AGENDA: CAPITAL BUDGETING DECISIONS

A. Present value concepts.
    1. Interest calculations.
    2. Present value tables.
B. Net present value method.
C. Internal rate of return method.
D. Cost of capital as a screening tool.
E. Further aspects of the net present value method.
    1. Total-cost approach.
    2. Incremental-cost approach.
    3. Least-cost decisions.
F. Uncertain future cash flows.
G. Preference rankings.
H. Payback period method.
I. Simple rate of return method.
J. (Appendix 13C) Income taxes in capital budgeting

PRESENT VALUE CONCEPTS

A dollar today is worth more than a dollar a year from now because a dollar received today can be invested, yielding more than a dollar a year from now.

MATHEMATICS OF INTEREST

If P dollars are invested today at the annual interest rate r, then in n years you would have F_n dollars computed as follows:

$$F_n = P(1 + r)^n$$

EXAMPLE: If $100 is invested today at 8% interest, how much will the investment be worth in two years?

$$F_2 = \$100(1 + 0.08)^2$$

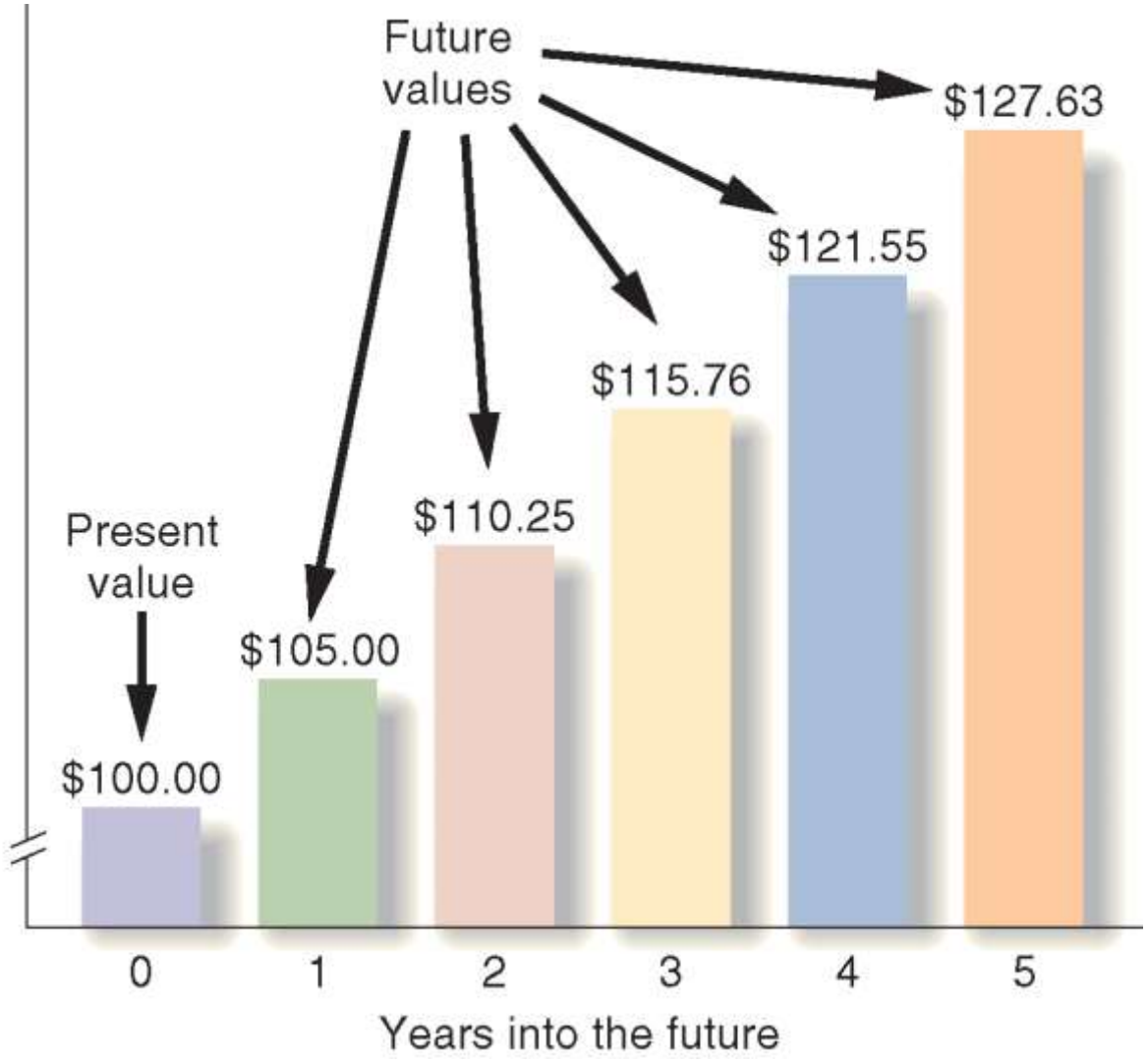
$$F_2 = \$116.64$$

The $100 investment earns $16.64 in interest over the two years as follows:

Original deposit.....	$100.00
Interest—first year ($100 × 0.08)	8.00
Total	108.00
Interest—second year ($108 × 0.08) ...	8.64
Total	$116.64

PRESENT AND FUTURE VALUES

The value of an investment can be viewed in two ways. It can be viewed either in terms of its value in the future or in terms of its value in the present, as shown below.



PRESENT VALUE

The present value of any sum to be received in the future can be computed by turning the interest formula around and solving for P:

$$P = F_n \left[\frac{1}{(1 + r)^n} \right]$$

EXAMPLE: A bond will pay off $1,000 in two years. What is the present value of the $1,000 if an investor can earn a return of 12% on investments?

$$P = \$1{,}000 \left[\frac{1}{(1+0.12)^2} \right]$$

$$P = \$1{,}000\ (0.797)$$

$$P = \$797$$

The following points should be noted:

