Government of Bangladesh World Food Programme Government of the Netherlands

CHAR DEVELOPMENT AND SETTLEMENT PROJECT II
চর উন্নয়ন ও বসতি স্থাপন প্রকল্প ২

BANGLADESH

COST BENEFIT ANALYSIS

Technical Report No. 18

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Consultants for Development Programmes

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List of abbreviations

BRAC : Bangladesh Rural Advancement Committee
CBA : Cost Benefit Analysis
CDSP : Char Development and Settlement Project
EIRR : Economic Internal Rate of Return
FAP : Flood Action Plan
FIRR : Financial Internal Rate of Return
GNAEP : Greater Noakhali Aquaculture Extension Project
HYV : High Yield Variety
IRR : Internal Rate of Return
NGO : Non-Governmental Organization
O&M : Operation & Maintenance

1. INTRODUCTION

There have been many economic assessments of polder (char) development in Bangladesh, usually in feasibility studies in order to justify investments. Almost always these were based on assumptions, often quite optimistic ones, as actual measurements of productive changes rarely took place. An overview of the cost benefit analysis results is presented in table 1.1.

Table 1.1 Results of various C-B Analysis Studies

	Study	Year	FIRR	EIRR
1.	CDSP I Polders	1991		5.5-7.0%
2.	Muhuri Pre-Feasibility Study	1996	7.0%	12.0%
3.	Muhuri Feasibility Study	1998	16.9%	20.2%
4.	South Hatiya Polder	2001	14.7%	15.9%
5.	Baggar Dona Catchment Area	2001	26.0%	28.0%
6.	CDSP I Polders	1999	12.5%	15.5%

In 1999, after the completion of the CDSP-I Polders: Char Bagga Dona II, Char Majid and Char Bair Tek, a cost benefit analysis has been conducted, based on the data then available. The costs for construction were known at that time, but the benefits in terms of agricultural production increase still had to be estimated to a large extent.
In the period 2000 - 2004, a monitoring programme took place in the three chars to assess the effect and impact of the char interventions. For the cost-benefit analysis the following data are relevant: costs for maintenance of the infrastructure, agricultural production in Aus, Aman and Rabi crops (See Annex 2).
The data allow for a more accurate cost benefit assessment of the interventions in the three chars.

This report deals with the cost benefit analysis based on the available monitoring data. The results will be compared with the 1999 analysis and assessments in other studies.

The report starts with an overview of the benefits and costs of char development in qualitative terms (chapter 2), followed by a summary of the monitoring data (chapter 3), which forms the basis for the financial and economic analysis in chapter 4. The concluding chapter (chapter 5) discusses the results and arrives at conclusions regards the feasibility of char development interventions.
Annex 1 contains the details of the cost benefit analysis, while annex 2 summarizes the monitoring data.

2. BENEFITS AND COSTS OF CHAR DEVELOPMENT

2.1 Benefits

The char development interventions in CDSP consist of the following main components (i) land settlement, (ii) peripheral infrastructure: embankments and main drainage system, (iii) internal infrastructure: roads, cyclone shelters, clustered villages, water and sanitation, (iv) agricultural extension.
CDSPs startegy has a pro-poor focus which is visible in (i) targeting the landless people in the land settlement programme, (ii) the opportunity given to the poorest *char* dwellers to settle in clustered villages which provides them housing, a communal pond and water and sanitation; additionally NGOs focus these clustered villages in their homestead programme..
Involvement of the char population in all phases of construction including operation and maintenance as well as a gender focus in all activities are characteristics of the project. Institutional strengthening of all parties involved has been another important feature of the project. The joint benefits accruing from these activities can be summarized as follows:

1. The land settlement activities providing land titles (*kathians*) to the hitherto landless people give the char population security over one of the main assets (land). Secured landownership in turn enhances the investments in land in terms of agricultural productivity. Monitoring data show that the land retention (after 7 years) is as high as 93%..
2. The constructed embankments and main drainage system provide (i) security to the lives and property of the *char* population, (ii) protection to the crops against (saline) water intrusions, (iii) improved soil conditions though gradual de-salinization allowing for the cultivation of higher value crops and higher cropping intensities, (iv) protection of homesteads allowing to invest in homestead gardening, fish culture and small livestock.
3. Construction of cyclone shelters will provide protection to the *char* population in case of emergency, while the buildings can be (and are) used for all kinds of other purposes: school, community centre, government office building.
4. Construction of the internal road structure will increase the accessibility of the char areas, resulting in lower prices for agricultural inputs, higher farmgate prices and stimulation of all kind of other economic activities[1].
5. Improved agricultural extension will contribute to higher crop production.

The pro-poor and gender focus of the project resulted in the following benefits for these target groups:

6. The landless, being the poorest segment of the char population, acquired landownership through the land settlement programme;
7. Women acquired title deeds through registration of the land on both the name of the wife and husband and through priority given to women headed households in land settlement
8. Women were exposed to agricultural extension through targeting women as farmers and not as farmers' wifes
9. Women participated in decision making through active participation in the planning and O&M institutions.

[1] See Latif, M.A. Impact of CDSP Infrastructure on Private Sector Activities; Internal Resource Report, 1999.

The project's emphasis on institutional strengthening will result in

10. A more cost effective planning and implementation of char development ,

The importance given to sustainable O&M of the infrastructure will result in

11. A better maintenance of the infrastructure and
12. A more cost effective way of O&M.

The benefits can be divided into economic and social benefits.
To the economic benefits belong: (i) the expected higher agricultural production and (ii) the lower O&M costs (iii) increased employment and (iv) other economic activities as a result of the project interventions.

The other benefits related to protection of life and property, secured landownership, pro-poor and gender focus are considered social benefits.

2.2 Costs

Costs in char development can be subdivided into:
- Construction and Maintenance costs in infrastructure
- Costs for agricultural extension and land settlement
- Costs for institutional development: training, equipment, group formation etc. and
- Costs for Technical Assistance.

