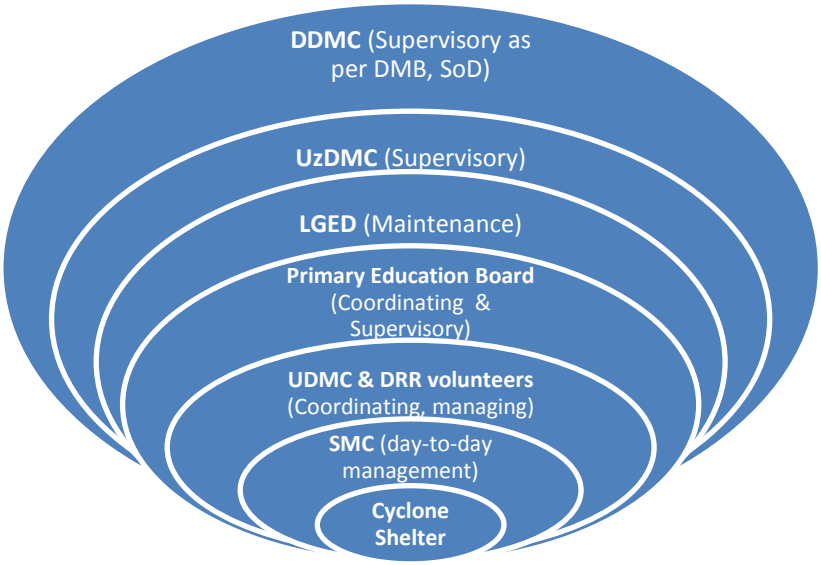


Figure 1: Hierarchical Management Framework of CSs in Bangladesh

To this end, partner NGOs formed community institutions in each of the CS in the name of Ashray Babasthapana Committees (ABCs) comprising of people (both men and women) from within the respective catchment areas. Each CS has its own defined catchment area which range from 1 to 5 villages as delineated by the communities along with partner NGOs. The ABCs formed have two tier committees viz. a general body (GB) and an Executive Committee (EC). The size of GB and EC varies by upazilas as can be seen that the GB of Morrelgonj comprises 42 members and the EC of 11 members.

The GB of Sharonkhola comprises 33 members with an EC of 5 members. Except in Morrelgonj ECs, all other cases both the GB and EC comprise men and women members. In addition, there is another tier, in the name of village development committee (VDC), has been formed in each of the villages within the catchment area. The size of VDCs varies by upazilas, in Morrelgonj each VDC comprises 42 members while VDCs of Sharonkhola are formed taking one representative from each of the households from within the catchment areas. The VDC members give monthly subscription of Tk. 5.00 and Tk. 10.00 each for maintenance of CSs. Despite having some limitations, all the ABCs are observed functional and the members take part in various activities towards achieving sustainable community-based management of CSs.

In remote coastal setting of Bangladesh there is hardly any suitable physical facility for communities to use for various common purposes. Apart from taking shelters during disaster times, these CSs have opened up opportunities and spaces for community purposes (social, economic, cultural) round the year. There exists high potential for earning incomes through renting out these CSs to individuals and institutions for organizing various events (viz. wedding receptions, training venue, office, making handcrafts, repairing fishing nets, organizing various social, cultural events, etc.).

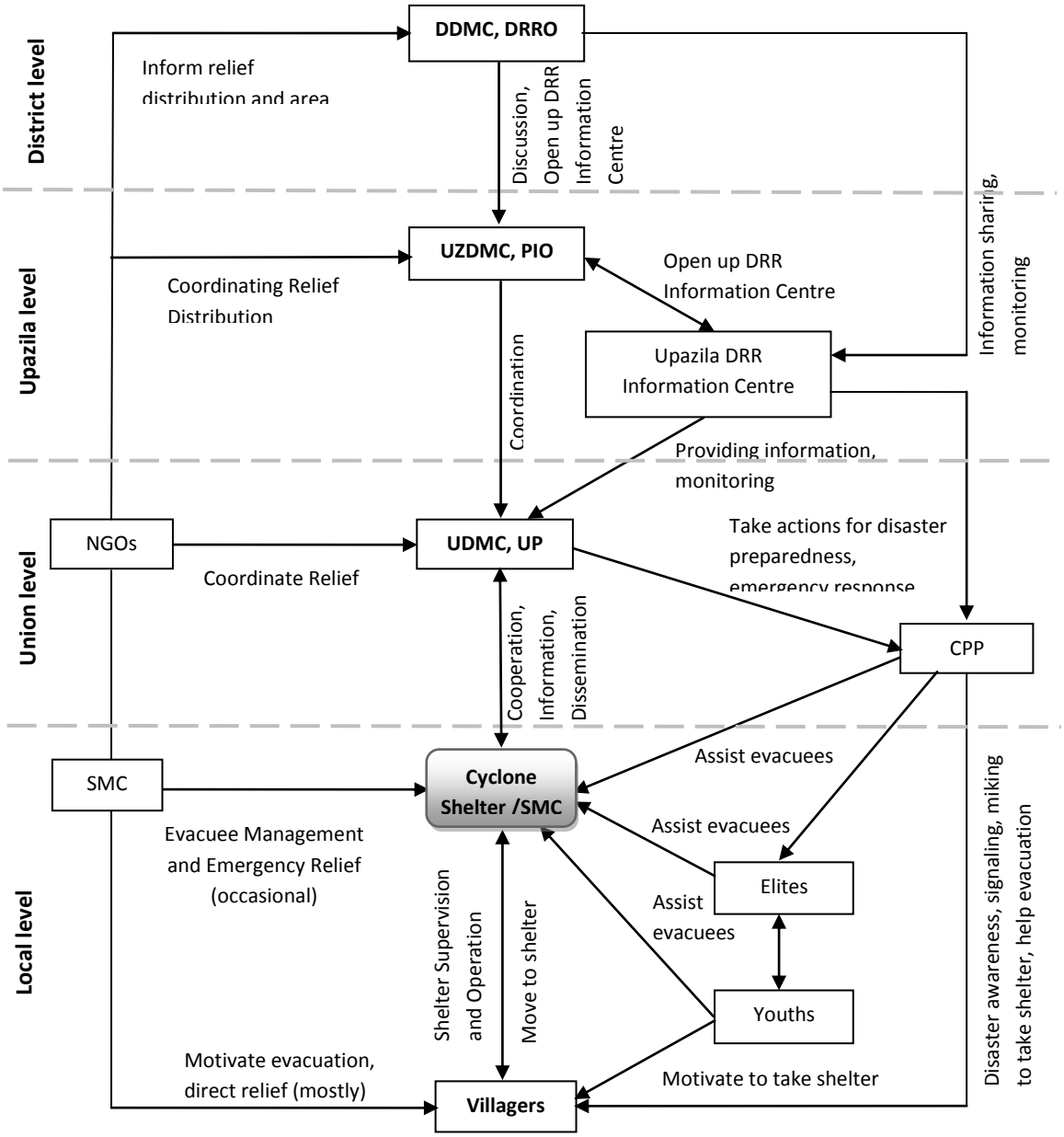


Figure 2: Shelter management hierarchies during disaster times (JICA CS Study, CNRS,

Most CSs have already started earning incomes from renting out shelter spaces which can be used for operation and maintenance of these shelters including meeting other associated management costs. To this end, each ABC is developing their CS-based "Business Plan" aiming to maximize utilization of CSs for social and economic development purposes. It is expected that the communities can sustainably manage the CSs in future with minimum or no financial assistance from outside (viz LGED, NGOs and others) as is seen for other donor supported shelters.

The ABCs are formed recently – age ranged from 14-24 months. Four ABCs in Morrelgonj formed 22-24 months back while the ABCs in Sharonkhlola formed 14-20 months back. The CSs are handed over to ABCs for around a year. As per the handover dates, the ABCs of Morrelgonj taken over the CSs for last 17 months while the ABCs of Sharonkhola received the CSs for last 3-5 months. Being newly organized, it seems too early to judge the effectiveness of their performances. However, it is expected that these assessment outcomes would help them taking measures to strengthen their institutional capacities. Rural people most of whom are semi literate or illiterate generally lack

management capacity and are week in rapport building with various government and private institutions and thus it would take longer time to build their capacity to become effective in self driver common resource management. Therefore, SDC has extended the community capacity building activities to 2013.

As reported, the ABC members hold monthly meetings, discussed various management issues, strived to resolve conflicts among them, and started contacting local institutions and agencies and so forth. Apart from organizational activities, ABCs also focusing on CS-based income generation activities needed to maintain these facilities. The ABCs "business plans" now being prepared with support of the Partner NGO and Khulna University seem would guide them to execute target oriented activities aiming to reach self sufficiency. Efforts in developing CS-based "business plans" is one of the indicators of making the CSs financially self sufficient.

The ABCs are now focusing more on earning incomes by renting out the facilities to other users which is one of the key objectives of raising funds for operation and maintenance (O&M) of these community-owned multipurpose CSs. The ABC members regularly pay visit to CSs and take care of the shelters including reporting back to partner NGO for any minor repairing and/ or any construction adjustment is required. As per the SoD, ABCs are not members of union and upazila level disaster management committees they however, attend such meetings (UDMC and UZDMC meetings) from time to time as observers along with the partner NGO.

ABCs are currently developing their constitutions with support of the partner NGO and planning to get registered with appropriate government agency to get the legal status as community based organizations (CBOs). Although very limited, the ABCs have also started communicating with upazila level government line agency officials and UP Chairmen seeking assistance. In the meantime, ABCs in Sharonkhola got tree saplings from the Forest Department (FD) for planning in CS premises and approach roads. Effective community management of CSs, among others, would largely depend on the capability of ABCs in establishing linkages and building relationships with various concerned agencies and institutions in the area in leveraging services and benefits in favor of them.

2.3 Communities' Knowledge and Linkages with Relevant DRR Institutions

Although, the management responsibilities of CSs are given to local communities, sustainability of CSs management would largely depend on the knowledge, attitude and capacity of ABCs (community institutions) including the local communities as a whole to effectively deliver consensual management services, maintain linkages with local DRR institutional frameworks and leverage activities beyond their respective CSs. To this end, knowledge of communities including ABC members were asked to express their knowledge and understanding on following DRR related rules and institutional actors at local level (see Figure 3):

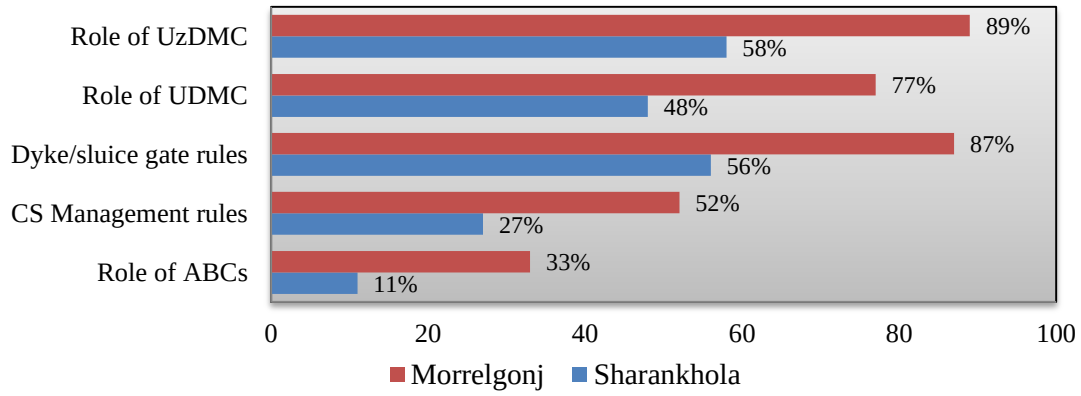
- Roles and responsibilities of upazila disaster management committee (UZDMC)
- Roles and responsibilities of union disaster management committees (UDMC).
- Dyke and sluice gate management rules
- Roles and responsibilities of ABC
- CS management rules and systems

To this end, we have found that majority of the communities are not much aware of UzDMC and UDMCs and their roles and functions. The level of relevant knowledge among the communities in Morrelgonj was found poorer compared to that of Sharonkhola areas (Figure 3). It is also important that the communities including ABC members should have adequate knowledge and awareness on the rules relevant to embankment and sluice gate management and role of communities and concerned agency (BWDB) to manage and protect the embankments. On this aspect, current knowledge and understanding of the catchment communities was also found poor.

To become cyclone/disaster resilient, the communities in the catchment area should have better understanding of the management rules & systems of coastal embankments as defined by the government. It is mentioned that the embankments should be treated as the first line of defense (in case where there is no mangrove forests) against the adverse impacts of cyclones and storm surges. Therefore, better management and protection of embankment is crucial to safeguard the people, even if there are cyclone shelters which may be treated as the second line of defense against disasters.

The CS management rules & systems and the roles & responsibilities of ABCs as community institutions are important as this applies to the communities living in the catchment areas. Effective management of CSs by the ABCs can ensure long term sustainability of these multipurpose DRR facilities to protect communities from disasters over the years to come. It is thus imperative that the catchment communities should have adequate knowledge on the rules that governs the CSs. Knowledge of communities in this respect was also found poor both in Morrelgonj and Sharonkhola. By contrast, communities' knowledge on roles of ABCs in CSs management was found better as majority is aware of that.

Figure 3: Percentage distribution of communities' having "no idea" on various local DRR institutional issues

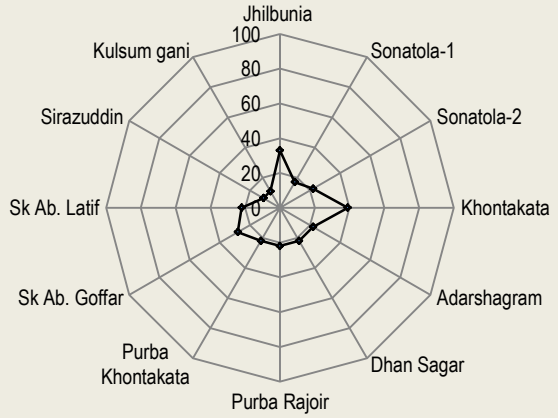


The overall knowledge base of communities in Sharankhola areas are found better compared to that of Morrelgonj. From the findings it is imperative that more work is needed in both the upazilas with especial focus on Morrelgonj to aware the respective communities on CS management issues including the role & responsibilities of ABCs as their representatives including the role of catchment communities. It appears that communities in Morrelgonj area are less aware of the issues than that of Sharankhola area. It is suggested that the partner NGO should plan target oriented focus on community mobilization and orientation around community-based management aspects of CSs. Courtyard meetings with small focused groups may yield better outcomes in this respect.

Institutional linkages, rapports and working relationships of ABCs with other relevant DRR and non – DRR service providing agencies /institutions at local level (union and upazila) is important and a pre-requisite towards achieving sustainable community-based management of CSs as multipurpose facilities. To this end, we assessed the extent each ABC built linkages and working relationships with other institutions in the area. While assessing this, we considered the extent ABCs maintain contacts and relationships with 6 different institutions in the area viz. villagers, concerned UP Ward Members, UP/ UP Chairmen, UDMCs, UNO/ UzDMCs and other agencies/ NGOs. We set four indicators against each of the six institutions and scored them to assess the extent of contacts made by ABCs. The scores obtained by ABCs were then converted to percentiles by each ABC and presented in graphical (Figure 4) and in tabular forms (Appendix 1).