- The process of finding the present value of a future cash flow is called discounting. We have discounted the $1,000 to be received in two years to its present value of $797.
- The 12% interest rate that we used to find this present value is called the discount rate.
- The present value factor 0.797 can be found:
  - Using the formula (perhaps with the power key y^x on a calculator).
  - Using a Present Value Table.

PRESENT VALUE TABLES

Excerpt from Exhibit 13B-1:

Present Value of \$1; $P = \frac{\$1}{(1+r)^n}$

Periods	. . .	*11%*	*12%*	*13%*	. . .
1		0.901	0.893	0.885	
2		0.812	0.797	0.783	
3		0.731	0.712	0.693	
4		0.659	0.636	0.613	
5		0.593	0.567	0.543	

Note:

- The numbers in the table represent the present value, at the specified discount rate, of \$1 received at the end of the specified period.
- The present value is the amount that would have to be put into the bank today at the specified interest rate in order to have accumulated \$1 at the end of the specified period.
- The present value factors decrease as the number of periods increase.
- The present value factors decrease as interest rate increases.

PRESENT VALUE TABLES (continued)

Some investments involve a series of identical cash flows at the end of each year. Such a stream of equal cash flows is called an annuity.

EXAMPLE: Lacey Company has purchased a tract of land on which a $1,000 payment will be due each year for the next five years. What is the present value of this stream of cash payments when the discount rate is 12%?

Year	*Cash Payment*	*12% Factor (Exhibit 13B-1)*	*Present Value*
1	$1,000	0.893	$ 893
2	$1,000	0.797	797
3	$1,000	0.712	712
4	$1,000	0.636	636
5	$1,000	0.567	567
		3.605	$3,605

We could have arrived at the same answer by multiplying the sum of the present value factors by the annual cash payment:

$$3.605 \times \$1{,}000 = \$3{,}605$$

We can avoid having to add together the present value factors by using the Present Value Table for an Annuity. The $1,000 equal cash payments constitute an annuity. The annuity table assumes that the first payment occurs at the end of the first period and then continues for n periods.