3. MONITORING DATA

3.1 Introduction

In 1999-2000 a baseline survey was conducted in all CDSP I and CDSP II project areas. For the CDSP II areas these data can be considered as the true baseline because CDSP II activities started in the year 2000.
For the CDSP I polders these 'baseline' data have to be considered with care. CDSP I activities started in 1994 in three different areas, which were in different stages of development:

- Char Baggar Dona II was already empoldered in the LRP time (1989/1990), however the polder became only fully protected in 1991 when the sluice construction was completed.
- Char Batir Tek was already embanked; during CDSP-I the embankment was closed with the construction of the sluices.
- Char Majid was a new polder; construction of the embankment started in 1995 and the sluice was completed in 1998.

From 2001 onwards the following data relevant to the cost benefit analysis were monitored: (i) maintenance costs, (ii) cultivated area in the three agricultural seasons, (iii) cropping patterns and (iii) yields. The monitoring data are presented in annex 2.
Aggregated data of the three polders are shown in table 3.1 and graphs 3.1a,b& c.

The agricultural data comprise the data of the field crops only. No monitoring was done in homestead agriculture (vegetables, trees, small livestock) and on pond fisheries. This is because, the homestead development programme was executed by the NGO component of which no data were known at the time of writing this report.
CDSPII was, contrary to CDSP I, not involved in pond fisheries. In 2002 the Greater Noakhali Aquaculture Extension Project (GNAEP) started and their extension activities also included the CDSP areas.

3.2 Costs

The construction costs were already known in 1999, the estimated annual maintenance costs have been modified from Tk 5 million to Tk 4 million, based on the experience with 5 years maintenance.

3.3 Agricultural Production

3.3.1 Interpretation

Agricultural data always have to be interpreted with care as these may fluctuate year by year and even season by season by the weather conditions, market prices for inputs and produce, etc.
Especially the area and cropping pattern in Rabi are sensitive to the weather and soil moisture conditions at the end of the Kharif-II season. Similarly the extent of Aus is to a large extent depending on the time of the onset of the rains.
A special event that occurred in the 2004 Kharif II season is the extensive flooding because of a 550 mm rainfall in September which reduced the Aman production by an estimated 40%.

Furthermore, there are big differences between the polders which influence their performance in crop production. Char Batir Tek appears to have the most favourable conditions in terms of the drainage situation and low salinity levels. Char Baggar Dona II has increasingly suffered from drainage congestion due to the silting up of the Baggar Dona River. For this reason people of the upstream areas regularly breached the northern embankment of the polder to release their drainage waters. Char Majid has the highest salinity levels and the highest portion of sharecropping.

But having indicated the limitations of the monitoring data, some important trends can be acknowledged, requiring modification of the earlier made assumptions in 1999.

3.3.2 Paddy Cultivation

The yields in paddy are higher than expected in 1999: HYV around 3.5 ton/ha instead of 3.0 ton/ha and for local varieties: around 1.9 ton/ha instead of 1.5 ton/ha.

However the expected shift from local varieties to HYVs of 75% of the total area did not take place. The data show that in Aus the proportion of HYV converges around 50%, while for Aman this figure is only 20% (graph 3.1.b).. There is no reason to assume that these percentages will increase in the future.
The limited adoption to HYVs has been subject to investigation in CDSP II (See TR 12). Main reasons are:

(i) The water management conditions often do not allow the cultivation of HYV: some lands are too low and are too deeply flooded during the monsoon, while other (higher) lands suffer from drought for a longer or shorter period.
(ii) Tenancy conditions: In most sharecropping arrangements, the landowner does not contribute to the costs, while the harvest is divided (often 50-50%) between the landowner and the tenant, making the cultivation of HYV unattractive to the tenant.
(iii) Labour: HYV cultivation requires higher labour inputs than the local varieties. Absentee landowners and people who migrate temporarily during the season therefore prefer to grow the local varieties.

