

14.2 Komatsu Cutting Technologies is considering replacing one of its CNC machines with one that is newer and more efficient. The firm purchased the CNC machine 10 years ago at a cost of \$135,000. The machine had an expected economic life of 12 years at the time of purchase and an expected salvage value of \$12,000 at the end of the 12 years. The original salvage estimate is still good, and the machine has a remaining useful life of 2 years. The firm can sell this old machine now to another firm in the industry for \$30,000. The new machine can be purchased for \$165,000, including installation costs. It has an estimated useful (economic) life of 8 years. The new machine is expected to reduce cash operating expenses by \$30,000 per year over its 8-year life, at the end of which the machine is estimated to be worth only \$5,000. The company has a MARR of 12%.

- (a) If you decided to retain the old machine, what is the opportunity (investment) cost of retaining the old asset?
- (b) Compute the cash flows associated with retaining the old machine in years 1 to 2.
- (c) Compute the cash flows associated with purchasing the new machine in years 1 to 8.

14.3

Air Links, a commuter airline company, is considering replacing one of its baggage-handling machines with a newer and more efficient one. The current book value of the old machine is \$50,000, and it has a remaining useful life of five years. The salvage value expected from scrapping the old machine at the end of five years is zero, but the company can sell the machine now to another firm in the industry for \$10,000. The new baggage-handling machine has a purchase price of \$120,000 and an estimated useful life of seven years. It has an estimated salvage value of \$30,000 and is expected to realize economic savings on electric power usage, labor, and repair costs and also to reduce the amount of damaged luggage. In total, an annual savings of \$50,000 will be realized if the new machine is installed. The firm uses a 15% MARR.

- (a) What is the initial cash outlay required for the new machine?
- (b) What are the cash flows for the defender in years 0 to 5?
- (c) Should the airline purchase the new machine?

- 14.4 Duluth Medico purchased a digital image-processing machine three years ago at a cost of \$50,000. The machine had an expected life of eight years at the time of purchase and an expected salvage value of \$5,000 at the end of the eight years. The old machine has been slow at handling the increased business volume, so management is considering replacing the machine. A new machine can be purchased for \$75,000, including installation costs. Over its five-year life, the machine will reduce cash operating expenses by \$30,000 per year. Sales are not expected to change. At the end of its useful life, the machine is estimated to be worthless. The old machine can be sold today for \$10,000. The firm's interest rate for project justification is known to be 15%. The firm does not expect a better machine (other than the current challenger) to be available for the next five years. Assuming that the economic service life of the new machine, as well as the remaining useful life of the old machine, is five years,
- (a) Determine the cash flows associated with each option (keeping the defender versus purchasing the challenger).
 - (b) Should the company replace the defender now?

An asset purchased 3 years ago is now challenged by a new piece of equipment. The present market value of the defender is Rs.130000. anticipated salvage values and Annual Operating Costs (AOC) for the next 5 years are given in the table. What is the minimum cost life to be used while comparing this defender with a challenger if a 10% year return is required.

Life in years	Salvage value	AOC
1	Rs 90,000	Rs 25,000
2	Rs 80,000	Rs 27,000
3	Rs 60,000	Rs 30,000
4	Rs 20,000	Rs 35,000
5	Rs 0.00	Rs 45,000

$$CR(i) = (P-F) (A/P, i, n) + Fi$$

Finding for n=1, 2, 3, 4, 5

n=1,

$$CR(i) = (1,30,000-90,000) (A/P, 10,1) + 90000 \times 0.1 = \mathbf{53000}$$

n=2,

$$CR = (1,30,000-80,000) (A/P, 10,2) + 80000 \times 0.1 = \mathbf{36810}$$

n=3,

$$CR = (1,30,000-60,000) (A/P, 10,3) + 60000 \times 0.1 = \mathbf{34147}$$

$$CR(i) = (P-F) (A/P, i, n) + Fi$$

$$n=4,$$

$$CR = (1,30,000-20,000) (A/P, 10,4) + 20000 \times 0.1 = \mathbf{36705}$$

$$n=5,$$

$$CR = (1,30,000-0) (A/P, 10,5) + 0 = \mathbf{34294}$$

Equivalent Annual Operating Costs for n= 1,2,3,4,5

n= 1, A= 25,000

n=2,

$$A = [25000 (P/F, 10, 1) + 27000 (P/F, 10, 2)] \times (A/P, 10, 2)$$

$$= 25952$$

n=3,

$$A = [25000 (P/F, 10, 1) + 27000 (P/F, 10, 2) + 30000 (P/F, 10, 3)] \times (A/P, 10, 3)$$

$$= 27174$$

Equivalent Annual Operating Costs for n= 1,2,3,4,5

n=4,

$$[25000 (P/F,10,1) + 27000 (P/F,10,2) + 30000 (P/F,10,3) + 35000 (P/F, 10,4)] \times (A/P, 10,4)$$

$$= 28861$$

n=5

$$A = [25000 (P/F,10,1) + 27000(P/F,10,2) + 30000 (P/F,10,3) + 35000 (P/F, 10,4) +$$

$$45000 (P/F,10,5)] \times (A/P, 10,5)$$

$$= 31504$$

Year	CR (i)	AOC	EUAC
1	53000	25000	78000
2	36810	25952	62322
3	34148	27174	61322
4	36702	28861	65563
5	34294	31504	65798

Minimum total EUAC occur at year 3.

Hence economic life of the asset is 3 years

- 14.8 A special-purpose machine is to be purchased at a cost of \$15,000. The following table shows the expected annual operating and maintenance cost and the salvage values for each year of the machine's service:

Year of Service	O&M Costs	Market Value
1	\$2,500	\$12,800
2	3,200	8,100
3	5,300	5,200
4	6,500	3,500
5	7,800	0

- (a) If the interest rate is 10%, what is the economic service life for this machine?

- 14.6 A firm is considering replacing a machine that has been used to make a certain kind of packaging material. The new, improved machine will cost \$31,000 installed and will have an estimated economic life of 10 years, with a salvage value of \$2,500. Operating costs are expected to be \$1,000 per year throughout the service life of the machine. The old machine (still in use) had an original cost of \$25,000 four years ago, and at the time it was purchased, its service life (physical life) was estimated to be seven years, with a salvage value of \$5,000. The old machine has a current market value of \$7,700. If the firm retains the old machine, its updated market values and operating costs for the next four years will be as follows:

Year-End	Market Value	Book Value	Operating Costs
0	\$7,700	\$7,889	
1	4,300	5,578	\$3,200
2	3,300	3,347	3,700
3	1,100	1,116	4,800
4	0	0	5,850

The firm's MARR is 12%.

- Working with the updated estimates of market values and operating costs over the next four years, determine the remaining useful life of the old machine.
- Determine whether it is economical to make the replacement now.

- 14.7 The University Resume Service has just invested \$8,000 in a new desktop publishing system. From past experience, the owner of the company estimates its after-tax cash returns as

$$A_n = \$8,000 - \$4,000(1 + 0.15)^{n-1},$$

$$S_n = \$6,000(1 - 0.3)^n,$$

where A_n stands for the net after-tax cash flows from operation of the system during period n and S_n stands for the after-tax salvage value at the end of period n .

- (a) If the company's MARR is 12%, compute the economic service life of the system.