Our assessment results showed that the state of ABCs' institutional linkages and relationships with other relevant organizations including catchment communities is very poor. Figure 4 shows that the scores obtained by ABCs based on their current institutional linkages ranged from a minimum of 11% (Sirazuddin MM and Kulshum Gani ABCs of Morrelgonj) to a maximum of 39% (Khontakata/Varanipar ABC of Sharonkhola) out of a total obtainable score of 100%. Reasons for getting poorest score by the two ABCs in Morrelgonj were due to their non relationships and contacts with catchment communities, UP ward members, UP Chairmen and with other agencies and NGOs. On the other hand, ABC informs catchment communities about their meetings decisions through VDCs and involvement of UP member as ABC member (facilitates establishing indirect linkages with UP) facilitated Khontakata/Varanipar ABC to get the highest score (38%). While in Jhilbunia CS in Sharonkhola, the concerned UP Chairman attended one ABC meeting on verbal requests and engagement of of UP member in the ABC contributed the Jhilbunia ABC getting the second highest score (33%)[1]. Besides building linkages with local DRR institutions, it is also important that communities and ABC members are aware of disaster early warning system (EWS), understand signals and take preparedness measures to reduce disaster risks at local levels.

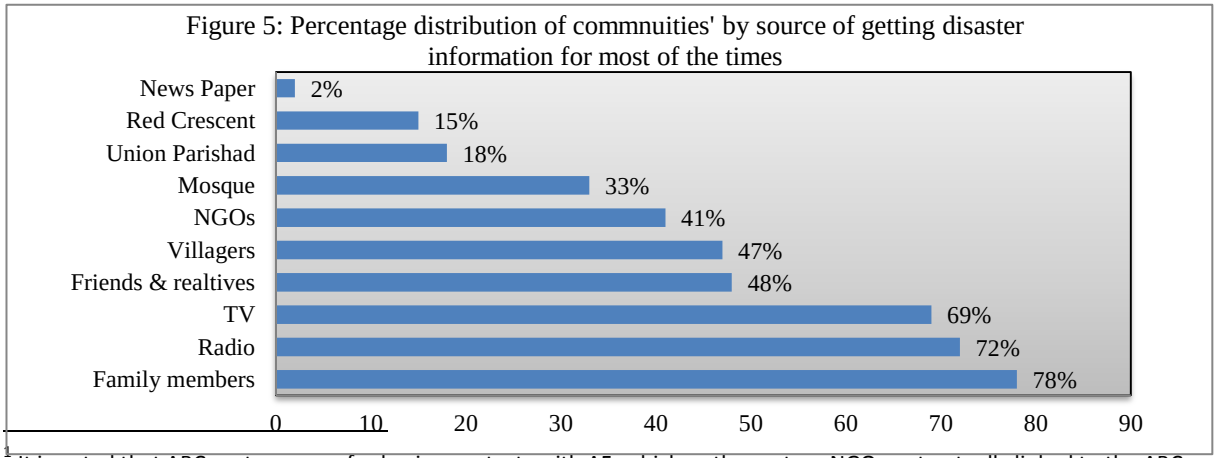
Figure 4: ABCs' Institutional likages



2.4 Disaster Early Warning Systems Communities' Actions

Local people of use to get disaster related early information/warning, particularly for cyclones, from various sources viz. individuals, agencies and electronic & print media (Figure 5). Of these various sources, it is found that the villagers of catchment areas get disaster information for "most of the times" from three sources viz. family members (78%), Radio (72%) and TV (69%). Next to these sources, friend & relatives (48%), villagers (47%) and NGOs (41%) playing good role in informing communities about disaster (Figure 5). It appears from the responses that print media (news paper) has insignificant role in informing the CSs communities as only 2% responded positively. Ironically, the role of local government (Union Parishad - (UP) to inform people about disaster risks is found frustrating as only 18% said they get disaster information (for most of the times) from UPs. According to SoD, UPs being the grass roots mainstream DRR institutions should have played the major role in informing people about disaster.

Figure 5: Percentage distribution of commnuities' by source of getting disaster information for most of the times



[1] It is noted that ABCs got no score for having contacts with AF, which as the partner NGO contractually linked to the ABCs.

This is where the communities and ABCs can works as pressure group to make UPs to function properly as local DRR focal points. The ABCs can also work in strengthening the early warning dissemination activities along with UPs and other actors. It is however, not enough that people get disaster warning in time but also equally important that how clearly they understand early warning messages and local level disaster signals and act accordingly.

It is widely recognized that effective dissemination of disaster messages through Early Warning System (EWS) and clear understanding of messages and signals by the communities can substantially reduce the disaster risks and damages. Although the current EWS in Bangladesh is being modernized in technologies, but its effectiveness as to what extent the target communities' understanding and use of the messages is not fully unpacked as yet. To this end, we have found that over one fourth (28%) of the villagers in catchment areas do not understand the EWS messages and signal numbers disseminated before the land fall of cyclones (Figure 6).

Figure 6: Percentage distribution of communities' understanding of EWS messages

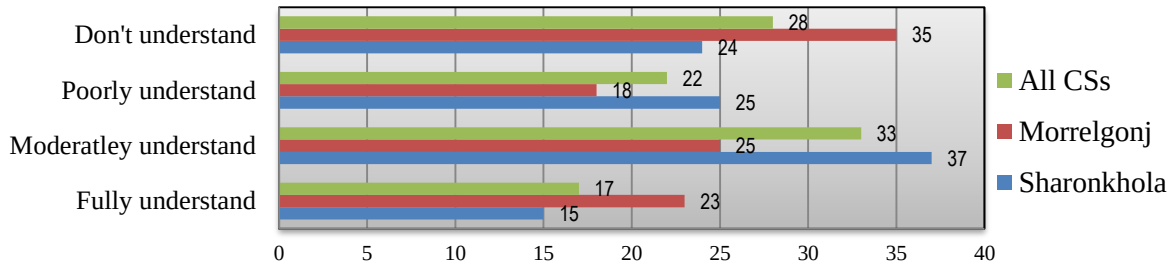


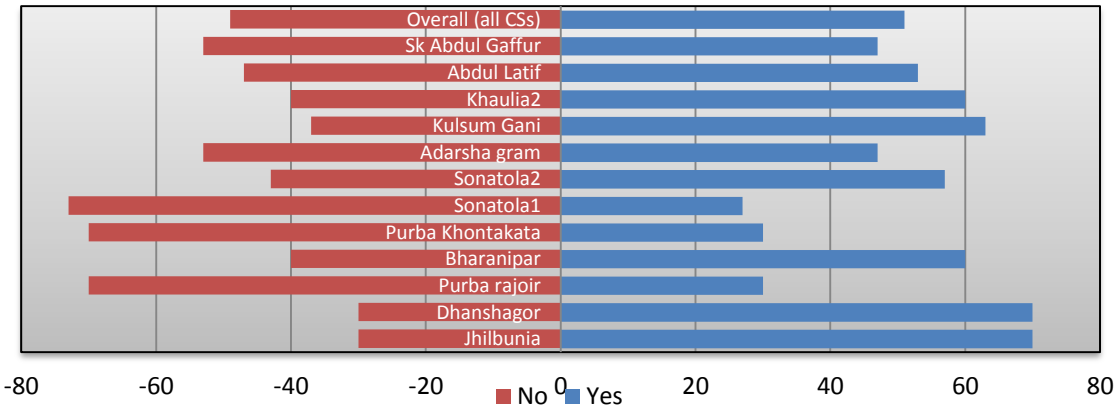
Figure 6 shows that only 17% respondents in two upazilas said can fully understand the EWS messages while 28% villagers expressed their inability to understand EWS messages. Although it is claimed that our national EWS system now works better than in the past but the situation is still not satisfactory. The EWS authorities should carry out an assessment of effectiveness of their EWS system and get feedback from the communities as how to improved the system to make it a people's friendly system that would really help people to take necessary preparedness measures against disasters. The partner NGOs and UDMC with the help of ABCs can take initiative to aware the people on EWS and signals.

.Apart from national level dissemination of disaster warning messages through print and electronic media, at the ground level Red Crescent Society through their trained volunteers has been working to aware people and take preparedness measures in the coastline of Bangladesh for long. One of their tools to aware people is hoisting of red flags in varying numbers at different populous places during pre disaster times to warn people of the potential danger viz.

1 Red Flag	Warning signal for potential danger and ask people to keep watching the situation
2 Red Flags	Danger signal for taking urgent preparedness measures for evacuation
3 Red Flags	Highly dangerous situation, all immediately move to cyclone shelters/safe places

It is important that the villagers should have clear understanding of local disaster signals and shape their responses accordingly. To this end, we have found knowledge gaps among the villagers at varying extents. Analyzing the survey data it is found that nearly 50% of the villagers in all CSs catchments expressed their ignorance in understanding the meanings of Red Crescent Volunteers' signals through hoisting of red flags at grass roots level (Figure 7). Repeated training and orientation at community and school levels can enhance understanding of communities on disaster signals. ABC can take up this responsibility of informing people in their catchment areas and beyond.

Figure 7: Distribution (%) of communities' understanding of local disaster signals



2.5 Strength, Weakness, Threats and Opportunities for ABCs

As in other community based resources management systems, sustainability of CSs will largely dependent on several key aspects. Firstly, the capacity of ABCs to remain functional over the years to come and continue to manage the facility in a participatory and pro-poor manner towards ensuring safety of the catchment population during disaster times and profitable & consensual use of the facility during normal times. Secondly, sustainability of the CSs will remain conditional as to what extent the ABCs would be able to continue its transparency and accountability in organizational & financial management and value democratic procedures in its every function.

The third aspect is to what extent the ABCs and villagers can raise funds from various sources needed to maintain the facility afterwards. Fourthly, the extent communities (ABC and villagers) would be able to face various social and political challenges to maintain these CSs as community owned facilities. Finally, to what extent the ABCs would be able to maintaining linkages and rapports with other DRR and non-DRR service providing agencies in the area and leverage services. To this end, we have conducted SWOT (Strength, Weakness, Opportunity and Threats) analysis of existing ABCs and have found a mixed feeling of opportunities and challenges in future endeavors of ABCs in managing their CSs.

The participating members of communities (men and women) mentioned various aspects of strengths of ABCs and CSs that they observe while they also noted down considerable weaknesses in the capacity of ABCs to sustainably manage the facilities down the road. Although, it may be too early to judge the effectiveness of ABCs in their efforts of CS management as their age only ranged from 14-24 months and the CSs have been handed over to them for 3-17 months. The ABCs in Sharonkhola received the CS only 3-5 months back while the ABCs of Morrelgonj received them 17 months back. However, the SWOT analysis conducted at this stage gives a good overview of each ABC in terms of their current status and capacity which if considered in the current efforts of ABC capacity building could substantially benefit the community-based CS management initiative in Bangladesh. Appendix-2 presents the summarized outcomes of SWOT analysis with the villagers including ABC members.

Strength and weakness of ABCs

Communities as a whole appraised these newly constructed multipurpose CSs in their villages otherwise they were helpless. These shelters are large in size, have capacity to accommodate good numbers of people during disaster time, spacious rooms and corridors, enough ventilation, adequate toilet and water facilities including power connections backed up with solar systems and generators. Having separate facilities for livestock shelter is appraised by all which has been a matter of great

concern of the communities for long. Besides, these shelters are built on donated lands' in suitable locations, very close to communities thus easy for them to come to the shelters during disaster time.

The participants while expressing the strength of ABCs they actually started by appraising the CS first and then moved on to ABC issues. In all the shelter sites, the participants while saying about strengths, they strived to highlight by saying, "these are our shelters, in our villages and we manage these"- a kind of community ownership was visible. They also mentioned that the ABC members works voluntarily, hold regular meetings, keep documents, have bank accounts and deposit money in the bank, etc. are on the positive aspects (Appendix 2). The other key positive aspect of community ownership is that the villagers contribute monthly subscription for the maintenance of these facilities which is lacking in all other CSs in Bangladesh. Women working as treasurers of ABCs in Sharonkhola highlighted as a step towards empowering women. Despite having strengths, the participating community members also highlighted about various limitations of ABCs in their ways of performing to manage the CSs in delivering assigned services (Appendix-2).

These weaknesses cross cuts with various aspects of CS management viz. planning, documenting, informing and performing. For example, while the communities mentioned that ABC hold regular meetings as strength but at the same time they mentioned that meeting minutes are not written in time and none of the ABC member can write meeting minutes. Even if the minutes are written (by the partner NGO staff) but there is hardly any execution of decisions in time. Even if some of the decisions are met but are often late and slow in progress. In most cases, PNGO staffs push the ABC members to act upon. However, this is fairly common in community-based management systems where the community groups need accompaniment supports for some initial years to perform by themselves as observed in other development projects in Bangladesh like LEAF, MACH, CBFM projects. Besides, the participants also mentioned other areas of weaknesses which are too important and need to be addressed on an urgent basis.

Issues of political influence, groupings and dominance of land donors' families in ABCs seem important aspect of weaknesses that the ABCs are to overcome. These problems discouraging general members to participate in full, some of the members showed reluctance attend meetings, women members get less or no priority to speak in meetings, and members from poor families get no port folio in ABCs. Besides, the issues of transparent fund management came in the discussion and the participating communities were found not aware of updated accounts of funds. They said that the ABC members lack fund management skills, funds are often not deposited in the bank in time, more money (cash) remains at hands of treasurers has high risk of being mismanaged.

Apart from the lack of fund management skills, the participating communities also said that ABC members lack fund raising skill and they are not proactively taking measures to raise funds for the ABCs from multiple sources. However, the issue of preparing the "Business Plans" seem not discussed with the wider communities in the catchment areas. To this end, they also added that ABC is still unable to make any linkages or working relationships with other agencies in the area to tape resources and services except getting some tree saplings form the FD (Forest Department). Some members said this may be intentional that ABC leaders do not like to collectivize the issue rather keen to keep it within themselves (a few) for some vested interests. It is noted that these weaknesses are mostly solvable but need skillful facilitation, motivation and accompaniment support from partners having experience of implementing community based projects in multiple social, cultural and environmental settings. It is imperative that PNGOs need to be more "down to earth" in understanding the insights of community dynamics around the CSs' management.

Opportunities and Threats

Apart from the opportunities of taking shelter during disaster times, the communities as a whole see various opportunities that the CSs have created can be realized provided that the ABCs can overcome the challenges (associated weaknesses and threats) and continue to function well in future. The participants highlighted that CS facilities have high potential to earn income through not only by giving rentals to other users but also through providing spaces for social, economic and cultural

development in the areas. Apart from the disaster risk reduction (DRR) facilities, the participants also opined out that the CSs have created opportunities to positively contribute to local development in the areas of health & nutrition, agricultural production systems, education, women development, livestock and other sub-sectors as center points of micro level growth and transformation (Appendix-3). These facilities have high potentials for using as health camps, vaccination centers, doctors' chamber, Free Friday Clinics, etc. thus could help improve the health situation.

With the use of these facilities as ECD (Early Childhood Development), adult learning schools and as coaching centers can potentially improve the literacy rates in these out of reach areas in the coast. In remote village settings there is hardly any physical facility for conducting training and awareness building purposes. These CSs have created suitable physical space with required logistics can be used by various NGOs and government projects to conduct such events and thereby can improve the skills and awareness levels of the communities including the women folk. Women can use these facilities by taking up various small income generating activities with the help of ABCs and NGOs like tailoring, embroidery, hand stitching materials, bamboo and cane products and so forth.

Apart from earning incomes and development activities, opportunities exist for conducting various social and cultural programs at the village levels. The communities are already using these CS for the purpose of local arbitrations, social gathering, religious congregations, wedding ceremonies, celebrating various national days. Above all, these CSs have opened up opportunities for the people in the catchment villages to use these as "community places" for recreation, conflict resolution, social and economic and cultural purposes which was lacking in the area in the past. However, the CSs have created these opportunities in the area would largely depend on how best these facilities are being managed (and continue to be managed) by the ABCs. The ABCs are also to face lots of threats and have to overcome these through collective efforts. To this end, it is a big challenge for the ABCs to develop their capacity and make breakthrough in their way towards reaching the goal.