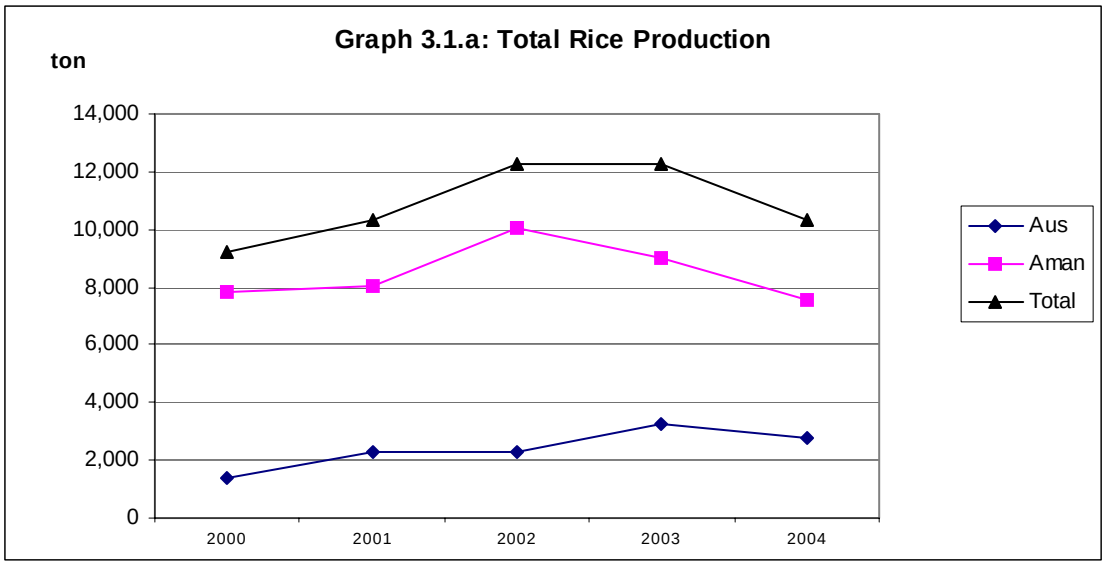
3.3.3 *Rabi* Crops

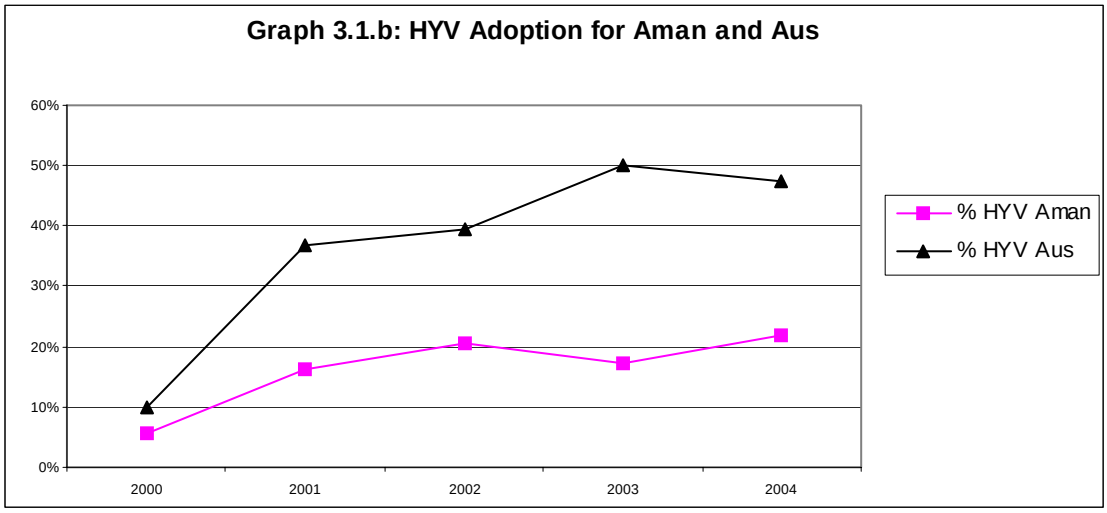
The area grown under Rabi crops has fluctuated over the years (graph 3.1.c) As has been explained before, the area under Rabi crops depends to a large extent on the rainfall and soil moisture conditions at the end of the Kharif II season, which is different every year.
Regards the type of crops grown there is a declining trend of Khesari and an increasing trend in mungbean. The proportion of chilli has remained constant (although fluctuating) and there in an increase in (high value) vegetables.

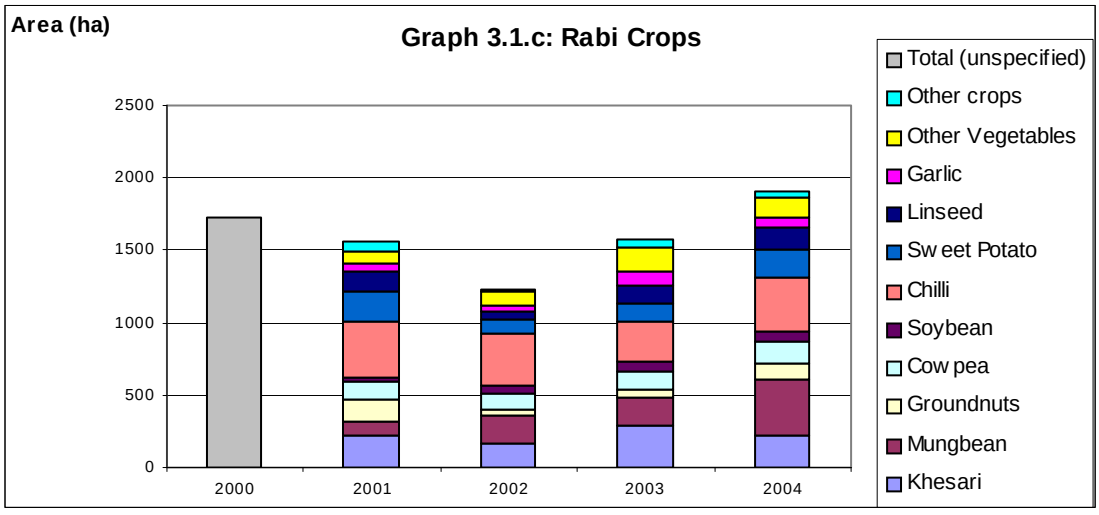
Table 3.1

CROP DATA CDSP- I POLDERS (Average of three polders)

ITEM	**Unit**	**2000**	**2001**	**2002**	**2003**	**2004**
Areas						
Gross Area	ha	5,200	5,200	5,200	5,200	5,200
Cultivated Area (Field Crops)	ha	3,810	3,810	3,810	3,810	3,779
Homestead Area	ha	504	504	504	504	508
Pond	ha	303	303	303	303	306
Total Productive Area	ha	4,617	4,617	4,617	4,617	4,593
Fieldcrops						
Aman						
HYV	ha	214	618	787	655	820
Local Varieties	ha	3,578	3,192	3,023	3,155	2,938
Total Aman	ha	3,792	3,810	3,810	3,810	3,758
Aus	ha					
HYV	ha	76	391	425	687	788
Local Varieties	ha	681	670	650	681	873
Total Aus	ha	757	1,061	1,075	1,368	1,661
Rabi	ha	1,733	1,561	1,234	1,620	1,955
Total	ha	6,282	6,432	6,119	6,798	7,374
Cropping Intensity	(-/-)	1.65	1.69	1.61	1.78	1.95
% HYV Aman	(%)	5.6%	16.2%	20.7%	17.2%	21.8%
% HYV Aus	(%)	10.0%	36.9%	39.5%	50.2%	47.4%
Yields						
Aman						
HYV	ton/ha	3.62	3.63	4.17	4.25	3.08
Local	ton/ha	1.97	1.82	2.23	1.97	1.72
Aus						
HYV	ton/ha	3.23	3.00	2.86	3.13	1.98
Local	ton/ha	1.72	1.64	1.64	1.64	1.36
Production						
Aman						
HYV	ton	775	2,241	3,284	2,784	2,526
Local	ton	7,049	5,799	6,731	6,205	5,053
Total Aman	ton	7,824	8,040	10,016	8,989	7,579
Aus						
HYV	ton	245	1,173	1,214	2,153	1,563
Local	ton	1,174	1,099	1,064	1,117	1,187
Total Aus	ton	1,419	2,272	2,278	3,269	2,750
TOTAL RICE PRODUCTION		9,243	10,312	12,294	12,258	10,329
Index (2000 = 100%)		100%	112%	133%	133%	112%
Total area rice production	ton	4,549	4,871	4,885	5,178	5,419
Average productivity	ton/ha	2.03	2.12	2.52	2.37	1.91


