THE STUDY ON ADDIS ABABA
FLOOD CONTROL PROJECT

CHAPTER 11

ECONOMIC EVALUATION

THE STUDY
ON
ADDIS ABABA FLOOD CONTROL PROJECT
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

CHAPTER 11 ECONOMIC EVALUATION

Contents

11. ECONOMIC EVALUATION

11.1 General

The priority projects selected in the Phase 1 study consist of the following sub-projects.

The Bantyiketu River System

(1) The Kechene River
- Kechene Weir
- Kostre Regulating Pond

(2) The Bantyiketu River
- Bantyiketu Regulating Pond
- River Channel Improvement
- Urban Drainage Improvement

Evaluation of the priority projects was made at the price level of June 1997 and applied foreign exchange rate is one U.S. dollar equivalent to 6.80 Birr and one Birr equivalent to 0.0593 Japanese Yen.

The flow chart showing the process of the economic evaluation is shown in Figure 11.1.1.

11.2 Methodology of Economic Evaluation

The methodology applied for the economic evaluation of the priority projects is same as that applied for the evaluation of the flood control master plan. The same general assets and agricultural assets have been used for estimation of the flood damages. The indirect damages and the other damages were also taken into account. The flood damages taken into account for the economic evaluation are shown in Figure 11.2.1.

11.3 Flood Reduction Benefits

Benefits of flood control projects are estimated from difference of the flood damages between those with and without project. In other words, they are flood damage reduction benefits.

	Annual Flood Reduction Benefit (1,000 Birr)	
	1997 (present)	2020 (target year)
The Priority Projects	8,434	13,576

11.4 Economic Project Costs

11.4.1 Project Costs

The financial project costs include construction costs, resettlement costs, engineering service costs, administration costs, costs for non-structural measures, physical contingency and price contingency.

The financial project costs have been converted into the economic project costs (accounting price) with the same manner as that applied for the evaluation of the flood control master plan. Namely, the standard conversion factor (SCF) has been applied to calculate the economic project costs of non-traded goods and services (local currency portion) and 10 % of the costs have been deducted for adjustment of import duties for the project costs of traded goods and services (foreign currency portion).

The economic project costs of both structural and non-structural measures are shown in Table 11.4.1 and 11.4.2, and summarized below.

Cost Item	Financial Cost	Economic Cost	
	(US$ 1,000)	(US$ 1,000)	Equivalent in 1,000 Birr
1. Construction cost	9,688	8,573	58,296
2. Resettlement cost	30	26	177
3. Engineering service cost	1,841	1,655	11,254
4. Administration cost	752	662	4,502
5. Sub-total of (1.- 4.)	12,311	10,916	74,229
6. Physical contingency	1,233	1,094	7,439
7. Sub-total of (5.- 6.)	13,544	12,010	81,668
8. Cost of non-structural measures	532	465	3,162
9. Total of (7.- 8.)	14,076	12,475	84,830

Annual disbursement of the economic costs based on the implementation schedule of the priority project is presented in Table 11.4.4.

11.4.2 Annual Operation and Maintenance Cost

Economic annual operation and maintenance costs for both structural and non-structural measures are estimated as shown in Table 11.4.3 and summarized below.

Annual O & M Cost	Financial Cost	Economic Cost	
	(US$ 1,000)	(US$ 1,000)	Equivalent in 1,000 Birr
1. Structural measures	40	35	238
2. Non-structural measures	29	25	170
9. Total of (1.- 2.)	69	60	408

11.4.3 Replacement Cost

Average lifetime of the metal and mechanical facilities related to the projects such as gates is assumed to be 25 years after their installation. The replacement cost covers replacement of such facilities after their lifetime within the project life (50 years). The replacement cost is assumed to be covered by annual reserve fund and it is included in the annual operation and maintenance costs discussed above.

11.5 Economic Evaluation

The cost-benefit analysis for the projects have been made by a cash flow analysis using three types of indicators, i.e. economic internal rate of return (EIRR), benefit cost ratio (B/C ratio), and net present value (NPV) which are commonly used for the same kind of project evaluation. By using a discounting procedure, benefits and costs of the project occurring at different points in time can be compared in terms of present values.

The economic viability of the projects is summarized below and its annual cash flow is shown in Table 11.5.1.

	EIRR	B/C ratio	NPV (1,000 Birr)
The Priority Project	12.2	1.23	13,428

Note: Discount rate of 10 % is assumed for calculation of B/C ratio and NPV.

