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Abbreviations

ACHS	Association for Community Health Services
ADB	Asian Development Bank
ADP	Annual Development Program
AEO	Agricultural Extension Officer
AEW	Agriculture Extension Worker
AEZ	Agro-ecological Zone
AL	Awami League
ATAO	Assistant Thana Agricultural Officer
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BFDC	Bangladesh Forest Industries Development Corporation
BFI	Bangladesh Forest Institute
BFRI	Bangladesh Forest Research Institute
BFS	Bangladesh Fertility Survey
BHN	Basic Human Needs
BIWTA	Bangladesh Inland Water Transportation Agency
BKB	Bangladesh Krish Bank
BMD	Bangladesh Meteorological Department
BPDB	Bangladesh Power Development Board
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BRRI	Bangladesh Rice Research Institute
BWDB	Bangladesh Water Development Board
CARE	Co-operative for American Relief Everywhere
CBR	Crude Birth Rate
CBFM	Community Based Fishery Management
CBWM	Community Based Wetland Management
CBO	Community Based Organization
CBV	Community Based Volunteer
CDC	Community Development Center
CDR	Crude Death Rate
CIDA	Canadian International Development Agency
CNRS	Center for Natural Resources Studies
CPR	Contraceptive Prevalence Rate
DAC	Development Assistance Committee
DAE	Department of Agricultural Extension
DANIDA	Danish International Development Agency
DD	Deputy Director
DFIG	Department for International Development of UK
DG	Director General
DHI	Danish Hydraulic Institute
DHS	Demographic and Health Survey
DICS	Development Information Communication Services
DMB	Disaster Management Bureau
DOE	Department of Environment

DoF	Department of Fisheries
DPHE	Department of Public Health Engineering
DTW	Deep Tubewell
ECA	Environmental Conservation Act
ECR	Environment Conservation Rules
EH	Eastern Hills (hydrological) Region
HER	Extended Hydrological Regions
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EU	European Union
FAO	Food and Agriculture Organization of the UN
FAP	Flood and Action Plan
FCDI	Flood Control, Drainage and Irrigation
FD	Forestry Department
FFWC	Flood Forecasting and Warning Centre
FFYP	Fifth Five Year Plan
FO	Fisheries Officer
FPP	CARE's Flood Proofing Project
FRB	Feeder Road Type-B
GCCR	Growth Center Connecting Road
GDMC	Gram Disaster Management Committee
GDP	Gross Domestic Product
GoB	Government of (the People's Republic of) Bangladesh
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit
HQ	Headquarters
HTW	Hand Tubewell
HYV	High Yield Variety
IDA	International Development Association
IDB	Islamic Development Bank
IEE	Initial Environmental Examination
IFAD	International Fund for Agricultural Development
IFSP	Integrated Food Security Program
IGA	Income Generating Activity
IMF	International Monetary Fund
JICA	Japan International Co-operation Agency
KFW	Kreditanstalt fur Wiederaufbau
KSS	Water User Group (Krissok Somboya Samity)
LCS	Labor Constructing Society
LDCs	Least Developed Countries
LGD	Local Government Division
LGEB	Local Government Engineering Bureau
LGED	Local Government Engineering Department
LGI	Local Government Institution
LLP	Low Lift Pump
LPS	Local Project Society
MLGRD&C	Ministry of Local Government, Rural Development and Cooperatives
MoA	Ministry of Agriculture

MOE	Minister of Education
MoEF	Ministry of Environment and Forest
MoFL	Ministry of Fisheries and Livestock
MoHFW	Ministry of Health and Family Welfare
MoI	Ministry of Industry
MoL	Ministry of Land
MoLGRDC	Ministry of Local Government, Rural Development and Co-operatives
MoWR	Ministry of Water Resources
MP	Member of Parliament
NC	North Central (hydrological) Region
NCBs	Nationalized Commercial Banks
NE	North East (hydrological) Region
NEMAP	National Environmental Management Action Plan
NEMIP	North-East Minor Irrigation Project
NEP	National Environmental Policy
NGO	Non-Governmental Organization
NPV	Net Present Value
NW	North West (hydrological) Region
NWMP	National Water Management Plan
Oxfam	Oxford Committee for famine Relief
PBS	Palli Bidyut Samity
PCM	Project Cycle Management
PIC	Project Implementation Committee
PIU	Project Implementation Unit
PLA	Participatory Learning and Action
PMO	Project Management Office
PMED	Primary and Mass Education Division
PRA	Participatory Rural Appraisal
PRDP	Participatory Rural Development Project
RDCD	Rural Development and Cooperatives
RDP	Rural Development Program
RDRS	Rangpur Dinajpur Rural Services
RE	Rivers and Estuary (hydrological) Region
REB	Rural Electrification Board
RIDP	Rural Infrastructure Development Program
RLCS	Rural Living Conditions Survey
RMG	Ready-made Garments
RRA	Rapid Rural Appraisal
RWP	Rural Works Program
SAARC	South Asian Association of Regional Cooperation
SC	South Central (hydrological) Region
SCF	Standard Conversion Factor
SE	South East (hydrological) Region
SEMP	Sustainable Environment Management Project
SIDA	Swedish International Development Cooperation Agency
SKS	Samaj Kallayan Sangstha
SOEs	State-owned Enterprise

SSWRDSP	Small Scale Water Resources Development Sector Project
STW	Shallow Tubewell
SW	South West (hydrological) Region
SWR	Shadow Wage Rate
TAO	Thana Agricultural Officer
TFR	Total Fertility Rate
TIP	Thana Irrigation Program
TLM	Total Literacy Movement
TTDC	Thana Training & Development Center
UB	Union Board
UC	Union Council
UCC	Union Coordination Committee
UCCA	Upazila Central Co-operative Associations
UHFWC	Union Health and Family Welfare Centre
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNO	Upasila Nirbahi Officer
UP	Union Parishad
USAID	US Agency of International Development
UZDMC	UZ Disaster Management Committee
VDC	Village Development Center
VO's	Village Organizations
VSC	Village Support Center
WARPO	Water Resources Planning Organization
WFP	World Food Programme
WID	Women in Development
WMCA	Water Management Cooperation Association Committee
WPW	Works Programme Wing

Bangla Terms

Akika	A Muslim festival held in connection with giving a name to the new born baby. It is a joyous occasion where invite guests including relations exchange presents and offer prayer to the Almighty Allah for His bestowing blessings to the new born.
Aman	Main monsoon rice crop
Aus	Late dry season, early monsoon rice crop
Bagda	Neocaridina sp.; Tiger Shrimp
Bangsho	Lineage
Baor	Oxbow lake - a crescent-shaped lake formed from an old section of river channel
Bari	homestead (might include more than one family)
Beel	Natural depression, normally a permanent or temporary water body or swamp
Bhadoi	monsoon season
Bheri	Fish culture in land enclosed by low dykes, which allow tidal water to flow over
Bigha	33 decimals or 0.33 acres
Bongolap	Rosa involucrate; a tree growin in Haor
Boro	Rabi season rice crop
Chailla	Hematheria protensa; a kind of grass grown in Haor, used for protection of mound from wave action
Char	Land newly formed by accretion of rivers
Chehlum	A special prayer for a departed soul, done after few days/weeks of death
Chira	Snacks made from rice (flat in shape)
Chula	A group that shares a common stove; household
Darbeshes	Old ultra religious person
Dhaincha	Leguminous crop; stalks are used for fencing and also for fuel
Dhancha	Thin and long local tree used extensively for fuel wood
Eid	Muslim major religious festival
Eid-ul-Azha	A muslim festival celebrated day after the Haj in Mecca
Eid-ul-Fitr	A muslim festival just after the Ramadan
Gher	Enclosure for shrimp cultivation
Golda	Panaeus monodon; Giant Freshwater Prawn
Gram	Village
Gur	Molases
Gushti	Lineage
Haor	Bowl-shaped natural depression between river levees, common in the North East
Hartal	Political protest, normally disrupting movement of people
Hijal	Barringtonia anutangula; a tree grown in Haor area, expected to used for reducing wave action
Ipil-ipil	A local variety of tree grown around the homestead
Jalmahal	Water body leased for capture fishing
Jhum	Shifting cultivation
Kacha	Makeshift (construction); unripe (fruit)
Kaisha	A local variety of local tree used mainly for fuel wood
Kanda	High and terrace land above flood levels in Haor area
Katha	Blanket
Khal	Channel
Khalashi	Sluice-gate operator
Kharif	Summer and monsoon cropping season

Khas	Government-owned land
Khatna	Circumcision
Koroch	Pongania pinnata; a tree growin in Haor area, expected to used for reducing wave action
Macha	Raized platform mostly by bamboo
Mahajan	Money lender
Maja	Shrine
Madrasha	Religious school
Matabbar	Influential people who act as a leader in a neighborhood through patron-client ties
Milad	A socio-religious ceremony performed by the muslims at large offering and gratefulness to the Almighty Allah for His bestowing mercy to people and providing worldly happiness.
Mohharam	Moharram is the first month of the Arabic calender. On the 10th of Mohharam the Ashura is observed with a mourning procession in remembrance of the martyr. While devout muslims keep fast during the day, special prayers are held in different localities followed by a milad.
Mouza	Sub-union administrative area
Muri	Snacks made from rice
Nakshi Katha	A hand made traditional Blanket
Oaz	Preaching on Islamic rules/life style done in religious gatherings
Palli	Rural
Panchayet	Village committee/society
Para	Village neighborhood consisting of a group of homesteads
Paribar	Related person who share meals; household
Parishad	Council
Paurashava	Municipality
Pucca	Solidly-built (construction); ripe (fruit)
Puja	Major Hindu festival
Rabi	Winter cropping season
Salish	Village council meetings which functions as resolving conflicts or regulating the villagers' behavior
Samaj	A group that is formed by followers of competing leaders
Samitee	An Association
Sarker	Government
Shomaj	Society
Thana	Sub-District administrative area
Union	Sub-Thana administrative area
Upazila	Alternative term for Thana
Zila	Alternative term for administrative District

1. INTRODUCTION

1.1 Study Background

Bangladesh, located on the low lying Bengali Delta formed by the three major rivers of Padma, Jamuna and Meghna, suffers from flood every year caused by the surface runoff out of the extensive river basins and the retard of drainage of rainfall over the land during the wet season. To cope with this chronic flood damage, Flood Control, Drainage and Irrigation Project (FCD/I), consisting of 58 huge projects aiming mainly at controlling flood, has been formulated since 1964 and then partly implemented. However, huge construction costs, long implementation period and technical problems made further implementation difficult.

After the devastating floods occurred in consecutive two years of 1987 and 1988, Bangladesh, in cooperation with donor countries and agencies under the initiative of the World Bank, initiated Flood Action Plan (FAP) to formulate comprehensive nation-wide plans against flood, and 26 studies have been conducted. While many studies have proposed structural measures to protect and/or control floods, others have introduced flood-proofing concept, which create better environment on living with floods allowing floods instead of controlling flood. The FAP studies have partly implemented up to date.

In the meantime, in July 1998, an unprecedented flood submerged three-fourth of the land area, brought about the loss of more than 1,000 lives as well as tremendous economic losses. Local people, especially living in flood vulnerable areas of Char and Haor were seriously suffered from the flood. Many of them have been evacuated from their living areas to municipalities nearby as well as Dhaka during the flood period, causing social problems due to poor shelter environment. Besides the steady population increase in the country, deteriorated environment in the upstream areas of the major rivers has been reported to exaggerate the flood scale. Under such situation, flood-proofing concept becomes increasingly important.

Local Government Engineering Department (LGED), established in 1992 under the Ministry of Local Government, Rural Development and Cooperatives (MLGRD&C), as a responsible agency for rural development, technology extension and rural infrastructure development, etc., has implemented small scale structural measures against flood, such as flood shelter, submersible embankment, etc., as well as non-structural measures like rural education and sanitation enlightenment. LGED, recognizing the necessity to formulate comprehensive flood measures according to the area specific conditions, requested the Government of Japan to extend a technical assistance on flood measures in flood vulnerable areas of Char and Haor in October 1999.

In response to the request, the Government of Japan through Japan International Cooperation Agency (JICA), an official agency of Japan responsible for extending technical assistance to developing countries, dispatched a preliminary mission to Bangladesh for 15 days from 5 to 19 of August, 2000, and the Scope of Work on the Study for Rural Development Focusing on Flood Proofing (the Study) was agreed and signed upon by both sides on 14 August.

Summary

1.2 Study Area and Objectives

(1) Study Area

The Study Areas to be covered by this technical cooperation are the Char area in four districts of Gaibandha, Jamalpur, Kurigram and Sirajganj and the Haor area in four districts of Habiganj, Kishoreganj, Netrokona and Sunamganj.

(2) Study Objectives

The study objectives, as agreed on by LGED and JICA, are:

- to formulate a master plan of flood-proofing in the study area;
- to conduct a feasibility study on the priority project(s); and
- to transfer technology to counterpart personnel in the course of the Study.

2. COUNTRY SETTING

2.1 Natural Condition

(1) Physiography

Situated on both sides of the Tropic of Cancer, Bangladesh lies within north latitudes 20°34' and 26°38' and east longitudes 88°01' and 92°41' and has a land area of about 147,540 sq. km. Although the country is generally termed as a flat alluvial plain, the physiography presents a considerable geographical divergence with about half of its area below 25ft (7.62m) contour line. Geologically the land is classified under three broad physiographic regions: the Tertiary Hills 12% (Chittagong Hill Tracts), the Pleistocene Uplands 8% (Madhupur Tract, Lalmai Hills and the Barind) and the Recent Plains 80% (areas other than those mentioned).

(2) Climate

The climate of Bangladesh is governed by two major weather regimes: the wet southwest monsoon that begins in May and continues through out September, and the dry northeast wind that begins in November and continues through mid-March. Mean annual rainfall ranges from about 1,200 mm in the west to almost 6,000 mm in the northeast. Tropical cyclones can occur in the pre- and post-monsoon seasons.

(3) The Major River System

Excepting the ones in the southeastern districts of greater Chittagong and the Hill Tracts, all rivers in the country belong to three major river systems - the Ganges, the Brahmaputra-Jamuna and the Meghna - having their origins in the neighboring upper riparian countries. The basin areas of the three rivers within Bangladesh account for only 7.5% of the total and the remaining 92.5% of the catchment lie outside in the neighboring countries. There exist about 300 rivers and channels of different sizes in the country. All the 3 major rivers and 47 others originate in the neighboring countries and carry their drainage flows through Bangladesh territory.

2.2 Socio-Economic Condition

With a present population of about 139 million, Bangladesh is the most densely populated country in the world. In December 1971, when Bangladesh gained Independence, its population was about 72 million and the rate of annual population growth was at least 2.5%.

Evolution of the Bangladesh economy's structure since Independence in 1972 has followed the path typical of developing countries, with a progressive reduction in Agriculture's share of GDP from 50% in 1972-73 to 29% in 1997-98, an increase from 38% to 54% in the services sector share and a modest growth in the industrial sector's share, from 13% to 17.5%. For most of this 26-year period the rate of economic growth has also been modest, at around 4%, greater than the rate of population growth but not sufficient to effect the radical economic transformation which is

Summary

necessary to raise living standards to more acceptable levels.

Official statistics show total GDP in 1996-97 as being some Tk. 1,400 billion (US\$ 32,900 million) at current market prices, equivalent to some US\$ 265 (about Tk. 13,000 at early 1999 exchange rates) per head. Despite the recent acceleration in growth rate, per capita incomes and standards of living are still extremely low.

2.3 Current Institutional Framework

(1) Central Government Institutions

Bangladesh has a unitary form of government. The President is the Head of State and the Prime Minister is the Head of Government. The Prime Minister is assisted by a Council of Ministers. The permanent officer-in-charge of the Ministries/Divisions is designated as Secretary who belongs to the Civil Service. There are now 35 Ministries and 52 Divisions. Altogether 37 central Government organizations, affiliated with 10 different Ministries, have been identified with functions relevant to the flood-proofing and rural development sector.

(2) LGED

LGED is headed by the Chief Engineer who is supported by 2 Additional Chief Engineers, 6 Superintending Engineers, 6 Executive Engineers and 6 Assistant Engineers at the HQ, 6 Superintending Engineers at the circles, 64 Executive Engineers at the districts and 463 Upazila Engineers at the upazilas. The total number of engineers and other staff under the permanent establishment of LGED is 9,600.

(3) NGO Activities

NGOs have grown very rapidly in Bangladesh since independence. If NGOs are broadly defined as private voluntary organizations, Bangladesh now has one of the largest concentrations of NGOs in the world. According to one estimate, there are at least 20,000 NGOs currently operating in Bangladesh. In 1995, the number of foreign-funded NGOs, registered with the NGO Affairs Bureau, was 986, compared to only 382 in 1990.

Almost 80% of the villages of Bangladesh have likely been covered by NGOs, but they directly benefit only around 24 million people, 20% of the population. NGOs which currently handle about 20% of the country's foreign-funded public investment programs- have been particularly effective in replicating successful projects, mounting nationwide campaigns, and advocating special issues. In particular, they have been highly successful in popularizing micro-credit. Currently about 65% of the total rural credit is disbursed by the NGOs.

2.4 Environmental Policies and Institutions

The National Environmental Policy (NEP, 1992) concerns in the water sector are broadly similar to

the fisheries policy, and this was echoed as a result of the National Environmental Management Action Plan studies. The objectives of the NEP are to: (1) maintain ecological balance and overall development through protection and improvement of the environment, (2) protect the country against natural disasters, (3) identify and regulate activities which pollute and degrade the environment, (4) ensure environmentally-sound development in all sectors, (5) ensure sustainable, long-term and environmentally sound use of all national resources, and (6) actively remain associate with all international environmental initiatives to the maximum possible extent.

The National Environment Management Action Plan (NEMAP) is published in 1992. NEMAP highlights the need for integrated management of wetlands, for emergency response systems and improved disaster preparedness, and for the Char management systems.

2.5 Floods

(1) People and the Flood

Annual floods are part of the natural environment of Bangladesh and people have adapted their lifestyle to accommodate them. However, in recent years, the characteristics of flood have changed for a number of reasons including change in landuse and man-made alterations to natural drainage systems. People's sorrows know no bounds when the severity of floods crosses the normal magnitude without some mitigation measures near at hands.

The low-lying regions of the country are worst affected in medium and severe floods due to disruption in communication, inundation of settlement areas, loss of properties, loss of crops and cattleheads, increased duration due to lack of adequate drainage etc. The Char areas of the major rivers are likewise extremely vulnerable to floods. Damage to crops and inundation of homestead associated with erosion, lack of normal facilities associated with other constraints make their life miserable especially during the flood season.

The floodwaters recede at a slower rate from the areas where land elevation is comparatively low. Due to the depressed land in the Haor areas the flood waters remain for a prolonged period causing miseries to the population. In those low lying areas, at the onset of monsoon's first flood in March to May, the paddy fields-bearing Boro at the harvesting stage - are threatened to be submerged. In some years, the floodwater inundates and damages the only crop (Boro) just a few days before harvesting. A hurried cropping at an early stage may result in a poor output. During the entire monsoon period, people of the Haor areas live a miserable life due to inundation of homesteads, roads, markets and other infrastructure. The wave action from the vast mass of flood water cause erosion to the villages, roads and other infrastructure during this period.

After the catastrophic floods of 1987, 1988 and 1991, the latest devastating one occurred in July 1998 inundating three quarters of the land of the country. This caused loss of more than 1,000 lives and also serious economic hardship to the country. During these floods, the worst hit were the people of the low lying Haors and the Char areas.

Summary

(2) Classification of Floods

Flood in Bangladesh can be classified.

- (a) Flash-flood during a short period due to heavy rainfall in hilly areas,
- (b) River flood originated by rising of the water stage or overflow along the major river courses,
- (c) Inundation flood in retardant areas due to lack of drainage of the rainfall waters and
- (d) High tide flood nearby the coastal zone along the Bay of Bengal caused by the high tide of cyclones.

(3) Flood-Proofing

- (a) Structural flood-proofing

The Structural flood-proofing include small physical interventions like the raising of homestead, tube wells etc. above flood levels. Structural flood proofing also includes provisions of refuge areas or flood shelters, ideally with water supply and health facilities operating throughout the flood period. Flood-proofing also includes raising of roads above peak flood levels, providing additional bridges and culverts to improve water flows across, stabilizing of village mounds, embankments and structures against chance of their being washed out. Structural flood-proofing may also encompass the low height dry season roads that will be submersible during the flood period. The low height roads used during dry season will compensate to some extent for the absence of all-season normal roads above flood level in a technically or otherwise non-viable situation.

- (b) Non structural flood-proofing

Amongst the non-structural measures under flood-proofing, the following major items are included.

- (i) the institutional measures that coordinate the activities related to the flood-proofing, planning and development in flood prone areas, account for the prevailing hydrological conditions and ensure hydrological data and analysis are available to those involved with design and construction of infrastructure and other facilities,
- (ii) the evacuation facilities, community education for improved health etc. and
- (iii) erosion protection by plantation and homestead gardening, plantation for nutritional support, etc.

(4) Flood Forecasting and Warning System

Flood Forecasting and Warning Centre (FFWC) of BWDB was established in 1972. The UNDP

supported the FFWC through different projects from the inception till 1992. The FFWC received assistance for its improvement and expansion from DANIDA during 1991-1995 through a component of the FAP. Currently the DANIDA-assisted project “Consolidation and Strengthening of Flood Forecasting and Warning Services” is under implementation for the period from January 2000 to December 2004.

The services rendered by the FFWC in relation to the flood and flood warning information are being used by various organizations, government and non-government agencies for carrying out their own operations.

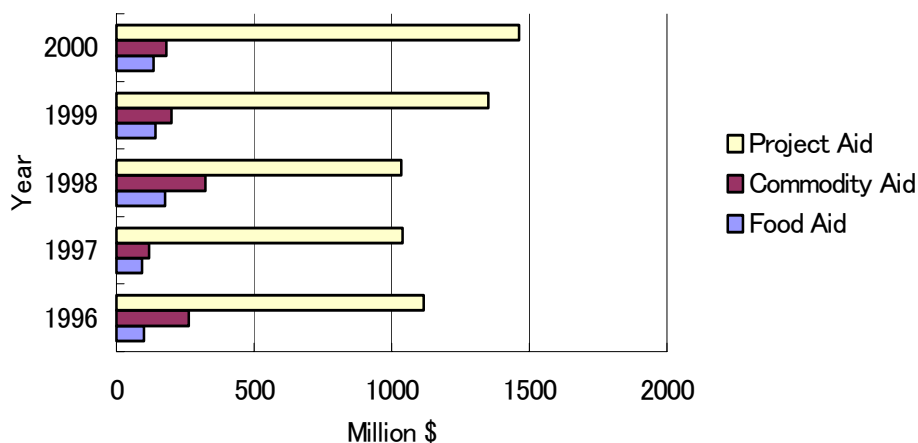
There are 14 telemetering stations installed in 1996. Six are now operational as they are directly connected with the FFWC. But the remaining 8 are connected through T&T micro wave. Due to problem in the T&T micro wave, those 8 are not functioning now.

2.6 Foreign Aid

Total amount of foreign aid amounts to approximately 34.8 billion US dollar from the Independence, 1971, to 1999. Breakdown of foreign aid: Grant occupies 48.2 %, and Loan occupies 51.8 %.

Aid comprises three forms; Food Aid, Commodity Aid and Project Aid. Mainstream of foreign aid was Food Aid and Commodity Aid by 1980. After that, Project Aid increased rapidly and it occupied approximately 70 % to 80 % of foreign aid recently (Figure 1).

Figure 1 Trend of Aid Form in Foreign Aid



Source: Economic Relations Division, Ministry of Finance

3. THE STUDY AREA

3.1 Socio-economy

(1) Demography and Social Conditions

The Char area has some 2,665 km² with estimated population of 1.4 million, while the Haor area occupies 6,502 km² with 3.5 million. Population density of the both areas is 525 people/km² for Char and 535 people/km² for Haor, respectively, compared to 1,046 people/km² for Char districts as a whole, and 744 people/km² for Haor districts, respectively (Table 1).