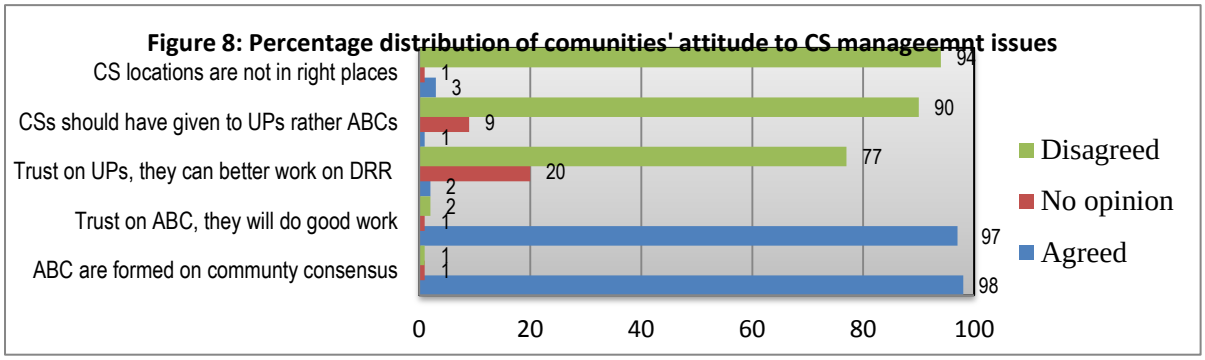
The threats that the participating communities foresee are from several strands. Although it is internal to the communities, the key threats they foresee may come from the rich and influential land donors. Communities have a general fear that when the project will be over (partner NGO will leave), the land donors and their associates may grab the property and use for their personal benefits especially during normal times. Even if they do not grab in full, they may create barriers to others to use on rentals or the rents may be taken up by the land owners or they may use these for their personal purposes without paying rent to the ABCs.

Besides land owners, the communities have fear that there could be political pressures and influence in future that may distort the functions of ABCs. They also scared that these shelters may be used for political purposes more often than community welfare and development purposes in future and specially during local and national election times. Many ABC members especially the influential office bearers are aligned with different national political parties have generated this feeling among the general villagers. The communities also detected threats from natural forcing viz. river erosion and embankment failure that may affect the CS facilities and thus on the ABC functions. Some of the CSs are built near to the river and river erosion may engulf the CSs in future if no protection measure is taken up. Besides river erosion, failure of coastal protective embankments during cyclones, storm surges and high tides may also affect the CSs.

2.6 Communities' Attitude to CS Management and Observation on DRR Practices

Despite having lots of weaknesses and threats to ABCs and internal conflicts among the members, they all showed their positive attitude to SDC's effort of community-based management of CSs. It appears that the communities at large have accepted and owned the CS as their assets which can protect them from disaster losses. While asked about the appropriateness of locations where the CSs are built, most of them (94%) responded positively (Figure 8). They also supported the idea of

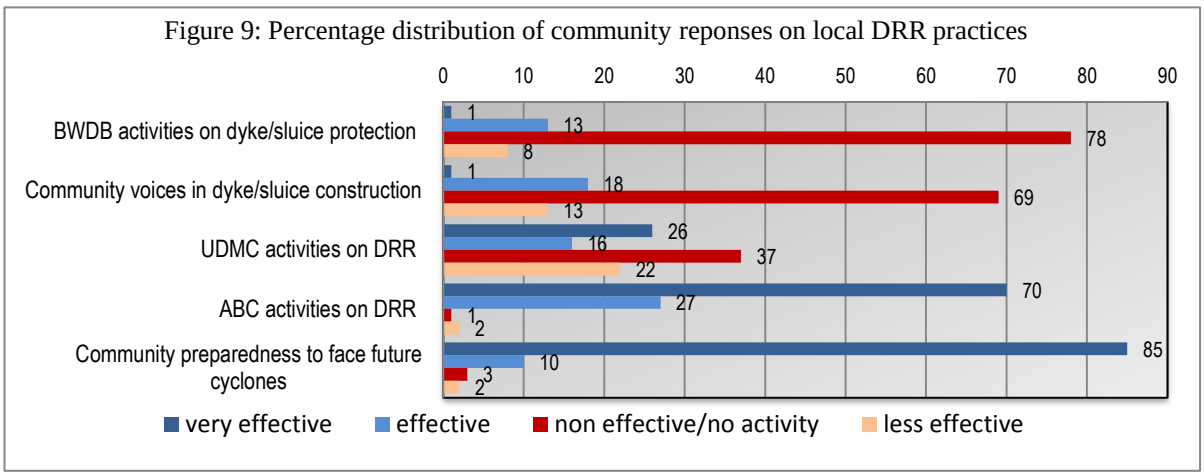
community management systems of CSs, as 90% said it is right to give the management responsibilities to communities rather to UPs or others.



It seems that communities' feeling about and trust upon UPs is not very enabling as 3 out of 4 respondents (77%) lack of trust on UP as local institution that can effectively tackle DRR issues. Since UP is a powerful and sensitive institutions, a good numbers of respondents (9 -20%) are found remained non responsive to this question by ticking out "no opinion" (Figure 8).

The situation of local DRR practices, particularly in the area of coastal protection embankment and sluice gates management & operations including community participation in such activities are found poor. In response our question on O&M of coastal dykes and sluice gates by BWDB, majority (78%) responded negatively and rated their activities as non effective or no such activity (Figure 9). Regarding community participation in dyke and sluice management, again the majority underlined non engagement of communities in such activities.

The DRR practices of UDMC were also found not very dependable as communities so witnessed. On the issue of UDMC activities on DRR at local level a quarter of the respondents (26%) though said positively (very effective) while more than one third (37%) responded negatively and 22% said UDMC activities on DRR are less effective. It might happen that in some unions UDMC perform better than others as it largely dependent on the attitude of the UP Chairmen. However, on the issue of ABCs' activities on DRR, most of the respondents (80%) showed positive (very effective /effective)



attitude (Figure 9). Local communities now feel well prepared and more secured to face any future cyclones as they now have large cyclone shelters with required facilities (water, toilets, lights and fans backed by solar and generators) including safe spaces for livestock in them.

2.7 Actions for Institutional Capacity Building of ABCs

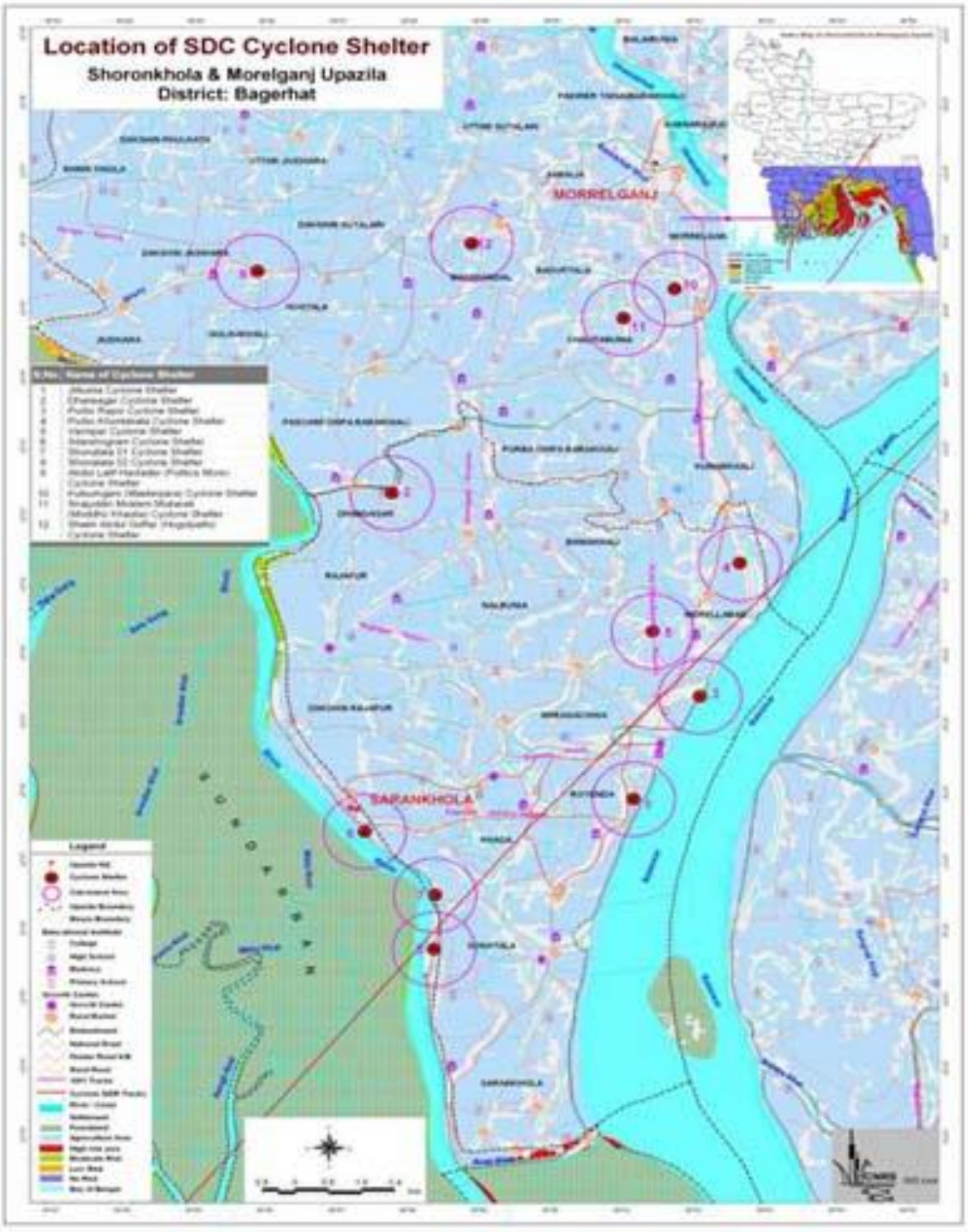
It appears from the quick institutional assessment of ABCs' it appears that urgent corrective measures are required to improve their capacity and functions to create a strong niche in the local DRR arena. In this regard, role of PNGO is crucial as to how skillfully they can conceptualize the insights of community dynamics, local power structure, responses of formal and non formal institutions to ABCs and the ABCs strategy to create a suitable niche in the local DRR and development framework. The ABCs has entered in to a stage when they should develop and apply various normative attributes to judge what works better in the realm of CB-DRR. Accompaniment support is crucial at this stage where PNGO to act as guide.

Apart from having various positive attributes, the ABCs show weaknesses in several areas in their consciousness, capacity and collective actions (3Cs) which is essential to acquire to create a position to influence change. The first step in this aspect for the ABCs is to gain confidence of people in the catchment areas as their leaders and then to build rapport with other DRR actors in the locality to leverage supports and services for the communities in their respective areas. PNGO should develop a capacity assessment tool for ABCs and periodically (six monthly or quarterly) assess their organizational capacity and functions jointly with the ABCs. This will help ABCs to visually see their weak areas and would try to overcome such shortcomings under light facilitations.

Training and orientation including exposure visits to CBO management activities in other areas can help building their organizational capacities. Rapport building workshops with local administration and service providers can help ABC to get financial and technical supports from public and private sources available at upazila level. Awareness and empowerment of communities in respective CS catchment areas towards building their capacity to act as "pressure group" would help ABCs to function properly. PNGO should work with the communities and ABCs to identify potential threats and develop a "threat management strategy" and operationalize the strategy in to actions would pave ways for ABCs to sustain in future. Finally, ABCs should develop strategies that transform them from their current status of local "DRR-based CBOs" to overall "community development CBOs" and act as center point of local development based on the MCSs.

3.0 Economic Evaluation

Economic evaluation is significant in making decisions for DRR projects; similarly, it also helps evaluate the efficacy and usefulness of interventions through quantified information. Though it has historically been used to assess larger scale infrastructure projects and public investment projects, its use for local or community level projects is becoming more widespread (Venton 2010). In this study, we have relied on cost benefit analysis (CBA) as an approach for economic evaluation of SDC-MCS intervention that addressed disaster risk at community levels in Morrelganj and Sarankhola *upazila*s (sub-districts) of Bagerhat District in Bangladesh (Map below shows the study area)**.**



3.1 Review of CBAs for DRR Projects

There is a substantial literature and specific manuals on using Cost-Benefit Analysis (CBA) and other similar project evaluation and appraisal methods in the context of natural disaster risk (Benson and Twigg 2004; Benson et al. 2007). The social and environmental benefits of disaster mitigation activities are well documented, including reductions in loss of life, minimized livelihood disruption, and resilient infrastructure such as power and water (Benson and Clay 2002; Wisner, et al. 2004). However, studies on economic benefit out of disaster reduction measures are scanty; especially benefit derived out of cyclone shelter establishment has hardly been measured in financial terms.

Exploration on the examples of cost and benefits of DRR projects reveals that Red Cross, World Bank, FEMA, Oxfam, ISET and similar other organization started appraising and evaluating their interventions for disaster mitigation in monetary terms - mainly since mid-1990s. Most of these DRR projects dealt with hazards like: floods, river-bank erosion and drought. A few examples, however, figured out the benefits out of coastal hazards mitigation that bear economic and livelihood significance for the local people. Box -1 in the Appendix-2 reviews the results of several cost benefit analysis done earlier by these aforesaid organization.

Meanwhile, saving livestock during the disaster event had been considered as primary concerns by the development interventionists only in a few cases. In San Isidro, Surigao Del Norte province of the Philippines a dyke was built to protect mainly livestock, crops and houses. However, a 15 year analysis period for the program showed a poor benefit-cost ratio i.e. 0.7. Another intervention strategy that built *hafir* (water retention pond) in Delai, Red Sea State of Sudan to provide water for livestock and people, found its investment beneficial - yielding 2.7 BC ratio with a 15 year analysis period.

Therefore, it is evident from the above exploratory review that though DRR interventions have multifaceted benefits mainly economic and social for the community people but at times the benefit in real economic terms may not worth investment. It therefore calls for a critical analysis in the form of a CBA in order to justify the investments by the development interventionists.

3.1.1 Multi-criteria Analysis

Multi-criteria analysis (MCA) involves considering several goals rather than just one. In such an approach the aid provider or donor identifies goals and trade-offs or in other words cost benefits between them - and then weighs the different goals to help select the best activity (IFRC 2010). In this program, with this intervention the SDC had options to build cyclone shelters with prevailing features like: mere shelter, shelter cum school, shelter cum *union parishad* complex, and shelter cum office building etc. All the existing cyclone shelters in Bangladesh are meant to save human lives and serve as venue for education or administrative purposes etc. Unlike others, SDC, apart from saving lives of human also aimed to save their main livelihoods assets i.e. the livestock possess by them. Therefore, saving livestock of this disaster prone coastal area has been the major criterion of intervention as considered by SDC.

The study in the following sections of its economic analysis delves out whether that approach bears a greater economic significance for the beneficiary communities. In order to identify the economic contribution of SDC-MCS it determines BCR, IRR and NPVs of the SDC intervention with livestock protection as the most significant economic components of the program forgoing the monetary value of human life savings - as it would be in contravention to SDC principles.

3.2 Characteristics of Hazards and Associated Risks, Vulnerability, and Effects in the Study Area

The study area is two contagious *upazilas* (sub-districts) in southern Bangladesh. It is a low lying area

exposed to the coastal mouth (Khulna –Sundarban coast of Bay of Bengal). Most of the area is reportedly about 2 to 3 meters higher (or even less) than the sea level– making it vulnerable to the coastal inundation. The most common and devastating disastrous events that take place in this region are cyclone and associated tidal surge.