11.6 Sensitivity Analysis

Sensitivity of the economic evaluation of the projects has been examined adopting increase in cost and decrease in benefit. The results of the analysis are shown below.

Sensitivity	The Priority Project		
	EIRR	B/C ratio	NPV (1,000 Birr)
(a) Base estimate	12.2	1.23	13,428
(b) Project cost increase of 15 %	10.7	1.07	4,567
(c) Benefit decrease of 15 %	10.4	1.04	2,553
(d) Combination of (b) and (c) above	9.1	0.91	-6,309

11.7 Results of Economic Evaluation

As a result of the economic evaluation including sensitivity analysis, the priority project has sufficient EIRR (12.2 %), and its B/C ratio and NPV are also high. The projects can be judged economically feasible from the results.

Table 11.4.1 Financial and Economic Project Cost of Structural Measures (The Priority Projects)

Bantyiketu River System

Cost Item	F.C. (US$1,000)		L.C. (US$1,000)		Total financial	Total economic	Total equivalent
	Financial cost	Economic cost	Financial cost	Economic cost	cost (US$1,000)	cost (US$1,000)	(1,000 Birr)
Structural Measures							
1. Construction cost	4,326	3,893	4,399	3,827	8,725	7,720	52,496
2. Resettlement cost	0	0	30	26	30	26	177
3. Engineering services	1,780	1,602	61	53	1,841	1,655	11,254
4. Administration	269	242	749	652	1,018	894	6,079
Sub-total of (1.- 4.)	6,375	5,737	5,239	4,558	11,614	10,295	70,006
5. Physical contingency	635	572	526	458	1,161	1,030	7,004
Total of (1.- 5.)	7,010	6,309	5,765	5,016	12,775	11,325	77,010

Table 11.4.2 Financial and Economic Project Cost of Non-structural Measures (The Priority Projects)

Bantyiketu River System

Cost Item	F.C. (US$1,000)		L.C. (US$1,000)		Total financial	Total economic	Total equivalent
	Financial cost	Economic cost	Financial cost	Economic cost	cost (US$1,000)	cost (US$1,000)	(1,000 Birr)
Non-structural Measures							
I. Installation of facilities							
1. River zone	0	0	189	164	189	164	1,115
2. Flood warning system	64	58	92	80	156	138	938
3. Flood fighting system	3	3	79	69	82	72	490
4. Social education	0	0	5	4	5	4	27
Sub-total of (1.- 4.)	67	61	365	317	432	378	2,570
5. Physical contingency	7	6	36	31	43	37	252
Total of (1.- 5.)	74	67	401	348	475	415	2,822
II. Administration	3	3	54	47	57	50	340
Total of (I.+ II.)	77	70	455	395	532	465	3,162

Table 11.4.3 Financial and Economic Annual O & M Cost (The Priority Projects)

Bantyiketu River System

Cost Item	F.C. (US$1,000)		L.C. (US$1,000)		Total financial	Total economic	Total equivalent
	Financial cost	Economic cost	Financial cost	Economic cost	cost (US$1,000)	cost (US$1,000)	(1,000 Birr)
Annual O & M Cost							
1. Structural measures	10	9	30	26	40	35	238
2. Non-structural measures	1	1	28	24	29	25	170
Total of (1.- 2.)	11	10	58	50	69	60	408

Table 11.4.4 Breakdown of Annual Economic Cost
(The Priority Project)

Bantyiketu River System Unit: 1,000 Birr

Item	Year						
	1997	1998	1999	2000	2001	2002	Total
Annual Economic Cost							
- Kechene River (Kechene weir and Kostre regulating pond)							
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and urban drainage)							
- Non-structural measures (River zone, flood warning system, flood fighting system, and social education)							
I. Structural measures							
1. Construction cost	-	-	-	26,248	26,248	-	52,496
2. Resettlement cost	-	-	177	-	-	-	177
3. Engineering services	-	-	5,627	2,814	2,814	-	11,254
4. Administration	-	608	1,824	1,824	1,824	-	6,079
Sub-total of (1.- 4.)	-	608	7,628	30,885	30,885	-	70,006
5. Physical contingency	-	61	763	3,089	3,091	-	7,004
Total of (1.- 5.)	-	669	8,391	33,974	33,976	-	77,010
II. Non-structural measures							
1. Installation of facilities	-	-	-	2,822	-	-	2,822
2. Administration	-	68	102	170	-	-	340
Sub-total of (1.- 2.)	-	68	102	2,992	-	-	3,162
Total of (I.+ II.)	-	737	8,493	36,966	33,976		80,172

