Chapter 2: Capital-Budgeting Principles and Techniques

QUESTIONS

1. ***a.*** *What is the relationship between accounting income and economic profit?*

Answer: Accounting income is calculated by taking revenues and subtracting all cash and non-cash expenses (such as depreciation). Accounting income also often recognizes losses for tax purposes as well, even though the economic loss may have taken place at another time. Economic profit is the sum of the present values of all the cash flows net of expenses generated by the firm's actions. Economic profit measures true increments to value, but is hard to measure. Accounting profit is correlated with economic profit, but not perfectly so. Accounting profit can be measured much more easily.

b. *What is the relationship between accounting rate of return and economic rate of return?*

Answer: The accounting rate of return is the ratio of after-tax profit to average book investment. Economic rate of return is the ratio of after-tax economic profit to the market value of the investment. Economic profit equals cash accruals to the asset combined with changes in its market value.

2. *In 1991, AT&T laid a transatlantic fiber optic cable costing $400 million that can handle 80,000 calls simultaneously. What is the payback on this investment if AT&T uses just half its capacity while netting one cent per minute on calls?*

Answer: $210 Million per year assuming the half capacity is for 24 hours a day, 365 days per year. The annual payback is then 53%.

3. *The satisfied owner of a new $15,000 car can be expected to buy another ten cars from the same company over the next 30 years (an average of one every three years) at an average price of $15,000 (ignore the effects of inflation). If the net profit margin on these cars is 20 percent, how much should an auto manufacturer be willing to spend to keep its customers satisfied? Assume a 9 percent discount rate.*

Answer: At a 20 percent profit margin, the auto company will earn an annuity of about $3,000 every three years for the next 30 years. Discounted at 9 percent, this annuity is worth $9,402, assuming that the first new car is purchased three years from today. Hence, an investment to keep customers satisfied will have a positive NPV as long as the amount spent is less than $9,402. Thus, a car company should be willing to spend up to $9,402 in present value terms to keep its customers satisfied. A trick is available to calculate the present value of this annuity. Recognize that an annuity received every three years for 30 years and discounted at 9 percent is equivalent

to a 10-year annuity discounted at 29.5029 percent since each cash flow term is discounted at $(1.09)3 = 1.295029$.

4. *Demonstrate that the following project has internal rates of return of 0 percent, 100 percent, and 200 percent.*

Year	1	2	3	4
Cash flow	–$1,200	+7,200	–13,200	+7,200

Answer: To demonstrate that an IRR calculation is valid, compute the net present value at the IRR. A valid IRR yields NPV = 0.

Year	Cash Flow	PV@0%	PV@100%	PV@200%
1	-1,200	-1,200	-600	-400.00
2	+7,200	+7,200	+1,800	+800.00
3	-13,200	-13,200	-1,650	-488.89
4	+7,200	+7,200	+450	+88.89
Total	0	0	0	0

5. *During 1990, Dow Chemical generated the following returns on investment in its different business units:*

Business Unit	Return on Investment (%)
Plastics	16.6
Chemicals/Performance Products	16.7
Consumer Specialties	12.7
Hydrocarbons/Energy	5.2
Other	1.6
Dow Chemical overall	11.8

Given these returns, which of the business units should Dow invest additional capital in? What additional information would you need in order to make that decision?

Answer: These figures tell you what Dow earned in 1990. In order to decide on future investments, you need the following information:

1. Whether these returns are representative of those expected to be earned in the future in these different divisions. What matters for investment decisionmaking are projected future returns, not past returns. To the extent that these returns vary widely from

year to year—which they do in the chemical business—historical return data for one year are meaningless. One reason these data may be misleading is that they are based on historical cost figures for investment. You really want to calculate returns on the replacement cost of assets. Inflation will cause asset values to be understated, which will lead the return on investment to be overstated.

2. The cost of capital for these divisions. Each division is likely to have its own risk and, hence, its own cost of capital. A high return could just indicate a high degree of risk and, therefore, a high required return. What matters is the projected return relative to the cost of capital. A high projected return that is less than the risk-adjusted cost of capital will yield a negative NPV investment. Conversely, a low projected return that exceeds the cost of capital will yield a positive NPV investment.