Geographically, the area is also positioned at the tail end of the Ganges delta which is marked by frequent disasters. Deltaic location is a blessing as well as a curse for Bangladesh (Paul et al. 2002), because each year the country experiences not only life-giving monsoons but also the catastrophic ravages of natural hazards such as cyclones, tornados, thunder storms, tidal surges, and floods (Islam 1995). Since 1960s more than 150 cyclonic and severe cyclonic storms[2] hit different coasts of the country – most of which caused tidal surge as well. SAARC Meteorological Research Centre (SMRC) reports that around 16% of the cyclones and storms that took place in Bangladesh hit Khulna-Sundarban coast which includes mainly Sarankhola and Morrelganj upazilas. Cyclone triggered storm surges that inundated these areas over the period were 0.61 to 4.55 meter high.

Meanwhile, in order to get a comprehensive picture on the disastrous events and hazard characteristics of the study area, 12 Focus Group Discussion (FGDs) were conducted with the communities within the catchment areas of individual MCS (one FGD each in all 12 SDC established MCS catchment area) which also largely support the SMRC data revealing the fact that Sarankhola and Morrelganj experienced more than 20 moderate to strong category cyclones during the last 40 years. However, the discussants in FGDs, most of which have been witnessing all these natural disasters since last 50 years or more[3] stated that among those 20 cyclones around 6 (30%) caused severe disastrous storm surge and inundation in their areas. The discussants identified three cyclones that occurred in 1968, 1988, and 2007 as most devastating - causing death and serious injuries to people - at the same time most of their livestock died or washed away due to these disastrous events.

On economic losses and risks in the study area due to such disasters, the key investigators had reconnaissance and key informant's opinion apart from the FGDs and survey that revealed many direct, indirect and secondary effects. The direct indirect and secondary effects in the study area as revealed by the discussants and respondents are:

3.2.1 Direct Effects

In doing the economic evaluation of the SDC intervention the study sets apart the primary direct effect of cyclone i.e. human death – as human life is invaluable and putting value on it is difficult or irrelevant. However, human injury as a direct effect has been reckoned as it has an economic implication in terms of productivity losses and health recovery cost (though data on health recovery cost is difficult to obtain). The followings are the nature of direct economic effects of disasters in the study area:

- Productivity loss and recovery cost: The losses that occur due to the injury of productive individuals as they fail to perform their daily jobs for a considerable time period. Besides, emergency relief both for the health and housing recovery causes a good amount of spending.
- Production losses: Death of livestock, destruction of crops, poor harvest, closure of small businesses, loss of cultured fishes from ponds – result in a reduction in income and in many cases substantial or total loss of livelihoods.
- Capital losses: Such losses include destruction of housing (which usually works as the production house as well for many rural enterprises), factories, means of communication (bridges, roads, railways, telephone system), and community infrastructures (schools,

[2] Cyclones with wind speed 63-87 km/hour is considered as cyclonic storm while more than 88 km/hour is regarded as severe cyclonic storm (Rahman and Damen 2002)

[3] To get historical data in FGDs we selected 60 years or older discussants (who witnessed all the severe cyclones occurred in the study area)

colleges, madrashas, mosques, temples, electricity networks, sanitation systems etc) – result in a tough and costly recovery to regain normal economic situation for the communities.

- Loss of stocks: The rural and coastal communities maintain many stocks either intended for final consumption, for use as production input, for sale in the market during lean period or at the time of necessity or familial hazards. In the study area such stocks include: seeds, harvested grains, green battle nuts, and other agricultural products –loss or damage of these stocks due to tidal inundation add to the plights of the community people.

3.2.2 Indirect and secondary effects

- The indirect effects are: Reduction of purchases of goods and services by people who have lost their jobs. Besides, supplier's activity reduces and all these eventually results reduction in tax revenues by government.
- Secondary effects are ample and multifaceted, the community people reported that epidemic in the form of various waterborne diseases, ecological changes especially changes in the local ecosystem take place due to salinity intrusion with storm water. One discussant reports

  "Cyclone er pore matir niche lobon pani baira jai amader tube-well e notun kore pipe lagaite hoy" - meaning that after each and every storm surge layer of saline water expands in the underground aquifer and therefore they need to go at least 100 feet deeper for sweet water extraction from the ground through tube-well which increases both tube-well maintenance cost as well as installation costs of new tube-wells in the locality.

3.2.3 Effects and risks addressable by SDC-MCS

Having looked at the effects and losses out of cyclonic disasters in the study area– the sort of economic questions the study faces or the SDC policy makers or analysts are likely to encounter that, what are the economic risks and losses that can be offset by the MCSs? What are the economic principles that can be very helpful in evaluating SDC policy option in establishing MCSs in the disaster prone coastal areas of Bangladesh? And what are the benefits or costs that are quantifiable under existing economic principles?

There is hardly any specific or special sub-set of economics or specific application of economic principles in measuring the financial dimensions of DRR programs. However, as disaster economics is presumably a sub-set of ecological economics, it considers damage avoidance costs as benefit and assesses the trade-offs between the benefits and costs to find an 'optimal solution' of the problem as well as support tools for decisions. This study, therefore, looks at overall consequences to the communities out of cyclone and cyclonic storms, elicits their measuring units and then lists tangible and intangible losses. Finally, it takes into account of the inclusionary and non-inclusionary components for the CBA in the light of existing economic rules.

In Appendix 3 the table on general lists of losses by cyclonic storms indicating extent of usefulness of SDC-MCS to address tangible and intangible losses as well as losses that can be included for CBA. Though the SDC-MCS is able to redress most of the tangible and intangible losses and effects out of cyclone and storm surge disasters but the utility that are offered by MCS in real term economic values are:

i. the avoidance of the of number of livestock loss by sheltering them in the MCS; and

ii. avoidance of productivity loss by keeping productive individuals uninjured by protecting them and their livestock in the shelter during the cyclonic storm

3.3 Back-ward Looking or Ex-post Evaluation – the Case of SDC Intervention Area

In order to evaluate the SDC-MCS the study adopted backward-looking approach based on the assessment of past damages to the catchment communities caused by cyclones and storm surges. The study tried to manifest the past risks and damages through recall data and updated the current risks based on these. Information on changes in hazard and vulnerability on three data points (past disaster events) were gathered as ex-post evaluation ideally requires figures on three past events. The study though had historical data on disasters in Bangladesh but the panel data on past events on the study area are virtually non-existent. With FGDs and Key Informant Interviews (KIIs) the study ranked three major disasters that catchment communities experienced during the last 50 years, which are:

- 1968-April Cyclone in Southern Bangladesh specific to Sarankhola and Morrelganj area of Khulna-Sundarban coast that claimed 850 human lives (Munich Re 2009) and huge amount of livestock from the study area – damage figures were derived through recall data as no official data available.
- November-1988 Cyclone with 162/km wind speed over the entire Khulna-Sundarban coast that caused both death and injuries to the community people (at a smaller scale) but they again suffered from huge loss of livestock. As official data is scanty the damage figure was surmised based on the recall data provided by those who directly experienced and suffered the events.
- Super Cyclone SIDR of 2007 with 220km/hr wind speed caused substantial damage to the communities of the study area. Primary data (from survey and FGDs) were triangulated with official ones to segregate the study area specific figures.

The field research participants also revealed that though three other cyclones (which were not severe) took place in the study area in the last 60 years these did not claim lives or live stocks as the storm surge height and wind velocity falling in that particular area was not devastating (implying the non-value of economically quantifiable MCS utility). AILA, a severe cyclone in 2009, though hit the Sundarbans coast but its impact in the SDC-MCS catchment area was not damaging, as reported by the participants. The following chart shows the loss of livestock and human injuries (death excluded) out of the disasters that caused devastation in the study area:

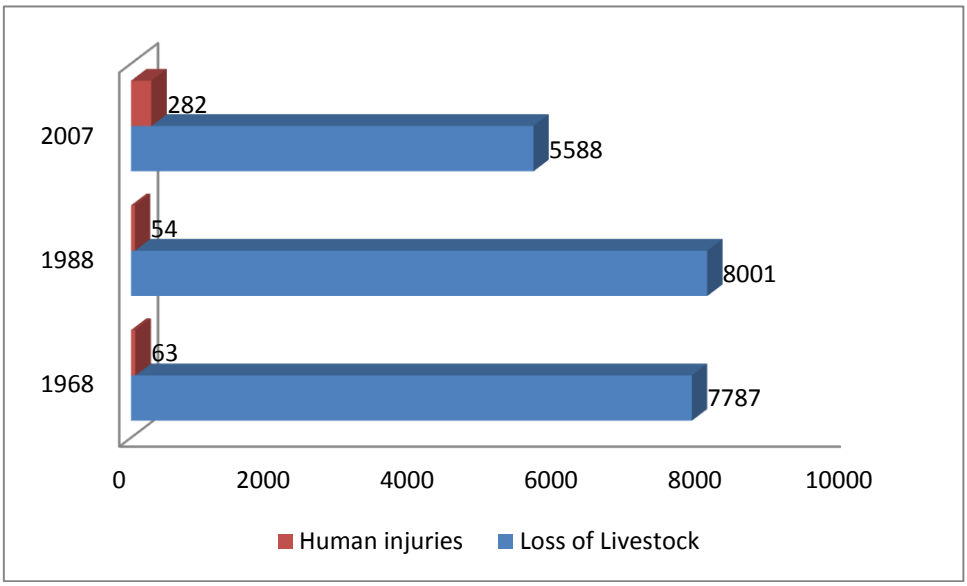


Figure 3.1: Number of Livestock Loss and Human Injuries due to the cyclones that hit the study area most

4.0 Cost- Benefit Analyses (CBA) of the SDC Multipurpose Cyclone Shelters (MCS)

4.1 Costs

Determining the cost of a cyclone shelter as a mere building could be done in a moment too soon, which literally involves establishment cost comprising land, labor, material and related ancillary services purchased. But the cyclone shelters as designed by SDC are not mere shelters – these are meant to work as an instrument for local development by both protecting lives and vital livelihoods assets of the local people as well as facilitating livelihoods means of them. Because of their unique objectives and multipurpose usage and long life time (60 years assumed) the determinants of the cost components of these shelters can be shown in a model as under:

$Cmcs = Ce+Cm+Co^{t}+Cmr^{ti}+Cpdr^{yd}+Cfb$

Where,

Cmcs is Cost for Multipurpose Cyclone Shelter

Ce – Cost of Establishment or Construction

Cm – Cost of mobilization

Co^{t} – Cost of operation of the centre's businesses and daily maintenance that includes expenses for generator's fuel, bulb, cleaning services, stationeries, electrical repairing and services etc.

Cmr^{ti}- Cost of maintenance and repairing at a regular time interval ($^{ti)}$; it has been assumed that the shelter buildings will require a maintenance job in each 5 years.

$Cpdr^{yd}$ - Cost of post disaster repair and refurbishment jobs; based on ex-post data we presume that a major cyclone will occur in the study area in every 20 years. Hence the shelter building has to undergo substantial refurbishment and repairing after each major cyclone in order to make it usable further, as it would endure a huge pressure of people and livestock especially during the period of inundation. Building on the past 60-year's cyclonic trend of this particular locality, it is presumed that at least three such major cyclone will occur in the MCS catchments and therefore repairing and refurbishment will have to be carried out thrice i.e. in the year of disaster (^{yd}).

Cfb – Cost of forgone benefits or productivity from the shelter land. The shelters are established on lands, which were productive earlier. The forgone benefits during shelter life time out of cropping and plantation have been calculated to comprehend the cost figures of this DRR scheme.

Therefore, this DRR scheme involves different types of costs, which are: one time (Ce and Cm), yearly recurring ($Co^{t)}$, periodical ($Cpdr^{yd}$ and Cmr^{ti}). The cost of mobilizing the communities is embedded in the initial cost of the scheme. This cost (BDT 15.72 m) has been spread over equally (i.e. around BDT 1.3 m) to all the shelters. The initial Yr-1 cost of the project include the expenses incurred for building establishment, community mobilization, first year operation, and total loss factorized for the forgone benefits. As part of the MCS's lifetime expenses apart from yearly operational cost periodical maintenance and post disaster refurbishment and repairing costs have been tallied to the cost figure duly.

Appendix-6 shows both shelter-wise and overall SDC scheme's cost. Cost measurement and calculation have been done based on an assumed 60 years lifetime of the shelters. The 12 shelters that SDC established under it's scheme with construction cost ranging from BDT 12.3 m to BDT 15.3 m carry NPV cost ranging from BDT 12.1 m to 16.3 m over 60 year life time with a common discount rate considered for public and infrastructural project (i.e. 8%).

4.2 Benefits and Uses of the SDC-MCS

Cyclone shelters built in the recent past in the cyclone prone coastal areas around the world (a vast majority of which are located in South Asia) are mainly designed as a home for human lives protection during the time of the cyclone. For the remaining period some of these are used as school or administrative purposes. Therefore, the benefits of cyclone shelters can be seen mainly in saving lives and fostering education. However, SDC through this program added new dimension to the bundle of benefits that can be derived from a cyclone shelter.

Apart from saving human lives the other most important benefits that can be derived from SDC-MCSs are protection of livestock - upon which livelihoods of the many community people mostly or even entirely depend. Livestock saving is therefore considered as extremely beneficial for these community-people, as unlike many other coastal communities who mostly live on fishing, majority people of these communities are dependent on agricultural and cattle rearing as revealed in the household survey.

These shelters are also designed as business hub. The basements of the shelters are planned to be used as a venue for village *haat*[4]. Other potential use of this venue could be: fishing net repairing place, poultry farm, handicrafts or cottage industry, training venue and other similar use. Venue rental could thus generate a yearly revenue stream. The main floor kept for sheltering livestock during cyclones are planned to be used as community centres for suitable social ceremonies and functions like: marriage ceremony, feasts on religious purposes, and other family functions. At times different programs conducted by NGOs, government or other authorities like: health campaign, vaccination, etc can be held in the shelter floor space. The following table shows the various purposes of potential use and components of benefit through which the shelters can generate income in the form of venue or space rental:

Table 4.1: Types of user-benefits (other than sheltering) offered by SDC-MCS that have rental value

Purpose of Use	Nature of Use	Commercial Potential	Nature of Benefit
Social Functions	Venue for holding programs like: marriage ceremony, religious functions, rituals and festivals etc.	There is a latent demand for posh and well equipped public venue in the rural areas. ABCs plan to offer shelter floor-space for such potential use is appreciable.	Cash economic benefits - ABC has decided to offer the shelter floor space on rental basis and already fixed rental rates based on nature of the program.
Health Campaign	Venue for organizing Free Friday Clinic, vaccination Centre, Primary Treatment Centre, Eye care camp, Family Planning camp etc.	Different government or non-governmental organization will be willing to use this space to accomplish their programs in this area by using this venue.	Cash benefits and social benefits- rental from these GOs or NGOs would be charged based on nature and extent (duration) of their use.
Training and Convention	Venue for conducting training programs on agricultural, fisheries, and livestock training and management and related convention.	Many NGOs and GOs hire training centres for the local beneficiaries in towns for imparting such trainings. Now these organizations will rather prefer to impart these trainings by using the shelter venue.	Cash benefits- rental from these GOs or NGOs would be charged based on nature and extent (duration) of their use.
Entrepreneurial	The basement or 1st level (raised for livestock	Micro-entrepreneurial activities are growing in the rural areas. If	Cash economic benefits- rental or profit sharing

[4] A daily, bi-weekly or weekly marketplace in rural areas

	shelter) can be used as production house for handicraft, and processing unit for small enterprises. Spaces of a few shelters are already being used for poultry rearing.	the spaces for shelters are offered a production house for them it will attract the potential micro-entrepreneurs.	arrangement between ABC and potential entrepreneur would generate income out of the shelter.
Education	The shelter floor can be used as a venue for conducting non-formal education programs.	Programs like: Pre-school education, adult literacy, education for drop-outs, vocational training etc are conducted by many government, voluntary, and non-formal organizations	Mainly social benefits; economic benefit will also come from this kind of use as some of the organizers may pay rentals for the venues.
Cultural and Recreation	Venue for village fair, cultural programs like-song, drama, feast or cooking spot for picnic makers etc.	Use of such facilities for recreational and cultural purpose has latent demand.	Cultural and economic benefits; ABC can charge rental or collect toll from the participants of the programs.
Others	Venue for village *haat*, net repairing, arbitration, and emergency social community meeting or gathering.	There is a scarcity of common facilities with good physical arrangement in the villages – the shelters would certainly fill up this gap.	Social, especially institutional benefits; though ABC reportedly charges nominally for some uses (arbitration), the study thinks tool from shops in the *haat* would be the feasible income.