Table 1 Area and Population of the Study Area

Char	Area (km ²)	Estimated population, 2001*	Population density (nos./km ²)	Haor	Area (km ²)	Estimated population, 2001*	Population density (nos./km ²)
Gaibandha	504	201,000	399	Habiganj	1,394	749,000	538
Jamalpur	528	377,000	715	Kishoreganj	1,694	1,255,000	741
Kurigram	854	335,000	392	Netrokuna	701	272,000	387
Sirajganj	779	486,000	623	Sunamganj	2,713	1,201,000	443
Char Total	2,665	1,399,000	525	Haor Total	6,502	3,477,000	535
Districts Total	9,005	9,416,000	1,046	Districts Total	11,735	8,726,000	744

Remarks: * Estimated based on 1991 Population Census, BBS
Source: JICA Study Team based on the Map Survey.

Almost all Char dwellers are Moslems while some 30% are Hindus in Haor.

Migration is taken place more dynamic in Char than in Haor, as the Char area is more vulnerable to erosion hazard. Major reasons for in-migration are the marriage or kinship ties and better employment for Char dwellers, and the same as well as landlessness for Haor people, respectively. Out-migration is induced mainly by erosion, landlessness, flood, and lack of employment in Char, while in Haor, landlessness, lack of employment and flood are the major reason.

The major land tenancy type in both areas is owner cum tenant who cultivates a portion of land and rent remaining portion to other cultivators, followed by tenant and owner farmer. Average land holding size is smaller in Char than in Haor.

Women suffer severe forms of discrimination due to the socio-cultural norms that favor men. Being regarded as “low social status”, women and girl children have limited access to resources including education, health, food/nutrition and finance throughout their life cycle. Decision making in the family is overwhelmingly done by men. Women are to stay at home engaging houseworks such as cooking, washing, house cleaning, child care, post harvest works, backyard livestock/poultry raising, water collection and fuel collection. Although women started to be involved in the economic activities outside houses, their wage rate is remarkable lower as compared with that of men.

Child labor is quite common in both Char and Haor areas. Child marriage and dowry as well as

disability are also prevalent in both areas.

Overall literacy rate is 18% for Char and 25% for Haor, respectively, indicating far lower rate than national average rate of 51% as of 1997, as well as that in rural area with 38% in the same year. There is a big gap in literacy rate between male and female in both Char and Haor.

Children in the both areas are poorly educated because of high drop-out rate caused by poverty, unawareness of guardians, frequent shut down of schools, etc. Education is also constrained by dilapidated school buildings, insufficient school facilities, long distance from the school, lack of school teachers, insufficient number of lady teachers, etc.

Malnutrition is generally seen among children and female. Being deficient in calorie and vitamin intake induces high incidence of anemia, angular stomatitis, night blindness, goiter, etc. The major diseases reported include cold/fever, dysentery, diarrhea, jaundice, etc. Problems related to health services include no regular visit by health workers, hard access to upazila health complex in the dry season, unavailability of medicine, unpracticed preventive measures against diseases by local people, physical weakness of people due to malnutrition, etc. Although ante-natal care is given to pregnant women by health workers, no service is extended after the delivery of child, which result in high rates of maternal mortality and infant mortality.

Most local people in the Char area do not use any type of latrine. On the other hand, majority people in Haor use hanging latrine.

Hand tubewells have been well established in both Char and Haor areas, and most people utilize them for drinking purpose throughout the year. However, many of them become unusable during wet season due to submergence.

Availability of fuel for cooking has been the most pressing problem in the Char and Haor areas. Locally available energy for cooking is not easily available. In both areas, cow dung and straw are by far the main fuel for cooking. Fuel becomes scarce in the wet season. The frequency of daily cooking decreases.

(2) Economic situation

More than 70% of total households in Char and Haor areas earn not more than Tk.30,000 annually (Table 2).

Per capita income of a household with annual income of Tk.30,000 is not more than Tk.4,290, or US\$80 annually, which is less than 30% of the national average (Tk.15,400 or US\$280). Surprisingly, those households that earn more than national average are merely 1% in Char and 4% in Haor, respectively. People in Char are poorer than those in Haor in terms of income level, as 61% of the total household are under the bracket of annual income with less than Tk.20,000, while 43% under the same category in Haor. The income being low, the share of food in the total expenditure is as high as over 70% in both Char and Haor areas.

Table 2 Average Annual Household Income Level of Char and Haor

Unit: %, household

District (sample village number)	Annual average household income (Taka)					
	<10,000	10,001-20,000	20,001-30,000	30,001-50,000	50,001-100,000	>100,000
Char						
Gaibandha (25)	41	31	16	10	2	0
Jamalpur (25)	32	27	20	16	4	1
Kurigram (34)	33	34	22	8	3	0
Sirajganj (31)	14	35	29	15	6	2
Char Total (115)	29	32	22	12	4	1
Haor						
Habiganj (35)	23	28	24	15	7	3
Kishoreganj (36)	11	30	27	18	10	4
Netrokona (33)	12	23	29	21	12	3
Sunamganj (37)	18	25	25	18	9	5
Haor Total (141)	16	27	26	18	9	4

Source: JICA Study Team based on the Rural Living Conditions Survey by DICS, 2001

In both areas, agriculture related activities (farmer, share-cropper and agri-labor) are the main occupation in the dry season. In wet season, however, agriculture related activities are interrupted due to submergence of farm land. While many people lose their income source, some other people change their occupation to earn money. Fishing becomes important in the wet season in Haor. Unemployment is more serious in Haor than in Char. Cottage industry has not developed in both Char and Haor areas.

Cropping intensity is higher in Char with 171% than in Haor with 105%. Cultivated crops are more diversified in Char than in Haor. Rice is by far the major crop in both areas. Rice accounts for 58% of the harvested area in Char, followed by jute and wheat. While in Haor, 97% of the harvested area is for rice. Chemical fertilizers are commonly used in both areas to obtain higher yield. Irrigation is also practiced for rabi crops by private sector using various types of pump. Crop performance is generally high, but often hampered by flood, unavailability of seeds, poor water management, etc. Agricultural infrastructure such as drying yard, rice milling and store house are very few within Char and Haor. There is no drying yard in Char, and in Haor area, average area per yard is much smaller than district average.

Open fisheries operated in beels and rivers are important. In Char, shrimp production is relatively active while fish catch dominates in Haor. Fishing boats that are being used to operate gear and transport fish vary greatly in size, and are predominantly non-mechanized country boats. In monsoon season, any people catch fish anywhere. On the other hand, in the dry season fishing places are limited mainly to beels and river courses, where fishing licence is required. Fishing rights to be renewed every three years are issued by Ministry of Land through competitive bidding, for which small fishermen have no chance to win. Fishery resources are reported to have been decreasing due to over-exploitation and sedimentation of beels and river beds.

Livestock and poultry raising is found in both areas. While goat and sheep are found more in Char, ducks are dominant in Haor. Cattle, important draft animal for cultivation and transportation, are found in both areas. During the flood, many animals are washed away every year despite the people's efforts for prevention. Feeds for animals become scarce in the wet season. Veterinary services hardly reach to the area.

Marketing facilities are insufficient both in number, in quality and in scale. Although LGED has been promoting the upgrade of open yard hat bazar to growth center, so far the share of growth centers in the total marketing facilities is merely 6.5% in Char and 23% in Haor, respectively. Unsteady supply, low quality and high price of inputs are constrained by local people, while dealers are not satisfied with farmers' low purchasing power and less knowledge on how to use chemicals.

Farmers have no choice but sell their products locally due to lack of formal marketing places and/or lack of transport and communication means. In Haor, rice is transacted more through wholesalers who control the market. Marketing places are not organized well and many of them are submerged even at normal floods.

Tele-communication has not been established yet in both areas. Rural electrification is also lagged behind, the rate being merely 8% for Char and 11% for Haor, respectively.

Provision of rural road is less developed in both Char and Haor as compared with the national average. In particular, rural road class 2, which is defined as the roads connecting villages and farm with hat bazars and Union Parishads, has not developed well. Reflecting the low population density, area based road density is low.

3.2 Natural Conditions

(1) River Systems and Morphology

The Char under the Study area are situated in the active floodplain of the Brahmaputra river system. The rivers flow in broad braided and meandered channels and change their courses every year. The floodwater carries large amount of sand and silt. The deposition of sand and silt on the channel/riverbed creates Chars. The Chars become prominent at low water period.

In Char area, the river system is characterized by rapid and substantial changes in platform. The river is becoming wider through retreat of both right and left banks. Average width of the river has increased about 130 m per year since 1973, and the widening of the river tends to continue. The right bank has been retreated to the west at an average rate of 65 m per year. Erosion risks are high for those dwelling along the river banks. The average number of low flow channels has increased by 40 percent since 1973 and their average length has increased by 30 percent. The intensity of braiding is in increasing trend.

The Haor is characterized by the saucer-shaped seasonally flooded inter-fluvial areas. The main rivers traversing the Haor area include Surma, Kalni, Kushiya, Baulai and Dhanu, which have

Summary

sinuous, meandering sand-bed channels with cohesive banks. The inflows from the tributaries of Surma and Kushiyara rivers cause considerable spilling during the monsoon.

Construction of flood control embankments, loop cuts, channel closers as well as on going channel changes over the last 25 years are responsible for the morphological changes in the river system. Negative impacts are envisaged aggrading of river bed due to deposition of silt on the lower Kushiyara-Kalni river. Increased sediment yields could accelerate ongoing sediment aggravation within flood control embankments on rivers such as Khowai and Chillikhali. Naturally occurring patterns of instability on alluvial fans may result in abandonment of some existing channels and development of new channels. Changes along the Surma/Baulai are also observed.

(2) Agro-ecology

The Char area as a whole is fallen into Agro-Ecological Zone (AEZ)-7 and occupied by sandy and silty alluvial soils, which are rich in minerals with slightly alkaline. Of the six general soil types found in the area, Non-calcareous alluvium predominates. Due to its coarse and/or medium in texture, water and nutrient holding capacities are low. Nitrogen is the most critical nutrient limiting crop growth followed maybe by potassium. Sulphur may be another critical nutrient for ensuring normal crop growth.

The Haor area belongs to AEZ-21: Sylhet Basin. Soils in the area are grey clays in the wet basins and silty clay loams and clay loam on the higher parts which dry out seasonally. Noncalcareous Floodplain soils and Acid Basin Clays are the major components of the general soil types. The soils are acidic in general and have moderate content of organic matter. Thanks to the supply of nutrients with loaded sediments by flood water as well as high nutrient holding capacity of soils, the fertility level of soils is medium to high. However, for ensuring high crop performance, application of potassium and sulphur is preferable.

3.3 Flood Situation

(1) Flood Environment

The Char area is highly dynamic due to erosion and deposition of sediments. From the viewpoint of stability against erosion, the Chars may be classified into (i) stable chars and (ii) unstable chars. The former are well-vegetated comparatively higher floodplain which accommodates semi-permanent population, having a useful life of at least 10 years. While the latter are the lower Chars and do not have any fixed locations. Usually, they vanish almost in every flood event creating new ones depending on the flow mechanism of the river.

Both inundation of the households in stable Chars and the erosion of the unstable Chars itself make the dwellers more vulnerable to floods, which often result in the shifting of the households. People living in stable Chars may move to a nearby flood free place temporarily till the flood recedes. In case for unstable Chars, the inhabitants may settle in a nearby location waiting indefinitely for the eroded char to re-emerge.

None of the Char villages is protected from flooding of any degree nor are from river erosion of the Char itself. Source of flooding is the main river, which causes erosion in Chars is a prime hazard as flood inundation. In normal flooding, most of the villages in Char experienced a depth of flooding less than 1.5 m for two to three months.

The Haor area receives abundant flood water from the river systems originated from the slope of Shillong Plateau in the north and Tripura hills in the southeast every flood season. In April-May when the *flash-flood* water reaches the Haor area, it is known as *early-flood*, which usually causes damages to standing Boro crop by submergence.

The Haor may be classified into two major types, namely, (a) Deep Haor areas and (b) Shallow Haor areas. The former lies below the 4m MSL and the latter falls under the elevation between 4 and 6m MSL. Flood depth in the Deep Haor areas is more than 3m while the flood depth of the Shallow Haor below 3m. From June through September, the water levels of the deltaic rivers raise in the Haor area to an alarming level. The accumulated water in the large Haors keep most of the surrounding area flooded for more than six months in a year.

Sedimentation that raise the river beds and disappeared flora that had protected homesteads from erosion by wave action are responsible for chronic flood damages.

Major actions taken by the people before the occurrence of floods in Haor area are: protection of mounds by indigenous method, raising of homestead floor, strengthening house structure and storing foods. During the flood season, they have to concentrate only for fighting wave erosion to protect the mounds of their homestead.

(2) Flood Damages

The extent of flood damages varies depending on the magnitude and timing of floods and on protective measures taken. In recent years, flood damage was the largest in 1998, in terms of inundated area, number of cattle died, number of damaged house, and casualties (Table3). Casualties are small in number in the floods of 1999 and 2000.

Table 3 Flood Damages of Char and Haor in 1998, 1999 and 2000

Char/Haor of District	Total area (km ²)	Sample survey area (ha)	Inundated Area (%)			Damaged Cattle (heads)			Damaged House (nos.)			Human life lost (nos.)		
			1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Gaibandha	504	9,310	75	49	42	506	0	0	1,028	19	14	0	0	0
Jamalpur	528	14,251	84	74	75	1,310	20	0	1,855	90	25	4	0	0
Kurigram	854	16,566	82	62	67	2,903	1,359	1,310	3,435	1,743	1,494	12	0	1
Sirajganj	779	7,793	37	26	30	539	290	208	629	396	330	16	1	1
Total Char	2,665	47,920	74	57	58	5,258	1,669	1,518	6,947	2,248	1,863	32	1	2
Habiganj	1,394	9,469	48	28	33	3,140	1,680	1,425	677	371	455	16	3	7
Kishoreganj	1,694	54,575	87	61	72	3,962	316	679	11,332	1,401	2,569	35	0	0
Netrokona	701	11,833	92	80	91	1,816	1,216	2,613	1,347	598	1,173	7	0	0
Sunamganj	2,713	22,690	71	51	36	1,644	161	289	3,100	475	385	0	0	0
Total Haor	6,502	98,567	80	58	63	10,562	3,373	5,006	16,456	2,845	4,582	58	3	7

Source: JICA Study Team based on the Flood Damage Survey, 2001

The response to inundation of homesteads are manifested mainly by (i) raising sleeping place during flood by constructing macha-raised platform, (ii) raising of homesteads (or rooms) by earthworks at pre-flood or post-flood time, (iii) taking shelter to a raised ground, road, embankment, flood shelter, or relatives' houses in flood free areas.

Flood shelters have been constructed in Char and Haor areas, but the capacity is too small to accommodate many people (Table 4).

Table 4 Number of Existing Flood Shelters and Their Capacities in Char and Haor

District	Char Population	No. of Flood shelters	Shelter Capacity (pers.)	Coverage (%)	District	Haor Population	No. of Flood Shelters	Shelter Capacity (pers.)	Coverage (%)
Gaibandha	201,000	4	700	(0.3%)	Habiganj	749,000	40	10,200	(1.4%)
Jamalpur	377,000	36	8,350	(2.2%)	Kishoreganj	1,225,000	41	11,500	(0.9%)
Kurigram	335,000	8	825	(0.2%)	Netrokona	272,000	21	10,640	(3.9%)
Sirajganj	486,000	184	49,290	(10.1%)	Sunamganj	1,201,000	66	11,906	(1.0%)
Total	1,399,000	232	59,165	(4.2%)	Total	3,477,000	168	44,246	(1.3%)

Source: JICA Study Team based on the Flood Related Facilities Survey, 2001

Due to insufficiency of shelters, schools or any raised grounds are used as shelters for human and livestock.

While the capacity of shelters are insufficient, there is no warning system to communicate from national level to community level in the Char and Haor areas due to lack of communication facilities and coordination guidelines. People in Char and Haor areas, therefore, decide to take shelter from their past experience and traditional means.

3.4 Administrative Structure

There are 4 districts, 19 upazilas and 98 unions in Char, while in Haor, 4 district, 29 upazilas and 201 unions.

The administrative system in Bangladesh is still highly centralized in spite of the decentralisation policy of the government. The Upazila parishad (council) is responsible for overall development of the area under its jurisdiction. It is to be headed by a Chairman to be elected by local people, but the election has never been taken place. An Upazila Nirbahi Officer (UNO) and other officers of different ranks appointed by the central government effectively control the parishad. Thus, Upazila parishad serves the political interests of the central government rather than the development goals of the local people.

As an institution, Union Parishad (UP) is responsible for the development planning and implementation as well as the administration of the Union, an administrative area under an upazila, in liaison with the Upazila Parishad. Union Parishad consists of a chairman, nine male members and three female members. The Chairman and male members are elected by popular votes while the female members are elected directly by the local people.

UP has practically no fiscal autonomy or capability, and their resource base depends on receiving development grants from the Government's annual development program (budget). UP is also responsible for collecting taxes from a number of sources, but in practice not much is collected.

Under the union, there are grams or villages. However, grams do not have authorized council despite several attempts to establish Gram Parishad in the past. The voices of local people hardly reach to UP. The use of the limited development funds allocated to UP is decided by UP members, so that beneficial area is confined to where UP members come from.

3.5 NGOs' activities

A clear feature of NGOs' activity in the Study Area is that most of them started with relief activities for refugees of civil war and victims of natural disasters. Then they changed their strategy from relief into development. Holistic approach has been adopted, as they had learned that hurdles to overcome were complex and that single sector approach could not solve the problem. Empowerment of local people is another theme to achieve their objectives. Unless the local people recognize themselves as main players of development, any efforts will not bear fruit.

Although the provision of the NGOs' services is requisite to satisfy the need of the villages of Chars and Haors, there are not much NGO activities in the Study Areas concerning flood-proofing excepting a few, namely, CARE and CONCERN in Haor areas and CARE and RDRS in the Char area. Others e.g. BRAC, Oxfam, ASA, Porshika and Gono Unnayan Sangstha, have multiple objectives and functions related to the socio-economic development of the flood-prone areas.

3.6 Lessons Learned from the Experiences of Existing Projects

Total of 10 existing and on-going development projects were studied to learn the lessons and reflect them into the planning in the Study.

Based on the case studies, various lessons which should be reflected in formulating projects on Rural Development Focusing on Flood Proofing, were learned. All the projects tried to establish certain mechanism for the projects to be sustainable. Common practices adopted by many projects for ensuring project sustainability include: (i) participatory approach to enhance ownership of the project by beneficiaries, (ii) organizing people to enhance solidarity and mutual cooperation among them, (iii) group savings and credit to strengthen economic base, and (iv) strengthening of linkage among rural people at village level and government services and NGOs to improve services delivery.

The above four issues are explained in the following.

Participatory approach has been adopted in all the projects. Local people in the project area are involved in the project from the planning stage through PRA or PLA. All the projects have target people, who are usually poor ones, and motivate them to form groups/organizations. Through enhancement of participation and cost sharing of project, sense of ownership is expected to be encouraged.

Organizing people is another important issue for self-sustained project/program. Poor people hardly have a chance to uplift their economic status individually. Collective efforts as group will enhance solidarity and mutual cooperation, which will be the engine of development.

Lack of access to reliable and fair financial instruments is a major constraint that works against the efforts of the poor to lift themselves out of poverty. By saving small amounts of money on a regular basis, the village organization gradually build up a local source of credit which can be used for small-scale income generating activities or for urgent needs, according to their own choices. From the self-sustained point of view, reliable opportunities to save in small amounts are valued highly. Moreover, these self-managed savings and credit programs are one of the most important elements in the mobilization and organization of the rural poor, and a crucial factor in institution building and sustainability of project/program.

Strong linkage between village and supporting services is also a crucial factor for ensuring project sustainability. To build capacity and empower local people, all the projects studied provided various training programs regarding institutional building, saving and credit, various skills for income generation, etc. These training have been provided by the projects, government institutions or NGOs.

The above issues are mutually related. Schematics below shows the flow of project in general to attain sustainability.

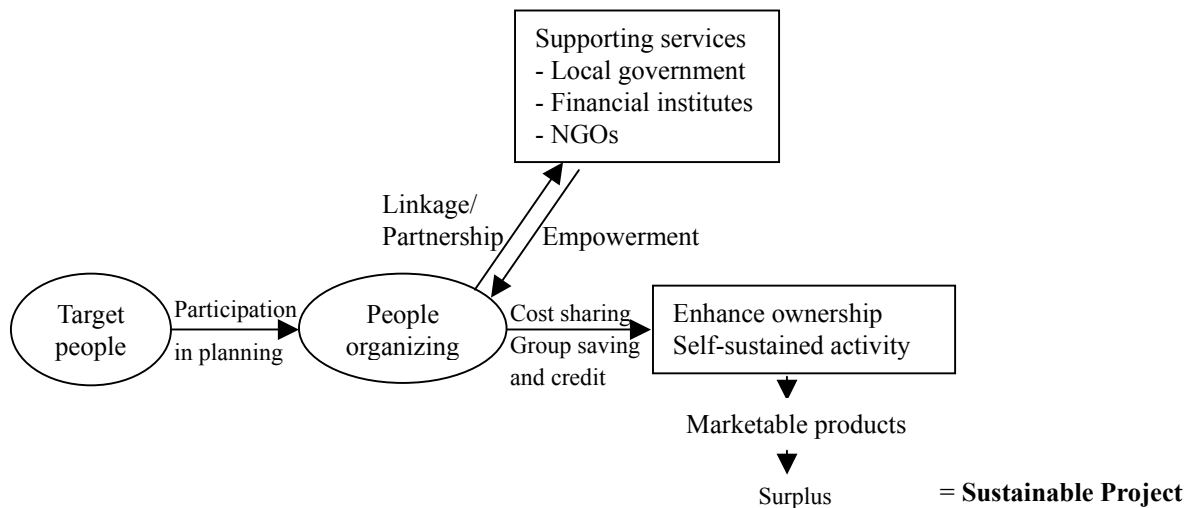


Figure 2 Flow of the Project for Attaining Sustainability

4. CONSTRAINTS AND PROBLEMS

4.1 Root Causes of Various Problems in the Study Area

Poverty and related problems are common not only in the Study Area but in Bangladesh as a whole. At the root of these problems, there exists a fundamental structure of the Bangladesh socio-economy composed of several interacting factors. The basic factor is the distorted economic structure inherited from colonial times, represented, among others, by unequal distribution of economic wealth and resources. This structure has been largely preserved to date due to hierarchical social system favoring large landowners and rural power structure dominated by patron-client ties. Development aids supposed to rectify the structure, removing negative effects of the economic structure and the hierarchical social system on the poor, have sometimes aggravated the situation. The Government has not been effective enough to control this process of the distorted economic structure and the rural power structure supporting or often strengthening each other.

Poverty and flood-related problems in the Study Area take place within the context of this fundamental structure. Thus, the root causes of various problems existing in the Study Area are the distorted economic structure, unequal distribution of economic wealth and resources, the traditional hierarchical system, and ineffective government control. The root causes are translated into specific conditions facing the local people in the Study Area through social processes or mechanisms that link various problems. These conditions make the local people vulnerable to external shocks such as natural hazards including floods. Sometimes, even human interventions such as major infrastructure work as external shocks for the vulnerable people.

These problems are expected to be overcome by planned development efforts with the participation of local people. Some problems, however, are external and cannot be addressed in the Study in view of feasibility. To define the scope of the Study and to formulate realistic measures to solve the problems, existing problems in Char and Haor areas are analyzed by various methods as reported in the subsequent sections.

4.2 Identified Problems

Many problems have been identified at different levels and by different groups of people for Char and Haor areas. Many of these problems are inter-related to cause undesirable phenomena observed.

Flood related problems of property loss and land loss, shortage of cooking fuel, crop loss and disruption of economic activities are directly caused by inundation and erosion.

Livelihood related problems of low agricultural income and few employment opportunities are caused by other problems including disruption of farming activities, crop losses, insufficient supply of inputs, poor extension services, etc., for low agricultural income; and difficult communication

conditions, inadequate credit facilities, inadequate human resources development, etc., for few employment opportunities, respectively.