3. The marginal return on investment in each division. Even if the figures for, say, the plastics and chemical/performance products divisions exceed their cost of capital and are representative of those expected to be earned in the future, that does not automatically justify additional investment in those divisions. These figures tell us the average ROI; for investment purposes you need the marginal ROI. That is, what matters for investment purposes is not the return on past investments but the return on future investments. As we have seen, many companies (e.g., Monsanto, Philip Morris) have divisions that yield high returns on past investments but very low returns on incremental investments.

4. The extent to which these divisions sell to one another. Dow Chemical is a vertically-integrated company. Its hydrocarbons/energy unit sells to its downstream plastics unit, which in turn sells to its consumer specialties unit. Thus, the profitability of these units depends critically on the prices at which these internal transactions take place. For example, the hydrocarbons/energy unit may be showing a low ROI simply because it sells petroleum to the plastics unit at a below-market price. That is, the hydrocarbons unit may be very profitable but its profits are showing up in the plastics unit in the form of a low price on raw materials. This is a form of cross-subsidization. Disentangling the true profitability of the different units of a vertically-integrated company like Dow turns out to be a very difficult task, but it is a necessary one for capital budgeting purposes. What matters is how profitable investments are from the standpoint of the overall company, not from the standpoint of the units undertaking those investments.

5. The returns associated with specific assets and activities within each division. What matters from an investment standpoint is not just how well each division can be expected to do in the future but how well specific projects within each division can be expected to do. For example, certain products within the profitable plastics division may be earning a 40% return while others are only earning a 2% return. Similarly, certain R&D investments may be expected to yield a high return relative to their riskiness,

whereas others have little chance of a significant payoff. At the same time, the low-return hydrocarbons/energy division may have some very high-return projects, which are masked by a lot of value-destroying activities elsewhere. Without detailed data on the returns associated with each division's various activities, customers, and products, one can't say where investment dollars would be best spent.

CHAPTER 2: PROBLEMS

1. *A firm is considering investing in a project with the following cash flows:*

Year	1	2	3	4	5	6	7	8
Net cash flow ($)	2,000	3,000	4,000	3,500	3,000	2,000	1,000	1,000

The project requires an initial investment of $12,500, and the firm has a required rate of return of 10 percent. Compute the payback, discounted payback, and net present value, and determine whether the project should be accepted.

Answer: Payback period = 4 years exactly.
Discounted payback period (r = 10%) = 5.84 years.
Net Present Value (r = 10%) = $1164.70. The project should be accepted.

Intermediate Calculations:

	Cash	PV	Cumulative
Cash Flows	-12,500.00		
1	2,000.00	1,818.18	1,818.18
2	3,000.00	2,479.34	4,297.52
3	4,000.00	3,005.26	7,302.78
4	3,500.00	2,390.55	9,693.33
5	3,000.00	1,862.76	11,556.09
6	2,000.00	1,128.95	12,685.04
7	1,000.00	513.16	13,198.20
8	1,000.00	466.51	13,664.70

2. *The Pennco Oil Co. must decide whether it is financially feasible to open an oil well off the coast of China. The drilling and rigging cost for the well is $5,000,000. The well is expected to yield 585,000 barrels of oil a year at a net profit to Pennco of $5 a barrel for four years. The well will then be effectively depleted but must be capped and secured at a cost of $4,000,000. Pennco requires an annual rate of return of 14 percent on its investment projects. Should Pennco open the well? (Assume all of a year's production occurs at the end*

of the year.)

Answer:
Net annual profit = 585,000($5.00) = $2.925M.
PV(Production) = $2.925M _ PVIFAr=14%,n=4 = 2.925M _ 2.9137 = $8.523M.
PV(Capping) = $4.000M _ PVIFr=14%,n=4 = 4 _ 0.5921 = $2.368M.
PV(Drilling) = $5.000M.
NPV = PV(Production) Ä PV(Capping) Ä PV(Drilling) = $8.523M Ä 2.368M Ä 5.000M = $1.154M.
The well should be drilled, since the present value of the benefits exceeds the present value of the costs. The term NPV (Net Present Value) refers precisely to the difference in present value between the benefits and the costs of a project.