The list of aggregate benefits out of a cyclone shelter over its life-time can be innumerable and multifaceted which are difficult to capture exhaustively and monetized and put into accounting book with existing economic rules. As illustrated in Table 3.1 the bundle of benefits that can be captured by the Shelters are as follows:

$S_b = La\ (Ls+Hi)^{yd} * N^d + Bu^n$

Where,

S_b denotes the specific bundle of financially quantifiable benefits out of the shelter establishment

La is the loss avoided with the shelter's protection which is the aggregate value of livestock loss (Ls) and Human injuries (Hi) avoided during the year of disaster (^{yd}).

N^d is the number of disasters claiming lives and livestock.

Benefits to be derived yearly (as rental) from the shelters use throughout the entire shelter life (n) has been expressed as Bu^n

Appendix-7 shows aggregate benefit calculation as well shelter-wise benefits in terms of NPV based the shelters reasonable lifetime (60 years). All the 12 shelters generate positive benefit as an investment scheme. With an 8% discount, net present value (NPV) of the benefits for the shelters range from BDT 15.87 m to 22.98 millions. The differences in shelter-wise benefits are the result of differences in the volume of protection services (i.e. saving of number of human lives from injuries and protection of livestock from being washed away). The aggregate net benefit of the 12 shelters is BDT 46.6 m.

4.3 Results

Benefit of SDC-MCSs Outweighs Cost

The bundle of financially measurable benefits (foregoing human life saving and other intangible benefits) that can be derived from the SDC-MCSs outweighs the costs of the shelters over their projected life. The following chart shows all the 12 shelters will derive positive benefits the lowest among them being around 10% by Rajoir and the highest is 44% by Varanipara.

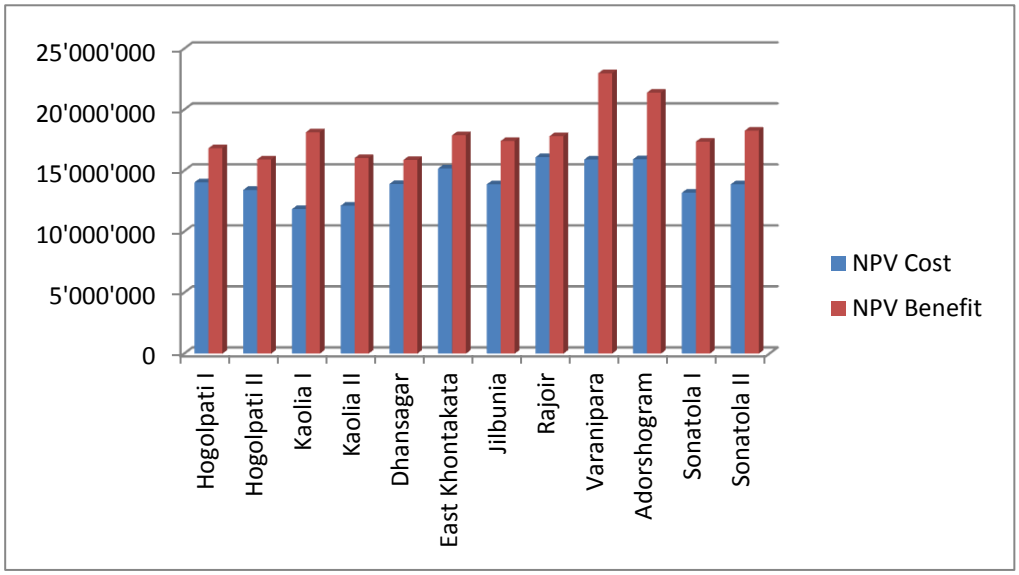


Figure 4.1: Comparison between the SDC-MCSs Cost and Benefit in terms of NPV in Bangladeshi taka (BDT)

The aggregate benefit cost ratio **(BCR)** of the 12 shelters i.e. the CBDRR initiative of the SDC in the study area is = 1.27 (See Appendix-7) implying that the sum of all benefits from all the shelters 1.27 times the sum of all costs in today's value.

The Integrated Shelter cum Business Concept Shows Optimal Return from Operation

Apart from their roles in protecting lives and livestock, as the 12 shelters are meant to be business operation centres as well this study found that the aggregate return on the costs of 12 shelters is 31.67%. The internal rate of return (IRR) by these shelters will vary from 16% (Dhansagar) to 58% (Kaolia). The following chart represents the IRRs of the respective shelters:

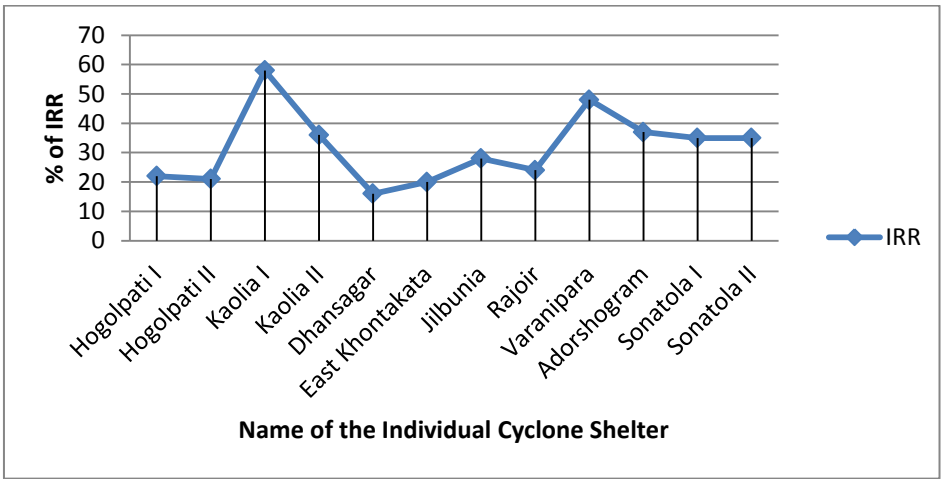


Figure 4.2: Internal Rate of Return (IRR) of the individual SDC-MCS in Sharankhola and Morrelganj area, Bagerhat, Bangladesh

The reasons for the variations in IRR are multiple; however, the main reasons are the variations in cost and investment sizes, the extent of damage avoidance, and the differences in business volume predicted (See Appendix-8).

A significant Net Present Value (NPV)

The Net Present Value of the DRR Scheme is BDT 46,577,362 (See Appendix-7). This value basically For the beneficiary communities. As 3400 households constitute the catchment communities the net benefit per house hold becomes BDT 13,700 out of this SDC intervention. However, this is only the value in terms of loss avoided and net profit from shelters' business operation. The intangible benefits that have not been monetized (e.g. socio-psychological benefit) are even more significant to them than the tangible ones

4.4 Effectiveness and Implications

Investment Cost per Life Secured from Disaster Risk

SDC-MCS Scheme's investment cost per life secured from disaster risk is nominal which is APE (Annual Premium Equivalent) CHF 1.15/Person or BDT 75.00 per person. As each shelter has a capacity to secure 1400 lives from the onslaught of cyclonic storm, therefore the total life saving coverage per event is 16,800. During the shelters (12) lifetime (60 years) as 3 major disaster is predicted based on past trend in equal period the shelters offer a secured provision for 50,400 human lives. The total SDC investment for the DRR scheme is CHF 3.5 million which stands to an investment of CHF 69.4 to secure per life from disaster risk for 60 years. If this amount is converted into annual premium an individual has to pay as insurance for disaster risk coverage - it is APE CHF 1.15 or BDT 75.00.

Investment Cost per Life and Livestock Secured from Disaster Risk

Similarly, if we calculate the investment cost in keeping both live and livestock free from disaster risk the figure is CHF 51.6 or BDT 3,351.7 for 60 years period. If this cost is split into an annual figure then the APE becomes 0.86 CHF or BDT 55.86.

A Better Shelter Building and Facility

Unlike many other cyclone shelter facilities SDC-MCSs offer better facility and benefit for the beneficiaries as revealed from field investigations. Within the study area and on the peripheries, there are cyclone shelters built by other agencies; many of the research participants are more or less knowledgeable about the features of those shelters. Besides, the field investigators enquired about the benefits and utilities of the shelters located around the locality with experts and key informants. Based on such observation and inquiries we record a comprehensive feedback on SDC-MCSs. A comparative qualitative evaluation on the features of SDC-MCSs and four (4) other shelters with the locality or periphery was drawn from the feedback which is depicted below:

Features	**SDC-MCSs**	**Other CSs within the Study Area or Periphery (N=4)**
Cost/m^2 in BDT	34,847 (Avg. of 12 MCSs)	40,000 and above = 3 35,000 and above = 1
Construction material used	Stone chips, stone gravel, brick chips, coarse sand, reinforcement bars, portland cement, first class burnt bricks. Structural foundation 2, 3 or 4 piles for each column	SDC compatible materials = 2 Materials reportedly may not be SDC compatible = 2
No of usable floors	Three floors are usable	Three Floors are usable = 1 Two Floors are usable = 3
Purposes/Benefit Mix	Shelter, Commercial Operations, Social and Cultural	Shelter, Education (School) =4
Livestock provision	Has provision to accommodate 500 livestock	Has Livestock provision = 1 No provision for livestock= 3
Accommodating	Can accommodate around 1200 people (Avg. of 12	Can accommodate around 1500

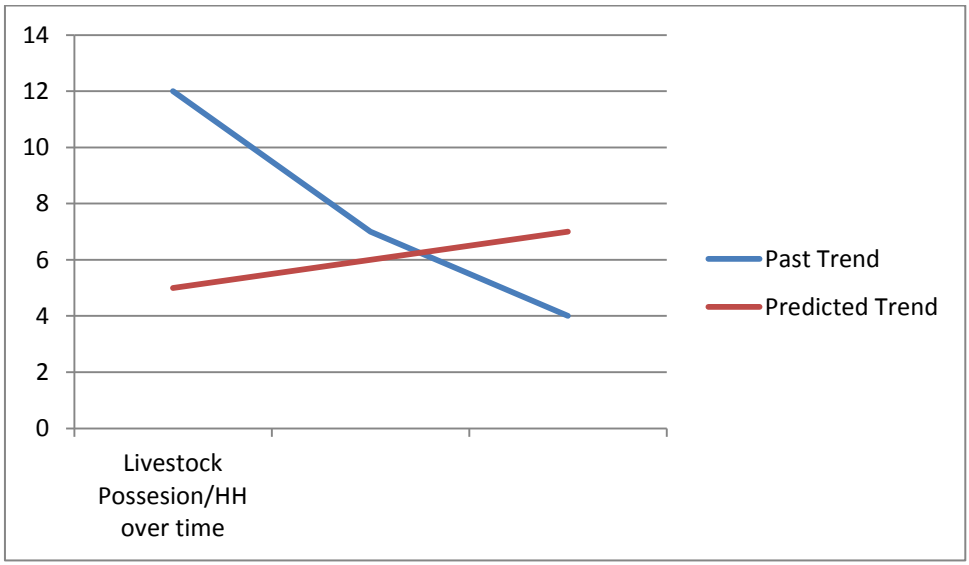
Features	SDC-MCSs	Other CSs within the Study Area or Periphery (N=4)
capacity	MCSs)	people = 2 Can accommodate around 1200 people= 2
Perceived Longevity	60 – 100 years	50-90 years

Increased resilience and Fewer Losses

This CBDRR approach by SDC is fundamentally oriented towards increasing the resilience of local communities as well as ensuring fewer economic losses. Both increased resilience and reduced loss reflect positive changes in household production and/or income. It is learnt from the research participants that disaster risk free situation will keep more economically active and motivated towards productive activities as the fear of losses especially in the case of (livestock) is largely diminished and lives of productive individuals are safer.

Livestock Production Functions

It is revealed both from household survey and FGDs that livestock possession per household used to be more in the earlier time points. Due to their exposure to disasters people became discouraged in rearing livestock as most or all of their livestock died or washed away during the major cyclones. The three data points, this study derived, shows that there is a sharp decline in livestock possession per household. In 1968, average livestock possession per household was 12 in the study area - this figure came down to 7 in 1988. After 90's though many external variables like, salinity intrusion, shrinkage of grazing land, etc came into force in diminishing the livestock production function curve, but still 'exposure to disaster' works as the principle factor for declining livestock resources in the study area. Therefore, the average livestock possession per household in 2004 became 4.



In the figure above, we therefore predict that a steady growth of livestock resources will take place in the future– as factors like risk, vulnerability, and 'exposure to disaster' etc are now largely weakened due to the construction of shelters for the livestock. The figure represents both the past factual trend and future predicted trend on the per household livestock possession in the study area – thus constructing the livestock production function curve for the study area.

5.0 Conclusions

The community-based management of multipurpose cyclones shelters with SDC initiative elicited a new modality of DRR that simultaneously addresses livelihoods apart from saving lives. It is step forward from the conventional coastal area entered DRR programs as the program has taken the communities along in designing and delivering the whole program. The most significant feature of the program is "eventually it is a program for the community, of the community, and by the community" As the ownership and management authority is given to the people and stakeholders from within the communities.

However, community based resource management needs capacity and patronization more at the initial stages of their journey. To this end, role of PNGO as a catalyst to organize, build and streamline the community institutions is crucial. However, it appears from the quick assessment of institutional capacity of ABCs that as community organizations they need to be strengthened in order to sustainably manage the CSs and act as local DRR actors. PNGO, therefore, has to pay attention in this particular area.

SDC looked at the initiative with an economic lens and saving livestock during the disaster event had been considered as one of the primary concerns unlike other MCSs. It is evident from the evaluation and review that such DRR interventions have multifaceted benefits mainly economic and social for the community people. Investment in cyclone shelter oriented MCSs does give positive economic return as the study following the ex-post evaluation methods found positive BCR, IRR and NPVs of the SDC intervention.

SDC's DRR approach with livestock protection as one of the primary components of the program really created value for the shelters. Both the shelter-wise and overall CBA showed optimal financial returns. Though the program is a more of humanitarian one, with an 8% discount, net benefit of the 12 shelters is BDT 46.8 m; IRRs ranges from 16 to 58 % while the BCR is 1.27 which is even lucrative as a commercial venture. It can therefore be safely concluded that the investment of SDC was financially sound and effective.