Social problems include low literacy rate, prevailing mal-nutrition and diseases, poor sanitary and hygienic conditions, discrimination against women and poor community activities.

4.3 Problems Structure Analysis

Widespread poverty is identified as the most serious problem phenomenon to be alleviated through planned development efforts. This phenomenon is a direct outcome of insufficient opportunities for income generation, low level of economic activities and productivity, and reduced working time and large health expenditure. Another subtle factor behind the widespread poverty is vulnerability (of rural communities) in flood and other crisis. This problem is socially deeply rooted, but directly reflects the lack of community-based alternatives for flood mitigation and livelihood development. In other words, rural people do not have sufficient capability to mitigate flood damages or to improve their livelihood. This problem, in turn, is traced back to a fundamental problem of the hierarchical social system. In Char areas, the problem is compounded by the large number of in-migrants contributing to the lack of social cohesiveness.

The widespread poverty and large damages/losses by flooding are main problem factors contributing to the lack of capital accumulation. The latter, of course, is the major factor causing the vulnerability in flood and other crisis. A typical vicious cycle is formed between the three major problem phenomena: widespread poverty, lack of capital accumulation and vulnerability in flood and other crisis.

To address to the problem structure with the vicious cycle effectively, more fundamental problems at the root of many observed problems would better be dealt with. Five fundamental problems are noted commonly for Char and Haor areas. Two of them are inherent problems: geographic isolation and transient nature of livelihood in Char and Haor areas. The latter is inherent to some extent due to physical conditions such as unstable nature of Char as well as habitual floods with inundation, erosion and wave actions (in Haor). The other three fundamental problems are institutional and social: inadequate development planning and weak local governments, traditional feudal system, and large number of in-migrant caused by population pressure.

4.4 Sequence of Problem Solution

Among the problem phenomena observed, the Study Team views that the establishment of flood-proof environment should be pursued first to ensure rural development. Chronicle floods occurred in Char and Haor areas affect the people's life every year in worsening living environment by inundation, isolation, limitation of living space, uneasiness, etc. During this period, economic activities are disrupted and social services delivery stops, and under such conditions, people cannot enjoy normal life.

Summary

In Char, most areas are unstable in nature and vulnerable in erosion by river flow due to loose foundation with sandy soil. In such areas, permanent structure will not be feasible. Flood-proofing measures may be taken to be free from inundation in stable chars. In Haor, wave-induced erosion of mounds where people live is the most serious concern of local people during flood. On an average mound area is reduced by one meter width per year. Unless erosion protection measures are taken, all mounds will be disappeared at last.

Under the flood-proof conditions, living environment shall be improved and livelihood development shall be enhanced with people's empowerment.

4.5 Envisaged Limiting Factors

Basic idea of coping with the floods is to establish flood proof environment. The concept of flood proofing is to provide long-term non-structural as well as minor structural measures to mitigate the effects of floods. Minor structural measures should be managed and maintained properly by the local people to ensure their sustainability. In realizing flood-proof conditions of the Study Area in the long run, however, following limiting factors should be taken into account.

- (i) Financial constraints
- (ii) Resource constraints
- (iii) Institutional constraints
- (iv) Social constraints

5. DEVELOPMENT GOAL, OBJECTIVES, STRATEGY AND FRAMEWORK

5.1 Development Goal and Objectives

(1) Idea of Flood-proof Rural Development

The ultimate goal to be aimed by the rural development in flood-prone Char and Haor areas is to realize self-reliant rural communities with people empowered by viable livelihood activities and flood-proof living environment. Ideally, human life should be protected from all the conceivable floods, and under flood-proof conditions the people should develop their livelihood activities into viable economic activities. The pursuit of this idea involves four specific objectives of the rural development: (i) flood-proofing, (ii) improvement of living environment, (iii) livelihood development, and (iv) enhancement of people's capacity with institutional development. This idea may not be realized within a foreseeable time frame, as resources available for the rural development are limited and may be augmented only through people's own efforts.

In reality, complete flood-proof conditions cannot be realized, and flood-proofing would be improved only in steps both in areal extent and for increasing levels of protection. The people may increase the level of flood-proofing, and under such conditions, develop various livelihood activities to enhance income levels and increase economic wealth in their rural communities. With the enhanced income levels and increased economic wealth, the people would continue to increase the level of flood-proofing further and/or to expand the area under reasonable flood-proofing. A key to the success of this step-wise development would be the establishment of a mechanism that would allow the people to feed themselves with their limited resources for both flood-proofing and livelihood development. Thus, the four objectives of the flood-proof rural development would be effectively pursued only in a parallel, mutually supportive way, as illustrated in Figure 3.

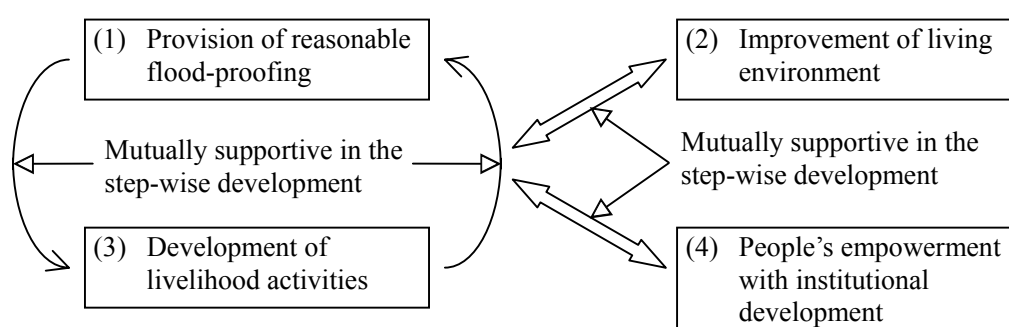


Figure 3 Four Mutually Supportive Objectives of Flood-proof Rural Development

(2) Flood Mitigation Targets

To set more realistic and attainable targets for the step-wise flood-proof rural development along

Summary

the idea clarified above, it is necessary to specify the level of flood-proofing at first. For this purpose, the concepts of “normal flood”, “severe flood” and “most severe flood” which are commonly applied in Bangladesh to plan for flood mitigation measures, are introduced for the study.

The normal flood is conventionally interpreted as the flood that certainly occurs every year, the severe flood is the one that occurs once in 20 years, and the most severe flood is the one that occurs once in 100 years.

Both LGED and CARE assume that the 1987 and 1998 floods are equivalent to the flood with a 20-year return period, and the 1988 flood is to the one with a 100-year return period. Under the ongoing Flood Proofing Project, LGED and CARE raised the foundation level of homesteads taking the 1987/1998 flood levels into consideration. For major structures such as flood shelters, LGED and CARE adopt the 1988 flood as the design flood.

Based on the aforementioned definitions of the levels of normal, severe and most severe floods, specific flood mitigation targets are set for the Study: (i) protection of every day livelihood activities from the normal flood, (ii) protection of household properties from the severe flood, and (iii) protection of human lives even under the most severe flood (i.e. with a 100-year return period).

(3) Development Objectives

With the definitions of the normal, severe and most severe floods presented above, the following development objectives are set that can be pursued within the planning period of the Master Plan:

- (i) To protect human lives from the “most severe flood” and household properties from the “severe flood”,
- (ii) To facilitate the improvement of living environment with flood-proofing under the “normal flood”,
- (iii) To support the livelihood development by providing training, education and other services together with flood-proofing under the “normal flood”, and
- (iv) To contribute to the enhancement of people’s capacity to make decisions on their own development through their participation in development projects.

5.2 Basic Strategy for Rural Development

The basic strategy for the rural development in flood-prone areas of Char and Haor consists of the following.

- (i) A step-wise development strategy is adopted starting with small model projects comprising minimal physical/structural measures combined with non-structural measures such as

livelihood support activities. The basic aim of the model projects is to establish such a mechanism that would allow the local people to use their limited resources and increase their resource capacity through the process of flood-proofing and livelihood development. Such a mechanism, with modifications to be made as deemed necessary reflecting lessons learned through the initial implementation, would be replicated in other larger areas in steps.

- (ii) To increase the chance of success of the initial project implementation, the model projects are formulated for Char and Haor areas that have comparatively more favourable conditions without hindrances or adverse interventions, but with revealed willingness of people to help themselves for flood mitigation.
- (iii) A participatory approach is taken throughout the planning, implementation, operation and management of every project in order to establish the sense of ownership by the local people and to empower them for continual flood-proofing and livelihood development efforts. Contribution of resources in kind (e.g., labor) and in cash by the local people is the basic condition of the successful project implementation.
- (iv) Over the entire project cycles, governmental organizations, NGOs and local communities will be involved in close coordination and communication with each other under the designated implementing arrangements, thereby ensuring solid monitoring and evaluation activities, leading to improved transparency and accountability of the projects.

In association with the basic strategy stated above, priority areas are first identified for Char and Haor respectively, where the chance of successful flood-proofing is higher. For the identified Char and Haor areas, model projects are formulated by combining complementary measures that can be implemented in the immediate future.

Implementation of the model projects will be monitored through the same implementing arrangements, and reflecting monitored results, projects for other areas will be formulated.

5.3 Development Framework

In formulating projects and related measures, two aspects are particularly important. One is to identify priority areas for Char and Haor respectively. The other is to formulate implementing arrangements for experimentation with the model projects. The basic form of such arrangements is proposed as another framework for project development, and implementation capacities are assessed. Project components to be included in the model and subsequent projects are clarified.

(1) Typology of Char and Haor

To guide the formulation of viable projects for various Char and Haor areas depending on their natural and physical conditions, Char and Haor areas are categorized. Char land is categorized into six groups by combination of type (attached, island and setback) and stability (over 20 years existing, 7-20 years and 0-7 years). As for Haor, the area is classified into four categories by

Summary

combination of inundation depth (above or below the water depth of 3 meters) and dominant transportation means in the dry season (land transport or water transport). The distribution of the area in each category is as follows:

Table 5 Typology of Char and Haor Area

Char

Classification	AI Total ①+②	Setback		Stable Char (over 20 years)		Unstable-I (7-20 years)		Unstable-II (1-7 years)		Charland Total③ ①~⑦ Area (ha) (%)	Sand ⑧ (ha) (%)	Water ⑩ (ha) (%)	Total (100) ③+⑧+⑩ (ha)
		A1 ①	A1 ②	B1 ③	A2 ④	B2 ⑤	A3 ⑥	B3 ⑦					
		(ha) (%)	Attached (ha) (%)	Island (ha) (%)	Attached (ha) (%)	Island (ha) (%)	Attached (ha) (%)	Island (ha) (%)					
Total	67,848 (43)	66,152 (42)	1,697 (1)	7,465 (5)	4,242 (3)	18,663 (12)	11,028 (7)	48,523 (31)	157,770 (59)	40,579 (15)	68,184 (26)	266,533	

Haor

Classification	A1 ①		A2 ②		B1 ③		B2 ④		Total Area ①+②+③+④ (ha) (%)
	Shallow		Shallow		Deep		Deep		
	Land Transport (ha) (%)		Water Transport (ha) (%)		Land Transport (ha) (%)		Water Transport (ha) (%)		
Total	328,759 (51)		219,311 (34)		61,096 (9)		41,026 (6)		650,192 (100)

(2) Implementing Arrangements

Model projects would include minimal structural or physical measures that can be planned in detail and implemented immediately by LGED within its capacities. The key for successful implementation of the projects is how to motivate local people in project areas and organize them to support the project implementation.

The proposed form of implementing arrangements is illustrated in Figure 4.

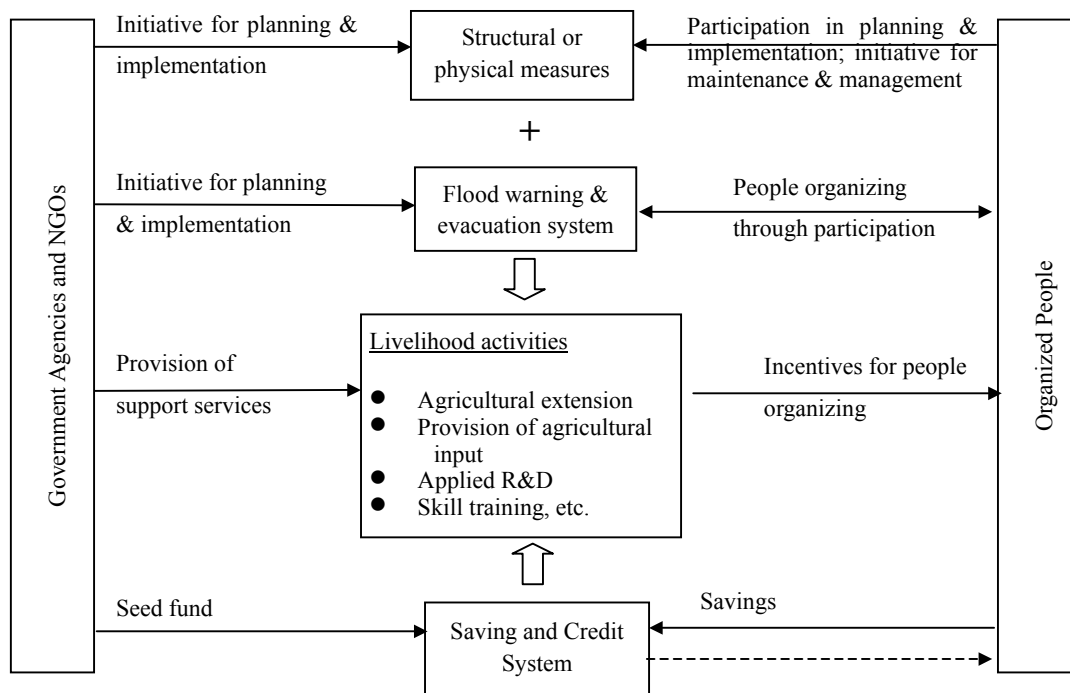


Figure 4 Schematics of Implementing Arrangements for Rural Development

(3) Project Components and Step-wise Development

As clarified by the implementing arrangements presented above, a set of measures need to be included as components of the rural development project. First, minimal structural or physical measures under organizing people need to be taken to convince NGOs to take part in project implementation. Second, a flood warning and evacuation system needs to be included as the means to organize people together with flood awareness campaign/education. Third, a set of support services needs to be provided to the organized people for their livelihood development. Specific services would depend on types of livelihood activities, which in turn vary for different areas of various socio-economic and physical characteristics. Fourth, a saving and credit scheme would provide a vehicle to drive the project implementation.

Other structural or physical measures would be introduced at a later stage. For instance, additional shelters would be constructed, following the evacuation planning, at a later stage of the model projects, if the initial implementation is assessed to be generally successful. Under the flood-proof conditions against the normal flood, the delivery of social services would be improved first for priority areas, focusing on primary education and primary health care. These would be implemented by the respective government agencies as part of their regular programs, but their effectiveness would be enhanced by the involvement of organized people in the priority areas. As the local people become better prepared to pursue more diversified livelihood activities under the flood-proof conditions, other economic infrastructures would also be improved in steps such as growth center construction and rural electrification. These would be implemented also by the respective sector agencies, but the priority should be accorded to the model project areas.

The step-wise development procedure and expected effects of projects are illustrated in Figure 5 and 6.

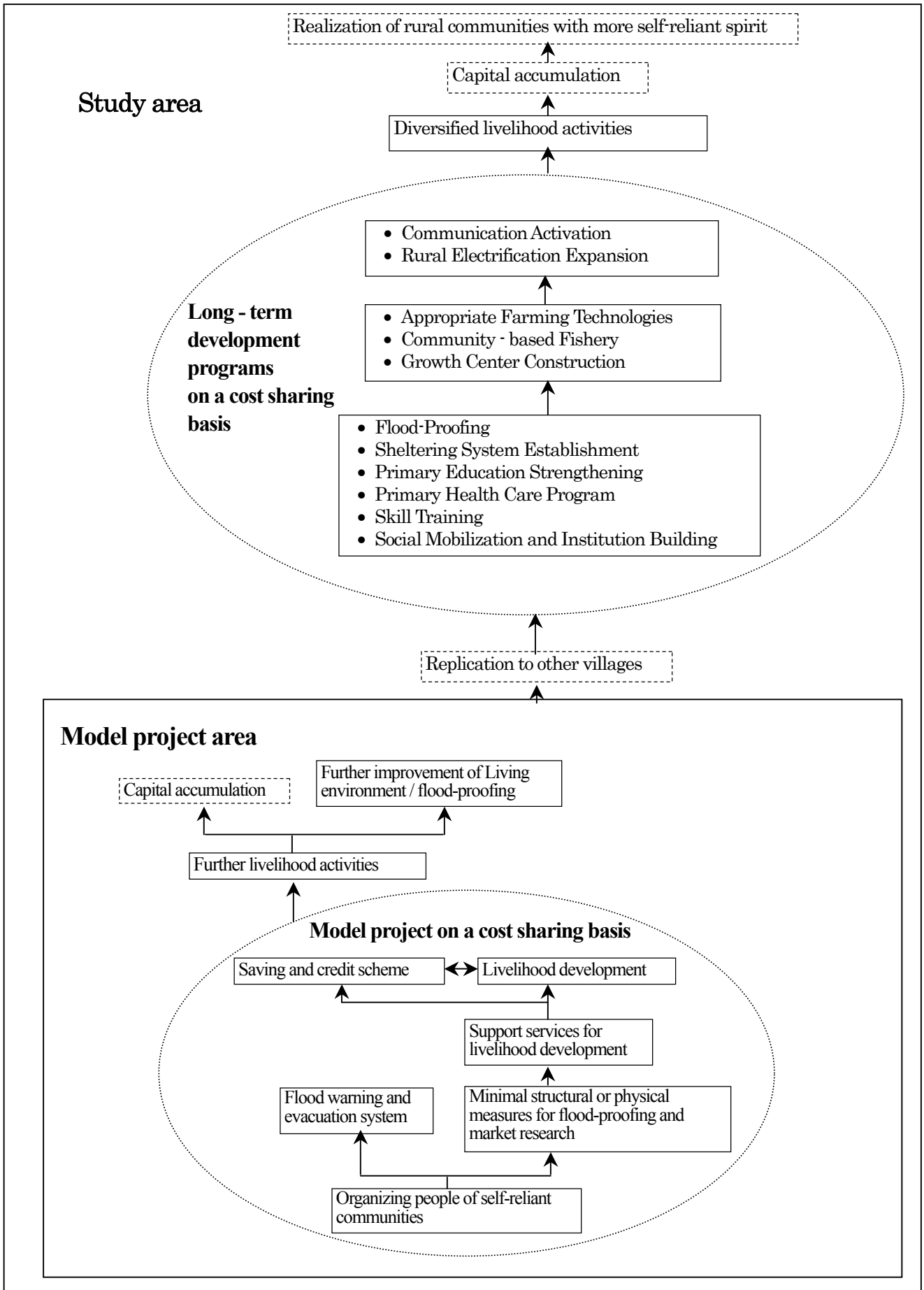


Figure 5 Step-wise Development

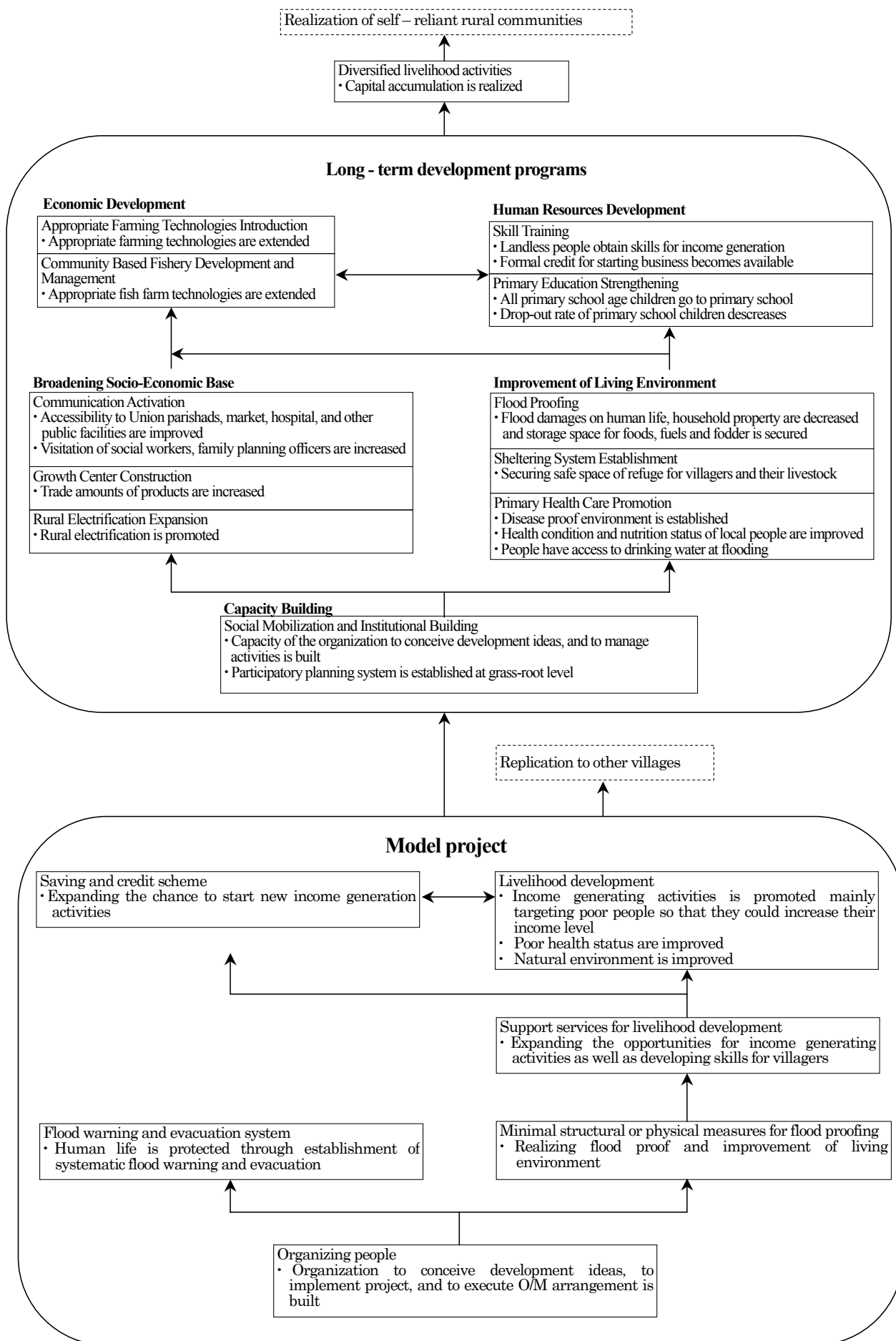


Figure 6 Expected Effects of Projects

6. DEVELOPMENT PLAN

6.1 Model Projects

(1) The Concept of the Model Projects

The model projects will be formulated first, to experiment the implementing arrangements with local participation. The model projects include, as components, minimal structural or physical measures that can be planned in detail and implemented immediately by LGED within its capacities, as well as flood warning and evacuation system, set of support services for livelihood development, and saving and credit system. Implementation of the model projects should be monitored under the same implementing arrangements, and the monitored results, including beneficiaries' response, the degree of participation, etc., will be evaluated and fed back to further project implementation for replication in other areas based on the basic strategy. In this monitoring and feedback process, unsuitable factors in the model projects can be detected and eliminated before the replication stage. These factors may include structure and membership of some organizations involved in implementing arrangements as well as technical factors related flood-proofing and/or livelihood activities.

Thus, the model projects would be more cost-effective involving less bureaucratic or administrative procedures due to the smaller size of implementing arrangements manageable by the local people. Besides, at the replication stage, projects in other areas can be formulated and implemented more efficiently with a better chance of success, based on the feedback and evaluation results of achievement of the model projects.

Unit of model project area

A key to the successful implementation of the proposed project is to establish proper implementing arrangements with the local people initiative, guided by LGED and supported by NGOs. Administrative units such as union, gram and para may be used to facilitate the guidance for the local people, but to ensure consensus among them on the implementing arrangements, local leadership would be a prerequisite. A model project area should be selected in such a way that the local leadership would function effectively.