3. *Jack Nicklaus, the golfing pro and real estate developer, is thinking of acquiring an 800-acre property outside Atlanta that he intends to turn into an exclusive community for 600 families. The cost of this property and the necessary improvements is $30 million. After setting aside a mandatory 25 percent of the property as green space, he figures he can sell the remaining lots for an average of $90,000 an acre. By putting in a golf course on the 200 acres of green space, Nicklaus believes he can instead sell the lots for an average of $140,000 an acre. The golf course, including clubhouse, has a projected price tag of $6 million. In either event, the project is expected to take eight years to sell out at a rate of 75 lots per year. Jack Nicklaus faces a marginal tax rate of 40 percent and can write off his land and development costs by prorating these costs against each lot sold.*

a. *If his required return is 14 percent, should Jack Nicklaus go ahead with the initial project (i.e., a community with no golf course)?*

Answer: The initial project, a community with no golf course, requires an initial outlay of $30M, and reaps 6.75M per year for 8 years in the absence of taxes and depreciation. The present value of the decision at r = 14% and t = 40% can be determined from the following formula:

b. *Should he put in the golf course?*

Answer: With the golf course, the cost is $36M, and pretax revenues are 10.5M per year. The same calculations as above can be made with the new data:

$$\text{NPV} = -36{,}000{,}000 + (1 - 0.40)(10{,}500{,}000)(4.6389) + (0.40)(4{,}500{,}000)(4.6389) = \$1{,}574{,}797.54.$$

Nicklaus should build the golf course (exactly as we expected).

a.b. * An alternate display is illustrative:

	Housing Only	With Golf Course
Annual Sales	$6,750,000	$10,500,000
Ann. Amortization	3,750,000	4,500,000
Ann. Pretax Profit	3,000,000	6,000,000
Tax (@ 40%)	1,200,000	2,400,000
Ann. Aftertax Profit	1,800,000	3,600,000
Cash Flow	5,550,000	8,100,000
PVIFA(r=14%,n=8)	4.638864	4.638864
Present Value	25,745,695	37,574,798
Cost	30,000,000	36,000,000
Net Present Value	─$4,254,305	$1,574,798

4. *The Coin Coalition is trying to get the U.S. government to replace the dollar bill with a gold-colored dollar coin. One argument is cost savings. A dollar bill costs 2.6 cents to produce and lasts only about 17 months. A dollar coin, on the other hand, while costing 6 cents to produce, lasts for 30 years. About 1.8 billion dollar bills must be replaced each year. The start-up costs of switching to a dollar coin are likely to be quite high, however. These costs have not been estimated.*

a. *What are the projected average annual cost savings associated with switching from the dollar bill to a dollar coin?*

Answer: Since each dollar bill in circulation lasts an average of 1.42 years (17/12), and 1.8 billion are replaced each year, this must mean that there are about 2.556 billion dollar bills in circulation. The cost of replacing 1.8 billion dollar bills each year at a cost per bill of 2.6 cents is $46.8 million. Since the dollar coin lasts 30 years, only about 85.2 million (2.556 billion/30) coins must be replaced each year at an annual cost of $5.1 million. Thus, the annual cost savings comes to approximately $41.7 million.

b. *Taking into account only the cost savings estimated in part a, how high can the start-up costs for this replacement project be and still yield a positive NPV for the U.S. government? Use an 8 percent discount rate.*

Answer: The present value of the cost savings perpetuity estimated in part a, discounted at 8 percent, is $41,700,000/.08, or $521.25 million. Hence, the start-up costs for replacing the dollar bill with a dollar coin can be as high as $521.25 million in present value terms and this project will still yield a positive net present value.

5. *Recent Census Bureau data show that the average income of a college-educated person was*

$34,391 versus $24,701 for those without college. At the same time, the annual tuition at public universities was $1,566 versus $7,693 for private colleges. In the following questions, assume there is no difference in income between public and private university graduates.

a. *Based on these figures, what is the payback period for a college education, taking into account the four years of lost earnings while being in college? Do these calculations for both public and private colleges.*

Answer: Based on the figures presented, the lost income during four years of college is 4 * $24,701 = $98,804 (if they don't go to college they earn non-college incomes). The cost of the four years of college at a public (private) university is $6,264 ($30,772). Combining these figures yields a total (undiscounted) cost for a public university of $105,068. For a private college, this cost comes to $129,576. The income advantage to a college education is $9,690 ($34,391 - $24,701). From graduation, it takes 105,068/9,690 = 10.84 years to recover the cost of a public university education. The equivalent figure for a private college is 129,576/9,690 = 13.37 years.

b. *Assuming college graduation at age 22 and retirement at age 65, what is the internal rate of return on a college degree from a public university? a private university?*

Answer: For a public university, the cash flows are four years of annual net cash outflows equal to $26,267 ($1,566 + $24,701) and then 43 years of net cash inflows equal to $9,690 annually. Whether all these cash flows occur at the beginning or end of the year, the IRR equals 7.89 percent (the timing of the cash flows doesn't matter because you are just multiplying the NPV—which must equal zero—by a constant).

