CHAPTER 5

FINANCIAL BENEFIT-COST ANALYSIS

CONTENTS

Tables

5.1 Introduction

1. The purpose of the financial benefit-cost analysis is to assess the financial viability of the proposed project, i.e., if the proposed project is financially attractive or not from the entity's viewpoint. This analysis is done for the chosen least-cost alternative which is identified following methodology described in Chapter 4.

2. In the financial benefit-cost analysis, the unit of analysis is the *project* and not the entire economy nor the entire water utility. Therefore, a focus on the *additional* financial benefits and costs to the water utility, attributable to the project, is maintained. In contrast, the economic benefit-cost analysis evaluates the project from the viewpoint of the entire economy whereas the financial analysis evaluates the entire water utility by providing projected balance, income, and sources and applications of fund statements. Financial analysis is the subject of the *ADB Guidelines on the Financial Analysis of Projects*.

3. The financial benefit-cost analysis includes the following eight steps:

(i) determine annual project revenues;
(ii) determine project costs;
(iii) calculate annual project net benefits;
(iv) determine the appropriate discount rate (i.e., weighted average cost of capital serving as proxy for the financial opportunity cost of capital);
(v) calculate the average incremental financial cost;
(vi) calculate the financial net present value;
(vii) calculate the financial internal rate of return; and
(viii) risk and sensitivity analysis.

4. Project revenues, costs and net benefits are determined on a with-project and without-project basis. They are estimated in constant prices for a selected year (e.g., constant 1998 prices), typically using the official exchange rate at appraisal. The revenues of the project comprise of entirely user charges, that is, no government subsidies are included.

5.2 Financial Revenues

5. The focus of the financial benefit-cost analysis is on the financial benefits and costs of the project intervention. Hence, the project's water sales revenues are determined on a with-project and without-project basis. In this way, the contribution of the project to the total revenues of the utility is estimated.

6. The project revenues are usually determined for different groups of users, such as households, government institutions and private commercial/industrial establishments. Each may have a different consumption pattern, may be charged a different tariff and may respond differently to tariff increases. These price-quantity relationships are part of the demand forecast presented in Chapter 3.

7. Table 5.1 illustrates the calculation of project revenues. In the example, the existing water supply system has reached its maximum supply capacity. It has been assumed that, without the project, the system will be properly maintained and operated so that the present volume and quality of water supply can be maintained in the future. With the project, the water supply system will be extended to supply (increased quantities of) water to existing as well as new consumers. The project water supply and revenues are determined as the difference between the with-project and the without-project situations.

Table 5.1 Estimation of Project Revenues *(1996 prices)*

		unit	1996	1997	1998	1999	2000	2005
1	Domestic consumers							
2	Water supplied with-project	'000 m³	1,239	1,518	1,864	2,289	2,819	3,954
3	Water supplied without-project	'000 m³	1,239	1,239	1,239	1,239	1,239	1,239
4	Project water supply	'000 m³	0	279	625	1,050	1,580	2,715
5	Average tariff	VND/m³	2,220	2,394	2,581	2,782	3,000	4,500
6	Project revenues	VND mn	0	668	1,613	2,922	4,740	12,217
7	Government establishments							
8	Water supplied with-project	'000 m³	293	300	308	315	324	454
9	Water supplied without-project	'000 m³	293	293	293	293	293	293
10	Project water supply	'000 m³	0	7	15	22	31	161
11	Average tariff	VND/m³	2,800	3,061	3,347	3,659	4,000	4,500
12	Project revenues	VND mn	0	21	50	80	124	726
13	Private establishments							
14	Water supplied with-project	'000 m³	332	339	348	356	366	513
15	Water supplied without-project	'000 m³	332	332	332	332	332	332
16	Project water supply	'000 m³	0	7	16	24	34	181
17	Average tariff	VND/m³	4,500	4,620	4,743	4,870	5,000	5,500
18	Project revenues	VND mn	0	32	76	117	170	997
19	Subtotal water revenues							
20	Total project water revenues	VND mn	0	722	1,739	3,119	5,034	13,940
21	Total project water supply	'000 m³	0	293	656	1,096	1,645	3,058
22	Connection fees							
23	Average connection fee	'000 VND	1,500	1,500	1,500	1,500	1,500	1,500
24	New connections with-project	number	0	1,701	2,045	2,459	2,957	0
25	New connections without-project	number	0	0	0	0	0	0
26	Additional connections	number	0	1,701	2,045	2,459	2,957	0
27	Project connection fees	VND mn	0	2,552	3,068	3,689	4,436	0
28	Total project revenues	VND mn	0	3,273	4,807	6,807	9,470	13,940