Table 11.5.1 Cost-Benefit Analysis

(The Priority Projects)

- Kechene River (Kechene weir and Kostre regulating pond)
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and urban drainage)
- Non-structural measures (River zone, flood warning system, flood fighting system, and social education)

Unit: 1,000 Birr

Year in order	Year	Benefit	Cost						Total Cost	Net Cash Flow
			Structural measures			Non-structural measures				
			Initial cost	O&M	Sub-total	Initial cost	O&M	Sub-total		
1	1997	0	0		0	0		0	0	0
2	1998	0	669		669	68		68	737	-737
3	1999	0	8,391		8,391	102		102	8,493	-8,493
4	2000	0	33,974		33,974	2,992	85	3,077	37,051	-37,051
5	2001	4,776	33,976	119	34,095		170	170	34,265	-29,489
6	2002	9,552		238	238		170	170	408	9,144
7	2003	9,776		238	238		170	170	408	9,368
8	2004	9,999		238	238		170	170	408	9,591
9	2005	10,223		238	238		170	170	408	9,815
10	2006	10,446		238	238		170	170	408	10,038
11	2007	10,670		238	238		170	170	408	10,262
12	2008	10,893		238	238		170	170	408	10,485
13	2009	11,117		238	238		170	170	408	10,709
14	2010	11,341		238	238		170	170	408	10,933
15	2011	11,564		238	238		170	170	408	11,156
16	2012	11,788		238	238		170	170	408	11,380
17	2013	12,011		238	238		170	170	408	11,603
18	2014	12,235		238	238		170	170	408	11,827
19	2015	12,459		238	238		170	170	408	12,051
20	2016	12,682		238	238		170	170	408	12,274
21	2017	12,906		238	238		170	170	408	12,498
22	2018	13,129		238	238		170	170	408	12,721
23	2019	13,353		238	238		170	170	408	12,945
24	2020	13,576		238	238		170	170	408	13,168
25	2021	13,576		238	238		170	170	408	13,168
26	2022	13,576		238	238		170	170	408	13,168
27	2023	13,576		238	238		170	170	408	13,168
28	2024	13,576		238	238		170	170	408	13,168
29	2025	13,576		238	238		170	170	408	13,168
30	2026	13,576		238	238		170	170	408	13,168
31	2027	13,576		238	238		170	170	408	13,168
32	2028	13,576		238	238		170	170	408	13,168
33	2029	13,576		238	238		170	170	408	13,168
34	2030	13,576		238	238		170	170	408	13,168
35	2031	13,576		238	238		170	170	408	13,168
36	2032	13,576		238	238		170	170	408	13,168
37	2033	13,576		238	238		170	170	408	13,168
38	2034	13,576		238	238		170	170	408	13,168
39	2035	13,576		238	238		170	170	408	13,168
40	2036	13,576		238	238		170	170	408	13,168
41	2037	13,576		238	238		170	170	408	13,168
42	2038	13,576		238	238		170	170	408	13,168
43	2039	13,576		238	238		170	170	408	13,168
44	2040	13,576		238	238		170	170	408	13,168
45	2041	13,576		238	238		170	170	408	13,168
46	2042	13,576		238	238		170	170	408	13,168
47	2043	13,576		238	238		170	170	408	13,168
48	2044	13,576		238	238		170	170	408	13,168
49	2045	13,576		238	238		170	170	408	13,168
50	2046	13,576		238	238		170	170	408	13,168

EIRR= 12.8%

B/C = 1.29 (at discount rate: 10 %)

NPV= 16,434 (at discount rate: 10 %)

Note: The O & M costs of the structural measures include annual reserve for replacement of gates.