The lowest administrative level linked directly with the Central Government is the Union Parishad. Every Union Parishad consists of nine male and three female members elected directly by the local people, representing the grams within its jurisdiction. A Union Parishad usually has about ten grams with 20,000-30,000 people. This population size is beyond the scope where any local leadership can function effectively, and thus would not be amenable to consensus.

With the representation at the union level, a gram would be the smallest administrative unit where coordinated actions with the local initiative and the guidance by the Government are expected. It is, therefore, natural to select target areas for government projects with the local initiative by gram.

Within any gram, however, only limited areas and people suffer from serious flood damages and/or dire poverty. Only those people in such areas have strong motivation to organize themselves for flood-proofing and/or poverty mitigation measures.

Based on these considerations, the model project formulation for the Study uses grams to select target areas, and takes para or a small group of paras as a unit to organize the local people. This is also the practice adopted by other projects such as the FPP by CARE and the Haor Development Project by Concern-Bangladesh.

(2) Priority Areas

The basic strategy for the rural development in flood-prone Char and Haor areas is to focus first on more promising areas for flood proofing, where minimal structural or physical measures and support services for livelihood development would be combined and implementing arrangements with local participation would be experimented. Based on typology of Char and Haor, priority areas for model projects are selected first at the Upazila level for both Char and Haor, and then specific villages are selected within each Upazila for model project formulation.

Willingness of the people to participate in the project and their actions to help themselves for flood-proofing and livelihood improvement are the two most important criteria to be applied for selection of priority areas. Further, the criteria shall evaluate the fact whether there is any serious impediments in the areas or not. Due to the limitation of the available data and information concerning the above and also taking fully the applicability of experienced approaches, however, it is noted that eight (8) criteria have been designed and applied under the present study. The followings are finally selected as priority areas for model projects:

Char areas: Fulchhari Upazila, Gaibandha District, and

Haor areas: Nikli Upazila, Kishoreganj District.

Summary

Fulchhari Upazila (Char areas)

Within Fulchhari Upazila, a village in Erendabari Union will be selected for model project formulation in Char areas. The average area and population per village in Erendabari are 306 ha and 1,761 people, respectively. A relatively large village would better be selected so that the planning is based on the land area of some 450 ha and the population of about 2,500 with the estimated average number of households of 400.

Nikli Upazila (Haor areas)

Within Nikli Upazila selected as the priority Upazila for Haor, a village in Gurai Union will be selected for model project formulation. The average area and population of villages in Gurai are 178 ha and 1,043, respectively. The average size of village mounds is 1.6 ha. A relatively large village with larger mounds would be selected for the model project so that the project planning is based on the land area of 250 ha and the population of 1,500. The number of households is about 220.

(3) Model Project Area

Priority villages for the model project planning are selected through a field survey. The model project will be implemented in the area where the chance of the successful flood-proofing is high, in line with the set basic strategy. In other words, the model project area should not have many constraints to rural development. Most important criteria are the willingness of people to participate and help themselves for flood-proofing and livelihood development, and sound and positive political will to help people.

Due to the limitation of the available data and information concerning the above and also taking fully the applicability of experienced approaches, however, it is noted that the following criteria has been designed and applied under the present study.

With the above in view, villages with long history, having community activities, being rich in resources and vulnerable in flood, and having sheltering place are put priority. And in principle, those grams having serious security problems are excluded.

Finally, Algar Char gram in Erendabari Union, Fulchhari Upazila, Gaibandha District and Gurai gram in Gurai Union, Nikli Upazila, Kishoreganj District have been selected for the model project formulation for Char and Haor, respectively.

Social constraints in the Study Area include poor community activities, hierarchical social system and to some extent political unrest. However, the selected grams have comparatively less social constraints.

The five broad criteria and also the security criterion may be generally applicable to the prioritization of other villages for subsequent project formulation and implementation. Specific criteria, however, need to be derived through field surveys.

Most important criteria are the willingness of people to participate and help themselves for flood-proofing and livelihood development, and sound and positive political will to help people as well as security conditions. These aspects would be revealed through participatory rural appraisal (PRA).

(4) Operations Plan

The model projects as formulated should not be taken as a gift for villagers, but rather positive the basis for discussion to elicit their ideas. Therefore, LGED Upazila officer should take the initiative to conduct a series of community workshops by mobilizing local or international NGOs having good track records for rural development in Bangladesh. At these workshops, the model projects as formulated would be presented first, emphasizing their concepts and expected outcomes. Another important function of these initial workshops is to identify all the stakeholders to be involved in project implementation, including traditional community leaders, matabbars, local politicians, village committee representatives and concerned aid organizations as well as local people. All the issues involved in the implementation of model projects would be identified through discussions.

To be clarified also at the workshops are division of responsibilities among stakeholders in general and contribution of resources in kind and in cash by them. In particular, the local people should be made aware of costs involved in the project and their sharing expected in the project implementation and management. Some project components may be modified in accordance with ability and willingness to share costs by the local people.

Implementation of the model projects would start upon successful people organizing through detailed planning for the structural/physical measures, the flood warning and evacuation system, and the saving and credit scheme. The latter would include the preparation and submission of initial proposals for new livelihood activities by local people. Operation and management of the flood warning and evacuation system and the saving and credit system may be modified through initial implementation. The model projects will be monitored both by LGED and organized people.

The outline of operations plan for the projects is shown in Figure 7, assuming its commencement in a dry season. Main activities are (i) formation of consensus on the model projects, (ii) administrative procedures, (iii) institutionalization, (iv) design work, (v) construction by LGED with participation of local communities for earthwork, etc., (vi) supporting activities for livelihood development, (vii) O&M (operation and maintenance) to be conducted by villagers under the guidance of PMO and (viii) monitoring and evaluation activities, and (ix) commencement of replication processes.

The outline of operation plan project is as shown below.

Summary

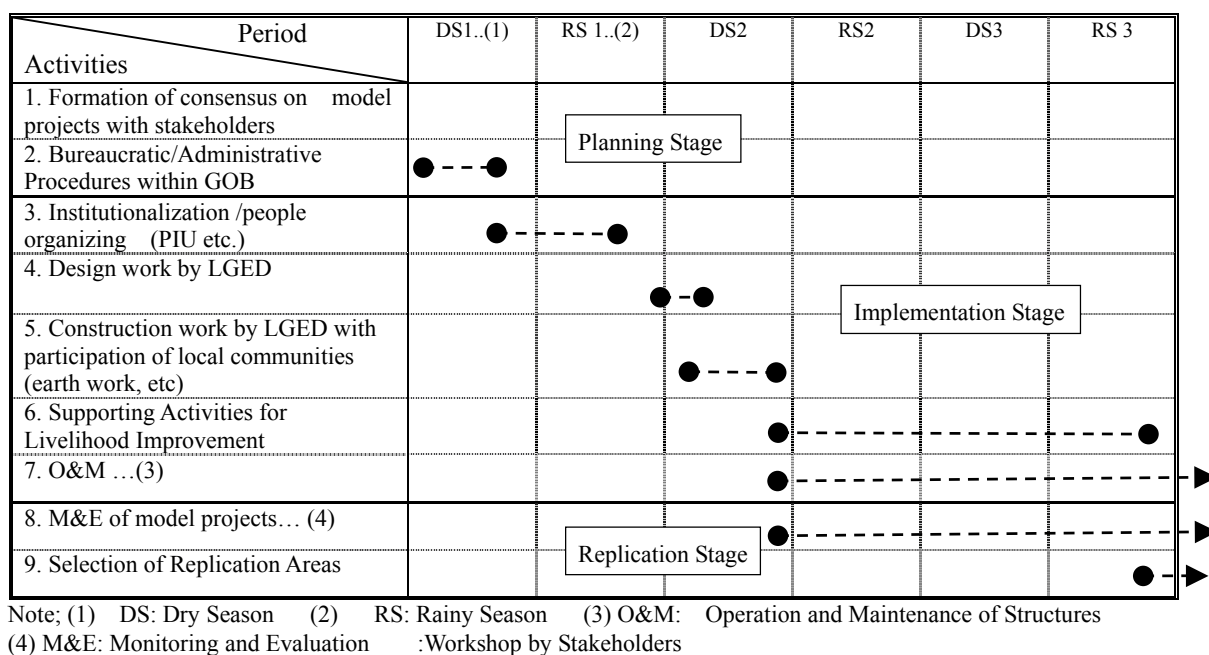


Figure 7 Typical Operations Plan

6.2 Long-term Development Direction

(1) Program Approach

For a long-term development of various project components and related projects in other sectors, 11 long-term development programs are defined. Each program broadly defines the direction to pursue and the scope of work to be covered in respective sector in order to attain the development objectives in the long run for the entire Study Area. These long-term development programs are proposed as follows, corresponding to the four development objectives defined.

Protection of human lives and household properties - Objective (1)

1. Flood proofing Program (1-1)
2. Sheltering System Establishment Program (1-2)

Living Environment Improvement - Objective (2)

3. Primary Health Care Promotion Program (2-1)
4. Rural Electrification Expansion Program (2-2)

Livelihood Development - Objective (3)

5. Communication Activation Program (3-1)
6. Appropriate Farming Technologies Introduction Program (3-2)

- 7. Community Based Fishery Development and Management Program (3-3)
- 8. Growth Center Construction Program (3-4)
- 9. Skill Training Program (3-5)
- 10. Primary Education Strengthening Program (3-6)

Capacity Building - Objective (4)

- 11. Social Mobilization and Institutional Building Program (4-1)

These long-term development programs are expected to evaluate from the model projects and some sector projects to complement the model project implementation as illustrated in Figure 8.

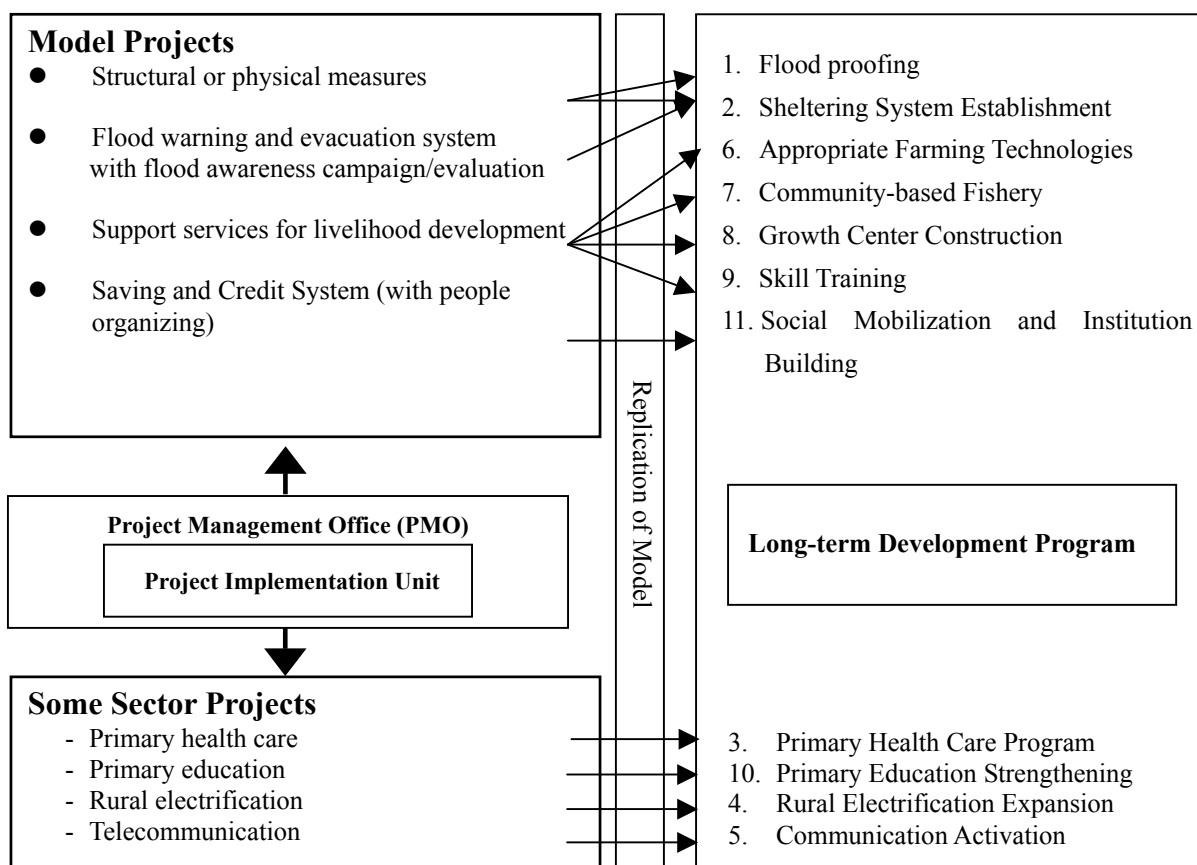


Figure 8 Formation Process of Long-term Development Programs

(2) Problems and Countermeasures

As is described in previous sections, the model projects and long-term development programs are defined, corresponding to the four development objectives and the four basic strategies which are based on the analyses of problems and constraints in Chapter 4.

Thus, the model project and long-term development programs are set that can be settled the problems and constraints in the Area as much as practicable.

Problem structure and countermeasures are illustrated in Figure 9, and problems and countermeasures are shown in Table 6.

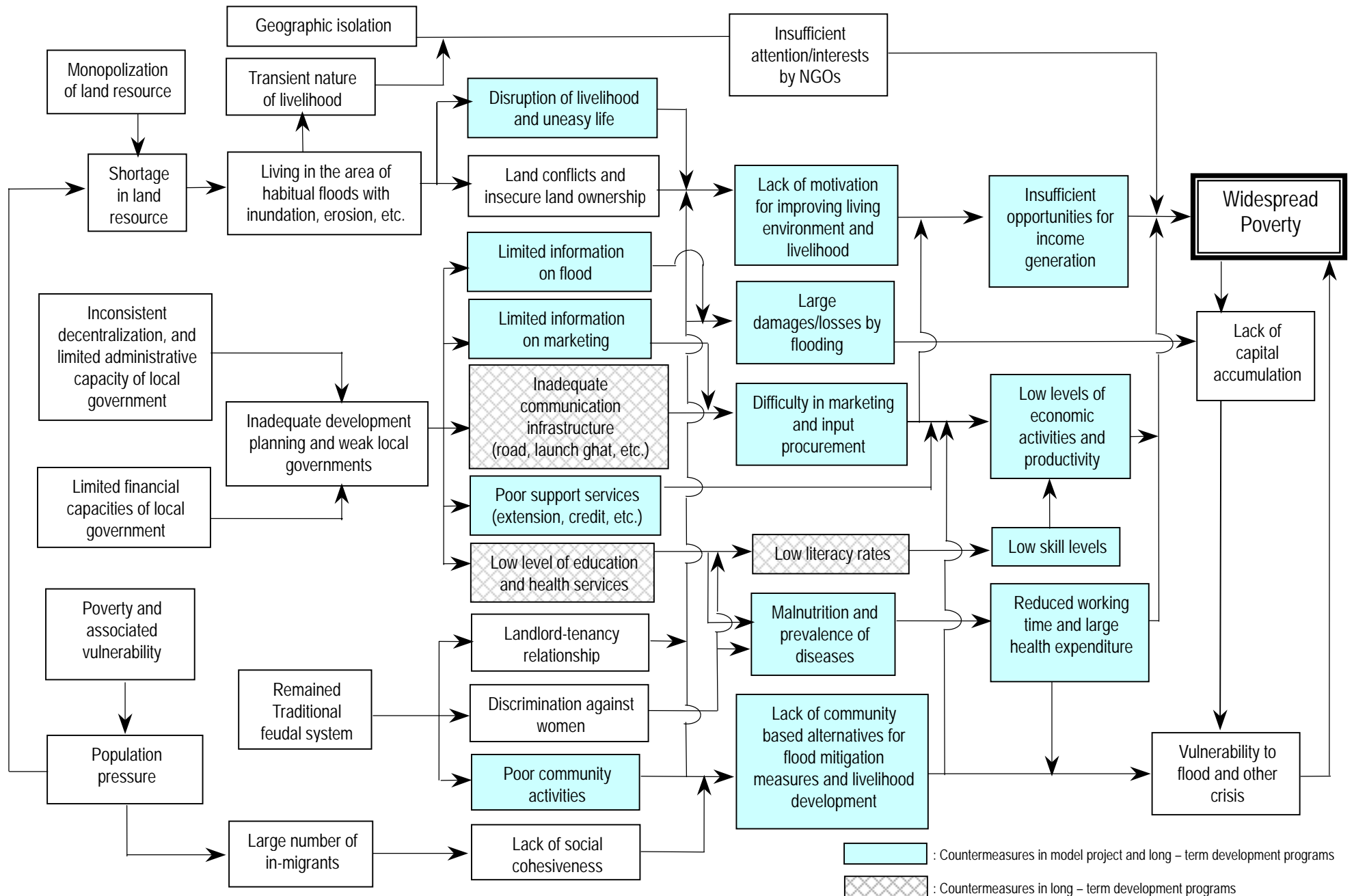


Figure 9 Problem Structure and Countermeasures

Table 6 Problems and Countermeasures

Problems	Countermeasures		
	Long-term development programs	Model projects	
		Algar char gram	Gurai gram
<ul style="list-style-type: none"> • Disruption of livelihood and uneasy life • Large damages/losses by flooding 	• Flood Proofing Program	• Homestead raising	• Mound protection
<ul style="list-style-type: none"> • Limited information on floods • Large damages/losses by flooding 	• Sheltering System Establishment Program	<ul style="list-style-type: none"> • Sheltering place by raising school ground • Approach road to sheltering place • Flood warning and evacuation 	• Flood warning and evacuation
<ul style="list-style-type: none"> • Low level of health service • Malnutrition and prevalence of diseases • Reduced working time and large health expenditure 	• Primary Health Care Promotion Program	<ul style="list-style-type: none"> • Raised hand tubewell • Home gardening promotion with nutrition education 	<ul style="list-style-type: none"> • Raised hand tubewell • Home gardening promotion with nutrition education
<ul style="list-style-type: none"> • Insufficient opportunities for income generation • Low skill levels 	• Skill Training Program	• Support services for livelihood development	• Support services for livelihood development
<ul style="list-style-type: none"> • Lack of motivation for improving living environment and livelihood • Poor community activities • Lack of community based alternatives for flood mitigation measures and livelihood development 	• Social Mobilization and Institutional Building Program	<ul style="list-style-type: none"> • Establishment of para committee • Appropriate facilitation by NGOs and LGED 	<ul style="list-style-type: none"> • Establishment of para committee • Appropriate facilitation by NGOs and LGED
<ul style="list-style-type: none"> • Low levels of economic activities and productivity • Malnutrition and prevalence of diseases • Limited information on marketing • Difficulty in marketing and input procurement • Poor support services (extension) 	<ul style="list-style-type: none"> • Appropriate Farming Technologies Introduction Program • Community Based Fishery Development and Management Program 	<ul style="list-style-type: none"> • Livelihood development <ul style="list-style-type: none"> - Poultry promotion - Skill training on hand weaving - Mulberry plantation and cocoon production 	<ul style="list-style-type: none"> • Livelihood development <ul style="list-style-type: none"> - Poultry promotion - Nursery development for social forestry - Technical training on fish culture - Training on entrepreneurship and business management
• Poor support services (credit)	[Expanding savings and credit scheme]	• Savings and credit scheme	• Savings and credit scheme
• Low levels of economic activities and productivity	• Rural Electrification Expansion Program	—	[Gram is electrified]
• Inadequate communication infrastructure (road, launch ghat, etc.)	• Communication Activation Program	[1 km to Union Parishad]	[Union Parishad in gram]
• Low levels of economic activities and productivity	• Growth Center Construction Program	[Existence of Bazaar in gram]	[Existence of Growth Center in gram]
<ul style="list-style-type: none"> • Low level of education • Low literacy rates 	• Primary Education Strengthening	[Existence of 2 primary schools, 1 secondary girls' school and 1 madrasa]	[Existence of 5 primary schools and 2 madrasa]
• Insufficient attention/interests by NGOs	[Assurance of flood proofing serve incentives for NGOs]	<ul style="list-style-type: none"> [5 NGOs active in gram] [LGED addresses NGOs to participate in Project] 	<ul style="list-style-type: none"> [2 NGOs active in gram] [LGED addresses NGOs to participate in Project]
<ul style="list-style-type: none"> • Land conflicts and insecure land ownership • Land lord-tenancy relationship 	[Project will be formulated for area without serious land conflict]	[No serious land conflict and less crime rate so far]	[No serious land conflict and less crime rate so far]
• Lack of social cohesiveness	[Projects will be formulated for area without feudal oppression]	[Existence of Matabbars of high reputation]	<ul style="list-style-type: none"> [Existence of Matabbars of high reputation] [Villagers tackle the problems of wave action by indigenous means]

[]: Some factors to minimize problems

6.3 Institutional Measures

(1) Key Institutional Issues

Key institutional issues related to rural development in Bangladesh are identified as follows:

- (i) Inconsistent decentralization policy,
- (ii) Intervention of political interests in local governance,
- (iii) Limited administrative and financial capacities of local governments,
- (iv) Poor quality of public services,
- (v) Limited beneficiary participation,
- (vi) Poor coverage by various government services,
- (vii) Small-scale projects dominated by influence persons,
- (viii) Limited NGO activities, and,
- (ix) Inactive village organizations.

(2) Institutional Strategy

Of the key institutional issues identified above, some would call for actions at the central level for resolution. These actions may be taken as part of the on-going administrative reforms carried out by the government for further decentralization. In particular, the following are conceived already and expected to be realized under the decentralization policy.

- Decentralization of budget administration to the Upazila level, and,
- Institutionalization of local participation at the gram level.

(3) Project Management Office

A key for effecting the institutional strategy described above is to establish a project management office (PMO). It is a centrally-based institution to promote local interests. A Project Management Office shall be established in LGED in Dhaka. The PMO shall be headed by an engineer of LGED at equivalent to or higher rank of Executive Engineer, one senior socio-economist, and relating to supporting staff. The PMO shall have full authority to execute the project. PMO may be initially supported also by consultants and NGO to augment its technical and management capacities.

A possible organization structure with PMO for implementation of the rural development with flood-proofing is illustrated in Figure 10.

(4) Project Implementation Unit

The Project Implementation Unit (PIU) consists of LGED Upazila offices, Upazila office, NGOs,

Union Parishad (including Union Coordination Committee), and para committees (PCs). The structure of PIU for the implementation of the rural flood-proofing development is illustrated in Figure 10.

The LGED Upazila office is the main promoter of the project implementation under the guidance of LGED District office supported by NGOs and Upazila Office. The LGED Upazila office's main functions for the project implementation are as follows:

- Coordinating with NGOs and Upazila Office according to the guidance of LGED District office;
- Selecting the target paras in cooperation with gram;
- Preparing an implementation plan and project budget of each project;
- Facilitating the establishment of PCs in cooperation with NGOs;
- Explaining the necessity of projects to Union Parishad members and the people in the model project areas;
- Facilitating participatory development of the model project areas in cooperation with NGOs;
- Transferring skills to PCs in planning and construction;
- Training PCs in operation and maintenance after implementation; and
- Coordinating between Union Parishad and PCs.

NGOs' main functions in PIU are as follows:

- Facilitating the establishment of PCs in cooperation with LGED Upazila offices; and
- Providing training and education in each livelihood program for PCs.

Upazila Office's main function in PIU is as follows:

- Supporting LGED Upazila offices in terms of each division's speciality and services.

Union Coordination Committee's main task at PIU is:

- Securing village people's consent to the model projects and the model project areas in cooperation with LGED Upazila offices.

PCs are basically composed of all the households in para to enhance their sense of ownership.

PCs main functions in PIU are as follows:

- Participating in the model projects from the planning stage to the O&M stage;
- Sharing the project costs by providing labor for construction; and
- Serving as the main entity of operation and maintenance after the project implementation.

PC members receive various training and education for O&M and livelihood programs.