Appendices

Appendix-1

Matrix scoring of ABC by their contacts and working relationships with other agencies/organizations

		Jhilbunia	Score	Sonatola-1	score	Sonatola-2	score	Khontakata (varani)	score
Contacts and relationship	**indicators with scores**	**description of indicators**		description		description		description	
Contacts with villagers									
	No contact/only with ABC members (0)								
	Contact for subscription only (1)	Collects monthly subscription from all HHs in the catchment	1	Collects monthly subscription from all HHs in the catchment	1	Collects monthly subscription from all HHs in the catchment	1		
	Regular contacts for 1/2 reasons(2)							Collects subscription and informs villagers via VDCs	2
	Regular contacts for various DRR/non DRR issues (3)								
Contacts with UP members									
	No contact (0)			No contact made yet	0	No contact made yet	0		
	Irregular contact (1)								
	UP member as ABC member (2)	UP member is ABC member	2					UP member as ABC member	2
	Formal, direct regular contacts (3)								
Contact with UP/UP Chairman									
	No contact (0)			No contact made yet	0				
	Irregular contact (1)	UP Chairman once attended ABC meeting on request	1			ABC applied for funds for furniture and O&M	1	UP is informed through UP Member	1
	Regular contacts with UP (2)								
	ABC has formal, direct and regular contacts with UP(3)								
Contacts with UDMC									
	No contact (0)								
	Irregular contact (1)	ABC with AF attend meeting as observer	1	ABC with AF attend meeting as observer	1	ABC with AF attend meeting as observer	1	ABC with AF attend meeting as observer	1
	ABC attend UDMC meeting as member (2)								
	ABC works closely with UDMC (3)								
Contacts with UNO/UzDMC									
	No contact (0)	No contact made yet	0	No contact made yet	0	No contact made yet	0	No contact made yet	0
	Irregular contact (1)								
	ABC attend UzDMC meeting (2)								
	ABC works closely with UzDMC (3)								
Contacts with other agencies/ NGOs									
	No contact/only with AF (0)								
	Irregular contact/get support from 1 agency/NGOs(1)	ABC got saplings from FD	1	ABC got saplings from FD	1	ABC got saplings from FD	1	ABC got saplings from FD	1
	Work jointly/get support from more than 1 agencies (2)								
	Work jointly work/get support more than 2 agencies(3)								
Total scores obtained			6		3		4		7
% of score against the			33.33		16.67		22.22		38.89

		Jhilbunia	**Score**	**Sonatola-1**	**score**	**Sonatola-2**	**score**	**Khontakata (varani)**	**score**
maximum total possible score									

		Adarsha gram	**score**	**Dhan Sagar**	**score**	**Purba Rajoir**	**score**	**Purba Khontakata**	**score**
Contacts and relationship	**indicators with scores**	description		description		description		description	
Contacts with villagers									
	No contact/only with ABC members (0)								
	Contact for subscription only (1)	Collects subscription from all villagers	1	Collects subscription from all villagers	1	Collects subscription from all villagers	1	Collects subscription from all villagers	1
	Contacts with most villagers (2)								
	Regular contacts for various purposes (3)								
Contacts with UP members									
	No contact (0)	No contact made yet	0	No contact made yet	0	No contact made yet	0	No contact made yet	0
	Irregular contact (1)								
	UP member as ABC member (2)								
	formal and direct regular contacts (3)								
Contact with UP/UP Chairman									
	No contact (0)					No contact made yet	0	No contact made yet	0
	Irregular contact (1)	ABC applied for funds for furniture and O&M	1	ABC applied for funds for furniture and O&M	1				
	Regular contacts with UP (2)								
	ABC has formal, direct and regular contacts with UP(3)								
Contacts with UDMC									
	No contact (0)								
	Irregular contact (1)	ABC with AF attend meeting as observer	1	ABC with AF attend meeting as observer	1	ABC with AF attend meeting as observer	1	ABC with AF attend meeting as observer	1
	ABC attend UDMC meeting (2)								
	ABC works closely with UDMC (3)								
Contacts with UNO/UzDMC									
	No contact (0)	No contact made yet	0	No contact made yet	0				
	Irregular contact (1)					ABC applied for funds for approach road	1	ABC applied for funds for approach road	1
	ABC attend UzDMC meeting (2)								
	ABC works closely with UzDMC (3)								
Contacts with other agencies/ NGOs									
	No contact/only with AF (0)								
	Irregular contact/get support from 1 agency/NGOs(1)	ABC got saplings from FD	1	ABC got saplings from FD	1	ABC got saplings from FD	1	ABC got saplings from FD	1
	work jointly/get support from more than 1 agencies (2)							ABC allowed Muslim aid to hold meetings	
	Work jointly work/get support more than 2 agencies(3)								
Total scores obtained			4		4		4		4
% of score against the maximum total possible score			22.22		22.22		22.22		22.22

		SK Abdul Goffar	**score**	**SK Abdul Latif**	**score**	**Sirazuddin**	**score**	**Kulsum Gani**	**score**
Contacts and relationship	**indicators with scores**	description		description		description		description	
Contacts with villagers									
	No contact/only with ABC members (0)	Collects subscription from ABC members	0	Collects subscription from ABC members	0	Collects subscription from ABC members	0	Collects subscription from ABC members	0
	Contact for subscription only (1)								
	Contacts with most villagers (2)								
	Regular contacts for various purposes (3)								
Contacts with UP members									
	No contact (0)			No contact made yet	0	No contact made yet	0	No contact made yet	0
	Irregular contact (1)								
	UP member as ABC member (2)	UP member is ABC member	2						
	formal and direct regular contacts (3)								
Contact with UP/UP Chairman									
	No contact (0)			No contact made yet	0	No contact made yet	0	No contact made yet	0
	Irregular contact (1)	UP is informed through UP Member	1						
	Regular contacts with UP (2)								
	ABC has formal, direct and regular contacts with UP(3)								
Contacts with UDMC									
	No contact (0)								
	Irregular contact (1)	ABC applied for inclusion of its 2 members	1	ABC applied for inclusion of its 2 members	1	ABC applied for inclusion of its 2 members	1	Applied for inclusion of 2 ABC members	1
	ABC attend UDMC meeting (2)								
	ABC works closely with UDMC (3)								
Contacts with UNO/UzDMC									
	No contact (0)								
	Irregular contact (1)	2 members attend UzDMC with AF	1	2 members attend UzDMC with AF		2 members attend UzDMC with AF	1	2 members attend UzDMC with AF	1
	ABC attend UzDMC meeting (2)			Got support and organized disaster fair	2				
	ABC works closely with UzDMC (3)								
Contacts with other agencies/ NGOs									
	No contact/only with AF (0)	No contacts	0			No contact made yet	0	No contact made yet	0
	Irregular contact/get support from 1 agency/NGOs(1)			Rented part of CS to SDF office	1				
	work jointly/get support from more than 1 agencies (2)								
	Work jointly work/get support more than 2 agencies(3)								
Total scores obtained			5		4		2		2
% of score against the maximum total possible score			27.78		22.22		11.11		11.11

Appendix 2

Strength and weakness of ABCs and CS

Strength	Weakness
We manage our own shelter - Communities taking care of CS	Meeting minutes not written regularly and timely
We have our CS in our villages	Monthly subscription is not paid regularly by all HHs
Hold regular monthly meetings	No execution of meeting decisions
Meeting minutes are documented	No asset register for the CS
ABCs have bank accounts	No constitution of the ABC
We have income from renting of CS	ABC is not skilled in organizational management
Cost and income are documented	ABC is not linked to other service providers agencies
ABCs have money in banks	Members are incapable of writing meeting minutes
Sub-committees are given respective duties to perform	ABC members are not well trained on DRR
Increasing DRR awareness	ABC has no income earning activities
ABC comprises members from various occupations	Meeting are not held regularly
Treasurer of ABC is a Woman	Attendance in ABC meeting by the members is poor
Villagers pay monthly subscription for CS management	No annual work plan, ABC members are not aware of their roles
ABC members attend various training sessions	Lack of trust among the ABC members, conflicts among members
CS is equipped with water, solar, power	ABC members are unwilling to work voluntarily
Women get opportunity to participate in CS management	Less participation in ABC from poor families
Both men and women involved in CS management	Poor people are not holding portfolio in the ABC
Women members attend ABC meetings	Delay in depositing funds to bank account
ABCs are developing CS-based business plans	ABC members lack fund rising skills
	All papers and documents not up to date
	Shortage of furniture for officials /meeting purposes
	ABC members lack skill in account management
	Women are unwilling and often not attend in ABC meetings
	Villagers unaware of meeting decisions
	Women members lack capacity
	Some ABCs suffer from political influence
	Lack of accountability, general members reluctant to participate
	All ABC members not aware of funds
	More than one members in ABC from a family (Kulsum Gani CS, Morrelgonj)
	All members do not get chance to speak in meetings
	Meeting minutes not written (Sirazuddin M.M CS, Morrelgonj)
	Treasurer and Secretary do not attend ABC meetings and have taken all documents of CS (Sirazuddin M.M CS, Morrelgonj)
	Land donors in ABC and influence/ dominate meeting decisions (Sirazuddin M.M. CS, Morrelgonj)

Appendix 3

Opportunities and Threats

Opportunities	Threats
Long term security for communities during disaster events	Land donors may influence and use the CS for their personal purposes
Source of earning income – by renting CS to other users for various purposes	Land donors may dominate CS management after phasing out of the project
Shelter facilities for cattle would encourage people to rear more cattle	Conflict may arise between the land donors and ABC members on keeping control over CS keys
A community place for various social, cultural and religious purposes	Land donors may use the CS personally during normal times free of charge
Can improve health & nutrition conditions through using the CS as training venue, family planning, vaccination camps, awareness	Weak conditions in land donating deeds may encourage land owners to occupy the CS
May improve local production systems through using the CS as training venue, information centers, farmers field school	There may be conflict among the land donors in case where more than one people donated lands (Kulsum Gani CS, Morrelgonj)
Potential to change status of women by providing various income earning schemes for women	Land donors do not want other people in the village should hold important portfolio of ABC
Bring womenfolk out of homes and engage in community development activities	CS may be threatened due to river erosion and dyke failure
Can improve literacy rate through using as adult learning school, ECD (early childhood development), coaching centre, technical learning	Future O&M cost could be higher and due to lack of funds O&M activities may be stopped in future
NGOs /different projects can use CS as office thus can better serve the people	If not properly maintained the valuable materials like solar, fan, generator can be damaged
Contribute to livestock & poultry health by using CSs as vaccination centers	Due to religious reasons women members may resign from ABCs
Can reduce dependency on UP for conflict resolution– ABC may resolve such issues	Political influence and grouping may hamper ABC functions and CSs could be used for political purposes
Can be good demonstration facilities - poultry and vegetables farming, aquaculture, nursery, etc.	Villagers may stop giving subscription in future
As permanent office room for ABC	Due to poor communication system some CSs may not be used by other agencies on rent
	CSs may become abandoned due to conflicts and non functioning of ABCs

Appendix-4

Box 1: Discussion on the Results of CBA of Different DRR Projects

IFRC (2002) had an ex-post evaluation of a Red Cross implemented mangrove plantation project for protection of coastal population against typhoons and storms in Vietnam where it found that the benefit of the project outweighed the cost by 52 times only in terms of saved dyke maintenance cost apart from other unaccounted tangible and intangible benefits.

A disaster mitigation and preparedness program in Bihar and Andhra provinces in India that helped reducing direct social and economic losses and indirect economic impacts was studied by Venton and Venton (2004) that showed a range of BC ratios from 3.17 to 4.58 in Bihar and 3.70 to 20.05 in Andhra province. Both the study used mixed methods i.e. qualitative and quantitative where survey and participatory approaches with communities were used to gather primary data and CBA of individual activities were conducted as part of wider evaluation.

A conglomerated disaster mitigation program implemented jointly by both British and Nepal Red Cross Society that primarily constructed evacuation shelters and other integrated structural, non-structural and livelihood activities to strengthen overall resilience, including riverbank strengthening, community organization, first-aid training and providing income-generation facilities in Ilam district of Nepal yielded a CB ratio of 19 (IFRC 2010).

Appendix-5

Table Showing the disaster risks and consequences that can be addressed by SDC-MCS and also those that can be included and monetized for Cost Benefit Analysis

		Losses and Effects		Addressable by SDC-MCS		Inclusionary for MCS-CBA	
Consequences/ Risks	**Measuring tool**	**Tangible (Tan)**	**Intangible (Intan)**	**Tan**	**Intan.**	**Tan**	**Intan.**
Deaths	Number of people	Loss of economically active individuals	Social and psychological effects on remaining community	Yes	Yes	No	No
Injuries	Number and injury severity	Medical treatment needs, temporary loss of economic activity by productive individuals	Social and psychological pain and recovery	Yes	Yes	Yes	No
Livestock Loss	Number and current market price of livestock	Value of lost livestock	Effects on livelihoods and discouraging effects on rearing further	Yes	Yes	Yes	Yes
Physical Damage	Inventory of damaged elements by number and damaged level	Replacement and repair costs	Cultural losses	No	No	No	No
Emergency Operations	Volume of labor, workdays employed, equipment and resources	Mobilization costs, investment in preparedness capability	Stress and overwork in relief participants	Yes, partially	Yes, partially	No	No
Disruption to Economy	Number of working days lost, volume of production lost	Value of lost production	Opportunities, competitiveness and reputation	Yes, partially	Yes, partially	No	No
Social Disruption	Number of displaced persons, homeless	Temporary housing, relief, economic production, community morale	Psychological social contacts, cohesion	Yes, partially	Yes, partially	No	No
Environmental Impact	Scale and Severity	Clean-up costs, repair cost	Poorer ecosystem services, health risk and risk of future disaster	No	No	No	No

Appendix -6

Cost : Shelter-wise and Overall Project Cost

Shelter	Hogolpati I	Hogolpati II	Kaolia I	Kaolia II	Dhansagar	E. Khontakata	Jilbunia	Rajoir	Varanipara	Adorshogram	Sonatola I	Sonatola II
Est Cost	13,100,000	12,300,000	10,600,000	10,900,000	13,000,000	14,300,000	12,900,000	15,300,000	15,100,000	15,100,000	12,400,000	13,000,000
Mobilization Cost	1,309,684	1,309,684	1,309,684	1,309,684	1,309,684	1,309,684	1,309,684	1,309,684	1,309,684	1,309,684	1,309,684	1,309,684
Foregone net Benefits	180,000	300,000	300,000	300,000	180,000	180,000	180,000	180,000	180,000	210,000	0	150,000
Projected Yrly Expenses	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520

* Yearly expenses of shelter operation has been considered as constant excluding market factors (price, inflation etc) ; so has been done for the yearly benefit

Periodical Refurbishment	After five years BDT 50,000 has been estimated to require for the refurbishment and repairing in each 5th year	
Post-Disaster Refurbishment	A major cyclonic storm has been predicted every after 20 years from the immediate past major disaster (for the next one the immediate past is SIDR 2007) after which each shelter needs to undergo major repair and maintenance- assumed cost is BDT 500,000 /refurbishment. Therefore three major disaster point has been assumed as 2028, 2048, and 2068 i.e. in Shelter Yr. 16, 36, and 56	
Discount rate	8%	Reasonable Life time of the Shelter Building has been estimated as 60 yrs.