PRESENT VALUE TABLES (continued)

Excerpt from Exhibit 13B-2

Present Value of an Annuity of $1 in Arrears

Periods	. . .	*11%*	*12%*	*13%*	. . .
1		0.901	0.893	0.885	
2		1.713	1.690	1.668	
3		2.444	2.402	2.361	
4		3.102	3.037	2.974	
5		3.696	3.605	3.517	

Exhibit 13B-2 is constructed by adding down the column in Exhibit 13B-1:

	12%		
Periods	*Exhibit 13B-1*		*Exhibit 13B-2*
1	0.893		0.893
2	+ 0.797	➔	1.690
3	+ 0.712	➔	2.402
4	+ 0.636	➔	3.037
5	+ 0.567	➔	3.605

CAPITAL BUDGETING

Capital budgeting is concerned with planning significant outlays that have long-run implications, such as acquiring new equipment.

CAPITAL BUDGETING METHODS

Capital budgeting methods can be divided into two groups:

1. Discounted cash flow:
    a. Net present value method.
    b. Internal rate of return method.
2. Other methods:
    a. Payback method.
    b. Simple rate of return method.

As the name implies, the discounted cash flow methods involve discounting cash flows, *not* accounting net operating income.

Typical cash flows:

- Cash outflows:
    - Initial investment.
    - Increased working capital.
    - Repairs and maintenance.
    - Incremental operating costs.
- Cash inflows:
    - Incremental revenues.
    - Reductions in costs.
    - Salvage value.
    - Release of working capital.

NET PRESENT VALUE METHOD

The net present value of an investment is the difference between the present value of all cash inflows and the present value of all cash outflows.

EXAMPLE: Harper Company has been offered a five-year contract to provide component parts for a large manufacturer. The following data relate to the contract:

- Costs and revenues of the contract would be:

Cost of special equipment	$160,000
Working capital required	$100,000
Relining of the equipment in three years	$30,000
Salvage value of the equipment in five years	$5,000
Annual revenues and costs:	
Sales revenue from parts	$750,000
Cost of parts sold	$400,000
Out-of-pocket operating costs (for salaries, shipping, and so forth)	$270,000

- At the end of five years the working capital of $100,000 would be released for use elsewhere.
- Harper Company uses a discount rate of 10%.

Given the above data, should the contract be accepted?

NET PRESENT VALUE METHOD (continued)

Sales revenue.....	$750,000
Less cost of parts sold	400,000
Less out-of-pocket operating costs	270,000
Annual net cash inflows	$ 80,000

	Year(s)	*Cash Flow*	*10% Factor*	*Present Value*
Investment in equipment	Now	$(160,000)	1.000	$(160,000)
Working capital needed.....	Now	$(100,000)	1.000	(100,000)
Annual net cash inflows	1-5	$80,000	3.791	303,280
Relining of equipment.....	3	$(30,000)	0.751	(22,530)
Working capital released	5	$100,000	0.621	62,100
Salvage value of equipment .	5	$5,000	0.621	3,105
Net present value				$ 85,955

INTERNAL RATE OF RETURN

The internal rate of return is the rate of return from an investment over its life.

The internal rate of return is computed by finding the discount rate that yields a net present value of zero for the investment.

EXAMPLE: Decker Inc. can purchase a new machine at a cost of $104,320 that will save $20,000 per year in cash operating costs. The machine will have a 10-year life. What is the internal rate of return?

When the future cash flows are the same every year, as in this example, the internal rate of return can be found by computing the "Factor of the internal rate of return" as follows:

$$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Net annual cash flow}}$$

$$= \frac{\$104,320}{\$20,000} = 5.216$$

Looking in Exhibit 13B-2 for the Present Value of an Annuity and scanning along the 10-period line, we find that the factor of 5.216 corresponds to a rate of return of 14%. We can verify that the internal rate of return is 14% as follows:

	Year(s)	*Amount*	*14 % Factor*	*Present Value*
Investment required.	Now	$(104,320)	1.000	$(104,320)
Annual cost savings .	1-10	$20,000	5.216	104,320
Net present value				$ 0

COST OF CAPITAL AS A SCREENING TOOL

- Businesses often use their cost of capital as the discount rate in capital budgeting decisions. The cost of capital is the overall cost to the company of obtaining investment funds, including the cost of both debt and equity sources.
- The cost of capital can be used to screen investment projects:

Net present value screening method. The cost of capital is used as the discount rate when computing the net present value of a project. Any project with a negative net present value is rejected unless there is some other overriding factor.