For a private university, the cash flows are four years of annual net cash outflows equal to $32,394 ($7,693 + $24,701) and then 43 years of net cash inflows equal to $9,690 annually. The IRR based on these numbers is 6.32 percent.

c. *Assuming a 7 percent discount rate, and the same working life as in part b, what is the net present value of a college degree from a public university? a private university?*

Answer: Assuming all cash flows occur at the end of the year (here the timing does matter), the NPV for a public university education is $10,878. For a private college, the NPV is -$9,876.

6. *The Fun Foods Corporation must decide on what new product lines to introduce next year. After-tax cash flows are listed below along with initial investments. The firm's cost of capital is 12 percent and its target accounting rate of return is 20 percent. Assume straight-line depreciation and an asset life of five years. The corporate tax rate is 35 percent. All projects are independent.*

Project	Investment	Year 1	2	3	4	5
A	$5,000	$800	$1,000	$350	$1,250	$3,000
B	7,500	1,250	3,000	2,500	5,000	5,000
C	4,000	600	1,200	1,200	2,400	3,000

a. *Calculate the accounting rate of return on the project. Which projects are acceptable according to this criterion? (Note: Assume net income is equal to after-tax cash flow less depreciation.)*

Answer:

	Project A	Project B	Project C
Total AT Cash Flow	6400	16750	8400
Total Depreciation	5000	7500	4000
Net Income	1400	9250	4400
Avg Net Income	280	1850	880

Acctg Rate of return (Average Net Income /Average Book Inv)
ABI = Total depreciation/2.
11.2% 49.3% 44%

Projects B and C are acceptable based on a 20% accounting rate of return.

b. *Calculate the payback period. All projects with a payback of fewer than four years are acceptable. Which are acceptable according to this criterion?*

Answer: Assuming depreciation effects are included in the cash flows:
Payback A (years) = 4.53, Payback B = 3.15, Payback C = 3.42.
Projects B and C are acceptable.

Assuming depreciation has not been included:
Payback A (years) = 4.06, Payback B = 2.73, Payback C = 3.06.
Projects B and C are acceptable.

c. *Calculate the projects' NPVs. Which are acceptable according to this criterion?*

Answer: NPV = PV(After Tax Cash Flows) ─ Initial Investment
Assuming depreciation has already been incorporated:
NPV A = ─$742.72, NPV B = $3801.83, NPV C = $1574.01.
Projects B and C are acceptable.

If depreciation has not been incorporated, and all writeoffs can be used:
NPV = PV(After Tax Cash Flows) ─ Init Inv + PV(Depr Tax Shield)
NPV A = $518.95, NPV B = $5694.34, NPV C = $2583.34.
All projects are acceptable.

d. *Calculate the projects' IRRs. Which are acceptable according to this criterion?*

Answer: IRR is the discount rate that makes NPV = 0.
Depreciation included:
IRR A = 7.0%, IRR B = 27.0%, IRR C = 23.37%
Projects B and C are acceptable. (IRR > 12%)

Depreciation not included:
IRR A = 15.43%, IRR B = 34.23%, IRR C = 30.50%
All projects are acceptable. (IRR > 12%)

e. *Which projects should be chosen?*

Answer: The firm should follow the guidelines of the NPV rule.