Cost Calculation- Shelter wise

Year	Hogolpati I	Hogolpati II	Kaolia I	Kaolia II	Dhansagar	E. Khontakata	Jilbunia	Rajoir	Varanipara	Adorshogram	Sonatola I	Sonatola II
1	14,610,804	13,930,804	12,230,804	12,530,804	14,506,604	15,812,004	14,412,004	16,812,004	16,612,004	16,640,804	13,727,204	14,477,204
2	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
3	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
4	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
5	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520

Year	Hogolpati I	Hogolpati II	Kaolia I	Kaolia II	Dhansagar	E. Khontakata	Jilbunia	Rajoir	Varanipara	Adorshogram	Sonatola I	Sonatola II
6	71,120	71,120	71,120	71,120	66,920	72,320	72,320	72,320	72,320	71,120	67,520	67,520
7	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
8	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
9	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
10	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
11	71,120	71,120	71,120	71,120	66,920	72,320	72,320	72,320	72,320	71,120	67,520	67,520
12	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
13	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
14	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
15	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
16	571,120	571,120	571,120	571,120	566,920	572,320	572,320	572,320	572,320	571,120	567,520	567,520
17	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
18	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
19	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
20	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
21	71,120	71,120	71,120	71,120	66,920	72,320	72,320	72,320	72,320	71,120	67,520	67,520
22	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
23	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
24	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
25	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
26	71,120	71,120	71,120	71,120	66,920	72,320	72,320	72,320	72,320	71,120	67,520	67,520
27	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
28	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
29	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
30	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
31	71,120	71,120	71,120	71,120	66,920	72,320	72,320	72,320	72,320	71,120	67,520	67,520
32	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
33	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
34	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
35	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
36	571,120	571,120	571,120	571,120	566,920	572,320	572,320	572,320	572,320	571,120	567,520	567,520
37	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
38	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
39	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520

Year	Hogolpati I	Hogolpati II	Kaolia I	Kaolia II	Dhansagar	E. Khontakata	Jilbunia	Rajoir	Varanipara	Adorshogram	Sonatola I	Sonatola II
40	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
41	71,120	71,120	71,120	71,120	66,920	72,320	72,320	72,320	72,320	71,120	67,520	67,520
42	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
43	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
44	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
45	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
46	71,120	71,120	71,120	71,120	66,920	72,320	72,320	72,320	72,320	71,120	67,520	67,520
47	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
48	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
49	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
50	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
51	71,120	71,120	71,120	71,120	66,920	122,320	122,320	122,320	72,320	71,120	67,520	67,520
52	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
53	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
54	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
55	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
56	571,120	571,120	571,120	571,120	566,920	572,320	572,320	572,320	572,320	571,120	567,520	567,520
57	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
58	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
59	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
60	21,120	21,120	21,120	21,120	16,920	22,320	22,320	22,320	22,320	21,120	17,520	17,520
Shelter Total	17,906,884	17,226,884	15,526,884	15,826,884	17,554,884	19,228,884	17,828,884	20,228,884	19,978,884	19,936,884	16,810,884	17,560,884
	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
PV Total	14,051,547	13,421,918	11,847,844	12,125,621	13,906,973	15,178,497	13,882,201	16,104,423	15,918,251	15,931,177	13,192,177	13,886,621
Total Cost	**169,447,251**											

Appendix 7

Benefit Calculation

	1968	1988	2007
Average Shelterable Livestock i.e. Cow, goat, buffalo, sheep possession per household:	12	7	4

	Cow	Goat	Buffalo	Sheep
The Ratio of Shelterable Lost Animal During the past three major disasters:	60	35	3	2

Average Current Market Price/Livestock Lost:

	%	tk.	
cow	60	15000	900000
goat	35	4000	140000
buffalow	3	25000	75000
sheep	2	3500	7000
	100		1122000
		avg	**11220**

Average Value of Working days lost due to human injury:

	No of Persons	Male	Female	
1968	63	11340	6300	
1988	54	9720	5400	
2007	282	50760	28200	
Total	399	71820	39900	**280**

	Ratio	Wage rate	Days Lost/PP
Male	40%	300	300
Female	60%	250	300

Daily wage rate for male has been estimated as tk. 300 for male and tk. 250 for female; and number of days lost by per injured person has been estimated as 300 days (as revealed from FGD)

Discount rate : 8% (largely used as a thumbrule for infrastrucre and social project)

Shelter Lifetime: 60 Yrs

Potential benefit that may come from the ground level space of the shelter by using it as a venue for daily haat/bazaar has not been considered

	No of Households			Shelterable Livestock Possesion			Estimated Livestock Loss in Numbers		
Shelter	**1968**	**1988**	**2007**	**1968**	**1988**	**2007**	**1968**	**1988**	**2007**
Hogolpati I	117	245	317	1404	1715	1268	983	1,029	634
Hogolpati II	90	190	320	1080	1330	1280	756	798	640
Kaolia I	70	150	230	840	1050	920	588	630	460
Kaolia II	80	140	230	960	980	920	672	588	460
Dhansagar	85	140	185	1020	980	740	714	588	370
East Khontakata	75	135	200	900	945	800	630	567	400
Jilbunia	80	150	210	960	1050	840	672	630	420
Rajoir	90	155	212	1080	1085	848	756	651	424
Varanipara	65	140	245	780	980	980	546	588	490
Adorshogram	80	225	300	960	1575	1200	672	945	600
Sonatola I	40	120	170	480	840	680	336	504	340
Sonatola II	55	115	175	660	805	700	462	483	350
	927	1905	2794				7,787	8,001	5,588

(….continued…)

Shelter	**Avg./Event/ Shelter**	**Shelterable /Event**	**Human Injuries**			**Value of Livestock Loss avoidance**	**Value of productivity loss avoided**	**Profit from Business Operation**
			1968	**1988**	**2007**			
Hogolpati I	882	500	7	5	0	16,830,000	1008000	26140
Hogolpati II	731	500	0	0	0	16,830,000	0	27364
Kaolia I	559	500	9	0	20	16,830,000	2436000	25132
Kaolia II	573	500	0	2	0	16,830,000	168000	24232
Dhansagar	557	500	1	0	0	16,830,000	84000	17164
East Khontakata	532	500	3	7	16	16,830,000	2184000	23728
Jilbunia	574	500	0	0	20	16,830,000	1680000	23944
Rajoir	610	500	7	4	14	16,830,000	2100000	23641
Varanipara	541	500	18	3	70	16,830,000	7644000	25930
Adorshogram	739	500	10	0	61	16,830,000	5964000	23770
Sonatola I	393	393	3	15	45	13,228,380	5292000	18928
Sonatola II	432	432	5	18	36	14,541,120	4956000	18412
	7,125	5,825	63	54	282	239,836,476	33,516,000	278,385

Benefit Calculation- Shelter wise

Year	Hogolpati I	Hogolpati II	Kaolia I	Kaolia II	Dhansagar	E. Khontakata	Jilbunia	Rajoir	Varanipara	Adorshogram	Sonatola I	Sonatola II
1	17,864,140	16,857,364	19291132	17,022,232	16,931,164	19,037,728	18,533,944	18,953,641	24,499,930	22,817,770	18,539,308	19,515,532
2	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
3	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
4	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
5	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
6	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
7	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
8	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
9	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
10	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
11	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
12	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
13	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
14	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
15	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
16	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
17	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
18	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
19	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
20	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
21	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
22	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
23	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
24	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
25	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
26	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
27	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
28	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
29	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
30	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
31	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
32	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
33	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
34	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
35	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
36	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
37	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
38	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
39	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
40	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
41	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
42	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
43	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
44	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412

Year	Hogolpati I	Hogolpati II	Kaolia I	Kaolia II	Dhansagar	E. Khontakata	Jilbunia	Rajoir	Varanipara	Adorshogram	Sonatola I	Sonatola II
45	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
46	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
47	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
48	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
49	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
50	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
51	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
52	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
53	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
54	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
55	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
56	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
57	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
58	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
59	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
60	26140	27364	25132	24232	17164	23728	23944	23641	25930	23770	18928	18412
Total	19,406,400											
DR	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
PV Total	16,840,190	15,922,005	18,149,936	16,038,797	15,873,542	17,899,226	17,435,233	17,820,372	22,982,035	21,399,746	17,382,763	18,280,766
Benefit	**216,024,613.05**											
Cost	**169,447,251.00**											
BCR	**1.27**											
NVP	**46,577,362.05**											

Appendix-8

Shelter-wise IRR

Hogolpati 1

Yr	Costs	Benefits	Net Benefit
0	14,589,604	0	-14,589,604
1	21,120	17,864,140	17,843,020
2	21,120	26140	5,020
3	21,120	26140	5,020
4	21,120	26140	5,020
5	71,120	26140	5,020
6	21,120	26140	-44,980
7	21,120	26140	5,020
8	21,120	26140	5,020
9	21,120	26140	5,020
10	71,120	26140	5,020
11	21,120	26140	-44,980
12	21,120	26140	5,020
13	21,120	26140	5,020
14	21,120	26140	5,020
15	571,120	26140	5,020
16	21,120	26140	-544,980
17	21,120	26140	5,020
18	21,120	26140	5,020
19	21,120	26140	5,020
20	71,120	26140	5,020
21	21,120	26140	-44,980
22	21,120	26140	5,020
23	21,120	26140	5,020
24	21,120	26140	5,020
25	71,120	26140	5,020
26	21,120	26140	-44,980
27	21,120	26140	5,020
28	21,120	26140	5,020
29	21,120	26140	5,020
30	71,120	26140	5,020
31	21,120	26140	-44,980
32	21,120	26140	5,020
33	21,120	26140	5,020
34	21,120	26140	5,020
35	571,120	26140	5,020
36	21,120	26140	-544,980
37	21,120	26140	5,020
38	21,120	26140	5,020
39	21,120	26140	5,020
40	71,120	26140	5,020
41	21,120	26140	-44,980
42	21,120	26140	5,020
43	21,120	26140	5,020
44	21,120	26140	5,020
45	71,120	26140	5,020
46	21,120	26140	-44,980
47	21,120	26140	5,020
48	21,120	26140	5,020
49	21,120	26140	5,020
50	71,120	26140	5,020

Hogolpati 2

Yr.	Costs	Benefits	Net Benefit
0	13909684	0	-13909684
1	21,120	16857364	16836244
2	21,120	27364	6244
3	21,120	27364	6244
4	21,120	27364	6244
5	71,120	27364	-43756
6	21,120	27364	6244
7	21,120	27364	6244
8	21,120	27364	6244
9	21,120	27364	6244
10	71,120	27364	-43756
11	21,120	27364	6244
12	21,120	27364	6244
13	21,120	27364	6244
14	21,120	27364	6244
15	571,120	27364	-543756
16	21,120	27364	6244
17	21,120	27364	6244
18	21,120	27364	6244
19	21,120	27364	6244
20	71,120	27364	-43756
21	21,120	27364	6244
22	21,120	27364	6244
23	21,120	27364	6244
24	21,120	27364	6244
25	71,120	27364	-43756
26	21,120	27364	6244
27	21,120	27364	6244
28	21,120	27364	6244
29	21,120	27364	6244
30	71,120	27364	-43756
31	21,120	27364	6244
32	21,120	27364	6244
33	21,120	27364	6244
34	21,120	27364	6244
35	571,120	27364	-543756
36	21,120	27364	6244
37	21,120	27364	6244
38	21,120	27364	6244
39	21,120	27364	6244
40	71,120	27364	-43756
41	21,120	27364	6244
42	21,120	27364	6244
43	21,120	27364	6244
44	21,120	27364	6244
45	71,120	27364	-43756
46	21,120	27364	6244
47	21,120	27364	6244
48	21,120	27364	6244
49	21,120	27364	6244
50	71,120	27364	-43756

Yr	Costs	Benefits	Net Benefit
51	21,120	26140	-44,980
52	21,120	26140	5,020
53	21,120	26140	5,020
54	21,120	26140	5,020
55	571,120	26140	5,020
56	21,120	26140	-544,980
57	21,120	26140	5,020
58	21,120	26140	5,020
59	21,120	26140	5,020
60	21,120	26140	5,020
		IRR	**22%**

Yr.	Costs	Benefits	Net Benefit
51	21,120	27364	6244
52	21,120	27364	6244
53	21,120	27364	6244
54	21,120	27364	6244
55	571,120	27364	-543756
56	21,120	27364	6244
57	21,120	27364	6244
58	21,120	27364	6244
59	21,120	27364	6244
60	21,120	27364	6244
		IRR	**21%**

Kaolia 1

Yr	Costs	Benefits	Net Benefit
0	12,209,684	0	-12,209,684
1	21,120	19291132	19,270,012
2	21,120	25132	4,012
3	21,120	25132	4,012
4	21,120	25132	4,012
5	71,120	25132	4,012
6	21,120	25132	-45,988
7	21,120	25132	4,012
8	21,120	25132	4,012
9	21,120	25132	4,012
10	71,120	25132	4,012
11	21,120	25132	-45,988
12	21,120	25132	4,012
13	21,120	25132	4,012
14	21,120	25132	4,012
15	571,120	25132	4,012
16	21,120	25132	-545,988
17	21,120	25132	4,012
18	21,120	25132	4,012
19	21,120	25132	4,012
20	71,120	25132	4,012
21	21,120	25132	-45,988
22	21,120	25132	4,012
23	21,120	25132	4,012
24	21,120	25132	4,012
25	71,120	25132	4,012
26	21,120	25132	-45,988
27	21,120	25132	4,012
28	21,120	25132	4,012
29	21,120	25132	4,012
30	71,120	25132	4,012
31	21,120	25132	-45,988
32	21,120	25132	4,012
33	21,120	25132	4,012
34	21,120	25132	4,012
35	571,120	25132	4,012
36	21,120	25132	-545,988
37	21,120	25132	4,012
38	21,120	25132	4,012
39	21,120	25132	4,012
40	71,120	25132	4,012
41	21,120	25132	-45,988
42	21,120	25132	4,012

Kaolia 2

Yr.	Costs	Benefits	Net Benefit
0	12488564	0	-12488564
1	21,120	17022232	17001112
2	21,120	27364	6244
3	21,120	27364	6244
4	21,120	27364	6244
5	71,120	27364	-43756
6	21,120	27364	6244
7	21,120	27364	6244
8	21,120	27364	6244
9	21,120	27364	6244
10	71,120	27364	-43756
11	21,120	27364	6244
12	21,120	27364	6244
13	21,120	27364	6244
14	21,120	27364	6244
15	571,120	27364	-543756
16	21,120	27364	6244
17	21,120	27364	6244
18	21,120	27364	6244
19	21,120	27364	6244
20	71,120	27364	-43756
21	21,120	27364	6244
22	21,120	27364	6244
23	21,120	27364	6244
24	21,120	27364	6244
25	71,120	27364	-43756
26	21,120	27364	6244
27	21,120	27364	6244
28	21,120	27364	6244
29	21,120	27364	6244
30	71,120	27364	-43756
31	21,120	27364	6244
32	21,120	27364	6244
33	21,120	27364	6244
34	21,120	27364	6244
35	571,120	27364	-543756
36	21,120	27364	6244
37	21,120	27364	6244
38	21,120	27364	6244
39	21,120	27364	6244
40	71,120	27364	-43756
41	21,120	27364	6244
42	21,120	27364	6244

Yr	Costs	Benefits	Net Benefit
43	21,120	25132	4,012
44	21,120	25132	4,012
45	71,120	25132	4,012
46	21,120	25132	-45,988
47	21,120	25132	4,012
48	21,120	25132	4,012
49	21,120	25132	4,012
50	71,120	25132	4,012
51	21,120	25132	-45,988
52	21,120	25132	4,012
53	21,120	25132	4,012
54	21,120	25132	4,012
55	571,120	25132	4,012
56	21,120	25132	-545,988
57	21,120	25132	4,012
58	21,120	25132	4,012
59	21,120	25132	4,012
60	21,120	25132	4,012
		IRR	**58%**

Yr.	Costs	Benefits	Net Benefit
43	21,120	27364	6244
44	21,120	27364	6244
45	71,120	27364	-43756
46	21,120	27364	6244
47	21,120	27364	6244
48	21,120	27364	6244
49	21,120	27364	6244
50	71,120	27364	-43756
51	21,120	27364	6244
52	21,120	27364	6244
53	21,120	27364	6244
54	21,120	27364	6244
55	571,120	27364	-543756
56	21,120	27364	6244
57	21,120	27364	6244
58	21,120	27364	6244
59	21,120	27364	6244
60	21,120	27364	6244
		IRR	**36%**