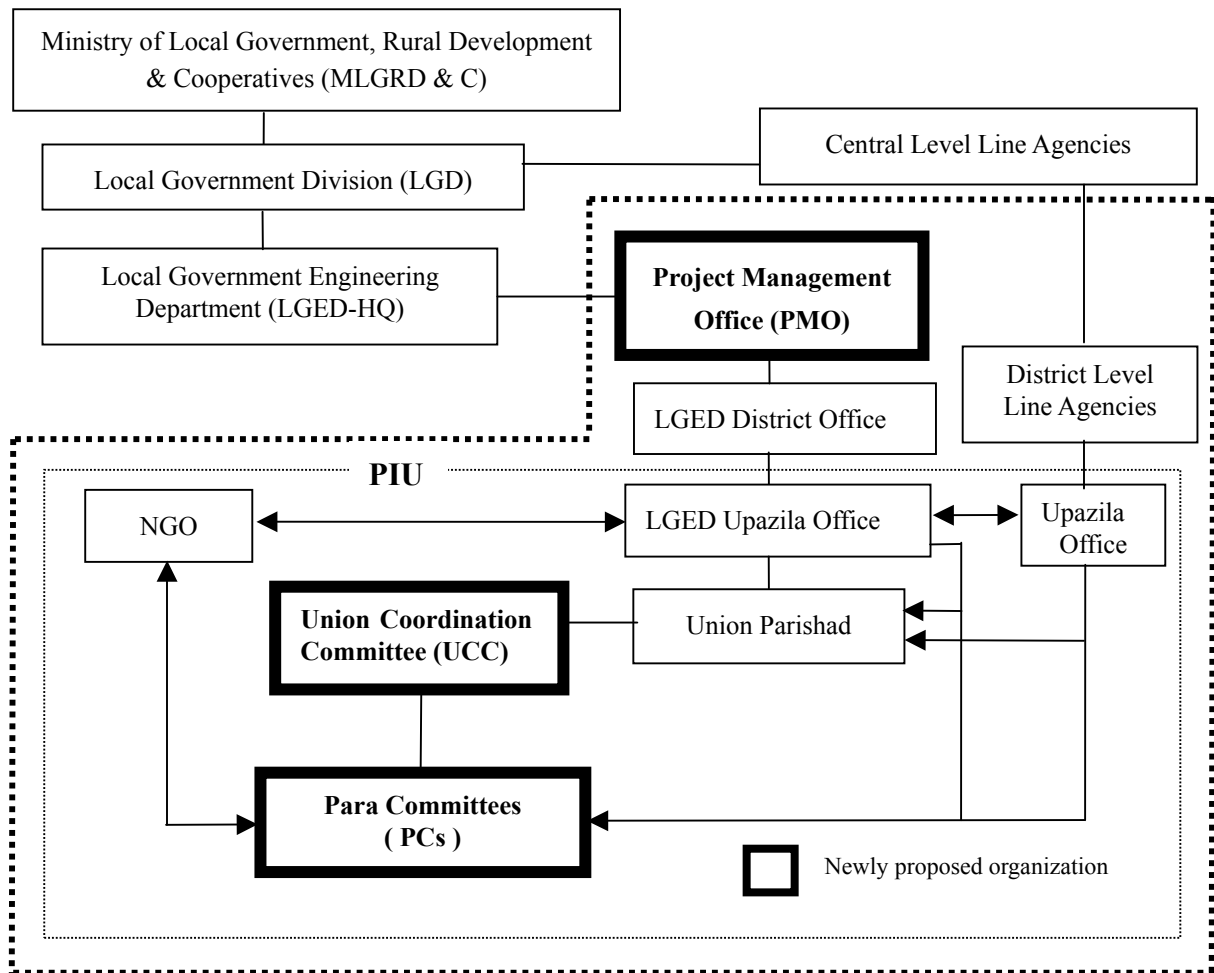


Figure 10 Project Implementing Arrangements

6.4 Initial Environmental Examination (IEE)

An initial environmental examination (IEE) has been conducted with the objectives of (i) identifying the project’s key environmental issues, (ii) evaluating potentially significant impact, (iii) recommending possible mitigation/abatement measures, and (iv) formulating a monitoring program for the significant environmental issues.

It is clear from the IEE study that the flood proofing would bring some adverse impact on natural and living environments.

The most significant impact is foreseen as the deterioration of soil fertility in Char areas. This may be caused by flood-proofing that would prevent nutrient rich silt from depositing and enriching light and low fertility Char soil. Other possible adverse effects include more serious soil erosion in other areas due to changes in water flow patterns caused by flood-proofing, increased sedimentation outside the flood proof areas and water logging, destruction of wetland and peat land by construction of structures, and changes in wetland flora and reduced floral diversity as

well as various socio-economic changes.

Most adverse effects foreseen would be mitigated through careful planning and adequate compensations. Further project development should incorporate these proposed mitigation measures. As locations and intervention measures are specified through the further project development, a comprehensive environmental impact assessment (EIA) needs to be carried out. Some important issues to be addressed during the EIA include (i) involuntary settlement, (ii) increase in domestic and other wastes, (iii) changes in vegetation, (iv) degradation of ecosystem with bio-diversity, (v) negative impact on important flora and fauna, (vi) destruction of wetland, (vii) soil erosion, (viii) changes in hydrological regimes, and (ix) sedimentation.

Extensive surveys would need to be carried out as part of the EIA. They should cover (i) water quality for surface water and groundwater, (ii) sanitation conditions, (iii) flora and fauna, (iv) soil fertility, (v) fish resources, (vi) health conditions, and others.

7. FEASIBILITY STUDY FOR THE MODEL AREA IN CHAR

7.1 The Study Area

(1) Area and Population

Algar Char gram is located on the left bank of the Jamuna river in Erendabari Union, north-eastern part of Fulchhari Upazila, Gaibandha District. It is bounded by Jigabari gram to the north, Jamalpur District to the east, Dakaitar Char gram to the south, and the Jamuna river to the west.

Access to the Algar Char is not easy. It is some 35 km away from the Fulchhari Upazila Headquarters and 25 km away from the Gaibandha District Headquarters, both across the Jamuna river.

The gram was established some 100 years ago, when the first settlers came to the place from Sirajganj District. Gradually other families from the same district settled down the area.

The Algar Char gram has an area of 713 ha, of which 7.3% or 52 ha are residential, 78.9% or 562 ha agricultural area, and 13.8% or 99 ha water body including pond and river.

The population of the whole gram totals 3,139, consisting of 1,610 male and 1,529 female. The gram is divided into seven paras or neighbourhoods consisting of group of homesteads: Jalal Sarkar/Hossain member para (Jalal para), Mokbul bapari para (Mokbul para), Razzak chairman para (Razzak para), Aklas member/Samad fokir para (Aklas para), Joynal member/Hassan Khalifa para (Joynal para), Zolil dewani para (Zolil para), and Maher munshi para (Maher para).

Para wise population by sex and households are shown in Table 7.

Table 7 Para-wise Population by Age Group and Sex, and Number of Households and Average Family Size

Age Group	Jalal Para		Moqbul Para		Razzak para		Eklas Para		Jahurul Para		Zolil Para		Meher Para		Total	
	M*	F**	M	F	M	F	M	F	M	F	M	F	M	F	M	F
> 60 yrs	14	20	8	7	10	17	14	11	21	13	1	0	4	3	72	71
18-59	184	187	65	62	219	167	142	148	137	158	38	28	47	47	832	797
9-17	90	93	24	23	39	33	72	55	48	39	26	22	11	20	310	285
5-8	39	37	16	14	42	33	46	27	35	38	7	10	15	12	200	171
1-4	24	24	15	13	34	42	24	26	29	35	10	10	14	10	150	160
<1	17	11	8	7	6	8	9	5	4	6	0	6	2	2	46	45
Total	368	372	136	126	350	300	307	272	274	289	82	76	93	94	1,610	1,529
G. Total	740		262		650		579		563		158		187		3,139	
Nos. HH***	142		51		127		114		111		31		35		611	
Family size	5.2		5.1		5.1		5.1		5.1		5.1		5.3		5.2	
Area (ha)	14.9		3.0		6.6		11.1		9.5		4.1		2.9		52.1	
Pop. Density (people/km²)	4,933		8,733		9,848		5,216		5,926		3,854		6,448		6,025	

Remarks: *:Male; **:Female; ***:Household

Source: JICA Study Team based on the PRA by DICS, 2002

(2) Socio-economic Conditions

(a) Land use and land ownership

Land use of the Algar Char gram is largely determined by elevation of land. In higher land including artificially raised land, people enjoy ordinary life. Homesteads with useful trees and garden, road, school, hat/bazaar, etc. are usually seen on highland. Medium land is utilized for homesteads and crop field. Lower land is utilized for temporary settlement, seasonal crop field, seasonal fish farming/rice cum fish farming, fishing, seasonal boat activities, etc. Water bodies are used for pisciculture.

Major crops grown are rice, wheat, jute, groundnut, chilli, sweet potato, potato, garlic, onion, coriander, sesame, mustard, safflower, pulses, lady's finger, pumpkin, egg plant, snake gourd, etc. Fruit trees grown include: mango, black berry, jackfruit, coconut, banana, guava, lemon, date, betel nut, papaya, etc. Trees grown on the homesteads and along road sides are: mahogany, Dalbergia sisso, eucalyptus, neem, bamboo, etc.

The absolute landless shares 205 households or 33% of the total households. A broad category of landless (combining the absolute landless, functional landless and landless) accounts for 415 households or 68% of the total. Lager farmers with 7.5 or and larger land are 11, 1.8% of the total households. More than 90% of female headed households fall in the broad category of landless. Some landless people and marginal farmers lease in the land from landowners for agricultural and homestead purposes.

Summary

(b) Social structure

Social customs and events in the gram are much related to the religion. Various ceremonies such as Khatna (circumcision), Milad (a socio-religious ceremony), Chehlum (special pray for departed soul of dead body), Eid-ul-Fitr (celebration after one month fasting), Eid-ul-Azha (sacrificing ceremony), Oaz (Preaching for Islamic life style), etc., are Muslim based events.

Cases of mutual cooperation are very rare in the gram. Some cooperative activities are found such as: (i) funeral activities of some poor people, (ii) marriage of a poor person's daughter, and (iii) assistance to poor during flood.

In the local society, a leader, referred to as a matabbar, has a power in terms of economy, politics, and judiciary. Matabbars exist in every para. They are generally rich landowner and very influential in decision making, judicial matters, etc. In Algar Char gram, each para is named after their name or names of their forefathers. In many cases they are elected Union Parishad members. Basically their power lies with their wealth. They keep a powerful brigade of followers who work for him as stalwarts. Usually villagers obey and follow the advice and instruction of the matabbars.

At the gram level, the Union Parishad Chairman of Erendabari Union, who lives in the Algar Char gram takes leadership and make decision. At the ward level, members of Union Parishad (UP), elected representatives of the ward, are considered as the leaders of a ward. Exercise of power of UP members are undoubtedly confined in a ward. Some para matabbars are so influential and powerful that UP members do not confront with them. Generally female UP members cannot play any significant role in the ward.

At the Union level, the UP Chairman is the chief executive of the lowest level governmental body. The UP Chairman, usually rich businessman or large agricultural producer, is the most influential person in the union. Being local government representative, they have ties with the political parties.

At the Upazila level, Upazila Nirbahi Officer (UNO) appointed by the Government has the power to hold and chair the meetings of Upazila Parishad. In addition, all related Upazila level officers such as LGED engineers, education officers, bank officers, land ministry officers, police officers in charge, etc., hold the power to influence the villagers before serving them any assistance.

(c) Occupation

Economically active population with the age of over 13 years, may be some 1,050 for male, and 1,000 for female. Most male seem to have more than two occupations. Assuming that not all female possess occupation, female who are involved in economic activities also have more than two occupations. Main occupations are self-employed farming, daily labor and agricultural labor, and share croppers. Agriculture related activities are by far dominant occupation in Algar Char gram. Other occupations include includes business, garments, fishing, cobbler, etc. for men, and

garments, handicraft, etc., for women.

In the dry season, agricultural work is the main profession, but not sufficient to accommodate all people's employment. Some people go out the gram to search jobs. In the wet season, employment opportunities in the gram decrease, due to submergence of agricultural field by raised water level of the Jamuna river. Only jute and aman paddy remain in the field.

(d) Income and expenditure

Large farmer's earning is the largest with an annual income of Tk.190,000, followed by family welfare assistant with Tk. 68,400, teacher with 56,000, village doctor with 50,000, etc. On the other hand, daily labor earns the least with an annual income of Tk.9,600 for female, and Tk.19,000 for male.

Food expenditure is much larger than other expenditures. It ranges from 46% for large farmer to 85% for daily labor. Other large expenditures are for housing, education, clothes, etc.

(e) Education and health

Literacy rate in Algar Char is 35% for male and 40% for female. Higher literacy rate in female may be due to recent primary education program putting more emphasis on girls.

There are 1,567 school-aged children in the gram, of which 46% or 719 are enrolled. There are two primary schools (government and registered) in Jalal para and Aklas para, one NGO school and one Madrasha in Aklas para and one girl's junior high school in Razzak para.

More than 50% of people receive health services within the gram or nearby gram. Village doctors are the most accessible health services for the majority of villagers. More female go to Family Welfare Assistant in the gram. In case of emergency or serious diseases, patients have to go to hospitals in Gaibandha or Rangpur to receive high quality medical services. There are several cases reported where patients died on the way to the hospital on the boat crossing the Jamuna river.

(f) Credit

Various credit facilities are available in the gram. There is one private bank, four registered NGOs, and nine unregistered local samitees, which extend loans. More borrowers apply for loans to local samitees, as the bank needs collateral for application and as NGOs confine borrowers to members only. Some 1,000 villagers get loan from local samitees, 93 from registered NGOs and 20 from the bank. Objectives of loan application are mainly for production activities such as poultry, livestock, agriculture, shallow pump, etc., as well as land lease and mortgage.

(3) Agriculture and Marketing

Agricultural land accounts for 78.9% of the total area with cropping intensity of 1.32.

Summary

The farm land is divided into the paddy field occupying 355 ha or 63% of the agricultural land and the upland field with 207 ha or 37%.

The average yield of cereals (Boro HYV) is 4.23 ton/ha in Gaibandha district but higher at 5.13 ton/ha in the Study Area.

Cropping season in Bangladesh is divided into three: Kharif I, Kharif II and Rabi. Kharif I corresponds to pre-monsoon cropping season from mid-March to mid-June. Kharif II is the cropping in the wet season from mid-June to mid-October. Rabi crops are cultivated in the post-monsoon period or dry season which lasts for five months from mid-October to mid-March. Cropping pattern in Algar Char gram, generally follows this schedule.

Crops cultivated in the Kharif season are limited mostly to rice and jute, while in the Rabi season, various kinds of crops including rice, wheat, pulses, groundnut, vegetable, etc. are cultivated. Sugarcane is cultivated throughout the year.

Extension activities are organized through regular visits by the Block Supervisors to the village and para. Block Supervisors are responsible for distribution and adoption of modern technologies by farmers. Block Supervisors services, however, are insufficient in the project area because of limited staff.

Fishery is considered one of the most important sources of cash-income. In Algar Char gram, the Jamuna river is the most important for natural fishing. On the other hand, the fish ponds are controlled by private owners with the net-income of Tk. 20,000 per year with a typical pond of 1.0 ha surface area.

There are three bazaars in Erendabari Union: Jigabari bazaar, Algar Char bazaar and Horiehandi bazaar, and Algar Char bazaar is located in Razzak Chairman para.

Algar Char bazaar is a public market, managed by Union Parishad. The market opens three times per week, with some 75 permanent and 150 temporary shops engaging. Middleman, so called "Paikari", and shopkeeper themselves, transport most of commodities, such as food and other daily necessities.

(4) Rural Infrastructure

One main village trunk road categorized as R2 (Rural Road Class 2), running from north to south within the Algar Char gram, connects to Jigabari where union parishad office is located about 1 km north from the center of the gram. Katcha (without pavement) roads with length of 5.82 km exist while there is no pucca (with pavement) within the gram. Of the total road length, 3.1 km are elevated, which were not submerged during the 1998 flood. Remaining 2.7 km length of the road are submerged even during the normal flood.

Boat landing place is available at Jigabari gram of Erendabari Union next to Algar Char gram to the

north. Villagers go to Gaibandha municipality, which is their administrative district for government services crossing the Jamuna river about 25 km away from Algar Char gram by taking three hours in the dry season and 2.5 hours in the rainy season, respectively.

There are 62 tubewells including both government and private ones in Algar Char gram, out of which 16 were inundated in the 1998 flood. Coverage by the flood condition shows that population service ratio by existing tubewells which shows Razzak Chairman para is insufficient with coverage of 163 population per one tubewell in comparison with other paras.

(5) Floods

(a) Flood environment

The Algar Char gram is situated in the active floodplain on the left bank of the Jamuna river. In the course of time the Algar Char gram has become an Attached Char to the left bank. Damage to their household properties, particularly the livestock and homesteads, is a regular feature in every flood.

People of Algar Char have to take preparation to meet the annual flood by procuring 'chira', 'muri', 'gur' and other rural food items with the scanty means they have. They are to depend on natural symptoms to understand about an approaching flood and look for a shelter when their houses are inundated or eroded. There are not enough rooms in the three schools cum shelters of the village during a flood season. Many evacuee families pass days and nights in open-air refuge places or on the unsubmerged roads. Even if a family gets space in a shelter there are many other problems they have to overcome. Inadequate food, problems of sanitation, scarcity of drinking water and medicine, lack of safety and security are some of the distressing problems the villagers confront in shelters/refuge places.

(b) Inundation

Table 8 shows the percent of 'homestead areas only' that suffered inundation during the years 1988, 1998 and 1999.

Table 8 Inundation of ‘paras’ (homestead only) in 1988, 1998 and 1999

Sl No.	Village/ ‘paras’	Total Homestead Area (ha)	Inundation 88			Inundation 98			Inundation 99		
			Inundated area		Average Duration (week)	Inundated area		Average Duration (week)	Inundated area		Average Duration (week)
			(ha)	%		(ha)	%		(ha)	%	
1	Jalal para	14.9	14.9	100%	3	7.3	49%	5	1.5	10%	2
2	Mokbul para	3.0	3.0	100%	3	1.9	62%	3	0.6	19%	2
3	Razzak para	6.6	6.6	100%	3	5.9	90%	3	0.5	8%	1
4	Aklas para	11.1	11.1	100%	3	6.5	59%	5	1.0	9%	1
5	Joynal para	9.5	9.5	100%	3	9.5	100%	3	1.1	12%	1
6	Zolil para	4.1	4.1	100%	5	4.1	100%	7	1.0	25%	2
7	Maher para	2.9	2.9	100%	4	2.9	100%	3	1.7	57%	2
	Total	52.1	52.1	100%		38.1	73%		7.4	14%	

Source: JICA Study Team

It is seen that 100% of the homesteads were submerged in 1988, while 73% of them went under water in 1998, while some 14% were inundated in the normal flood year of 1999.

The crop damages are due to the floods of 1988 and 1998, and that there was no damage in the normal flood year of 1999. The farmers generally do not grow crops in the low lying areas of the chars which are most likely to be inundated in monsoon by normal yearly floods.

Damage to cattle occurs only during the severe floods. During the severe floods of 1988 and 1998 cattle were lost to the tune of 433 and 79 respectively, while in 1999 normal flood there was no loss.

Loss of human life in the village Algar Char occurred mostly in 1988 with 17 deaths and also in 1998 with four deaths. However, in the normal flood year of 1999 there was no death.

(c) Existing flood shelters and flood warning

Although there is no proper flood shelter with all the possible facilities in the village, three existing schools/madrassa are so remodelled as to serve for flood shelters with raised lands. Besides, two rural roads are commonly used by the flood affected people as refuge place for themselves and their cattle.

There is no systematic flood warning system at work in any of the seven paras of Algar Char. People decide to evacuate by observing the rise of water level and other natural symptoms when the flood is already in their doorsteps. Not that all members of the family evacuate to a safer place, rather in most cases some may decide to stay on at their premises to look after the belongings by surviving on raised platforms (macha).

From the government or NGO side, advanced evacuation of the flood affected people is not done;

more exactly the marooned people are rescued by the government and non-government agencies only under extreme circumstances.

(d) Overall constraints in Algar Char

Main problems in Algar Char are inundation of homesteads and lack of adequate number of shelters.

Villagers of Algar Char (four out of seven paras) think inundation of households is the most troublesome problem (59%). However, reason for low percentage (16%) in favour of inundation of households by Razzak chairman para is probably due to the raising of homesteads by CARE in 2001. People in Zolil Dewani para (12%) and Mehar Munshi para (0%) do not think homestead inundation is their most serious problem although most of their houses have the maximum inundation every year. These two paras are most vulnerable to erosion as well as inundation due to their location and relatively lower elevations. Apprehending the homestead raising there is infeasible, the villagers might have opined for some other items.

(6) Existing Organization and Government Support Services

There are several organizations in Algar Char established with different purposes.

Members of the organizations on businessmen, schools and madrasha, and mosques are village leaders, UP members, UP chairman and local elites. Fishermen are united to cooperate one another through credit. These organizations are largely active, but securing fund for sustaining their activities is the major issue.

Although several development activities and support services are provided by the Government, villagers are generally not satisfied with them.

(7) Non-governmental Organizations' (NGOs) Activities

There are four NGOs active in Algar Char. They are all targeting socially weak segment of the society like landless poor, daily laborers, women, etc., with the objective of uplifting their living standard through the provision of credit for IGAs and training on agriculture, health, education, etc. A total of 370 people participate in the activities.

Although villagers expect more support from NGOs in the fields of health, water and sanitation, education, credit, relief, agriculture, etc., they appreciate the activities of NGOs and feel benefited from them so far.

7.2 Problems and Constraints

(1) Problem structure analysis

A participatory approach is taken to reflect views and opinions of various stakeholders who are

Summary

more familiar with the area. Two methods are used: project cycle management (PCM) workshops and participatory rural appraisal (PRA).

The causal relationships between various problem factors identified for the core problem of aggravating poverty have been analyzed, and the problem structure constructed as shown in Figure 11. This is the problem structure of aggravating poverty as perceived by the villagers in Algar Char.

(2) Constraints to Rural Development in Algar Char

The problem structure analysis, showing in figure 11, based on the PCM workshop results has clarified that religious resistance against family planning, early marriage and preference of male children, all rooted in the traditional value system, are among the fundamental problem factors causing high birth rates that contribute to aggravating poverty. Discrimination against girls/women, another societal problem, has been revealed by the PRA in the form of lower wages, smaller size of land for inheritance, and social customs related to marriage.

Another root cause of various inter-related problems, clarified by the PRA, is the local power structure dominated by the rich, often tied with the political system. This problem, in fact, also has a social/traditional dimension as represented by the dominance of patron-client ties to a prominent/influential man in a village neighborhood (para). Most local people are trapped in this hierarchical socio-political problem structure. Within this structure, the people face the transient and unstable nature of their livelihood due to habitual flooding and erosion. They are severely constrained by limited political power as well as limited resources to overcome flood-related problems, and their meager efforts often turn out to be futile against next floods.

Despite the existing problem structure outlined above, the PRA notes some positive changes. For instance, literacy has improved more for women as a result of the recent emphasis on the importance of primary education for girls. Recent efforts to improve the living conditions of rural people have changed their priority needs. For instance, villagers have expressed their needs for more sanitary latrines, reflecting their heightened awareness of sanitation. Hand washing has been promoted by distribution of free soaps as part of the FPP by LGED-CARE. Also, homestead inundation is now perceived by villagers as less of a problem in Razzak chairman para as a result of homestead raising by CARE in 2001.

The problem structure would only be dissolved slowly if continued efforts are made to address to those various aspects identified in this section, including literacy education, health and sanitation, training for livelihood, land tenure improvement, and others as well as physical/structural measures for flood mitigation. Villagers' perceptions and needs would change through their involvement in planned development efforts as manifested in the recent projects. NGOs would be instrumental in involving villagers through organizing and training. In Algar Char, there are four NGOs active in livelihood development. Their efforts would only need to be augmented and continued.