Note: Years 2001-2004 are not shown in this example.

8. The average tariff presented in constant 1996 prices as shown in Table 5.1, was projected to increase significantly with the implementation of the project, to achieve a higher level of cost recovery, as follows (VND/m³):

	Year		
consumers	1996	2000	2005
domestic	2,220	3,000	4,500
government	2,800	4,000	4,500
private	4,500	5,000	5,500

9. This tariff proposal took into account the ability to pay of domestic consumers and involves some degree of cross-subsidization between domestic and non-domestic consumers.

10. The water demand forecast used for illustrative purposes includes the effect of price as well as real per capita income increases on demand. Overall increase in water demand will mainly result from new domestic consumers connected to the new water system project, as shown in Table 5.1.

5.3 Project Costs

11. Once the least-cost alternative has been selected, the preliminary project cost estimates are typically worked out in greater detail by the engineer. The following main categories are distinguished:

(i) investments;
(ii) operation and maintenance; and
(iii) re-investments during the life cycle.

12. Again, the costs should be attributed to the project on a with-project and without- project basis. Only the additional costs due to the project should be taken into account. The basis to attribute costs to the project should be the formulated with-project and without-project scenarios. In Section 5.2 for example, it was assumed that without the project, the existing water supply would be properly maintained and operated, and that the present level of services would continue if the project were not implemented. The project costs should be calculated on an annual basis and should be equal to the with-project costs less the without-project costs. It should also be noted that in many cases the system would deteriorate further in the without-project scenario.

5.3.1 Investments

13. The breakdown of an investment cost estimate of total US$83.00 million (including IDC) is shown in Table 5.2 where foreign and local currency components were distinguished to establish the foreign exchange implications of the project and counterpart financing requirements. Following the general principles of discounting according to which costs and benefits are entered in the analysis in the year in which they occur, interest during construction (IDC) is excluded from the costs used in the financial benefit-cost analysis.

Table 5.2 Project Cost Estimates [a/] ($ million)

Component	Foreign Currency	Local [b/]	Total
A. WATER SUPPLY			
1. Land	-	1.17	1.17
2. Civil Works			
- Drilling of Wells by Contractors	0.92	1.85	2.77
- Civil Works by Contractors	12.75	19.94	32.69
- Civil Works by WDs	1.85	10.15	12.00
3. Procurement of Equipment			
- Pipes and Fittings	4.16	0.46	4.62
- Pumps and Motors	1.39	0.15	1.54
- Water Meters	2.78	0.30	3.08
- Office Equipment	0.28	0.03	0.31
- Stored Materials	1.60	0.47	2.07
4. Studies and Construction Management by Administration	-	1.54	1.54
Subtotal (A)	25.73	36.06	61.79
B. HEALTH EDUC & WATER TESTING			
1. Health and Hygiene Education Program	-	0.08	0.08
2. Water Quality Testing Program			
a. Training for Staff and Conduct of Testing	-	0.02	0.02
b. Civil Works	-	0.18	0.18
c. Procurement of Equipment			
- Equipment for Water Analysis Laboratories	0.56	0.06	0.62
- Chemicals and Reagents	0.07	0.01	0.08
- Portable Water Analysis Kits	0.41	0.05	0.46
d. Land	-	0.16	0.16
Subtotal (B)	1.04	0.56	1.60
C. INSTITUTIONAL DEVELOPMENT			
1. Capacity-Building Program			
- Training of Water Districts' Staff	-	0.96	0.96
- LWUA's Project Management Staff	0.06	0.03	0.09
2. Benefit Monitoring and Evaluation	-	0.07	0.07
3. Consulting Services	1.60	3.25	4.85
Subtotal (C)	1.66	4.31	5.97
D. INTEREST DURING CONSTRUCTION	6.68	6.96	13.64
TOTAL	35.11	47.89	83.00
PERCENT	42.3	57.7	100.00