7. *Aptec, Inc., is negotiating with the U.S. Department of Housing and Urban Development (HUD) to open a manufacturing plant in South Central L.A., the scene of much of the rioting in April 1992. The proposed plant will cost $3.5 million and is projected to generate annual after-tax profits of $550,000 million over its estimated four-year life. Depreciation is straight-line over the four-year period and Aptec's tax rate is 35 percent. However, given the risks involved, Aptec is looking for a tax-exempt government subsidy. According to Aptec, the subsidy must be able to achieve any of the following four objectives:*
(1) Provide a 2-year payback.
(2) Provide an accounting rate of return of 35 percent.
(3) Raise the plant's IRR to 22 percent.
(4) Provide an NPV of $1 million when cash flows are discounted at 18 percent.

a. *For each alternative suggested by Aptec, develop a subsidy plan that minimizes the costs to HUD of achieving Aptec's objective. You can schedule the subsidy payments at any time over the four-year period.*

Answer. Here are the alternatives with their costs:
Payback. The annual cash flows are the sum of after-tax profits plus depreciation of $306,250 (0.35*$3,500,000/4), or $856,250. The sum of the first two years' cash flows is $1,712,500. To bring the payback to two years will require a subsidy of $1,787,500 ($3,500,000 - $1,712,500). Since the computation of payback is insensitive to when the subsidy is paid, as long as it happens within the two-year period, the present value of its cost can be minimized by providing it at the end of year 2.

ARR. The accounting rate of return is 31.43% (550,000/1,750,000). In order to bring this up to 35%, it is necessary to bring average annual income up to $612,500 (0.35*1,750,000), an average

annual increase of 62,500. The subsidy will equal $250,000 (62,500*4). Since the computation of ARR is insensitive to when the subsidy is received, its present value can be minimized by providing it at the end of the four years.

IRR. With a subsidy of $1,365,000 at time 0, thereby lowering its net investment to $2,135,000, Aptec will get its IRR up to 22%. Any delay will result in a correspondingly higher required subsidy (it will accrue at the rate of 22% annually. For example, if the subsidy were to be provided at the end of the first year, it would have to equal $1,665,300 ($1,365,000 ? 1.22) to get Aptec's IRR up to 22%. Hence, HUD will minimize its costs of getting Aptec's IRR up to 22% by providing the subsidy immediately instead of waiting.

NPV. The NPV of the project, discounted at 18%, is (1,196,635). Hence, a subsidy equal to $1,196,635 that is paid up front will just provide a zero NPV when discounted at 18%. The subsidy will rise at the rate of 18% annually if it is paid in a future year.

b. *Which of the four subsidy plans would you recommend to HUD if it uses a 15 percent discount rate?*

Answer. The winning subsidy plan is that associated with the ARR criterion. By paying $250,000 at the end of the four-year period, the present value of HUD's cost when discounted at 15% will be $142,938.

8. *The Fast Food chain is trying to introduce its new Hot and Spicy line of hamburgers. One plan (S) will include a big media campaign but less in-house production capability. The other plan (L) will concentrate on a more gradual roll-out of the project but will involve more investment in personnel training and so forth. The cost of capital is 15 percent. The cash flows ($000) are listed below. The initial investment for each is $400,000.*

Plan	Year 1	2	3	4	5
S	$250	$250	$150	$100	$ 50
L	100	125	200	250	125

a. *Construct the NPV profiles for plans S and L. Which has the higher IRR?*

Answer: Plan S has NPV(000's) = $187.09 and IRR = 39.28%, Plan L has NPV(000's) = $118.06 and IRR = 25.63%. Plan S has the higher IRR.

b. *Which plan should Fast Food choose using the NPV method?*

Answer: Plan S also has the higher NPV.

c. *Which plan (S or L) should Fast Food choose? Why?*

Answer: Under either criterion, Fast Food should choose Plan S.

d. *At what cost of capital will the NPV and the IRR rankings conflict?*

Answer: For this discount rate (15%), the NPV and IRR do not conflict. To find the discount rate where a conflict might occur, calculate the discount rate that makes the present value of the difference in cash flows zero. In this case, the cash flow differences are:

Year	1	2	3	4	5
Diff	$150	$125	−$50	−$150	−$75

Inspection reveals that the present value is zero when the discount rate is zero. NPV and IRR give identical recommendations for all positive discount rates in this example.

9. *The Roost Corp. is considering a multiple-use dockside complex in a major lakeside city. Roost uses accounting rate of return as its sole capital-budgeting criterion. The sales and expenses (excluding depreciation) are as follows ($000):*

Year	1	2	3	4	5
Sales	$800	$5,000	$15,000	$25,000	$25,000
Expenses	700	3,500	10,500	17,500	18,500

Investment in the project is $40 million today and the accelerated depreciation schedule applicable to this project is

Year	1	2	3	4	5
	15%	22%	21%	21%	21%

a. *Should Roost accept the project using straight-line depreciation? Assume a target rate of return of 15 percent. Its tax rate is 40 percent.*

Answer: We assume that Roost Corp. has sufficient income to take full advantage of the tax shields afforded by depreciation.