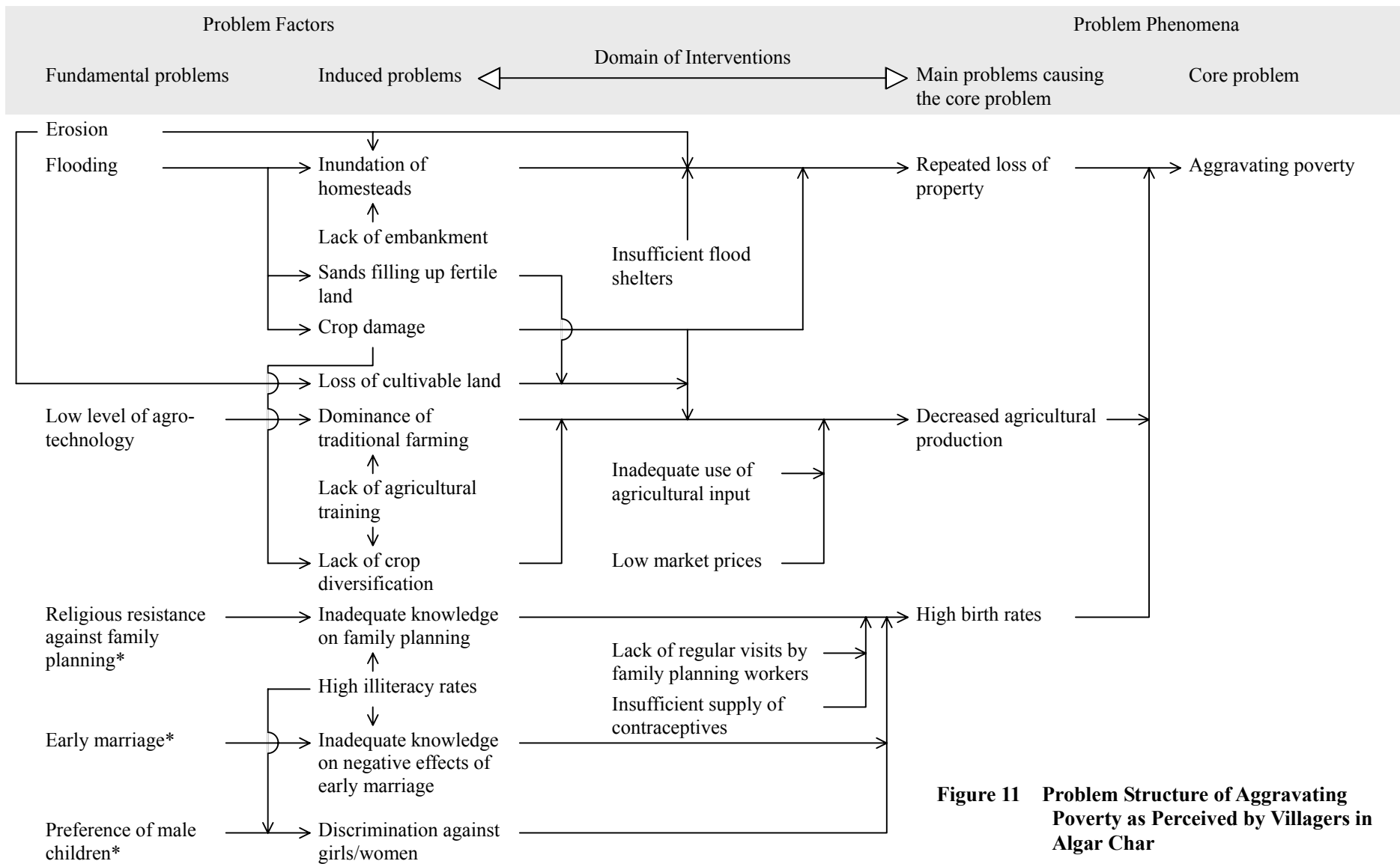


Figure 11 Problem Structure of Aggravating Poverty as Perceived by Villagers in Algar Char

*Due to traditional value system

7.3 Development Plan

The development plans are formulated in five paras: Mokbul bapari para, Aklas member/Samad fokir para, Joynal member/Hassan khalifa para, Zolil dewani para and Maher munshi para. CARE has carried out works of homestead raising in two paras: Jalal Sarker/Hossain member para and Razzak chairman para. Therefore, these two paras are excluded from the development program.

(1) Flood-proofing and Improvement of Living Environment

(a) Homestead raising

In principle, the homestead raising shall be implemented in a stable char that has not been affected by flood induced erosion for at least 20 years. Two of the five target paras namely Zolil dewani para and Maher munshi para are at present vulnerable to river erosion. Hence these two paras are excluded from the consideration of development by homestead raising. The remaining three paras, namely Mokbul bepari para, Aklas member/Samad Fokir para and Joynal member/Hassan Khalifa para will be taken up for homestead raising under the model project of Algar Char gram.

Table 9 Number of Houses in 3 paras with inundated Depth

Sl.no	Name of para	Year	Total no. of houses in the para	No. of houses with maximum range of depth in cm of flooding					No. of Proposed Homestead Raising
				0	0-50	50-100	100-150	>150	
2	Mokbul bepari para	1999	59	48	10	1	0	0	11
4	Akklas member/Samad fokir para	1999	238	216	12	10	0	0	22
5	Joynal member/Hassan khalifa para	1999	225	197	14	14	0	0	28
Total			522	461	36	25	0	0	61

Source: JICA Study Team

The 61 houses submerged under 0-100 cm of water in 1999, should be raised against severe flood level of 1998.

The volume of earth for raising of homesteads in three paras is shown in Table 10.

Table 10 Earthwork volume in homestead raising

Sl. no of para	Name of para	No. to be raised	Average area of (m ²)	Average height of fill including freeboard 30 cm (m)	Volume of earth (m ³)
2	Mokbul bepari para	10	100	1.25	1,250
		1	100	1.75	175
4	Aklas member/ Samad fokir para	12	100	1.25	1,500
		10	100	1.75	1,750
5	Joynal member/ Hassan khalifa para	14	100	1.25	1,750
		14	100	1.75	2,450
	TOTAL	61			8,875

(b) Sheltering place by raising school ground

There are three school-cum-flood-shelters having total capacity of 340 persons. Obviously, this is insufficient. Most of the evacuees, therefore, take refuge on the open-air space in front of the school cum shelter and on the un-submerged parts of village roads, which too comes in acute shortages during a severe flood. Therefore it will be imperative that an open-air raised refuge place be implemented in the village. In Aklas member/Samad fokir para there is a primary school (Algar Char Government Primary School) having in front an open ground measuring 60 m x 75m. This should be raised to develop as a refuge place for about 1,500 people and their cattle.

Table 11 School Ground Raising

School ground area (m ²)	Average present ground level (m)	1988-flood level in the area (m)	Free board (m)	Proposed EL of raising (m)	Total height of raising (m)	Total volume of earthwork (m ³)
4,500	20.40	21.66	0.60	22.26	1.86	8,370

(c) Approach road to sheltering place

The approach road to the above sheltering place of Algar Char government primary school's ground, located at Aklas member/Samad fokir para (No.4), is required to be raised up for evacuation use before and during flood. Design elevation is proposed at 21.50 m, the same as designed homestead raising in consideration of evacuation from their homestead areas.

A total length of the approach road to be raised is proposed to be 503 m by earth filling involving three culverts as appurtenant works.

(d) Raised hand tubewell

Following numbers of tubewell are required either by raising pit of existing tubewells or installing new tubewell of which a total number is 6 to the target paras, as shown in Table 12.

Table 12 Proposed Numbers of Hand Tubewell

Sl. No. and Name of Para	Population (no.)	Existing condition			Proposed numbers of tubewell		
		Numbers of well (no.)	Inundated in 1998 flood (no.)	Coverage (popl./well.)	Raising of existing well (no.)	Newly required (no.)	Coverage (popl./well.)
2. Mokbul bapari	262	5	0	52	-	-	52
4. Aklas member/ Samad fokir	579	12	0	48	-	-	48
5. Joynal Member/ Hassan khalifa	563	15	0	38	-	-	38
6. Zolil dewani	158	4	4	-	3	-	53
7. Maher munshi	187	2	2	-	2	1	62
Total (Average)	1,749	38	6	(55)	5	1	(46)

Source: Questionnaire survey by JICA Study team

(e) Flood warning and evacuation

After a message of warning is received from the Fulchhari UZDMC, the Union DMC will disseminate it through its Committee members, volunteers and Chowkidars to Algar Char gram and other grams. Local school teachers, Imams of the mosques, members of the UP will play important roles in dissemination by announcing in schools, religious congregations, drum beating in markets and using microphones of the village mosques. Gram DMC, therefore, is proposed to organize those members of Algar Char gram through the project.

The dwellers of Algar Char gram, being informed of the impending floods, will look for appropriate shelters. In most cases, they will move by their own arrangement of boats. However, in some cases, the Gram and Union Disaster Management Committee under the support of the UZDMC and the district administration will arrange boats as it was done before.

Training on flood warning and evacuation is targeted to dwellers of Algar Char gram who will be refugees as well as messengers to disseminate flood warning to the Gram DMC from Union DMC and Fulchhari UZ DMC. The training program may be organized by FFWC, LGED and NGOs.

(2) Livelihood Development

(a) Support services for livelihood development

Although the villagers of Algar Char will be the main players of livelihood development, external support is necessary in the beginning, given the constraints to further development identified in the previous section, including decreased agricultural production, inadequate use of agricultural inputs, low market prices, dominance of traditional farming, etc.

Among the constraints, decreased agricultural production is attributed to the inadequate use of agricultural inputs and dominance of traditional farming. Limited employment opportunities are another constraints to improve livelihood conditions. While trying to improve agricultural

productivity through extension, livelihood development shall be enhanced through the provision of various support services to expand the opportunities for income generating activities as well as develop skills for the villagers of Algar Char.

Under the limited land area for homesteads and poor economic activities, livelihood development activities to be promoted shall not need wide homestead area for non-farm economic activities, and ideally take advantage of the land specificity in terms of soil, climate, etc., for farming economic activities, in principle.

(i) Home gardening promotion with nutrition education

Home gardening will be promoted utilizing raised homestead area to improve nutrition status of local people through maximum use of the limited available land, in light with poor health status at present. Vegetable cultivation technology will be extended with certified seed distribution. This should be accompanied by nutrition education to enhance the awareness of the people. This activity may be promoted by NGOs. Target group will be women.

(ii) Poultry promotion

Poultry rearing (layer chicken) technology will be extended by extension worker of Department of Livestock or NGOs. This activity will be promoted mainly for utilizing a limited homestead area of individual houses. Target group will be landless women.

(iii) Skill training on hand weaving (embroidery)

Current weaving activity by women in the gram will be upgraded by skill training. Women will be organized to form a producers group. With the improved skills, quality products will be brought outside markets for sale by NGOs.

(iv) Mulberry plantation and cocoon production

The JICA Study Team sees sericulture development in the gram promising. To promote it, mulberry trees will be planted after training on mulberry tree cultivation conducted at first. Mulberry fruits will also be utilized for jam making in the long run. The target group will be landless farmers. This will be promoted by NGOs.

(b) Livelihood development

After the training, beneficiaries will start income generating activities under the supervision of NGOs and concerned government extension workers. Expected benefits of each activity are estimated in Table 13.

Table 13 Expected Benefits of Each Activity

Income generating activities	Nos. of beneficiaries	Unit	Production	Gross profit (Tk./year)	Total cost (Tk./year)	Net profit (Tk./year)
Poultry (layer)	50	Chicks Eggs	1,200 90,000	54,000 225,000	129,000	150,000
Local embroidery (Nakshikatha)	10	Nos.	360	288,000	206,460	81,560
Mulberry planting	1	Sapling	5,000	5,200	3,300	1,900
Cocoon production	20	Kg	2,800	260,000	130,000	130,000

Source: Gender Development Research Center (GDRS) and BRAC

(3) Savings and Credit Scheme

Three main components of any savings and credit scheme are (i) sources of funds, (ii) allocation/distribution/disbursement methods, and (iii) use of credit. Alternative schemes are conceived by combining different options for each component. Possible combinations are examined for the rural development in Char areas.

It is proposed that compulsory savings and surcharges to user fees of livelihood support services be combined for the model project in Algar Char. This would help strengthen the linkage between flood proofing and livelihood development. Those who would benefit more from flood proofing have strong motivations to save more, or conversely, those who save more through availing of livelihood support services would benefit more from flood proofing.

Sources of funds for the credit scheme include the following:

- Savings, compulsory and voluntary, by potential beneficiaries,
- Seed capital to be provided by donors and/or the Government, and
- Matching fund, a variant of seed capital to be provided in proportion to savings by potential beneficiaries.

Seed capital should be allocated only partly in proportion to the number of PC members to encourage the PC formation. The remaining bulk should be distributed in accordance with the amount of own savings, effectively making it a matching fund.

Credit should be used for both purposes: insurance against unexpected events and loans for IGAs and flood proofing/mitigation works. This would introduce more complicated management needs than in the case in which only loans are provided. It is necessary in any case, however, to supervise and monitor savings of PC members and allocation of the seed fund as well as credit and insurance payments at any given point in time. For the model project, essential options for both sources and use of funds should be included in the savings and credit scheme so that management issues would be clarified through initial implementation and modifications of the scheme made for subsequent implementation.

7.4 Implementing Schedule

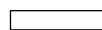



The implementation of the model project in Alga Char will start from Aklas Member/Samad Fokir para and Joynal Member/Hasan Khalifa para, which are vulnerable to inundation with 82% of proposed homestead raising. In the subsequent phase, Mokbul Beparie para, Zolil Dewani para, and Maker Munsh para will be covered by the model project.

In each project para, a series of community work would be initiated by LGED Upazila officer and conducted by a selected lead NGO. At the initial workshop, the model project as formulated would be presented first, clarifying its approach, proposed components, and expected effects. Para people should be made aware of costs involved in the project and cost sharing expected to be born by them in the project implementation and management. Some project components may be modified in accordance with the ability and willingness to share costs by the para people.

The establishment of implementing arrangements through the series of community workshops would take place during the wet season. Successful people organizing at para with the consensus among them on cost sharing and management responsibilities is a prerequisite for the model project to proceed for the implementation. If successful in this step, the project would be implemented in the subsequent dry season as illustrated in Figure 12.

Figure 12 Implementing Schedule

Sl. No. and Name of Para	Year				
	2003	2004	2005	2006	2007
4 Aklas member/Samad fokir					
5 Joynal member/Hassan khalifa					
2 Mokbul bapari			(*)		
6 Zolil dewani					
7 Maher munshi					

-  : Preparatory Works (Bureaucratic/Administrative Procedures within GOB, Institutionalization/people organizing (PIU etc.), Design work by LGED)
-  : Construction Work by LGED with participation of local communities (earth work, etc.)
-  : Supporting Activities for Livelihood Improvement, Saving and Credit Scheme
-  : Operation and Maintenance of Structure, Monitoring and Evaluation

(*) Including School Ground Raising and Aproach road to School

Proposed Measures by Para

Sl. No. and Name of Para	Proposed Measures
2 Mokbul bapari	
4 Aklas member/Samad fokir	①Homsted Raising, ⑤Flood Warning and Evacuation, ⑥Support Service for Livelihood Development, ⑦Saving and Credit Scheme
5 Joynal member/Hassan khalifa	
6 Zolil dewani	④Raised Hand Tubewell, ⑤Flood Warning and Evacuation
7 Maher munshi	
4 Aklas member/Samad fokir	②School Ground Raising, ③Aproach Road to School
5 Joynal member/Hassan khalifa	

7.5 Project Cost

(1) Summary of Project Cost

Table 14 Summary of Project Cost in Algar Char Gram

(unit: '000 Tk.)		
Description	Amount	Remarks
A. Direct Cost		
I. Flood Proofing and Improvement of Living Environment		
I-1 Sheltering place by raising school ground	817	A=4,500 m ²
I-2 Approach road to sheltering place	484	L=503 m
I-3 Homestead raising	935	61 H/H
I-4 Raised hand tubewell	8	(1+5) nos.
I-5 Flood warning and evacuation	20	
II. Support Services for Livelihood Development		
II-1 Home gardening promotion with nutrition education	20	
II-2 Poultry promotion	20	
II-3 Skill training on hand weaving	14	
II-4 Mulberry plantation and cocoon production	20	
Direct Cost Total (A)	2,338	
B. Land Acquisition	363	A=10,674 m ²
C. Indirect Cost		
I. Administrative cost	117	5 % of Direct cost
II. Engineering fee	187	8 % of Direct cost
D. Physical Contingency	234	10 % of Direct cost
E. Price Contingency	162	5 % of total cost
Ground Total (A+B+C+D+E)	3,401	

(2) Summary of Annual Maintenance Cost

Table 15 Summary of Annual Maintenance Cost in Algar Char Gram

(Unit: '000 Tk.)	
Description	Amount
I. Flood Proofing and Imprpvement of Living Condition	
I-1 Sheltering place by raising school ground	28.2
I-2 Approach road to sheltering place	20.3
I-3 Flood warning and evacuation	0.0
I-4 Homestead raising	53.5
I-5 Raised hand tubewell	1.3
Maintenance Cost Total	103.3

(3) Share of Cost

Villagers provide the land for borrow pit, and bear the OM cost and a part of construction cost.

Table 16 Share of Construction Cost

(Unit: Tk.)

Name of Scheme	Construction Cost	Share		Number of Beneficial HH	Cost/HH
		Government (80 ~ 90%)	Villager (10 ~ 20%)		
1. Sheltering place by raising school ground	1,301,000	1,041,000 ~	130,000 ~	225	600 ~
2. Approach road to sheltering place		1,171,000	260,000		1,200
3. Homestead raising	935,000	748,000 ~ 841,000	94,000 ~ 187,000	61	1,500 ~ 3,000

Beneficial villagers bear 10 ~ 20% of construction cost. One villager shares about Tk.600 ~ Tk.1,200 for sheltering place, equivalent to 2 ~ 4% of annual average income of Tk.28,000. For homestead raising, one villager shares about Tk.1,500 ~ Tk.3,000, equivalent to 5 ~ 11% of annual income. Villagers can choose the way of payment from cash or labor work. Cost sharing of beneficiary will be decided through the meeting between Para Committee and LGED in detailed design stage.

7.6 Project Evaluation

(1) Social Evaluation

Positive social impacts are expected to the people of Algar Char by the Project. The major positive impacts include: (i) empowerment of local people, (ii) strengthening of social cohesiveness, (iii) improvement of health conditions, and (iv) poverty reduction. They are explained in the following.

Local people will be empowered by participating in the whole project process. Planning process will empower people by learning about flood preparedness, their roles and responsibility in the project through organizing themselves. They will be empowered further through implementation process by participating in various activities including homestead raising, training in income generating activities, savings and credit, and other group activities. Organized people will finally be responsible for regular operation and maintenance of road and flood shelter as well as savings and credit activities to make the project sustainable.

Women will be empowered through home gardening and nutrition education, income generating activities such as poultry rearing, hand weaving, etc. Through these activities, it is expected that their social status will be enhanced.

The collective efforts of various activities by the organized people will strengthen social cohesiveness, which will contribute to promote social morality and justice. Such strong ties will reduce the case of crimes and assure public security.

Homestead raising and raising of hand tubewells will assure the normal life for the local people

under the normal flood conditions. It will contribute to the improvement of hygiene conditions, which will reduce the chance of outbreak of epidemics like diarrhea and dysentery. Home gardening with nutrition education will also contribute to the improvement of their health status.

Establishment of flood-proof conditions under normal flood will elongate the normal life, reducing the cost for rehabilitating the damaged houses by flood. Income generating activities will be promoted mainly targeting poor people so that they could increase their income level. Improved health conditions through promotion of home gardening, through establishment of flood proofing conditions and through raising of hand tubewells, will reduce expenditure on medical care and increase available time for socio-economic activities. Savings and credit will also expand the chance to start new income generating activities.

Through the above impacts, living standard of the local people will be enhanced.

(2) Economic Evaluation

Economic analysis is carried out on the basis of the proposed projects, which are expected to generate direct and tangible benefits. Economic validity of the projects is assessed on the basis of three criteria, Net Present Value (NPV), Benefit/Cost Ratio (B/C Ratio) and Economic Internal Rate of Return (EIRR). The results of the analysis are summarized below.

Table 17 Result of Economic Analysis

Project Component	NPV (Tk.)	B/C	EIRR (%)
Homestead Raising	-286,467	0.76	10.0
Scholl Ground Raising, Approach Road to School, and Flood Warning and Evacuation	69,276	1.04	15.7
Raised Hand Tubewell	-1,869	0.83	9.3
Poultry Promotion (chicken)	425,337	1.51	32.2
Skill Training on Handicraft	274,249	1.22	36.9
Mulberry Plantation for Sericulture Promotion	178,056	1.20	19.1
Total	403,118	1.07	16.9

The above result shows that the proposed projects in Algar Char gram are economically feasible as a total. Result of economic analysis in view of EIRR is 16.9%, and B/C ratio at discount rate of 12% is 1.07. The opportunity cost of capital in Bangladesh is around 12%, and the results of total evaluation satisfy the evaluation criteria. The major benefit is generated by such livelihood activities as handicraft production, mulberry plantation and sericulture, and chicken rearing.

(3) Financial Evaluation

The results of the analysis are summarized below.

Table 18. Result of Financial Analysis

Project Component	NPV (Tk.)	B/C	FIRR(%)
Poultry Promotion (chicken)	472,766	1.51	32.2
Skill Training on Handicraft	305,072	1.22	37.0
Mulberry Plantation for Sericulture Promotion	198,099	1.20	19.1

The results show that all support services for livelihood development is financially viable. Among three activities, skill training on handicraft, Nakshi katha waving, is the most profitable. As for these livelihood activities, we can refer to another evaluation results. According to Grameen Bank's estimation, the rate of return on poultry production, handicraft (Nakshi katha) production, and sericulture at first year are estimated at 35%, 292%, and 38% respectively.

(4) Technical Evaluation

The proposed development in three of the seven paras of Algar Char gram in raising the homesteads involves simple earthworks only. Only the homesteads, which have some land to spare earth from, will be finally chosen for raising. Therefore, availability of earth will not pose any problem. As per the existing system, the villagers whose houses are taken up for raising will temporarily take out their existing structures for facilitating the earthwork. After the earthwork is completed they will again erect their houses on the raised grounds. Immediately after completion of earth works the house owners will take vegetative protection against erosion of homesteads. As the houses in char areas are built with such materials that can be moved away in time of need, the temporary removal of the houses and their resetting will be technically possible. As per the existing practice, as they did in CARE projects, the house owners will carry out O&M of the raised earthworks in homestead area as soon as it becomes necessary.

The raising of the school ground of Algar Char Government Primary School for a refuge place is also simple earthwork of a similar nature. At present the ground is vacant. Borrow earth will have to be taken by the local initiative from the nearby fields. CARE did the similar kind of work in other paras of the village in 2001 in raising the three school platforms to convert them school-cum-shelters with the local initiative. The School Committee will do vegetative protection on the periphery of the raised ground through the local initiative. O&M will be possible in this case also by the local people.

7.7 Environmental Impact Assessment (EIA)

It is clear that the flood-proofing would bring some adverse effects on the natural and living environments. The main negative effects and their possible mitigation measures are examined. They are ; 1) Population increase, 2) Drastic change in population composition, 3) Residual toxicity of agrochemicals, 4) Change in vegetation, 5) Negative impact on important or

indigenous fauna and flora, 6) Degradation of ecosystems with biodiversity, 7) Destruction of wetlands and peat lands and 8) Soil erosion. It is also true that complete flood-proofing is not feasible. Any flood-proofing intervention, therefore, would better aim at protecting and enhancing the livelihood of the project area, while providing an adequate level of flood-proofing. Livelihood development and flood-proofing should only be undertaken in mutually supportive steps. With this view, the following are recommended to ensure sustainable livelihood development with enhanced resources capacity.