a/ August 1996 price level

b/ Local cost includes duties and taxes estimated at $6.4 million equivalent or 10% of civil works, equipment, materials and consulting services.

5.3.2 Operation and maintenance

14. Estimates of operation and maintenance (O&M) costs are usually provided to the economist by the engineer or financial analyst. In practice, different ways of estimating O&M costs are used. One approach is to estimate the O&M costs as a percentage of (accumulated) investment costs. Another approach might be to analyze the utility's past performance and to relate the total O&M costs to the volume of water produced and/or distributed. And a third approach relates specific costs items to specific outputs and totals them in a second step. For example, costs of electricity and chemicals could be calculated on the basis of a specific requirement per m^3 produced and the labor requirements could be calculated on the basis of the number of employees per connection.

15. The elements of O&M costs may include:

- labor;
- electricity;
- chemicals;
- materials;
- overhead;
- raw water charges;
- insurance;
- other.

5.3.3 Reinvestments

16. Different project investment assets have different lifetimes and need replacement within the project lifetime. The cost of those reinvestments needs to be included in the project's benefit-cost calculation.

5.3.4 Residual values

17. The residual value of project assets at the end of the project life should be included in the benefit-cost analysis as a negative cost (or benefit).

5.4 Net Financial Benefits

18. The project net benefit is the difference between the project revenues and project costs. Sometimes, the net benefit stream is called the (net) cash flow.

19. An example of a net benefit calculation is shown in Table 5.3. Here, the project revenues are drawn from Table 5.1. The project costs comprise of (i) phased investment costs during 1996-1999; (ii) operation and maintenance costs (VND1,400 per m^3 water sold); (iii) sales taxes (1 percent on water sales, 3 percent on connection fees); (iv) business and land taxes (lump sum of VND100 mn per year); and (iv) connection costs (VND1.425 mn per connection).

Table 5.3 Net Financial Benefits *(1996 VND mn)*

		1996	1997	1998	1999	2000	2005 2026
1	Project revenues						
2	Water sales revenues						
3	Domestic consumers	0	668	1,613	2,922	4,740	12,217
4	Government establishments	0	21	50	80	124	726
5	Private establishments	0	32	76	117	170	997
6	Subtotal	0	722	1,739	3,119	5,034	13,940
7	Connection fees	0	2,552	3,068	3,689	4,436	0
8	Total project revenues	0	3,273	4,807	6,807	9,470	13,940
9	Project costs						
10	Investments	7,184	43,107	64,660	28,738	0	0
11	Operation and maintenance	0	410	918	1,534	2,303	4,281
12	Sales taxes	0	84	109	142	183	139
13	Business/land tax	0	100	100	100	100	100
14	Connection costs	0	2,424	2,914	3,504	4,214	0
15	Total project costs	7,184	46,125	68,702	34,018	6,800	4,520
16	Net financial benefit	-7,184	-42,852	-63,895	-27,211	2,669	9,420

Note: Years 2001-2004 are no shown in this example.

20. Discounted at FOCC, the net benefit stream during the lifetime of the project (30 years) shows the project's worth. An internal rate of return calculated on the net benefit stream shows the project's profitability. Both profitability measures will be further discussed in section 5.6. after the discount rate to be used is determined.

5.5 Financial Opportunity Cost of Capital

and Weighted Average Cost of Capital

21. For water supply projects (WSPs), the weighted average cost of capital (WACC) is typically used as the benchmark to assess the financial viability of the project. Although it is an accepted benchmark, it is important to understand that the WACC may not fully reflect the financial opportunity cost of capital (FOCC) in the market. Although a project may generate sufficient returns to allow full recovery of all investment and O&M costs while still yielding a small return on investment, this return may not be sufficient incentive for the owner to make the original investment or to maintain the investment.