Graph 3.1.a: Total Rice Production
ton
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
2000
2001
2002
2003
2004
Aus
Aman
Total


Graph 3.1.b: HYV Adoption for Aman and Aus
60%
50%
40%
30%
20%
10%
0%
2000
2001
2002
2003
2004
% HYV Aman
% HYV Aus


Area (ha)
Graph 3.1.c: Rabi Crops
2500
2000
1500
1000
500
0
2000
2001
2002
2003
2004
Total (unspecified)
Other crops
Other Vegetables
Garlic
Linseed
Sweet Potato
Chilli
Soybean
Cowpea
Groundnuts
Mungbean
Khesari

4. COST BENEFIT ANALYSIS

4.1 Introduction

This Cost-Benefit Analysis (CBA) will be compared with the earlier one, undertaken for CDSP in 1999 (see Technical Report 26, June 1999). For reasons of comparison the year 1997/98 has been kept as the baseline, so that constant prices are also based on that year. The average estimates for the three chars are used. Details of the CBA are presented in Annex 1.
The baseline data of 1997/98 used in the 1999 CBA can be summarized as follows:

Table 4.1: Landuse in 1997/98 used in 1999 CBA

Cropping Season	Area (ha)	Crops grown
Kharif-I Kharif II Rabi	750 3800 1150	Aus: 100% LV T.Aman: 100% LV Khesari 50%, Groundnuts 20%, Chilli 20%, Other 10%

4.2 Costs

Investment costs for polder development (protection) in the three chars have been estimated at Tk 317 million, in constant 97/98 prices. This is based on real figures for CDSP-I, with some corrections. Expenditure items like cyclone shelters have been taken out, as these have little to do with economic benefits. All cost for technical assistance has also been excluded, as is normally the case in CBA. Inflation correction has been applied to reduce all cost to 1997/98 prices. Earlier investments in the same polders before CDSP-I have been included, as these relate directly to the supposed protection.
On balance, actual costs have decreased from Tk 423m to Tk 317m. This comes to almost Tk 62,000 per ha, with noticeable differences per char: from around Tk 40,000 to Tk 70,000.

Operation and maintenance Cost (O&M) have been assessed at Tk 4m per annum.
As even with reasonable O&M major rehabilitation works will be necessary after around 20 years; the lifetime of the project has been set at 20 years.

A discount rate of 12% has been assumed, as common in FAP studies, reflecting a certain appreciation of the cost of capital in Bangladesh. As a rationing device for public funds, it implicates that only projects with a larger rate of return than 12% should be considered. But the extent to which this crucial parameter is still up to date, after 15 years, is not exactly known, introducing some caution into the analysis.

In comparison with the earlier CBA (for 1999) two minor changes occur. Investment cost were then slightly higher (Tk 340m), because 15% of the technical assistance was included. And O&M was then set at Tk 5m p.a., as a real estimate was not yet available.

4.3 Benefits

Embankments and water management lead to a number of potential benefits, which have to be realized through, among others, agricultural extension and improved accessibility (roads). Direct economic benefits are mainly expected in increased yield of field crops (paddy and rabi crops), homestead gardening and culture fisheries.
Some indirect benefits are also likely, like increased agricultural employment because of higher crop production and more trading activities. But these indirect effects are captured in the economic analysis through the use of shadow prices: reflecting the effects on the national economy. In the financial analysis only the direct effects are captured, so that the difference between the economic and the financial analysis is precisely the indirect effects.

Because of protection from flooding by saline water, a gradual reduction in soil salinity levels and improved drainage, farmers now have the following new options: They can grow a high-yielding variety of T. Aman where there is good water control, particularly on medium land, they can grow Aus paddy as soon as salinity levels start to decline, and an increasing number and variety of *rabi* and homestead crops (and trees) as well due to desalinization.

The following concrete changes have been observed in CDSP-I as a result of the project.

4.3.1 *T. Aman*

There is an increase in area under HYV from 214 to 720 ha (average 4 years), so that an extra 500 ha has been brought under HYV as a result of the project. Yield of HYV Aman will increase from 2.2 to 3.5 t/ha, and yield of local varieties (LV) from 1.2 to 1.9 t/ha.
We may assume another 10% output increase every year as a result of prevented flood damage every 10 years,
Total extra output p.a. from year 2 onwards is 2960 tons, valued at Tk 19.5 million net at constant 97/98 prices. (see annex 1 for details)

In the CBA of 1999 the yields were predicted at 3.0 ton/ha for HYV and 1.5 ton for local varieties. The yields are higher than was predicted 3.5 t/ha for HYV and 1.9 t/ha for local varieties.
However the area increase of HYV is much lower than was predicted: not 400 ha per year increase (for seven years) but only once an extra of 500 ha.
Yet, the extra net benefits of Tk 19.5m are quite lower than the predicted ones in 1999 of Tk 25.8m.