Agriculture and soil

In Char areas, quick maturing trees may be planted in highest ridge sites and 'Dhaincha' on lower land to minimize soil erosion even if no structural measures are considered. More fertilizers for silty soil and more manure/compost for sandy soil should be used to increase yields. Early summer crops such as maize, sorghum, cheena, kaon, groundnut, and sweet potato may be cultivated to further secure agricultural outputs of these areas. Pesticides should be provided to support these activities.

Ecological resources

The original topsoil should be put back over the filled earth after raising the plinth level for plants, grasses and weeds to grow and cover the ground. Ground-covering plants such as Benna ghas (*Vetivaria zizaniodes*), Durba ghas (*Cynodon dactylon*) and Motapata ghas (*Axonopus compressus*) may also be introduced.

To recover biodiversity in the clustered house area, it is desirable that bushy plants (e.g. bamboo) and ground-covering plants be planted. To restore habitats for amphibians, lizards, and other species, burrows may be provided on the premises.

Socio-economic issues

Appropriate compensations for those who will not move voluntarily need to be planned in consultation with all the affected stakeholders. To reduce income disparities, the less privileged need to be involved in development projects with micro credit, small and cottage industries and other support measures.

Proper planning is required to reduce domestic and other human wastes. Garbage bins and community latrines need to be constructed at suitable locations easily accessible by the local residents.

The project includes the provision of raised hand tube wells in the area. In Algar Char, groundwater from a depth of about 17m contains a high level of iron (12.8 mg/l) and arsenic (0.06 mg/l), both beyond the allowable limits for drinking water. Raising hand tube wells itself will not solve this problem, for it will only prevent floodwater intrusion. To reduce the risk of the mineral toxicity in drinking water, tube wells should be installed in deeper aquifer, preferably over 20m depth.

8. FEASIBILITY STUDY FOR THE MODEL AREA IN HAOR

8.1 The Study Area

(1) Area and Population

Gurai gram is located in the western edge of Haor area. It belongs administratively to Gurai Union, south-western part of Nikli Upazila, Kishoreganj District. It is bounded by Nikli Union to the north, Chatir Char gram to the east, Daulatpur gram to the south, and Chhetra gram to the west. It is about 5 km south of Nikli Upazila headquarters and 30 km away from the Kishoreganj District headquarters.

Gurai gram has a long history. It was founded some 800 years ago by a Sultan. Muslim rulers invaded this village in the medieval age and their army built temporary camps at Gurai. A mosque named “Shahi Masjid”, which still exists, was built by those soldiers. Afterwards people started to live first at the present Majsid para.

Gurai gram has an area of 569 ha, of which 7.9% or 45 ha are homestead area, 89.2% or 507 ha are agricultural area, and 3.9% or 17 ha are water body including ponds.

The population of the whole gram totals 12,132 consisting of 6,656 male and 5,476 female. The map of Gurai, the gram is divided into 17 paras or neighbourhoods, each consisting of a group of homesteads. They are: Chila para, Bania para, Atka para, Uttar para, Fakir para, Jal para, Kuna para, Masjid para, Namsud para, Dakhin para, Purba para, Ghosh para, Pashchim para, Shibir para, Pal para, Naogaon para and Moddon para. These paras are clearly divided by canals and roads.

Para wise population by sex and households are shown in Table 19.

Table 19 Para-wise Population by Sex and Average Family Size and Population Density

No.	Name of Para	Population			HH*	Family size	Homestead area (ha)	Density** (people/km ²)
		Male	Female	Total				
1.	Chila para	81	67	148	21	7.0	0.5	29,600
2.	Bania para	226	189	415	58	7.2	0.8	51,875
3.	Atka para	410	345	755	109	6.9	1.8	41,944
4.	Uttar para	235	203	438	62	7.1	1.7	25,765
5.	Fakir para	56	47	103	15	6.9	1.2	8,583
6.	Jal para	324	273	597	85	7.0	3.8	15,711
7.	Kuna para	175	97	272	39	7.0	1.4	19,429
8.	Masjid para	1,001	836	1,837	248	7.4	7.8	23,551
9.	Namasud para	84	72	156	22	7.1	0.6	26,000
10.	Dakhin para	350	293	643	85	7.6	1.2	53,140
11.	Purba para	1,010	823	1,833	256	7.2	3.6	50,917
12.	Ghosh para	302	253	555	81	6.9	3.0	18,500
13.	Pashchim para	444	371	815	116	7.0	1.5	54,333
14.	Shibir para	411	338	749	107	7.0	3.0	24,967
15.	Pal para	469	372	841	121	7.0	3.8	22,132
16.	Naogaon para	745	601	1,346	205	6.6	4.8	28,042
17.	Moddon para	333	296	629	90	7.0	2.7	23,296
	Total	6,656	5,476	12,132	1,720	7.1	43.2	27,135

Remarks: *:Number of household; **:Population density based on the homestead area

Source: JICA Study Team based on the PRA by DICS, 2002

(2) Socio-economic Conditions

(a) Land use and land ownership

Land use of Gurai gram is determined largely by elevation of land: high land, medium land and low land. In higher land including artificially raised land, people enjoy ordinary life. Homesteads with useful trees and garden, road, school, hat/bazaar, etc. are seen on highland. Medium land around the mounds is utilized for crop fields for potatoes, groundnuts, tomatoes, chilli, onion, garlic, coriander, etc. Lower land, extends over the Haor area, is mainly for paddy cultivation in the dry season by using groundwater as irrigation source. Fish ponds have been established within the mounds and commonly used for fish farming. By villagers' perception, the whole gram is divided into three broad categories of land: (i) Ati or homestead land; (ii) Bandh or agricultural field; and (iii) Pagar or fish pond.

Major crops grown are rice, groundnut, chilli, potatoes, garlic, onion, coriander, snake gourd, etc. Fruit trees grown include: mangoes, black berry, jackfruit, coconut, banana, betel nut, papaya, etc. Trees grown on the homesteads include: mahogany, Dalbergia sisso, eucalyptus, rain tree, etc.

The absolute landless share 284 households or 16.5% of the total households. The broad category

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of landless, combining absolute landless, functional landless and landless accounts for 821 households or 48% of the total. Larger farmers with 7.5 acre or larger land total 49, or 2.8% of the total households. More than 70% of female headed households fall in the broad category of landless.

Not only landless and marginal farmers, but also small farmers work as daily laborers, as demand for labor by medium and large farmers is high, especially in transplanting and harvesting seasons. Functional landless and landless go fishing for livelihood while marginal and small farmers cultivate others land by sharecropping; medium and large farmers do business.

(b) Social structure

Social customs and events in the gram are much related to the religion. Various ceremonies such as Khatna (circumcision), Milad (a socio-religious ceremony), Chehlum (special pray for departed soul of dead body), Eid-ul-Fitr (celebration after one month fasting), Eid-ul-Azha (sacrificing ceremony), Oaz (Preaching for Islamic life style), etc., are Muslim based events.

For Hindus, Puja, a series of religious worship, represents important communal activities. On an occasion of Puja, they prepare emblems of goddesses in three Hindu temples after worshipping. They also prepare sweets and hotchpotch and distribute them to the community people.

Every year the gram organize a gram fair with their collective efforts. In the fair spiritual Fakirs appear and sing spiritual songs including Baul songs, Dehotori and Bhatiali. During the fair, furniture, toys, food items and other materials are bought and sold. Jatra also is staged in the fair. A committee is formed for the fair. Important people of 15-20 constitute the committee. The committee selects a chairman. The overall supervision is made by the Chairman of Gurai Union Parishad.

In case of any disputes and conflicts, the Chairman of the Union Parishad, members, medical practitioners, businessmen and the members of political parties participate in the mediation and settlement of the problems through salish (village mediator).

In the local society, a leader, referred to as a matabbar, has a power in terms of economy, politics, and judiciary. Matabbars exist in every para. They are generally rich landowners, school teachers, village doctors, ex. UP members, etc., and very influential in decision making, judicial matters, etc. Basically their power lies with their wealth. Usually villagers obey and follow the advice and instruction of the matabbars with respect.

At the gram level, the Chairman of Union Parishad, who lives in Gurai gram takes the leadership and make decisions. At the ward level, members of Union Parishad (UP), elected representatives of the ward, are considered as the leaders of a ward. Exercise of power by UP members are undoubtedly confined in a ward. Some para matabbars are so influential and powerful that UP members do not confront with them. Generally female UP members cannot play any significant

role in the ward.

At the Union level, the Union Parishad Chairman is the chief executive of the lowest level governmental body. The UP Chairman, usually rich businessman or large agricultural producer, is the most influential person in the union. Being local government representatives, they have tie with the political parties.

At the Upazila level, the Upazila Nirbahi Officer (UNO) appointed by the Government has the power to hold and chair the meetings of Upazila Parishad. In addition, all related Upazila level officers such as LGED engineers, education officers, bank officers, land ministry officers, police officers in charge, etc., hold the power to influence the villagers before serving them any assistance.

(c) Occupation

The total working population is 3,023. Agriculture related activities such as agricultural labor, share cropping, and self-employed farming are by far dominant occupation in Gurai. Other occupation includes fishing, trading, rickshaw/van puller, teacher etc. for men, while garments, maid servant, etc., for women.

As the agricultural work is the main profession in the dry season, many people become jobless in the wet season, due to submergence of agricultural fields by floods. Economic activities are very limited only to fishing, boat transport, etc.

(d) Income and expenditure

Annual average income and expenditure by occupation are presented in Table 20.

Table 20 Annual Average Income and Expenditure Profile by Occupation

	Occupation								
	Large Farmer	Small Farmer	Daily Labor	Poultry Rear	Fishing	Bank clerk	FP*	Teacher*	Shop keeper
Income	108,000	28,800	19,800/10,800	19,800	18,000	60,000	60,000	54,000	28,800
Expenditure	96,000	36,800	25,800/24,000	27,000	24,000	72,000	72,000	64,000	36,000
Difference	12,000	-8,000	-6,000/-13,200	-7,200	-6,000	-12,000	-12,000	-10,000	-7,200

Note: Two different figures for daily labors is for male and female respectively.

Remarks: *: Both male and female's occupations

Source: Verbal communication with villagers through Focus Group Discussion under PRA by DICS, 2002

In most cases, the expenditure surpasses the income. The deficit is filled by credit obtained from different sources, according to the interview to the villagers.

Food expenditure is generally much larger than other expenditures. It ranges from 39% for Bank clerks to 83% for female daily laborers and fishermen.

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(e) Education and health

Literacy rate in Gurai is 70% for male and 63% for female. Higher literacy rates for both male and female may be due to the Total Literacy Movement (TLM).

There are 1,950 school-aged children in the gram, of which 73% or 1,500 are enrolled. There are four primary schools (one government and three registered private), two NGO schools, and two Madrasha. In the four primary schools, children – teacher ratio is 43:1 on average ranging from 38:1 to 49:1. Schools do not have enough capacity to accommodate all school-aged children due to lack of facilities as well as insufficient number of teachers. Drop-out rate as of 2001 was 35%. The reasons for drop-out include: (i) poverty of family; (ii) early marriage; (iii) lack of communication; (iv) lack of awareness of the parents, and (v) school closing in flood season.

Most villagers take rice and ruti (bread) as staple food. Ruti is usually taken at breakfast. Side dishes include pulses, potatoes, and some vegetables.

Due to mal-distribution of nutrients, nutritional disorders like anemia, night blindness, angular stomatitis, etc. are observed. Malnutrition are observed more in female, as food intake is generally less because of discrimination due to socio-cultural background.

Major diseases reported in Gurai include fever, flu, dysentery, diarrhea, peptic ulcer, small pox, etc. Cases of fever, flu increase in the winter season, while dysentery and diarrhea are observed more in the rainy season and summer time.

More than 80% of patients in the gram receive health services within the gram or nearby gram. Village doctors are the most accessible health services for the majority of villagers. Many female go to Family Welfare Center in the gram. Only limited number of people who are generally rich have access to modern treatment outside the village.

(f) Credit

Various credit facilities are available in the gram. There are one national agricultural bank, two national NGOs, one BRDB, one Social Welfare Department, and many local money lenders, which extend loans to villagers.

Objectives of applying for credit vary from the sources. The Agricultural Bank limits its utilization on agricultural production like purchase of inputs, breeding animals, installation of pumps, etc. NGOs extend loans for various purposes such as agricultural production, business, housing, etc. Local money lenders do not limit utilization purpose. Annual interest rates of loan varies from 8% by BRDB to 120% by local money lenders. The number of borrowers in the gram totals more than 3,000.

(3) Agriculture and Marketing

The share of agricultural land in the total area is some 89.2% with cropping intensity of 1.02. The farm land is divided into the paddy field with 482.6 ha or 95.1% and the upland field with 24.7 ha or 4.9%.

In Gurai gram, Kharif season cropping is impossible due to submergence of the whole agricultural area during the wet season while Rabi season crop is almost all paddy because of high water contents in soil and heavy soil textures.

Extension activities are mainly organized through regular visits by the Block Supervisors to the village. Block Supervisors are responsible for distribution and adoption of modern technologies by farmers. Block Supervisors services, however, are insufficient in the project area because of limited staff.

Fishery is considered the most important source of cash-income. In Gurai gram, the flooding and inundation area are important fishing grounds. On the other hand, fish ponds are contracted with private owners with the net-income of Tk.4,000 for a typical pond of 0.21 ha surface area.

There is only one bazaar in Gurai Union, and is not opened officially at the time of field survey, conducted on March 2002. The bazaar committee, composed of 270 members, owns the new Gurai Noya bazaar, and the union chairman heads the committee. Every Friday is the hat day and there are some shop owners already started their business in advance of official opening.

(4) Rural Infrastructure

One main village trunk road categorized as R2 is running from north to south within homestead area of Gurai gram. At the north side, this road connects to submersible road under construction, which goes to the Nikli Upazila parishad office, and to the south, connect to Hiluchia town with elevated road by crossing river.

Kacha (without pavement) roads with length of 6.35 km exist while there is no pucca (with pavement) within homestead area of the gram. Out of 6.35 km, 3.45 km length is elevated road, which is not submerged during 1998 flood. Remaining 2.9 km length of the road is submerged during the normal flood.

There are several boat landing places that villagers use for going to either Hilucha, Bajitpur or Nikli during the rainy season. During rainy season, water transport is the only way to go to Nikli town which is their administrative upazila. Although a road is connected to go to bazaars located at Hiluchia and Bajitpur, they use boats as water transport is easier than using road.

The tubewell density in Atka Para (No.3) is remarkably insufficient, while Moddon Para (No.17) is better off as compared with other paras, where the average is 77 population/tubewell. There are 187 tubewells, both government and private, in Gurai gram, of which 44 were inundated in the

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1998 flood. In particular, in the four paras of Bania, Atka, Kuna and Dakhin, no tubewells were available for safe water during the flood.

491 household of Gurai Gram is electrified with coverage rate of 29 %. Villagers pay about Tk.250 per month a meter for electricity bills.

Two private drying yards exist including parboiling plants, rice milling machine and storage in the gram. These drying yards with capacity of approx.1.5 ton per day, cover approximately 40 to 50 % of the total paddy harvested within Gurai. Farmers insist to sell paddy to these owners of private drying yards, or else at the market without parboiling.

(5) Floods

(a) Flood environment

Gurai gram is located in a shallow Haor area near the course of Ghorauttar river which carries flow from Surma-Baulai, Mogra, Dhanu and Kangsha rivers to the south through Bhairab Bazar. Farmland of the village is not under protection of any submersible flood embankment to save Boro crop from early floods. The village mound, which is erosion prone due to monsoon waves, accommodates the settlements stretching about 1.2 km in north-south and 0.9 km in east-west direction. The mound is partly protected from wave erosion by brick walls on the eastern side for separated lengths of 190m and 20 m. Elsewhere on eastern, northern and southern sides there are protection works by indigenous method i.e. earthfilled gunny bags, vegetative cover, bamboo fencing etc.

Inhabitants of Gurai gram start preparing for annual floods in advance by collecting bamboo stakes, empty sacks and other local materials for protection against the wave erosion. Paddy is boiled and Chira, Muri, Gur and other rural foods are stocked. Cattle and poultry in the homesteads, culture fishery in the ponds are taken care of; valuable articles are shifted to secured places. In pre-flood days they get busy in preparation for the ensuing event. As they will be in a flood environment without proper warning and evacuation system in place, they have to make their own decision for evacuation by observing the natural symptoms like a cloudy sky, continuous south-eastern winds, flying of grasshoppers and/or the rising of water level. They know their village mound will be having the onslaught of waves in coming days, resulting in erosion of land with homesteads.

The wave erosion which is most serious problem facing the Gurai gram population, is a common phenomenon in each monsoon. Villagers have to fight a constant battle throughout the monsoon season to save their homesteads from this kind of erosion. The indigenous measures by putting bamboo fence, cement bag, brick and water hyacinth are crushed by severe wave action. The indigenous protection of the village mound, which they practice throughout their lives, dominates all their activities in the monsoon season draining most of their resources leaving very little for any productive works during the period of four to six months a year.

(b) Inundation

Vulnerability to floods is assessed from the records of inundation caused by floods of three recent years: 1988, 1998 and 1999.

In the Haor areas, villages are generally situated on the raised mounds. Problem of inundation of the homesteads is not as acute as prevails in Char areas. However, in the severe floods of 1988 and 1998, the submergence of homesteads was 84% and 20% respectively. In the lean year of 1999 the inundation of homesteads was almost nil - only 3%.

Crops are not grown in the Haor areas during the monsoon flood. In some years, early floods damage the Boro crops. Severe floods of the years 1988 and 1998 occurred between June and September when there was no crops in the field. In the lean year of 1999, there was no early flood that caused damage to Boro crop before harvesting. Loss of cattle and human lives occurred in 1988 and 1998, but damage to houses occurred only in 1988.

There is a tin roofed flood shelter in Gurai gram having a floor area of 2,032 m² in four sheds. It is quite dilapidated and can hardly accommodate 240 people. Many of the displaced people on the eastern side of the village mound having lost their homesteads to the wave erosion, found abode in the flood shelter since long. It is reported that the shelter was built by an NGO (MES) in 1974.

(c) Vulnerability of Gurai gram

Gurai gram mound is situated in a shallow Haor area. The village mound has been subjected to wave erosion during the monsoon from east, north and south sides. The eastern periphery having a vast open fetch length of about 10 km in front, is the worst affected side while the north and south sides have a less significant rate of erosion. The wave generating winds blow mostly from the eastern and the north-eastern direction, while moderate winds blow from the south-eastern direction also. Generally, monthly maximum windspeed during the monsoon varies between 10 to 20 knots. On all the sides that are exposed to wave actions, erosion has intruded about 30m into the village mound, against the indigenous protection works, during the last 30 years. Erosion could be more without the indigenous protection.

It can be seen that the main problem in Gurai is the wave erosion. The average rate of erosion of the mound due to monsoon waves is 1 m/year even with effort of the villagers to resist erosion by their indigenous means.

(6) Existing Organization

There are several organizations established with different purposes.

These organizations may be classified into several sectors. The Gurai bazaar committee, farmers' associations, and deep tubewell management committees are for economic development while school committees, madrasa committees and juvenile's club are formed for education

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development. The mosque committee is to maintain Muslim culture, and other organizations are for social development including livelihood development, mainly targeting poor households including women. They are largely active, but face various problems with their facilities and materials, fund, etc.

(7) Non-governmental Organizations' (NGOs) Activities

There are two NGOs active in Gurai. Both are Dhaka based, major national NGOs which extend their activities in the whole country. They target socially weak societies like landless poor, daily laborers, women, etc., with the objective of uplifting their living standard by empowering them through the provision of credit for income generating activities and training on agriculture, health, education, etc. A total of 1,154 people are involved in the activities.

8.2 Problems and Constraints

(1) Problem structure analysis

A participatory approach is taken to reflect views and opinions of various stakeholders who are more familiar with the area. Two methods are used: project cycle management (PCM) workshops and participatory rural appraisal (PRA).

The causal relationships between various problem factors identified for the core problem of aggravating poverty have been analyzed, and the problem structure constructed for Gurai gram in Haor as shown in Figure 13. This is the problem structure of aggravating poverty as perceived by the villagers in Gurai gram.

(2) Constraints to the Rural Development in Gurai

As clarified through the PCM workshops and the PRA, Gurai gram faces the same set of problems rooted in socio-cultural norms of the traditional value system but probably to a lesser degree than Algar Char. Literacy rates are much higher for both male and female, and opportunities for education and access to health services better. Also, the availability of credit facilities is better in the gram with one national agricultural bank and various other lenders extending loans to villagers. Gurai gram has traditional livelihood activities well established through its long history, which are still viable.

Despite these favorable conditions, the income levels in Gurai are generally lower than in Algar Char, and poverty and malnutrition are widespread. This is a reflection of the inherent natural conditions represented by erosion and flooding, and the poor endowment of natural resources including highlands and farmland for double cropping. This situation makes alternative livelihood activities during the wet season and investments to enhance agricultural productivity even more important.

Old and well established, the society of Gurai gram may have been well adapted to the unfavorable

natural conditions and even to the harsh economic conditions. The recurrent expenditure on flood/wave protection seems to represent both villagers' receptive attitude and their intention to adapt themselves to flooding and erosion. The main constraint to the rural development in Gurai, therefore, may be the lack of mechanism to muster their collective intention as well as limited resources for sustainable flood/wave protection works and livelihood development. The local initiative is expected for these, utilizing the favorable political climate existing in the gram.

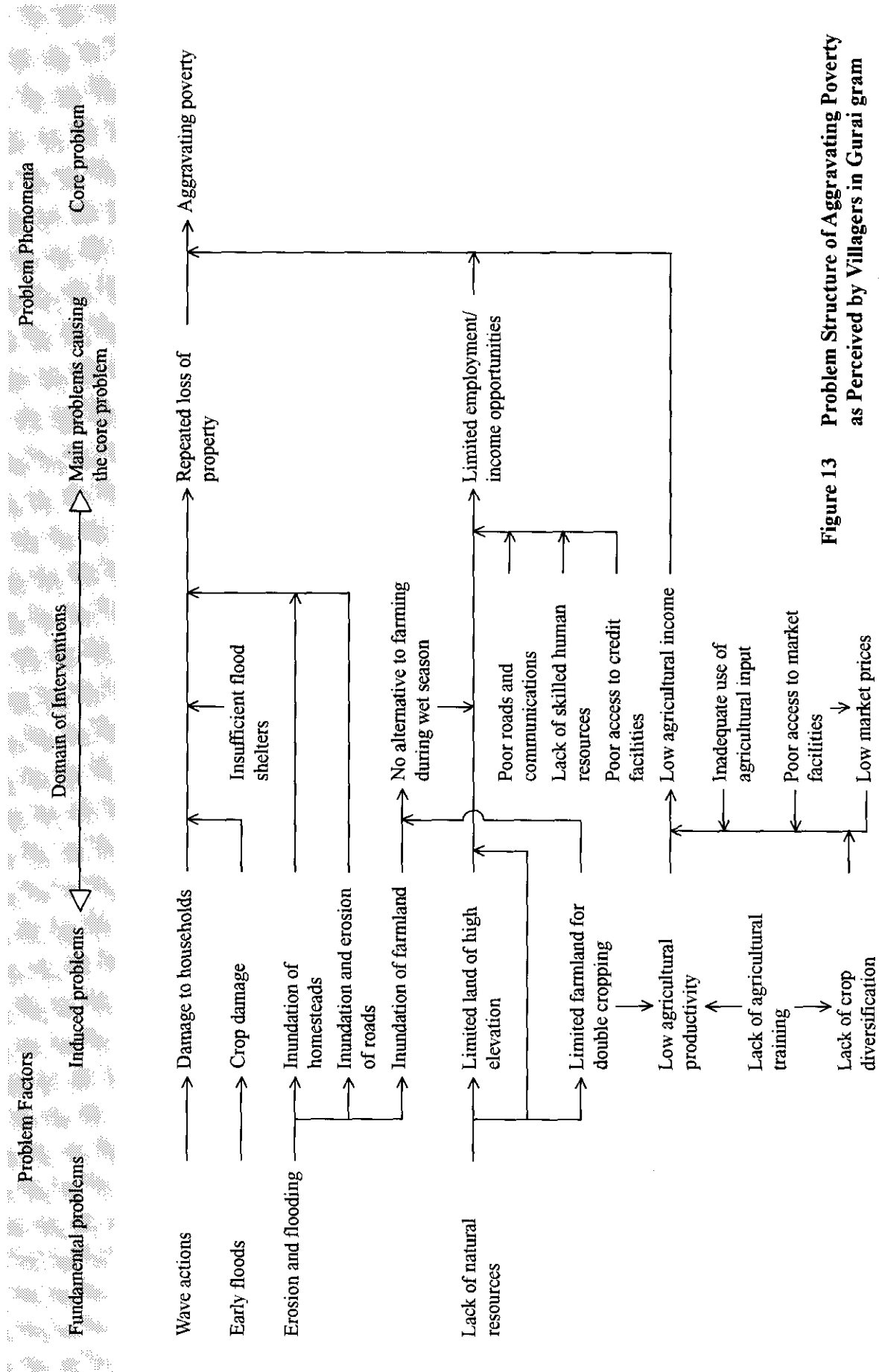


Figure 13 Problem Structure of Aggravating Poverty as Perceived by Villagers in Gurai gram

8.3 Development Plan

Out of 17 paras of the village, eight paras of Chaila para, Bania para, Uttar para, Fakir para, Jal para, Kuna para, Dekhin para and Purba para are now facing the onslaught of the wave action. These paras are target paras for development schemes.

