

Chapter 9: Economic analysis in public sector (Numerical problems)

1. A city government is considering two types of town-dump sanitary systems. Design A requires an initial outlay of \$400,000, with annual operating and maintenance costs of \$50,000 for the next 15 years; design B calls for an investment of \$300,000, with annual operating and maintenance costs of \$80,000 per year for the next 15 years. Fee collections from the residents would be \$85,000 per year. The interest rate is 8%, and no salvage value is associated with either system.

(a) Using the benefit–cost ratio $BC(i)$, which system should be selected?

(b) If a new design (design C), which requires an initial outlay of \$350,000 and annual operating and maintenance costs of \$65,000, is proposed, would your answer in (a) change?

2. The U.S. government is considering building apartments for government employees working in a foreign country and living in locally owned housing. A comparison of two possible buildings indicates the following:

Assume the salvage or sale value of the apartments to be 60% of the first investment.

Use 10% and a 20-year study period to compute the B/C ratio on incremental investment, and make a recommendation. (Assume no do-nothing alternative.)

	Building X	Building Y
Original investment by government agencies	\$8,000,000	\$12,000,000
Estimated annual maintenance costs	240,000	180,000
Savings in annual rent now being paid to house employees	1,960,000	1,320,000

3. Three public-investment alternatives with the same service life are available: A1, A2, and A3. Their respective total benefits, costs, and first costs are given in present worth as shown. Assuming no do-nothing alternative, which project would you select on the basis of the benefit–cost ratio $BC(i)$ on incremental investment?

Present worth	Proposals		
	A1	A2	A3
I	100	300	200
B	400	700	500
C'	100	200	150

4. A local city that operates automobile parking facilities is evaluating a proposal that it erect and operate a structure for parking in the city's downtown area. Three designs for a facility to be built on available sites have been identified (all dollar figures are in thousands): At the end of the estimated service life, whichever facility had been constructed would be torn down, and the land would be sold. It is estimated that the proceeds from the

resale of the land will be equal to the cost of clearing the site. If the city's interest rate is known to be 10%, which design alternative would be selected on the basis of the benefit–cost criterion?

	Design A	Design B	Design C
Cost of site	\$240	\$180	\$200
Cost of building	2,200	700	1,400
Annual fee collection	830	750	600
Annual maintenance cost	410	360	310
Service life	30 years	30 years	30 years

5. The federal government is planning a hydroelectric project for a river basin. In addition to producing electric power, this project will provide flood control, irrigation, and recreation benefits. The estimated benefits and costs expected to be derived from the three alternatives under consideration are listed in the following table:

The interest rate is 10%, and the life of each of the projects is estimated to be 50 years.

(a) Find the benefit–cost ratio for each alternative.

(b) Select the best alternative on the basis of $BC(i)$.

	Decision Alternatives		
	A	B	C
Initial cost	\$8,000,000	\$10,000,000	\$15,000,000
Annual benefits or costs:			
Power sales	\$1,000,000	\$1,200,000	\$1,800,000
Flood control savings	250,000	350,000	500,000
Irrigation benefits	350,000	450,000	600,000
Recreation benefits	100,000	200,000	350,000
O&M costs	200,000	250,000	350,000

6. Two different routes are under consideration for a new interstate highway:

For either route, the volume of traffic will be 400,000 cars per year. These cars are assumed to operate at \$0.25 per mile. Assume a 40-year life for each road and an interest rate of 10%. Determine which route should be selected.

	Length of Highway	First Cost	Annual Upkeep
The “long” route	22 miles	\$21 million	\$140,000
Transmountain shortcut	10 miles	\$45 million	\$165,000

7. The government is considering undertaking four projects. These projects are mutually exclusive, and the estimated present worth of their costs and the present worth of their benefits are shown in millions of dollars in the table:

All of the projects have the same duration.

Assuming no do-nothing alternative, which alternative would you select? Justify your choice by using a benefit–cost ($BC(i)$) analysis on incremental investment.

Projects	PW of Benefits	PW of Costs
A1	\$40	\$85
A2	150	110
A3	70	25
A4	120	73