4.3.2 *Aus*

One could observe an area increase from 750 to 1650 ha after 4 years. Assuming saturation then, an extra area of 900 ha from year 4 onwards has been brought under *Aus* cultivation as a result of the project. HYV adoption is 50%, so that from year four onwards an extra 450 ha is under HYV, at a constant 2.6 t/ha. From LV there is 1.8 t/ha extra from 450 ha.
Again, due to prevented flood damage there is an extra output of 10% p.a., say from year 4 onwards.
Total extra output from year four onwards is 2,437 tons, valued at Tk 10.6m net

These net benefits are a bit higher than was predicted in 1999 (Tk 9.8m p.a.). Yet, then an area increase of 1,200 ha was assumed, more than now. HYV adoption was also set at 50%, as

now, but with a yield increase to 3 t/ha, contrary to the constant 2.6 t/ha now. But for LV the actual yield observed is higher than the predicted one: 1.8 t/ha instead of 1.6. And the prevented flood damage was not included in 1999.

4.3.3 *Rabi*

Contrary to optimistic assumptions in 1999 of an area increase for *rabi* crops of 20% p.a., up to 2000 ha, the actual area did only increase by 400 ha on average. And there was no clear shift from low to high value crops, despite some fluctuations in area under various crops.
That means we can only count an extra annual income of Tk 3.6m from year two onwards, based on an average net income of Tk 9,000 per ha (97/98 prices).
This is much lower than the earlier assumption in 1999 of a gradual increase to net annual benefits of Tk 50m.

4.3.4 Homestead gardening

No actual monitoring took place here. There is mixed evidence on any increase for vegetables here, visible but not really quantified recently. Earlier on (94-97) yield improvements of 30 to 40% were noted. There is also evidence of increased poultry now, not earlier calculated (see CBA for South Hatiya). And some new trees are visible as well. The relevant area is 500 ha, not the 150 assumed before.
Therefore, we may still assume plus 10% p.a., half of the earlier assumption in 1999, but which is now Tk 7,500 x 500 = Tk 3.7m p.a (instead of Tk 3m in 1999).

4.3.5 Fish Ponds

Again, no actual monitoring took place. But earlier there were clear indications of increased production as a result of better management. And the earlier assumptions were modest, also in view of those later made for South Hatiya.
Therefore, we may still assume Tk 8.8m from year 6 onwards, the same as in 1999, with a gradual increase before.

This leads to the following project benefits (see table 4.2). Total benefits over the lifetime of the project will now be Tk 837m, 60% of what was assumed before (in 1999). Almost half of these are from Aman, 20% from Aus, less than 10% from Rabi crops and vegetable gardens, and 18% from fish ponds.
Especially the assumed gains from rabi crops did not materialize, thereby depressing total benefits of the project. Actual benefits from Aman are a bit lower than was expected, those from Aus a bit higher, and those from gardens and fish have been assumed in line with 1999

Table 4.2 Project Benefits (in Tk million, constant 97/98 prices).

Year	Aman	Aus	Rabi	Garden	Fish	Total
1						0
2	19.5		3.6	3.7	1.0	27.8
3	19.5		3.6	3.7	3.0	29.8
4	19.5	10.6	3.6	3.7	4.8	42.2
5	19.5	10.6	3.6	3.7	6.8	44.2
6	19.5	10.6	3.6	3.7	8.8	46.2
7	19.5	10.6	3.6	3.7	8.8	46.2
8	19.5	10.6	3.6	3.7	8.8	46.2
9	19.5	10.6	3.6	3.7	8.8	46.2
10	19.5	10.6	3.6	3.7	8.8	46.2
11	19.5	10.6	3.6	3.7	8.8	46.2
12	19.5	10.6	3.6	3.7	8.8	46.2
13	19.5	10.6	3.6	3.7	8.8	46.2
14	19.5	10.6	3.6	3.7	8.8	46.2
15	19.5	10.6	3.6	3.7	8.8	46.2
16	19.5	10.6	3.6	3.7	8.8	46.2
17	19.5	10.6	3.6	3.7	8.8	46.2
18	19.5	10.6	3.6	3.7	8.8	46.2
19	19.5	10.6	3.6	3.7	8.8	46.2
20	19.5	10.6	3.6	3.7	8.8	46.2
Total	370.5	180.2	68.4	70.3	147.6	837.0

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4.4 Cost and Benefits Compared

A comparison of cost and benefits discounted at 12% - the official discount rate in Bangladesh – looks as follows.

Table 4.3: Economics of Char Development (in mln Tk; constant 97/98 prices)

Year	Financial Cost	Financial Benefits	Financial Cash flow	Discount factor at rate (%) 12,0%	Discounted Financial Cash flow	Economic Cost	Economic benefits	Economic Cash Flow	Discounted Economic Cash flow
0	317		-317,0	1,000	-317,0	272,6		-272,6	-272,6
1	4		-4,0	0,893	-3,6	3,2		-3,2	-2,9
2	4	27,8	23,8	0,797	19,0	3,2	29,3	26,1	20,8
3	4	29,8	25,8	0,712	18,4	3,2	31,3	28,1	20,0
4	4	42,2	38,2	0,636	24,3	3,2	45,8	42,6	27,1
5	4	44,2	40,2	0,567	22,8	3,2	47,8	44,6	25,3
6	4	46,2	42,2	0,507	21,4	3,2	49,8	46,6	23,6
7	4	46,2	42,2	0,452	19,1	3,2	49,8	46,6	21,1
8	4	46,2	42,2	0,404	17,0	3,2	49,8	46,6	18,8
9	4	46,2	42,2	0,361	15,2	3,2	49,8	46,6	16,8
10	4	46,2	42,2	0,322	13,6	3,2	49,8	46,6	15,0
11	4	46,2	42,2	0,287	12,1	3,2	49,8	46,6	13,4
12	4	46,2	42,2	0,257	10,8	3,2	49,8	46,6	12,0
13	4	46,2	42,2	0,229	9,7	3,2	49,8	46,6	10,7
14	4	46,2	42,2	0,205	8,6	3,2	49,8	46,6	9,5
15	4	46,2	42,2	0,183	7,7	3,2	49,8	46,6	8,5
16	4	46,2	42,2	0,163	6,9	3,2	49,8	46,6	7,6
17	4	46,2	42,2	0,146	6,1	3,2	49,8	46,6	6,8
18	4	46,2	42,2	0,130	5,5	3,2	49,8	46,6	6,1
19	4	46,2	42,2	0,116	4,9	3,2	49,8	46,6	5,4
20	4	46,2	42,2	0,104	4,4	3,2	49,8	46,6	4,8
TOTAL	397	837,0	440,0		-73,1	336,6	901,2	564,6	-2,2
		IRR:	8,8%					EIIR:	11,9%

The financial IRR is 8.8%, which makes the project not feasible in financial terms.