(1) Flood -proofing and Improvement of Living Environment

(a) Wave protection plan

Eight paras are situated on south, east and north sides of the village mound. The main onslaught of the waves come from the eastern side while the other two sides have it in a lesser degree.

The para-wise approximate length of erosion is stated in Table 21. Average height of the village mound from the ground level is 2.5m.

In view of the comparative study, maintenance and public demand, brick retaining wall is recommended for construction with a length of 1,756m on north, east and south sides.

Table 21 Para-wise erosion length

Sl. No. of para	Name of para	Length of erosion (m)	Approximate intrusion of erosion into mound during last 30 years (m)
1	Chaila para	115	20
2	Bania para	230	20
4	Uttar para	307	20
5	Fakir para	154	30
6	Jal para	266	30
7	Kuna para	202	30
10	Dakhin para	227	20
11	Purba para	253	30
	TOTAL	1,756	

(b) Raised hand tubewell

A total number of requirement is 19 for new tubewell and 27 for raising only for respectively, as shown in Table 22.

Table 22 Proposed Numbers of Hand Tubewell in Gurai Gram

Sl. No. and Name of Para	Population (no.)	Existing condition			Proposed numbers of tubewell		
		Numbers of well (no.)	Inundated in 1998 flood (no.)	Coverage (popl./well.)	Raising of existing well (no.)	Newly required (no.)	Coverage (popl./well.)
1. Chila	148	1	0	148	0	1	74
2. Bania	415	2	2	-	2	4	69
4. Uttar	438	34	0	13	0	-	13
5. Fakir	103	2	1	103	1	-	52
6. Jal	597	4	0	149	0	4	75
7. Kuna	272	10	10	-	10	-	27
10. Dakhin	643	6	6	-	6	3	71
11. Purba	1,833	18	8	183	8	7	73
Total (Average)	4,449	77	27	(89)	27	19	(46)

Source: Questionnaire survey by JICA Study team

(c) Flood warning and evacuation system

After a message of warning is received from the Nikli UZDMC, the Union DMC will disseminate it through its Committee members, Volunteers and Chowkidars to Gurai gram mound and other grams. Local school teachers, Imams of the mosques, members of the UP will play important roles in dissemination by announcing in schools, religious congregations, drum beating in markets and using microphones of the village mosques. Gram DMC, therefore, is proposed to organize those members of Gurai gram through the project.

The dwellers of Gurai gram, being informed of the impending floods, will look for appropriate shelters. The raised platform of the newly constructed market can serve as a good refuge place in time of need. In most cases, they will move by their own arrangement of boats. However, in some cases, the Union Disaster Management Committee under the support of the UZDMC and the district administration will arrange boats.

The existing flood shelter situated in Shibir para in the village mound may be repaired under the initiative of LGED.

Training on flood warning and evacuation against to wave action during flooding is targeted to dwellers of Gurai gram who will be refugees as well as messengers to disseminate flood warning to the gram from Union DMC and Nikli DMC. The training program may be organized by FFWC, LGED and NGOs.

(2) Livelihood Development

(a) Support services for livelihood development

Although the villagers of Gurai will be the main players, external support is necessary to develop livelihood in the gram, given the constraints to further development identified in the previous section, including limited employment opportunities, lack of skilled human resources, low agricultural income, no alternative to farming during the wet season, etc.

Among the constraints, low agricultural income is attributed to the small land size, not the productivity, as the average paddy yield is recorded at nearly 6 tons/ha. Livelihood development, therefore, shall be planned through the provision of various support services to expand the opportunities for income generating activities as well as develop skills for the villagers of Gurai. Another option to be considered is to reduce the post-harvest losses after harvest at the field. Taking the very limited mound area into consideration, income generating activities to be promoted in Gurai shall be land intensive and shall not need large area, in principle.

i) Poultry promotion (Duck rearing)

Low level of protein intake is another constraint to improve health conditions of local people. Poultry (duck) rearing technology will be transferred through training by a NGO and actual activities will be monitored and advice given by a block supervisor of Department of Livestock. Duck rearing will be promoted utilizing existing natural ponds inside the gram and borrow pits to be utilized for fish culture as mentioned above.

ii) Home gardening promotion with nutrition education

Home gardening shall be promoted utilizing the expanded mound area to improve nutrition status of local people in the light of their poor health status at present. Vegetable cultivation technology will be extended with certified seed distribution. Surplus amount of crop harvest can be sold at the local market. The target group will be women. This activity will be made jointly by DAE and NGOs.

iii) Nursery development for social forestry

Useful tree species including mahogany, ipil-ipil, mango, jackfruit, Hijal, Koroch, etc., will be planted more on the mound as well as low land to improve natural environment as well as augment resources. For this purpose, a nursery will be established to grow seedlings for those species.

Technology on nursery establishment and seedling growing will be extended by Department of Forestry or environmental NGOs active in Haor areas. Some 20,000 seedlings will be grown every year.

Summary

iv) Technical training on fish culture utilizing borrow pits

Utilizing borrow pits to be created for mound expansion, fish culture will be promoted. Fishery extension will be made by extension staff of the Department of Fishery. The target group will be landless farmers.

v) Training on entrepreneurship and business management for a parboiling plant operation

At present, some 50 % of the total paddy produced in Gurai are brought into the private dry yard in the gram for drying and processing, and the remaining are marketed in neighboring places outside the gram. This is due to limited capacity of the existing dry yard and parboiling plants in the gram. One possibility for augment income in the gram is to establish a new parboiling plant with dry yard and rice mill.

Through the training on entrepreneurship and business management, business minded enthusiastic villagers will be identified. The plant will be operated and maintained by organized village people. Owners of existing parboiling plants with dry yard in the gram will be fully involved in the business.

(b) Livelihood development

After the training, beneficiaries will start income generating activities under the supervision of NGOs and concerned government extension workers. Expected benefits of each activity are estimated in Table 23.

Table 23 Expected Benefits of Each Activity

Income generating activities	Scale	Unit	Quantity	Gross profit (Tk./year)	Total cost (Tk./year)	Net profit (Tk./year)
Duck farming	0.36 ha	nos. eggs	5,000	25,000	11,000	14,000
Social forestry	200 m ²	nos. seedlings	20,000	100,000	64,000	36,000
Inland fishery	0.36 ha	Kg	720	36,000	16,500	19,500
Drying, parboiling & millng	400 m ²	Ton	400	3,445,000	3,275,000	170,000

Source: JICA Study Team, Gender Development Research Center (GDRS) and Association for Community Health Services (ACHS)

(3) Savings and Credit Scheme

Three main components of any savings and credit scheme are (i) sources of funds, (ii) allocation/distribution/disbursement methods, and (iii) use of credit. Alternative schemes are conceived by combining different options for each component.

Sources of funds for the credit scheme include the following:

- Savings, compulsory and voluntary, by potential beneficiaries,

- Seed capital to be provided by donors and/or the Government, and
- Matching fund, a variant of seed capital to be provided in proportion to savings by potential beneficiaries.

Possible criteria for allocating/distributing the seed fund to different project paras include the number of members of para committee (PC), amount of own savings, and demand for credit. Some portion of the seed capital may be allocated in proportion to the number of PC members. Distribution of the seed capital in proportion to own savings makes it operate as a matching fund. Allocation by demand for credit generally encourages economic efficiency.

Two main uses of credit are insurance against unexpected events such as flood damages and crop failure, and loans to be used for either IGAs or flood-proofing/mitigation works. Pooling savings by PC members into a common fund for use against unexpected events inflicting on any member corresponds to mutual insurance. Such mutual cooperation as well as shared responsibilities would be an essential condition for the success of any savings and credit scheme.

It is proposed that compulsory savings and surcharges to user fees of livelihood support services be combined for the model project in Gurai. This would help strengthen the linkage between flood-proofing and livelihood development. Those who would benefit more from flood-proofing have strong motivations to save more, or conversely, those who save more through availing of livelihood support services would benefit more from flood-proofing.

Seed capital should be allocated only partly in proportion to the number of PC members to encourage the PC formation. The remaining bulk should be distributed in accordance with the amount of own savings, effectively making it a matching fund.

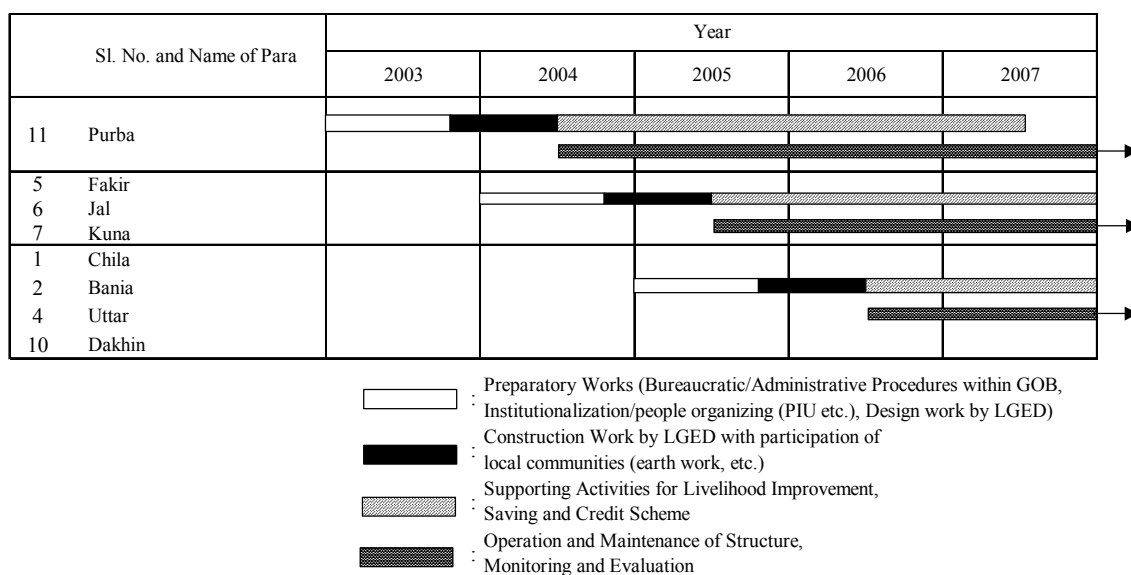
Credit should be used for both purposes: insurance against unexpected events and loans for IGAs and flood proofing/mitigation works. This would introduce more complicated management needs than in the case in which only loans are provided. It is necessary in any case, however, to supervise and monitor savings of PC members and allocation of the seed fund as well as credit and insurance payments at any given point in time.

8.4 Implementing Schedule

The implementation of the model project in Gurai will start from Purba para, which is more vulnerable to wave erosion than other paras, as it has the longest eastern boundary exposed to wave actions. It also has a wave protection wall covering a part of the eastern boundary constructed some 15 years ago, and thus most cost effective protection may be provided. In the subsequent phase, Fakir para, Jal para and Kuna para will be covered by the model project, followed by Chila para, Bania para, Uttar para, and Dakhin para. Implementing arrangements will be established during the wet season, followed by the implementation in the dry season, respectively.

Summary

Figure 14 Implementing Schedule



Proposed Measures by Para

Sl No. and Name of Para	Proposed Measures
1 Chila 2 Bania 5 Fakir 6 Jal 7 Kuna 10 Dakhin 11 Purba	①Wave Protection Plan, ②Raised Hand tubewell, ③Flood warning and Evacuation, ④Support Service for Livelihood Development, ⑤Saving and Credit Scheme
4 Uttar	①Wave Protection Plan, ③Flood warning and Evacuation, ④Support Service for Livelihood Development, ⑤Saving and Credit Scheme

8.5 Project Cost

(1) Summary of Project Cost

Table 24 Summary of Project Cost in Gurai Gram

(Unit: '000 Tk.)		
Description	Amount	Remarks
A. Direct Cost		
I. Flood Proofing and Improvement of Living Environment	11,679	
I-1 Mound protection	11,482	L=1,756 m
I-2 Raised hand tubewell	177	(19+27) nos
I-3 Training on Flood warning and evacuation	20	
II. Support Services for Livelihood Development	96	
II-1 Poultry promotion	22	
II-2 Home gardening promotion with nutrition education	20	
II-3 Nursery development for social forestry	14	
II-4 Technical training on fish culture utilizing borrow pit	14	
II-5 Training on entrepreneurship & business management for a parboiling plant operation	26	
A. Direct Cost Total	11,775	
B. Land Acquisition	662	
C. Indirect Cost	1,531	
I. Administrative cost	589	5 % of direct cost
II. Engineering fee	942	8 % of direct cost
D. Physical contingency	1,178	10 % of direct cost
E. Price contingency	757	5 % of total cost
Ground Total (A+B+C+D+E)	15,903	

(2) Summary of Annual Maintenance Cost

Table 25 Summary of Annual Maintenance Cost in Gurai Gram

(Unit: '000 Tk.)	
Description	Amount
I. Flood Proofing and Imprpvment of Living Condition	
I-1 Mound protection	211.6
I-2 Raised hand tubewell	18.5
Maintenance Cost Total	230.1

(3) Share of Cost

Villagers provide the land for borrow pit, and bear the O&M cost and a part of construction cost.

Table 26 Share of Construction Cost

(Unit; Tk)

Name of Scheme	Construction Cost	Share		Number of Beneficial Households	Cost/HH
		Government (80 ~ 90%)	Villager (10 ~ 20%)		
1..Mound protection	11,482,000	9,186,000 ~ 10,334,000	1,148,000 ~ 2,296,000	621	1,850 ~ 3,700

Beneficial villagers bear 10 ~ 20% of construction cost. One villager shares about Tk.1,850 ~ Tk.3,700 for mound protection, equivalent to 8 ~ 17% of annual average income of Tk.22,000. Small farmers spend 6% of total expenditure for flood/wave protection in the every rainy season. Villagers can choose the way of payment from cash or labor work. Cost sharing of beneficiary will be decided through the meeting between Para Committee and LGED in detailed design stage.

8.6 Project Evaluation

(1) Social Evaluation

Positive social impacts are expected to the people of Gurai by the Project. The major positive impacts include: (i) stabilization of normal life, (ii) empowerment of local people, (iii) strengthening of social cohesiveness, (iv) improvement of health conditions, and (v) poverty reduction. They are explained in the following.

Established flood-proof conditions under normal flood will assure the local people of stabilized social life. They will be released from uneasy life under the normal flood conditions. Hygiene conditions will be improved and normal schooling will be assured.

Local people will be empowered by participating in the whole project process. Planning process will empower people by learning about flood preparedness, their roles and responsibility in the project through organizing themselves. They will be empowered further through implementation process by participating in various activities including construction of wave protection walls, training in income generating activities, savings and credit, and other group activities. Organized people will finally be responsible for regular operation and maintenance of wave protection wall as well as savings and credit activities to make the project sustainable.

Women will be empowered through home gardening and nutrition education, income generating activities such as social forestry, which is expected to raise their social status.

The collective efforts of various activities by the organized people will strengthen social cohesiveness, which will contribute to promote social morality and justice. Such strong ties will reduce the case of crimes and assure public security.

Construction of wave protection wall and raising of hand tubewells will assure the normal life for the local people under normal flood conditions. It will contribute to the improvement of hygiene conditions, which will reduce the chance of outbreak of epidemics like diarrhea and dysentery. Home gardening with nutrition education will also contribute to the improvement of their health status.

Establishment of flood proof conditions under normal flood will prolong the normal life, which will reduce the expenditure on flood mitigation. Income generating activities will be promoted mainly targeting poor people so that they could increase their income level. Improved health conditions through promotion of home gardening, through establishment of flood proofing conditions and through raising of hand tubewells, will reduce expenditure on medical care and increase available time for socio-economic activities. Savings and credit will also expand the chance to start new income generating activities.

Through the above impacts, living standard of the local people will be enhanced.

(2) Economic Evaluation

Table 27 Result of Economic Analysis

Project Component	NPV (Tk.)	B/C	EIRR(%)
Wave Protection Plan	318,022	1.03	15.6
Hand Tubewell	148,727	1.79	38.7
Technical Training on Fish Culture Utilizing Borrow Pit	43,182	1.30	18.8
Poultry Promotion (duck)	27,466	1.37	23.7
Training on Entrepreneurship and Business Management for a Parboiling Plant Operation	876,547	1.06	45.0
Nursery Development for Social Forestry	22,489	1.07	15.7
Total	1,362,413	1.05	17.3

The above result shows that the proposed projects are economically feasible as a total. Result of economic analysis in view of EIRR is 17.3%, and B/C ratio at discount rate of 12% is 1.05. The major benefit is generated by such livelihood activities as parboiling operation, nursery development, and pond fishery. The opportunity cost of capital in Bangladesh is around 12%, and the results of total evaluation satisfy the evaluation criteria.

(3) Financial Evaluation

The results of the analysis are summarized below.

Table 28 Result of Financial Analysis

Project Component	NPV (Tk.)	B/C	FIRR(%)
Technical Training on Fish Culture Utilizing Borrow Pit	41,741	1.26	17.8
Poultry Promotion (duck)	30,517	1.37	23.7
Training on Entrepreneurship and Business Management for a Parboiling Plant Operation	813,721	1.05	36.0
Nursery Development for Social Forestry	25,722	1.07	15.8

The above result shows that the all support services for livelihood development is financially feasible. All results of FIRR are more than 13%, the interest rate of medium term agriculture sector loan in Bangladesh. According to Grameen Bank's estimation, the rate of return on pond fishery, duck farming, and rice mill at first year are estimated at 76%, 72%, and 25% respectively.

Following is the result of sensitivity analysis for the parboiling project.

Table 29 Result of Sensitivity Analysis for Parboiling Plant Operation

Conditions	FIRR (%)
Case 1 Increase in project costs by 10%	32.5
Case 2 Increase in project costs by 20%	29.6
Case 3 Decrease in procurement of Boro paddy by 20%	27.6
Case 4 Decrease in procurement of Boro paddy by 50%	14.1
Case 5 Combination of Case 2 and Case 4	10.7

The result shows that decrease in deal amount of paddy products is more sensitive to the parboiling plant operation than increase in project cost. In case procurement of boro paddy decreases 20%, FIRR is 27.6%, more than 15%, the effective interest rate for running capital loan at Bangladesh Agriculture Bank. On the other hand, if deal amount of paddy decreases to 50%, the result shows 14.1%, financially unfeasible. When decreasing rate is 40%, FIRR is 18.8%. Therefore, it can be said that the operators of parboiling plant, organized village people, have to keep operation more than 60% of plant capacity.

(4) Technical Evaluation

The development work proposed for Gurai Gram is construction of 1,756 m of brick wall for the purpose of protection against wave erosion in monsoon. It will be a retaining wall in nature. The ground in the locality has adequate bearing capacity to support the 2-3 m high brick wall with normal foundation. LGED built about 230m of such wall in Purba para about 15 years ago. The existing wall is now in good shape and is resisting well the wave erosion in the part of the para

where it is situated. The brick wall does not require heavy maintenance. However, the village people carry out the small repair works themselves when required.

Bricks and cement are available plenty in Bangladesh. The materials are available also in near about locations of Gurai Gram. As the village is well connected by road with the neighboring bazaars, carrying of construction materials to site in dry season will be quite feasible. The village people can carry out the repair works themselves when required as they are doing the same for the existing part of the brick wall at present.

8.7 Environmental Impact Assessment (EIA)

It is clear that the flood proofing would bring some adverse effects on the natural and living environments. The main negative effects and their possible mitigation measures are examined. They are (i) Population increase, (ii) Drastic change in population composition, (iii) Income disparities, (iv) Increased use of agrochemicals, (v) Residual toxicity of agrochemicals, (vi) Increase, (vii) Change in vegetation, (viii) Negative impact on important or indigeneous fauna and flora, (ix) Degradation of ecosystems with biodiversity, (x) Destruction of wetlands and peat lands, and (xi) Soil erosion domestic and other human wastes. It is also true that complete flood proofing is not feasible. Any flood proofing intervention, therefore, would better aim at protecting and enhancing the livelihood of the project area, while providing an adequate level of flood-proofing. Livelihood development and flood-proofing should only be undertaken in mutually supportive steps. With this view, the following are recommended to ensure sustainable livelihood development with enhanced resources capacity.

Agriculture and soil

The local Boro varieties should be replaced by HYV early maturing variety e.g. BRR-28. Just after receding of floodwater, chili, potato, mustard and high yielding groundnut should be cultivated. Khira, Bangi, and watermelon may be introduced in this area. To protect the homestead from soil erosion, Dhancha should be extensively cultured around the homestead. This will also serve as fuel, and soil fertility will be increased.

An awareness program should be introduced, tied with the agricultural extension program, to reduce the use of pesticides, which in turn will reduce the likelihood of the anticipated toxicity of soil.

Ecological resources

The original topsoil should be put back over the filled earth after raising the plinth level for plants, grasses and weeds to cover the ground. Ground-covering plants such as Benna ghas (*Vetivaria zizaniodes*), Durba ghas (*Cynodon dactylon*), and Motapata ghas (*Axonopus compressus*) may also be introduced.

To recover biodiversity in the clustered house area, it is desirable that bushy plants (e.g., bamboo)

Summary

and ground-covering plants be planted. To restore habitats for amphibians, lizards and other species, burrows may be provided on the homestead.

Socio-economic issues

Appropriate compensations for those who will not move voluntarily need to be planned in consultation with all the affected stakeholders. To reduce income disparities, the less privileged need to be involved in development projects with micro credit, small and cottage industries and other support measures.

Proper planning is required to reduce domestic and other human wastes. Garbage bins and community latrines need to be constructed at suitable locations easily accessible by the local residents.

The project includes the provision of raised hand tube wells in the area. In Gurai gram, the tube wells water quality is within the allowable limits as specified by the Bangladesh Drinking Standard though the arsenic content of water sample from one of the tested tube wells was just above allowable limit (0.055mg/l). Therefore, the location and depth of tube wells should be carefully selected to minimize the risk of the mineral toxicity in drinking water.

9. RECOMMENDATION

- (1) It is strongly recommended that the model projects formulated in the Study be implemented immediately, in the light of very vulnerable situation in flood induced erosion (Char) and wave action (Haor) and of widespread poverty in both areas.
- (2) In order to implement the model project, the LGED headquarters should make an arrangement in setting up Project Management Office (PMO) and in allocating budget for the project.
- (3) PMO should identify NGOs to be involved in the model project implementation and/or ask related government agencies for cooperation through MLGRD&C.
- (4) LGED Upazila officers, in cooperation with NGOs, should start talking with the local people and Union Parishad in the model project areas regarding the project concept to make an agreement and prepare necessary actions including establishing Union Coordination Committees and para committees.
- (5) Repeated dialogues between LGED/NGO and the local people should be made through workshops until the local people are fully aware of the project and until they have a sense of ownership of the project.
- (6) Model projects should be closely monitored and necessary modification should be made in accordance with the lessons learned.