Dhansagar

Yr	Costs	Benefits	Net Benefit
0	14,489,684	0	-14,489,684
1	16,920	16931164	16,914,244
2	16,920	17164	244
3	16,920	17164	244
4	16,920	17164	244
5	66,920	17164	-49,756
6	16,920	17164	244
7	16,920	17164	244
8	16,920	17164	244
9	16,920	17164	244
10	66,920	17164	-49,756
11	16,920	17164	244
12	16,920	17164	244
13	16,920	17164	244
14	16,920	17164	244
15	566,920	17164	-549,756
16	16,920	17164	244
17	16,920	17164	244
18	16,920	17164	244
19	16,920	17164	244
20	66,920	17164	-49,756
21	16,920	17164	244
22	16,920	17164	244
23	16,920	17164	244
24	16,920	17164	244
25	66,920	17164	-49,756
26	16,920	17164	244
27	16,920	17164	244
28	16,920	17164	244
29	16,920	17164	244
30	66,920	17164	-49,756
31	16,920	17164	244
32	16,920	17164	244
33	16,920	17164	244
34	16,920	17164	244

East Khontakata

Yr.	Costs	Benefits	Net Benefit
0	15789684	0	-15789684
1	22,320	19037728	19015408
2	22,320	23728	1408
3	22,320	23728	1408
4	22,320	23728	1408
5	72,320	23728	-48592
6	22,320	23728	1408
7	22,320	23728	1408
8	22,320	23728	1408
9	22,320	23728	1408
10	72,320	23728	-48592
11	22,320	23728	1408
12	22,320	23728	1408
13	22,320	23728	1408
14	22,320	23728	1408
15	572,320	23728	-548592
16	22,320	23728	1408
17	22,320	23728	1408
18	22,320	23728	1408
19	22,320	23728	1408
20	72,320	23728	-48592
21	22,320	23728	1408
22	22,320	23728	1408
23	22,320	23728	1408
24	22,320	23728	1408
25	72,320	23728	-48592
26	22,320	23728	1408
27	22,320	23728	1408
28	22,320	23728	1408
29	22,320	23728	1408
30	72,320	23728	-48592
31	22,320	23728	1408
32	22,320	23728	1408
33	22,320	23728	1408
34	22,320	23728	1408

Yr	Costs	Benefits	Net Benefit
35	566,920	17164	-549,756
36	16,920	17164	244
37	16,920	17164	244
38	16,920	17164	244
39	16,920	17164	244
40	66,920	17164	-49,756
41	16,920	17164	244
42	16,920	17164	244
43	16,920	17164	244
44	16,920	17164	244
45	66,920	17164	-49,756
46	16,920	17164	244
47	16,920	17164	244
48	16,920	17164	244
49	16,920	17164	244
50	66,920	17164	-49,756
51	16,920	17164	244
52	16,920	17164	244
53	16,920	17164	244
54	16,920	17164	244
55	566,920	17164	-549,756
56	16,920	17164	244
57	16,920	17164	244
58	16,920	17164	244
59	16,920	17164	244
60	16,920	17164	244
		IRR	**16%**

Yr.	Costs	Benefits	Net Benefit
35	572,320	23728	-548592
36	22,320	23728	1408
37	22,320	23728	1408
38	22,320	23728	1408
39	22,320	23728	1408
40	72,320	23728	-48592
41	22,320	23728	1408
42	22,320	23728	1408
43	22,320	23728	1408
44	22,320	23728	1408
45	72,320	23728	-48592
46	22,320	23728	1408
47	22,320	23728	1408
48	22,320	23728	1408
49	22,320	23728	1408
50	122,320	23728	-98592
51	22,320	23728	1408
52	22,320	23728	1408
53	22,320	23728	1408
54	22,320	23728	1408
55	572,320	23728	-548592
56	22,320	23728	1408
57	22,320	23728	1408
58	22,320	23728	1408
59	22,320	23728	1408
60	22,320	23728	1408
		IRR	**20%**

Jilbunia

Yr	Costs	Benefits	Net Benefit
0	14,389,684	0	-14,389,684
1	22,320	18533944	18,511,624
2	22,320	23944	1,624
3	22,320	23944	1,624
4	22,320	23944	1,624
5	72,320	23944	-48,376
6	22,320	23944	1,624
7	22,320	23944	1,624
8	22,320	23944	1,624
9	22,320	23944	1,624
10	72,320	23944	-48,376
11	22,320	23944	1,624
12	22,320	23944	1,624
13	22,320	23944	1,624
14	22,320	23944	1,624
15	572,320	23944	-548,376
16	22,320	23944	1,624
17	22,320	23944	1,624
18	22,320	23944	1,624
19	22,320	23944	1,624
20	72,320	23944	-48,376
21	22,320	23944	1,624
22	22,320	23944	1,624
23	22,320	23944	1,624
24	22,320	23944	1,624
25	72,320	23944	-48,376
26	22,320	23944	1,624

Rajoir

Yr.	Costs	Benefits	Net Benefit
0	16767364	0	-16767364
1	22,320	18953641	18931321
2	22,320	23728	1408
3	22,320	23728	1408
4	22,320	23728	1408
5	72,320	23728	-48592
6	22,320	23728	1408
7	22,320	23728	1408
8	22,320	23728	1408
9	22,320	23728	1408
10	72,320	23728	-48592
11	22,320	23728	1408
12	22,320	23728	1408
13	22,320	23728	1408
14	22,320	23728	1408
15	572,320	23728	-548592
16	22,320	23728	1408
17	22,320	23728	1408
18	22,320	23728	1408
19	22,320	23728	1408
20	72,320	23728	-48592
21	22,320	23728	1408
22	22,320	23728	1408
23	22,320	23728	1408
24	22,320	23728	1408
25	72,320	23728	-48592
26	22,320	23728	1408

Yr	Costs	Benefits	Net Benefit
27	22,320	23944	1,624
28	22,320	23944	1,624
29	22,320	23944	1,624
30	72,320	23944	-48,376
31	22,320	23944	1,624
32	22,320	23944	1,624
33	22,320	23944	1,624
34	22,320	23944	1,624
35	572,320	23944	-548,376
36	22,320	23944	1,624
37	22,320	23944	1,624
38	22,320	23944	1,624
39	22,320	23944	1,624
40	72,320	23944	-48,376
41	22,320	23944	1,624
42	22,320	23944	1,624
43	22,320	23944	1,624
44	22,320	23944	1,624
45	72,320	23944	-48,376
46	22,320	23944	1,624
47	22,320	23944	1,624
48	22,320	23944	1,624
49	22,320	23944	1,624
50	122,320	23944	-98,376
51	22,320	23944	1,624
52	22,320	23944	1,624
53	22,320	23944	1,624
54	22,320	23944	1,624
55	572,320	23944	-548,376
56	22,320	23944	1,624
57	22,320	23944	1,624
58	22,320	23944	1,624
59	22,320	23944	1,624
60	22,320	23944	1,624
		IRR	**28%**

Yr.	Costs	Benefits	Net Benefit
27	22,320	23728	1408
28	22,320	23728	1408
29	22,320	23728	1408
30	72,320	23728	-48592
31	22,320	23728	1408
32	22,320	23728	1408
33	22,320	23728	1408
34	22,320	23728	1408
35	572,320	23728	-548592
36	22,320	23728	1408
37	22,320	23728	1408
38	22,320	23728	1408
39	22,320	23728	1408
40	72,320	23728	-48592
41	22,320	23728	1408
42	22,320	23728	1408
43	22,320	23728	1408
44	22,320	23728	1408
45	72,320	23728	-48592
46	22,320	23728	1408
47	22,320	23728	1408
48	22,320	23728	1408
49	22,320	23728	1408
50	72,320	23728	-48592
51	22,320	23728	1408
52	22,320	23728	1408
53	22,320	23728	1408
54	22,320	23728	1408
55	572,320	23728	-548592
56	22,320	23728	1408
57	22,320	23728	1408
58	22,320	23728	1408
59	22,320	23728	1408
60	22,320	23728	1408
		IRR	**24%**

Varanipara

Yr	Costs	Benefits	Net Benefit
0	16,567,364	0	-16,567,364
1	22,320	24499930	24,477,610
2	22,320	25930	3,610
3	22,320	25930	3,610
4	22,320	25930	3,610
5	72,320	25930	-46,390
6	22,320	25930	3,610
7	22,320	25930	3,610
8	22,320	25930	3,610
9	22,320	25930	3,610
10	72,320	25930	-46,390
11	22,320	25930	3,610
12	22,320	25930	3,610
13	22,320	25930	3,610
14	22,320	25930	3,610
15	572,320	25930	-546,390
16	22,320	25930	3,610
17	22,320	25930	3,610
18	22,320	25930	3,610

Adorshogram

Yr.	Costs	Benefits	Net Benefit
0	16619684	0	-16619684
1	21,120	22817770	22796650
2	21,120	23770	2650
3	21,120	23770	2650
4	21,120	23770	2650
5	71,120	23770	-47350
6	21,120	23770	2650
7	21,120	23770	2650
8	21,120	23770	2650
9	21,120	23770	2650
10	71,120	23770	-47350
11	21,120	23770	2650
12	21,120	23770	2650
13	21,120	23770	2650
14	21,120	23770	2650
15	571,120	23770	-547350
16	21,120	23770	2650
17	21,120	23770	2650
18	21,120	23770	2650

Yr	Costs	Benefits	Net Benefit
19	22,320	25930	3,610
20	72,320	25930	-46,390
21	22,320	25930	3,610
22	22,320	25930	3,610
23	22,320	25930	3,610
24	22,320	25930	3,610
25	72,320	25930	-46,390
26	22,320	25930	3,610
27	22,320	25930	3,610
28	22,320	25930	3,610
29	22,320	25930	3,610
30	72,320	25930	-46,390
31	22,320	25930	3,610
32	22,320	25930	3,610
33	22,320	25930	3,610
34	22,320	25930	3,610
35	572,320	25930	-546,390
36	22,320	25930	3,610
37	22,320	25930	3,610
38	22,320	25930	3,610
39	22,320	25930	3,610
40	72,320	25930	-46,390
41	22,320	25930	3,610
42	22,320	25930	3,610
43	22,320	25930	3,610
44	22,320	25930	3,610
45	72,320	25930	-46,390
46	22,320	25930	3,610
47	22,320	25930	3,610
48	22,320	25930	3,610
49	22,320	25930	3,610
50	72,320	25930	-46,390
51	22,320	25930	3,610
52	22,320	25930	3,610
53	22,320	25930	3,610
54	22,320	25930	3,610
55	572,320	25930	-546,390
56	22,320	25930	3,610
57	22,320	25930	3,610
58	22,320	25930	3,610
59	22,320	25930	3,610
60	22,320	25930	3,610
		IRR	**48%**

Yr.	Costs	Benefits	Net Benefit
19	21,120	23770	2650
20	71,120	23770	-47350
21	21,120	23770	2650
22	21,120	23770	2650
23	21,120	23770	2650
24	21,120	23770	2650
25	71,120	23770	-47350
26	21,120	23770	2650
27	21,120	23770	2650
28	21,120	23770	2650
29	21,120	23770	2650
30	71,120	23770	-47350
31	21,120	23770	2650
32	21,120	23770	2650
33	21,120	23770	2650
34	21,120	23770	2650
35	571,120	23770	-547350
36	21,120	23770	2650
37	21,120	23770	2650
38	21,120	23770	2650
39	21,120	23770	2650
40	71,120	23770	-47350
41	21,120	23770	2650
42	21,120	23770	2650
43	21,120	23770	2650
44	21,120	23770	2650
45	71,120	23770	-47350
46	21,120	23770	2650
47	21,120	23770	2650
48	21,120	23770	2650
49	21,120	23770	2650
50	71,120	23770	-47350
51	21,120	23770	2650
52	21,120	23770	2650
53	21,120	23770	2650
54	21,120	23770	2650
55	571,120	23770	-547350
56	21,120	23770	2650
57	21,120	23770	2650
58	21,120	23770	2650
59	21,120	23770	2650
60	21,120	23770	2650
		IRR	**37%**

Sonatola 1

Yr	Costs	Benefits	Net Benefit
0	13,709,684	0	-13,709,684
1	17,520	18539308	18,521,788
2	17,520	18928	1,408
3	17,520	18928	1,408
4	17,520	18928	1,408
5	67,520	18928	-48,592
6	17,520	18928	1,408
7	17,520	18928	1,408
8	17,520	18928	1,408
9	17,520	18928	1,408
10	67,520	18928	-48,592

Sonatola 2

Yr.	Costs	Benefits	Net Benefit
0	14459684	0	-14459684
1	17,520	19515532	19498012
2	17,520	18142	622
3	17,520	18142	622
4	17,520	18142	622
5	67,520	18142	-49378
6	17,520	18142	622
7	17,520	18142	622
8	17,520	18142	622
9	17,520	18142	622
10	67,520	18142	-49378

Yr	Costs	Benefits	Net Benefit
11	17,520	18928	1,408
12	17,520	18928	1,408
13	17,520	18928	1,408
14	17,520	18928	1,408
15	567,520	18928	-548,592
16	17,520	18928	1,408
17	17,520	18928	1,408
18	17,520	18928	1,408
19	17,520	18928	1,408
20	67,520	18928	-48,592
21	17,520	18928	1,408
22	17,520	18928	1,408
23	17,520	18928	1,408
24	17,520	18928	1,408
25	67,520	18928	-48,592
26	17,520	18928	1,408
27	17,520	18928	1,408
28	17,520	18928	1,408
29	17,520	18928	1,408
30	67,520	18928	-48,592
31	17,520	18928	1,408
32	17,520	18928	1,408
33	17,520	18928	1,408
34	17,520	18928	1,408
35	567,520	18928	-548,592
36	17,520	18928	1,408
37	17,520	18928	1,408
38	17,520	18928	1,408
39	17,520	18928	1,408
40	67,520	18928	-48,592
41	17,520	18928	1,408
42	17,520	18928	1,408
43	17,520	18928	1,408
44	17,520	18928	1,408
45	67,520	18928	-48,592
46	17,520	18928	1,408
47	17,520	18928	1,408
48	17,520	18928	1,408
49	17,520	18928	1,408
50	67,520	18928	-48,592
51	17,520	18928	1,408
52	17,520	18928	1,408
53	17,520	18928	1,408
54	17,520	18928	1,408
55	567,520	18928	-548,592
56	17,520	18928	1,408
57	17,520	18928	1,408
58	17,520	18928	1,408
59	17,520	18928	1,408
60	17,520	18928	1,408
		IRR	**35%**

Yr.	Costs	Benefits	Net Benefit
11	17,520	18142	622
12	17,520	18142	622
13	17,520	18142	622
14	17,520	18142	622
15	567,520	18142	-549378
16	17,520	18142	622
17	17,520	18142	622
18	17,520	18142	622
19	17,520	18142	622
20	67,520	18142	-49378
21	17,520	18142	622
22	17,520	18142	622
23	17,520	18142	622
24	17,520	18142	622
25	67,520	18142	-49378
26	17,520	18142	622
27	17,520	18142	622
28	17,520	18142	622
29	17,520	18142	622
30	67,520	18142	-49378
31	17,520	18142	622
32	17,520	18142	622
33	17,520	18142	622
34	17,520	18142	622
35	567,520	18142	-549378
36	17,520	18142	622
37	17,520	18142	622
38	17,520	18142	622
39	17,520	18142	622
40	67,520	18142	-49378
41	17,520	18142	622
42	17,520	18142	622
43	17,520	18142	622
44	17,520	18142	622
45	67,520	18142	-49378
46	17,520	18142	622
47	17,520	18142	622
48	17,520	18142	622
49	17,520	18142	622
50	67,520	18142	-49378
51	17,520	18142	622
52	17,520	18142	622
53	17,520	18142	622
54	17,520	18142	622
55	567,520	18142	-549378
56	17,520	18142	622
57	17,520	18142	622
58	17,520	18142	622
59	17,520	18142	622
60	17,520	18142	622
		IRR	**35%**