ADVANCED CAPITAL BUDGETING DECISIONS

CLASS 13-HW-Q32

Topic Replacement Project

Question 32:

A machine used on a production line must be replaced at least every four years. Costs incurred to run the machine according to its age are:

	Age of the Machine (years)				
	0	**1**	**2**	**3**	**4**
Purchase price (in ₹)	60,000				
Maintenance (in ₹)		16,000	18,000	20,000	20,000
Repair (in ₹)		0	4,000	8,000	16,000
Scrap Value (in ₹)		32,000	24,000	16,000	8,000

Future replacement will be with identical machine with same cost. Revenue is unaffected by the age of the machine. Ignoring inflation and tax, determine the optimum replacement cycle. PV factors of the cost of capital of 15% for the respective four years are 0.8696, 0.7561, 0.6575 and 0.5718.

(Source: ICAI)

ANSWER:

Working Notes

First of all, we shall calculate cash flows for each replacement cycle as follows:

One Year Replacement Cycle

₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	32,000	16,000

Two Years Replacement Cycle

₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	24,000	2,000

Three Years Replacement Cycle

₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	16,000	(12,000)

Four Years Replacement Cycle

₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	-	(28,000)
4	-	(36,000)	8,000	(28,000)

Now we shall calculate NPV for each replacement cycles

		1 Year		2 Years		3 Years		4 Years	
Year	PVF@ 15%	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV
0	1	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000
1	0.8696	16,000	13,914	-16,000	-13,914	-16,000	-13,914	-16,000	-13,914
2	0.7561	-	-	2,000	1,512	-22,000	-16,634	-22,000	-16,634
3	0.6575	-	-	-	0	-12,000	-7,890	-28,000	-18,410
4	0.5718	-	-	-	0		0	-28,000	-16,010
			-46,086		-72,402		-98,438		-1,24,968

Replacement Cycles		EAC (₹)
1 Year	46,086/0.8696	52,997
2 Years	72,402/1.6257	44,536
3 Years	98,438/2.2832	43,114
4 Years	1,24,968/2.855	43,772

Since EAC is least in case of replacement cycle of 3 years hence machine should be replaced after every three years.

Note: Alternatively, Answer can also be computed by excluding initial outflow as there will be no change in final decision.

ALTERNATIVE SOLUTION

HW. Q 32

Optimum Replacement Cycle / Economic Life :-

Years	1	2	3	4
a) Op. & Mc. cost	16000	22000	28000	36000
b) D.f. @ 15%	0.8696	0.7561	0.6575	0.5718
c) P.V. of op. & mc. cost	13914	16634	18410	20585
d) Cum. P.V. of cost	13914	30548	48958	69543
e) Salvage value	32000	24000	16000	8000
f) P.V. of S.V. (e x b)	27828	18146	10520	4574
g) Initial outlay	60000	60000	60000	60000
h) P.V. of Total cost (d + g - f)	46086	58488	98438	124969
i) Annuity factor	0.8696	1.6257	2.2832	2.855
j) UAE = (h/i)	52997	35977	43114	43772