22. Private foreign investors will be looking for returns on equity that also includes an allowance for risks, such as political and economic. Private domestic investors will also have alternative investments, whether they be in financial assets, other productive activities or areas such as real estate. Government investment may be guided by whether the funds are fungible, by the real cost of investment funds and the economic benefits of the project. If funds are fungible, they may be more interested in investing in projects with higher returns, economic and/or financial.

23. Finally, projects with low returns are riskier to implement and strain the financial sustainability of the corporate entity (public or private) charged with its operation and maintenance. Consequently, it is important to keep these issues in mind when comparing the FIRR of a project against a benchmark such as the WACC. These issues become particularly important as the role of government in the supply and operation and maintenance of infrastructure services changes and private sector participation becomes more prevalent.

5.6 Calculating the Weighted Average Cost of Capital

24. The discount rate to be used in financial benefit-cost analysis is the weighted average cost of capital (WACC). This WACC represents the cost incurred by the *entity* in raising the capital necessary to implement the project. Since most projects use several sources to raise capital and each of these sources may seek a different return, the WACC represents a weighted average of the different returns paid to these sources. The WACC is calculated first by estimating the nominal cost of the different

sources of capital. In Table 5.4, the nominal cost after corporate tax is shown. In a second step, the WACC in nominal terms is corrected for inflation to form the WACC in real terms, as shown in Table 5.4.

Table 5.4 Sample Calculation of Weighted Average Cost of Capital

	Weight	Nominal Cost	After Tax (Tax 40%)
ADB loan	40%	6.70%	4.02%
Commercial loan	20%	12.00%	7.20%
Grant	5%	0.00%	0.00%
Equity participation	35%	10.00%	10.00%
Total	100%		
WACC,nominal			6.55%
Inflation rate			4.00%
WACC,real[(1+0.0655)/(1+0.0400)]-1			2.45%

25. In this example, the project provides its own equity capital (35 percent) and raises additional capital from local banks (20 percent), from the ADB (40 percent), and obtains a grant from the government (5 percent). The project entity pays a different nominal return to each source of capital, including the expected return of 10 percent on its equity to its shareholders.

26. Interest payments to the ADB and to the commercial bank are deductible from pretax income, with corporate taxes of 40 percent (60 percent of interest payments to the ADB and to the commercial bank remains as the actual cost of capital to the project). Dividend paid to shareholders (if any) is not subject to corporate tax; it might be subject to personal income tax, which does not impose a cost to the utility.

27. The weighted average cost of capital in nominal terms is obtained by multiplying the nominal cost of each source of capital after tax with its respective weight. In Table 5.4, it is calculated as 6.55 percent. To obtain the WACC in real terms, the nominal WACC is corrected for inflation of 4 percent as follows:

$$\text{WACC real} = \{(1+ \text{WACC nominal})/(1+\text{inflation})\} - 1$$

28. In the example, the WACC in real terms amounts to 2.45 percent. This is the discount rate to be used in the financial benefit-cost analysis of this particular project as a proxy for the financial opportunity cost of capital (FOCC).

29. The sample calculation in Table 5.3 has been done “after tax”. For the purpose of distribution analysis, however, the NPV is calculated “before tax”, using a discount rate of 12 percent in both financial and economic analysis.

5.7 Financial IRR and NPV

30. The profitability of a project to the entity is indicated by the project’s financial internal rate of return (FIRR). The FIRR is also the discount rate at which the present value of the net benefit stream in financial terms becomes zero.

31. In Table 5.5, project revenues, project costs and project net benefits have been presented for the full project period (i.e., 30 years) where, for the purpose of the illustration, it has been assumed that revenues and costs will remain constant from year 2006 onwards.