In economic terms, some corrections in prices will result from shadow pricing (for details see Technical Report 26, 1999). The price of domestic materials (40% of investment cost) will be deflated by 0.9, that of unskilled labour (40% of investment cost) by 0.75, with the remaining 20% the same. That leads to economic investment cost of the project of Tk 272.6m.
Economic O&M cost will be reduced from Tk 4m to Tk 3.2m.

On the benefit side an economic paddy price of Tk 7,350 per ton has been used, in line with the world market (and domestic Tk 7000), and a conversion factor of 0.9 for rabi crops. Labour costs (70% of production cost) have been reduced by a factor 0.25, as a result of

(hidden) unemployment off-season which reduce the cost of labour to the economy (25% below the market wage).
This will increase annual benefits from T.Aman from Tk 19.5m to Tk 20.8m, for *Aus* an increase from Tk 10.6m to Tk 12.7m; for *Rabi* an increase from Tk 3.6m to Tk 3.8m.; and no changes for homestead gardening and fish ponds (rough estimates anyway).
The economic IRR will be 11.9%.

This shows that in economic terms the project is almost feasible, just falling short of the 12% (discount rate). As the latter has not been re-estimated recently, and is likely to be depreciated rather than appreciated in view of recent economic developments in Bangladesh, we can speak more or less of a break-even situation. That is a good result, which can be justified by the social benefits that also result from the project and that have been neglected in this analysis.

5. CONCLUSIONS

With an EIRR of 11.9% , polder development is marginally feasible for the national economy as a whole This is largely due to the indirect effects related to it, and reflected in cheaper labour cost than the actual market wage. In financial terms – purely direct effects – it is not feasible.
This result is much more modest than the one from 1999, purely based on assumptions. Then the financial IRR was 12.5% and the economic one 15.5%. Especially the assumptions with respect to an expansion of the area under Rabi crops (an extra 20% p.a.) proved to be wrong.

In comparison with other feasibility studies these results are also more modest, (see table 1) Although studies in the early 90s were quite pessimistic, confirming the marginal nature of polder development in economic terms, the later feasibility studies seem over optimistic. But the differences are partly related to area specific characteristics.

Our results are also in line with a number of relevant studies done under FAP (FAP 1 and 98), confirming the general conclusion that at the present stage of socio-economic development in Bangladesh, works to protect agricultural land are hardly feasible from an economic point of view. Only if urban centres also benefit from such works, or if there are other related benefits, could the necessary investments be justified.

Still, as long as there is (almost) a break-even point, as seems to be the case in CDSP-I, the present investments are certainly justified from a social point of view, as there are clear social benefits resulting from polder development.

ANNEX 1: THE CALCULATION OF ECONOMIC BENEFITS

T. Aman

We might say that every year (from year 2 onwards) there is 500 ha extra under HYV, constant, no further increases, and that yield increases in year 2 to 3.5 t/ha. That means extra paddy of 500x (3.5 – 1.9, the difference between HYV and LV yield) = 800 ton.
From LV there is 500 ha less, down from 3800 to 3300, but due to yield increase from 1.2 to 1.9, there is every year say from year 2 onwards an extra 1700 ton.
Due to prevented flood damage there is every year from year 2 onwards an extra output of 1.2 x 3800 x 10% = 460 ton.
Total extra output p.a. from year 2 onwards is 2960 ton. Valued at Tk 7000 each gives Tk 20.72m. Minus extra cost of production of HYV of 500 (ha) x Tk 2500 (cost per ha) = Tk 1.25m. Net value Tk 19.5m.

In economic prices, the output increase will be valued at Tk 7350, which gives Tk 21.7m. But extra cost of production of HYV are now depreciated (shadow wage rate 0.75%) to Tk 0.9m, which brings net economic benefits of Tk 20.8m p.a.

Aus

From year 4 onwards an extra 450 ha is under HYV, at a constant 2.6 t/ha. That leads to an extra output from HYV of 450x 2.6 = 1170 ton.
From LV there is 1.8 t/ha extra from 450 ha, that is 810 ton; plus extra yield of 1.6 minus 1.1 t/ha is 0.5 ha from the baseline area of 750 ha, that is 375 ton.
Again, due to now prevented flood damage we may assume an extra output –say also from year 4 onwards of 10% - is 1.1 x 750 x 10% = 82.5 ton.
Total extra output say from year 4 onwards 1170+810+375+ 82.5= 2437.5 ton.
Valued at Tk 7000 per ton that equals Tk 17.1m.
To be added for by-products (straw) Tk 1000 per ha, equals 900 x Tk 1000 = Tk 0.9m; added to Tk 17.1m is Tk 18m.
Still to be deducted extra cost of production from the extra 900 ha: 450x 7350 (.75 % of gross margin) = Tk 3.3m for LV; and 450x 9200 = Tk 4.14m for HYV. Total deduction of Tk 7.44 leaves net benefits from year 4 onwards of Tk 10.6m.

In economic prices (Tk 7,350 per ton; 70% of cost of production for labour reduced by Shadow Wage Rate of 75%) gross benefits will be Tk 17.9m p.a. and net ones Tk 12.7m.