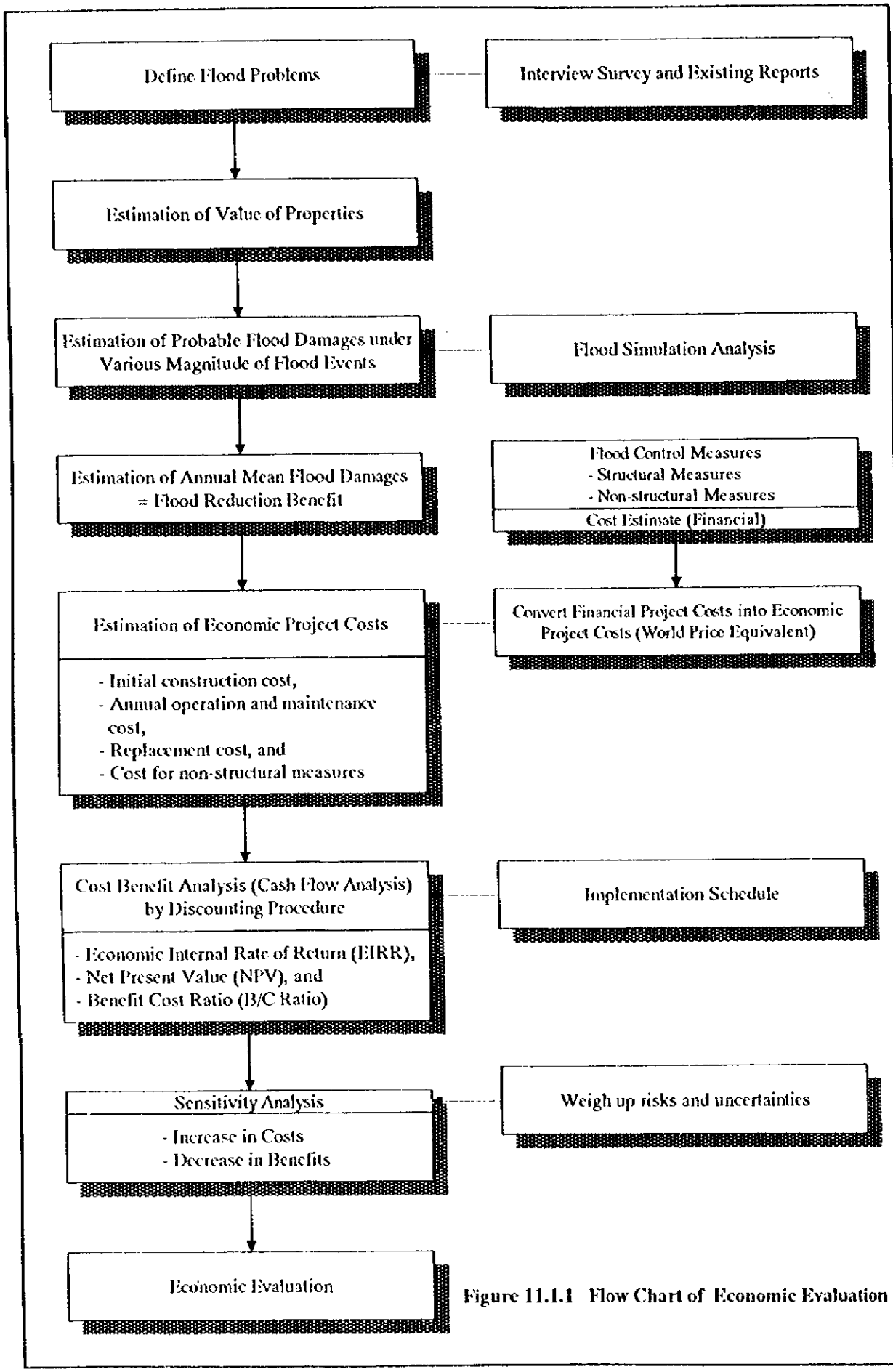

Figure 11.1.1 Flow Chart of Economic Evaluation

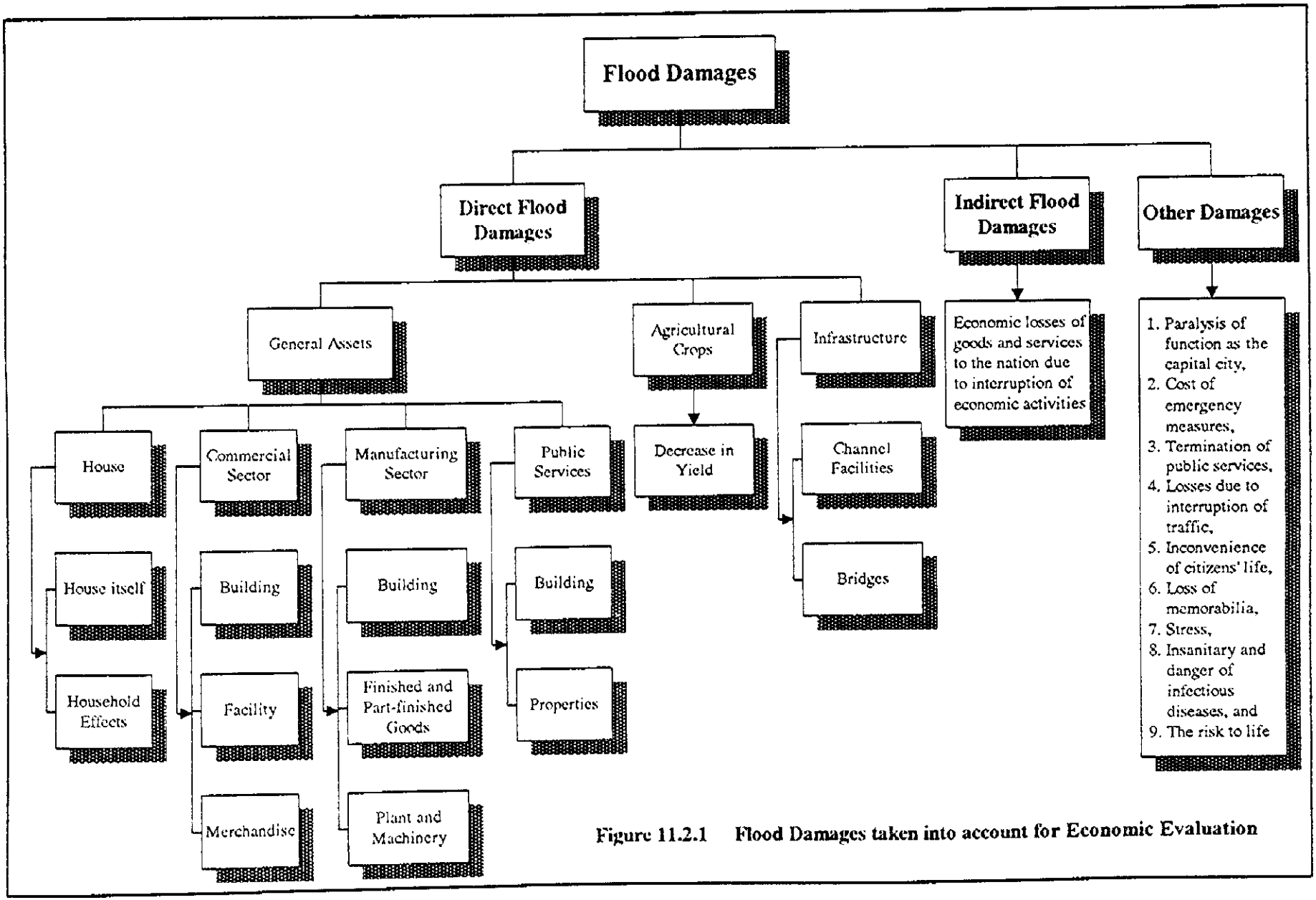

Figure 11.2.1 Flood Damages taken into account for Economic Evaluation

CHAPTER 12

IMPLEMENTATION PLAN

THE STUDY
ON
ADDIS ABABA FLOOD CONTROL PROJECT
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

CHAPTER 12 IMPLEMENTATION PLAN

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12. IMPLEMENTATION PLAN

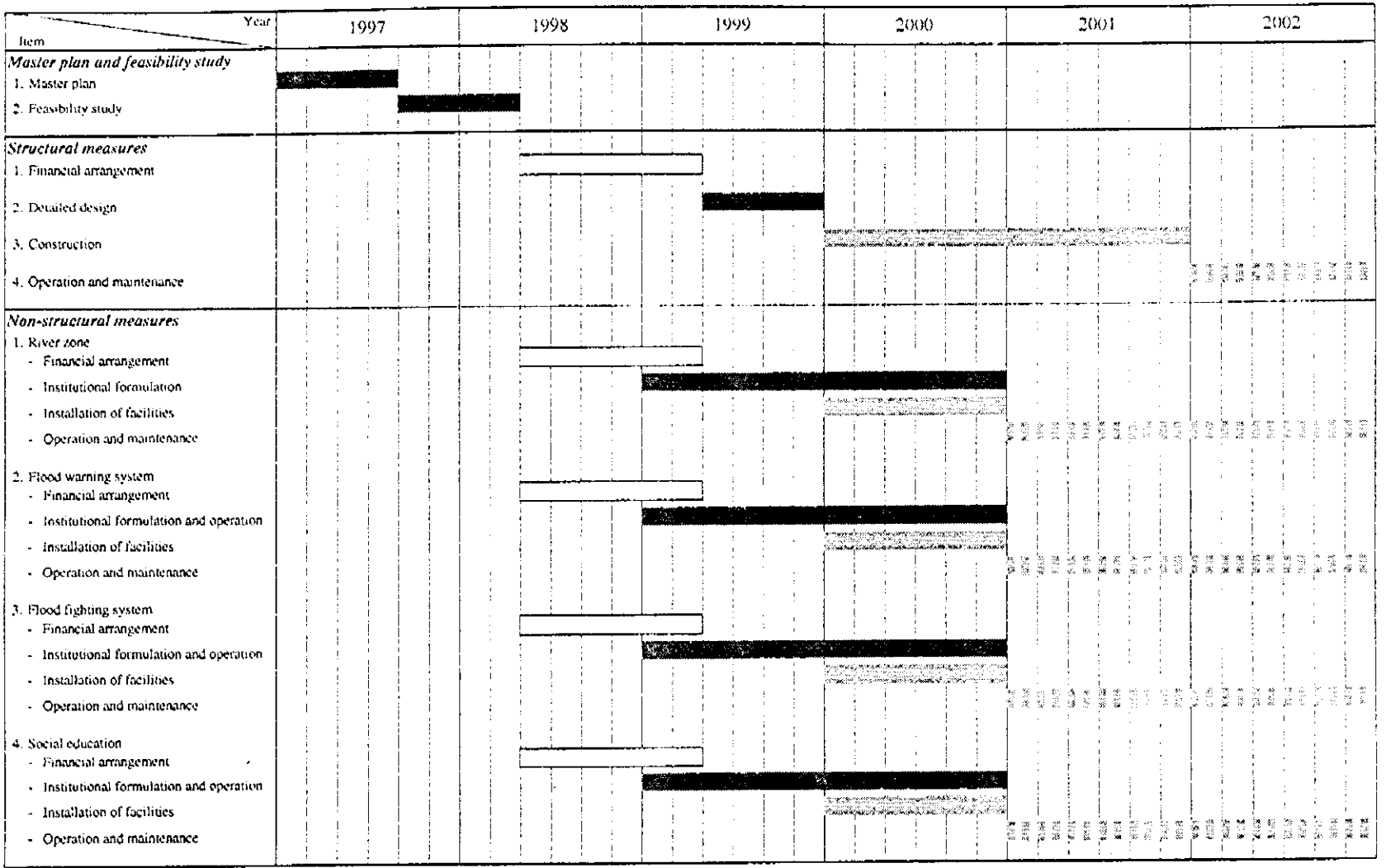
The implementation plan of priority project is formulated respecting that of master plan study.

Supposed that it is decided to implement the project just after this feasibility study, the implementation will be commenced from the year of 1999 after some period of financial arrangement.

Structural measures will be commenced with detailed design in the middle of 1999. The detailed design including tender for construction will be conducted for eight months. EIA (Environmental Impact Assessment), if required, and resettlement for construction works will be executed simultaneously with the detailed design. The detailed design including tender for construction will be finished at the end of 1999. After the detailed design, the construction works will be executed for two years. It will be commenced in the beginning of 2000 and will be completed at the end of 2001. Operation and maintenance will be carried out successively after the completion of the construction works from 2002.

Non-structural measures of river zone, flood warning system, flood fighting system and social education will be implemented simultaneously. The non-structural measures will be commenced with the formulation of institution in the middle of financial arrangement, under the yearly budget of present AFCPO, from the beginning of 1999. The institution will be formulated for two years from 1999. The facilities of non-structural measures will be installed within a year of 2000. The institutional formulation and the installation of facilities will be completed at the end of 2000. Operation and maintenance will be carried out successively from 2001.

Proposed implementation plan of priority project is shown in Figure 12.1.1.



Note: - Feasibility study includes the study on both structural and non-structural measures.
- EIA and resettlement are conducted simultaneously with the detailed design.
- Detailed design includes tender for construction.

Figure 12.1.1 Proposed Implementation Plan of Priority Project