Table 5.5 Estimation of FIRR and FNP
(1996 prices)

Year	Project Water ('000 m³)	Project Cost (VND mn.)	Project Revenues (VND mn.)	Project Net Benefit (VND mn.)
1996	0	7,184	0	-7,184
1997	293	46,125	3,273	-42,852
1998	656	68,702	4,807	-63,895
1999	1,096	34,018	6,807	-27,211
2000	1,645	6,800	9,470	2,669
2001	1,891	2,810	6,306	3,496
2002	2,153	3,193	7,795	4,602
2003	2,435	3,604	9,535	5,931
2004	2,736	4,045	11,568	7,522
2005	3,058	4,520	13,940	9,420
2006	3,058	4,520	13,940	9,420
2007	3,058	4,520	13,940	9,420
2008	3,058	4,520	13,940	9,420
2009	3,058	4,520	13,940	9,420
2010	3,058	4,520	13,940	9,420
2011	3,058	4,520	13,940	9,420
2012	3,058	4,520	13,940	9,420
2013	3,058	4,520	13,940	9,420
2014	3,058	4,520	13,940	9,420
2015	3,058	4,520	13,940	9,420
2016	3,058	4,520	13,940	9,420
2017	3,058	4,520	13,940	9,420
2018	3,058	4,520	13,940	9,420
2019	3,058	4,520	13,940	9,420
2020	3,058	4,520	13,940	9,420
2021	3,058	4,520	13,940	9,420
2022	3,058	4,520	13,940	9,420
2023	3,058	4,520	13,940	9,420
2024	3,058	4,520	13,940	9,420
2025	3,058	4,520	13,940	9,420
2026	3,058	4,520	13,940	9,420
PV@2.45%	52,440	224,359	240,285	15,925
Per m³		4,278	4,582	304

FIRR		3.24%
FNPV @ 2.45%	VNDmn	15,925
FNPV @ 3.24%	VNDmn	0
FNPV @ 12.00%	VNDmn	–66,903

32. The discount rate at which the present value of the net benefits becomes zero works out to be 3.24 percent. This is the FIRR, which should be compared to the WACC. If the FIRR exceeds the WACC, the project is considered to be financially viable. If the FIRR is below the WACC, the project would only be financially viable if subsidized by the government. In the example, the FIRR of 3.24 percent is above the WACC of 2.45 percent, and hence the project is financially viable.

33. The financial net present value (FNPV) shows the present value of the net benefit stream, or the projects' worth today. The discount rate to be used here is the WACC. A positive FNPV indicates a profitable project, i.e. the project generates sufficient funds to cover its cost, including loan repayments and interest payments. If the FNPV, discounted at the WACC of 2.45 percent, turns out to be positive, the project is earning an interest of at least the required 2.45 percent. In the example, as the FIRR is 3.24 percent, the project earns an interest of 3.24 percent. The project, thus, earns more than the required 2.45 percent interest, recovers all investment and recurrent costs, and yields a very small profit.

34. A negative FNPV points to a project that does not generate sufficient returns to recover its costs, to repay its loan and to pay interest. Note that, as a general principle of discounting cash flows for the purpose of IRR calculations, loan repayments and interest payments are not considered part of the economic cost.

35. Discounted at the WACC of 2.45 percent, the FNPV of the project is positive VND1.59 billion. The project is thus financially profitable. If a discount rate of 3.24 percent is used (equal to the FIRR), the FNPV equals (by definition) zero.

36. The example shows that if the discount rate used (2.45 percent) is below the FIRR (3.24 percent), the FNPV is positive; vice versa, if the discount rate used (5, 10, 12 percent) is above the FIRR (3.24 percent), the FNPV is negative.

37. The last line of Table 5.4 has included the discounted volume of project water and the discounted values of project costs, revenues and net benefits. The AIFC is VND4,278 per m^3 calculated as the present value of project costs divided by the present value of the quantity of project water. Similarly the present value of project revenues divided by the present value of project water represents the average financial revenue per m^3, in the example VND4,582 per m^3; and the present value of project net benefits divided by the present value of project water indicates the profit (loss) per m^3, in the example VND304 per m^3.