Rabi

Based on an average net income of Tk 9,000 per ha (baseline 97/98), the extra 400 ha under cultivation from year two onwards, leads to extra annual benefits of Tk 3.6m p.a.
The Tk 9,000 was based on an equal distribution (0.2 ha each) of the main crops Khesari (Tk 2,500 per ha), groundnuts (Tk 10,000 per ha), chillies (Tk 14,500 per ha), garlic (Tk 15,000 per ha) and sweet potatoes (Tk 3,000). Although some shifts to other crops occurred (water melon, okra, cucumber, mungbeen), this is not (clear) enough to change the net average ofTk 9,000.

In economic terms this amount is deflated by 0.9, as a result of some price protection which inflates domestic prices 10% in comparison to world market prices. This gives net economic benefits of Tk 3.2m p.a. But the cost of production will be reduced by 20% as a result of the lower shadow price for labour (0.75 of market wage). This increases the net economic benefits to Tk 3.8m p.a.

Homestead

Vegetable growing can now reach gross margins of Tk 50-100,000 per ha (in 97/98 prices), as new crops and better varieties can now be grown with flood protection. Some extra income from trees is now also possible, as well as from poultry.

Assuming a 10% net increase because of improved soil conditions on a total homestead area of 500 ha, net annual benefits are roughly Tk 7,500 x 500 = Tk 3.75m.

Fish Ponds

Improved culture fishing will be possible on roughly 200 ha. In view of fish yields in ponds of around 500 kg/ha before (baseline 1994), yields of 1300-1400 kg/ha in non-demonstration plots during 1996-908 and yields of 2000 kg/ha on demonstration plots after CDSP' s input stopped (down from 3000 kg/ha), it seems fair to assume an extra output due to the project of 1500 kg/ha.

On a total of 200 ha this would lead to 40,000 kg in year 2 (700 per pond, 200 more than before), 80,000 in year 3, 120,000 in year 4 , 160,000 in year 5 and an extra 200,000 from year 6 onwards. At a price of Tk 49 per kg (1997/98) its value would reach Tk 9.8m after five years. Deducting extra cost of production leads to a gradual increase to net benefits of Tk 8.8m from year 6 onwards.

ANNEX 2: CDSP I MONITORING DATA FOR COST BENEFIT ANALYSIS

Compiled by SAA

Project area (total of 3 chars) : 5000 ha

CBD-II	2083 ha
CM	1281 ha
CBT	1785 ha
	5149 ha

Cultivated area : 4000 ha

Project investment (million Taka):

Item	Amount	Remarks
Gross investment:		
1. Cyclone shelter	64	
2. Road	48	
3. Sluices	31	
4. Canals	28	
5. Bridges & culverts	23	
6. Dykes	19	
7. CV ponds	19	
8. Deep/Shallow Tube well	9	
9. Others	8	
Sub-total	249	As against 250 shown in TR26
Other investment:		
1. CERP structure in CBT	70	
2. CDSP through LRP in CBD-II	22	
3. Extra infrastructure by LGED	14.5	
4. Extra staff of LGED	1.5	
5. Land acquisition by GOB	5	
6. Others (15% of TA)	23	
Sub-Total	136	
Grand Total	385	
Investment ignored:		
1. Cyclone shelter	64	
2. Tube well	9	
3. Saving from CM sluice	6	
4. Others	8	
Total	87	
Net investment (385-87)	298	As against 299 shown in TR26
O&M cost	4% for roads & 2% for water control	
Investment per char		
CBD-II	84	
CM	88	
CBT	127	
Investment per ha	59,800	As against 58,000

PROJECT BENEFITS

Assumptions:

Earlier assumptions	Present observations/findings
1. HYV aman adoption after One year @10%/year	: In rainfed agriculture 10% annual growth not possible. It varies considerably among chars
2. Adoption of aus begins in 3rd year with a target of 50% coverage	: Prediction of 50% coverage at project end is an overestimated. This is a high risk-prone crop whose adoption may fluctuate tremendously among years. Availability of suitable land also varies with chars.
3. Extra 20% land coverage each year after one year	: This was possible only in the suitable areas but it did not happen because salinity reduction did not occur at the expected rate.
4. Crop loss due to flood will be reduced	: Did not happen within four years due to incomplete protection of the polders or slow drainage.
5. 20% increase in homestead production due to improved soil condition	: Such increase may be possible only in newly settled households. Annual growth of such households may not exceed 1%.
6. Increase in fish production	: No study but observations do not say so because most ponds are only seasonal.

Other assumptions:

Earlier assumptions	Our observations/findings
1. T. aman	
Total cropped area 3000	: 3700 - 3800
HYV adoption 10% per year	: Highly variable, varies from 5 to 15%
Yield increase of LV from 1.2 to 1.5 t/ha	: Increased from 1.2 to 1.9 t/ha
Yield increase of HYV from 2.2 to 3 t/ha	: Increased from 2.2 to 3.5 t/ha
2. Aus	
New Aus area 1200	: Total area increased from 757 ha (baseline) to 1000-1600 ha after four years (saturated?)
HYV adoption 50% at project end	: Varies considerably among chars; ranged from about 40 to 50%
Yield increase of LV from 1.4 to 1.6 t/ha	: Increased from 1.1 t/ha to 1.4-1.8 t/ha
Yield increase of HYV from 2.6 to 3 t/ha	: No change
3. Rabi crops	
New area coverage 2000 ha	: No growth due to unfavorable weather
Extra 20% area increase per year	: Did not happen
Income (Tk./ha) from: assumed	Actual
Khesari 2500	: 12,890
Groundnut 10000	: 9,190
Chilli 14500	: 14,800
Garlic 15000	: 15,000
Sweet potato 3000	: 38,000
Water melon (new introduction)	: 56,000
Okra (new introduction)	: 28,900
Field Cucumber (new introduction)	: 7,500