Year	1	2	3	4	5
After Tax Income	180	900	2700	4500	3900
SL Depr	8000	8000	8000	8000	8000
ACC Depr	6000	8800	8400	8400	8400
SL Net Cash Flow	3380	4100	5900	7700	7100
ACC Net Cash Fl	2580	4420	6060	7860	7260

Under straight-line average book value is the same, namely $20,000. Average after tax income is $2556, and average annual depreciation is $8000. The accounting rate of return is (2556 −

8000)/20,000 = ─27.22%. The project would be rejected on this basis.

b. *Would your answer to (a) change if Roost used accelerated depreciation?*

Answer: Accelerated depreciation results in the same numbers.

c. *With a cost of capital of 10 percent, would the project have a positive NPV under straight-line depreciation? Under accelerated depreciation?*

Answer: With a cost of capital of 10%, the present value of the net cash flows under straight-line depreciation is $20.56M. Under accelerated depreciation, the figure comes to $20.43M. Note that "accelerated depreciation" does not improve the present value in this problem. Neither method of depreciation justifies the $40M expense; the net present value is negative regardless of the depreciation method chosen.

10. Sweet Delights Co. is considering a marketing policy for its brand of chocolates. Two <u>mutually exclusive</u> advertising strategy changes are under consideration. The cash flows associated with each are as follows. The cost of capital for Sweet Delights is 10 percent.

Strategy	Year 0	1	2	3	4	5
	-80	+40	+40	+40	-	-
B	-40	+20	+20	+20	+20	+20

a. *Which of the two strategies would you prefer if <u>neither</u> decision can be repeated (i.e., all future strategies/ decisions are expected to have zero NPVs)?*

Answer: If neither decision can be repeated, then one should choose the strategy with the highest NPV. For plans A and B, the NPV's are 19.47 and 35.82, respectively. Therefore, plan B would be preferred.

b. *Which of the two strategies would you prefer if each strategy can be repeated as often as possible?*

Answer: If each strategy can be repeated as often as possible, one should calculate the equivalent annual benefit derived from each of the proposals.
Equivalent Annual Benefit * PVIFA = NPV.

Plan	A	B
Summary of NPV Results:	19.47	35.82
Years	3	5
PVIFA	2.48	3.79

EAB	7.83	9.45

Plan B would be preferred in this instance as well.

CHAPTER 2: SPECIAL PROBLEM

1. *Owen Corporation plans to purchase a new machine that costs $120,000, has six years of economic life, and generates a net annual cash flow of $40,000 at the end of years 1-6 (all cash flows have taken into account depreciation and taxes). The firm also has the option to sell the machine at the end of years 1-6. The following are the net cash flows Owen will receive from the sale of the machine at the end of each year.*

End of Year	Net Cash Flow From Sale
1	$100,000
2	85,000
3	75,000
4	60,000
5	30,000
6	0

The manager wants to determine an optimal replacement policy for the machine. Once a policy has been adopted, it will be implemented perpetually because it is assumed that the cost of the machine, the cash inflows, and the net cash flow from selling the old machines will be the same over time. Determine the optimal policy, assuming a 12 percent discount rate.

Answer: The optimal replacement policy for the machine requires that the machine be sold on the date that maximizes the equivalent annual benefit derived from running the machine. For example, if the machine is placed in service for 3 years only, the cash flows are:

Year	1	2	3
Cash Flow	$40,000	$40,000	$40,000+75,000 = $115,000

With an initial investment of $120,000, the NPV at r=12% is given by $29,456.77. On an annual basis, this represents a $12,264.30 benefit. This fact follows from the equation:

NPV = Equivalent Annual Benefit * PVIFA

The table below summarizes the results for all possible service lives:

Termination Year	NPV	EAB
1	5,000.00	5,600.00
2	15,363.52	9,090.57
3	29,456.77	12,264.30
4	39,625.06	13,045.93*
5	41,213.85	11,433.12
6	44,456.29	10,812.91

The maximal equivalent annual benefit is realized when the machine is replaced every four years.