COST BENEFIT ANALYSIS

		Char Majid					**Char Baggar Dona II**				
Sl.No.	Items	Baseline	2001	2002	2003	2004	Baseline	2001	2002	2003	2004
1	Area, ha	1300	1300	1300	1300	1300	2100	2100	2100	2100	2100
2	Cultivated area, ha	897	897	897	897	897	1575	1575	1575	1575	1575
3	Homestead area, ha	126	126	126	126	126	185	185	185	185	185
4	Pond, ha	65	65	65	65	65	84	84	84	84	84
5	Total Household (HH)	2283	2283	2283	2283	2329	2267	2267	2267	2267	2267
6	HH with homestead	1780	1780	1780	1782	1816	2264	2264	2264	2264	2267
7	Size, kitchen garden, ha	31.5	31.5	31.5	31.5	31.5	46.3	46.3	46.3	46.3	46.3
8	Cropped area, ha										
	Total Aman	897	897	897	897	879	1569	1575	1575	1575	1536
	HYV aman	38	85	57	109	87	93	282	358	282	433
	Local aman	859	812	840	789	810	1476	1293	1218	1293	1103
	Total aus	53	60	86	84	83	528	369	421	413	803
	HYV aus	1	28	41	40	22	47	131	159	169	430
	Local aus	52	32	45	44	60	480	238	262	244	373
	Rabi	357	231	236	226	298	803	706	570	539	901

		Char Batir Tek					**Total of 3 chars**				
Sl.No.	Items	Baseline	2001	2002	2003	2004	Baseline	2001	2002	2003	2004
1	Area, ha	1800	1800	1800	1800	1800	5200	5200	5200	5200	5200
2	Cultivated area, ha	1338	1338	1338	1338	1324	3810	3810	3810	3810	3779
3	Homestead area, ha	193	193	193	193	194	504	504	504	504	508
4	Pond, ha	154	154	154	154	155	303	303	303	303	306
5	Total Household (HH)	2445	2445	2445	2445	2470	6995	6995	6995	6995	7065
6	HH with homestead	2421	2421	2421	2421	2445	6465	6465	6465	6465	6858
7	Size, kitchen garden, ha	48	48	48	48	49	42	42	42	42	42
8	Cropped area, ha										
	Total Aman	1326	1338	1338	1338	1325	3792	3810	3810	3810	3758
	HYV aman	84	252	372	265	300	214	618	787	655	820
	Local aman	1243	1087	966	1073	1026	3578	3192	3023	3155	2938
	Total aus	177	633	569	872	775	757	1062	1076	1368	1661
	HYV aus	28	233	225	479	335	76	391	425	687	788
	Local aus	149	400	344	393	440	681	670	650	681	873
	Rabi	573	624	428	855	757	1733	1561	1234	1620	1955

Area (ha) under rabi crops

Crop	CBD-II 2001	CBD-II 2002	CBD-II 2003	CBD-II 2004	CBT 2001	CBT 2002	CBT 2003	CBT 2004	CM 2001	CM 2002	CM 2003	CM 2004
Batisak												
Brinjal		13	14	8	22	13	14	20		3		4
Cabbage						2	13					
Carrot						3						
Cauliflower												
Cheena												
Chili	146	160	125	217	183	140	100	80	50	55	59	83
China sak												
Cowpea	94	80			24	15		25	18	18		
Cucumber								3				
Felon			44	110			69				17	20
Garlic	18	31	36	23	39	20	58	51	6	1	2	4
Groundnut	118	29	48	74	11	2		15	17	10	11	19
Indian spinach						3						
Khesari	49	25	84	20	109	113	207	188	61	28	5	19
Khira		15					5					
Knolkhol						2						
Lin seed	51	15	26	18	78	26	88	136	13	3	4	
Maize	25				9	2	10		1			
Millet				6	4			27	3			
Mungbean	77	109	48	264		5	42	27	22	83	92	87
Mustard					6	5	31			1		
Okra					2		5	8	4	7		3
Onion	8		17		2	3		3				
Potato							2		3			
Radish			5			7	18	3				
Red Amaranth						3	6			1		
Rice					4						5	8
S. Gourd					17	7	21	35				1
S. Potato	95	48	5	69	85	39	98	88	27	17	20	27
Sesame												
Soybean	18	48	56	55	6		8	13		3		1
Spinach							10	3				
Sugarcane						3	2					1
Sunflower					4	3			1			
Tomato	2	6	12	20	15	3	26	13	4	1		3
Water melon					2			3			1	1
Wheat			9		4							
Total	701	579	529	884	626	419	833	741	230	231	216	281

Rice yield, t/ha (mean of varieties):

Area	Crop	Variety	Baseline	2000	2001	2002	2003	2004*
CBD-II	Aman	HYV	0	3.52	3.83	4.23	4.35	3.06
		LV	1.21	1.82	1.96	2.62	2.00	2.01
	Aus	HYV	3.30	3.24	3.15	2.86	3.43	1.95
		LV	2.09?	1.59	1.77	1.85	1.68	1.30
CBT	Aman	HYV	0	3.80	3.65	4.18	4.40	3.47
		LV	2.05	2.16	1.80	2.32	1.90	1.79
	Aus	HYV	2.81	3.22	3.03	2.93	3.12	2.00
		LV	1.15	1.70	1.73	1.80	1.66	1.37
CM	Aman	HYV	0	3.55	4.11	4.11	4.00	2.71
		LV	1.05	1.93	1.76	1.74	2.00	1.35
	Aus	HYV	0	-	2.74	2.78	2.85	2.93
		LV	0	1.88	1.78	1.26	1.58	1.75

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* Severe flood in aman season reduced production by 40%

Adoption of improved crops (Total of 3 chars)

Crops	Baseline	2001	2002	2003	2004
HYV aman	5.6	16.2	20.7	17.2	21.8
HYV aus	10.1	36.9	39.5	50.2	47.4
Rabi	45.7	41.0	32.4	42.5	52.0