Internal rate of return screening method. The cost of capital is compared to the internal rate of return of the project. Any project with an internal rate of return less than the cost of capital is rejected unless there is some other overriding factor.

NET PRESENT VALUE: TOTAL-COST APPROACH

White Company is trying to decide whether to remodel an old car wash or remove it entirely and install a new one in its place. The company uses a discount rate of 10%.

	New Car Wash	*Old Car Wash*
Annual revenues	$90,000	$70,000
Annual cash operating costs	30,000	25,000
Annual net cash inflows	$60,000	$45,000

	Year(s)	*Cash Flows*	*10% Factor*	*Present Value*
Install new car wash:				
Initial investment	Now	$(300,000)	1.000	$(300,000)
Salvage of old equipment	Now	$40,000	1.000	40,000
Replacement of brushes	6	$(50,000)	0.564	(28,200)
Annual net cash inflows	1-10	$60,000	6.145	368,700
Salvage of new equipment	10	$7,000	0.386	2,702
Net present value				$ 83,202
Remodel old car wash:				
Initial investment	Now	$(175,000)	1.000	$(175,000)
Replacement of brushes	6	$(80,000)	0.564	(45,120)
Annual net cash inflows	1-10	$45,000	6.145	276,525
Salvage of old equipment	10	$0	0.386	0
Net present value				$ 56,405
Net present value in favor of the new car wash				$ 26,797

NET PRESENT VALUE: INCREMENTAL-COST APPROACH

When only two alternatives are being considered, the incremental-cost approach is often simpler than the total-cost approach.

The data on White Company's car washes are shown below in incremental format. The table considers only those cash flows that would change if the new car wash were installed (i.e., only the relevant cash flows).

	Year(s)	*Cash Flows*	*10% Factor*	*Present Value*
Increased investment required for the new car wash	Now	$(125,000)	1.000	$(125,000)
Salvage of old equipment	Now	$40,000	1.000	40,000
Reduced cost of brush replacements	6	$30,000	0.564	16,920
Increased annual net cash inflows	1-10	$15,000	6.145	92,175
Salvage of new equipment	10	$7,000	0.386	2,702
Net present value in favor of the new car wash				$ 26,797

LEAST COST DECISIONS: TOTAL-COST APPROACH

In decisions that do not affect revenues, the alternative that has the least total cost from a present value perspective should be selected.

EXAMPLE: Home Furniture Company is trying to decide whether to overhaul an old delivery truck or purchase a new one. The company's discount rate is 10%. Using the total cost approach, the analysis would be conducted as follows:

	Year(s)	*Cash Flows*	*10% Factor*	*Present Value*
Buy the new truck:				
Purchase cost	Now	$(21,000)	1.000	$(21,000)
Salvage value of old truck.....	Now	$9,000	1.000	9,000
Annual cash operating costs .	1-5	$(6,000)	3.791	(22,746)
Salvage value of new truck...	5	$3,000	0.621	1,863
Present value.....				$(32,883)
Keep the old truck:				
Overhaul cost	Now	$(4,500)	1.000	$ (4,500)
Annual cash operating costs .	1-5	$(10,000)	3.791	(37,910)
Salvage value of old truck.....	5	$250	0.621	155
Present value.....				$(42,255)
Net present value in favor of purchasing the new truck				$ 9,372

LEAST COST DECISIONS: INCREMENTAL-COST APPROACH

Least cost decisions can also be made using the incremental-cost approach.

Data relating to Home Furniture Company's delivery truck decision are presented below focusing only on incremental costs. Only those cash flows that would change if the new truck were purchased are included in the analysis.

	Year(s)	*Cash Flows*	*10% Factor*	*Present Value*
Incremental cost to purchase the new truck	Now	$(16,500)	1.000	$(16,500)
Salvage value of old truck	Now	$9,000	1.000	9,000
Savings in annual cash operating costs	1-5	$4,000	3.791	15,164
Difference in salvage value in 5 years	5	$2,750	0.621	1,708
Net present value in favor of purchasing the new truck				$ 9,372

UNCERTAIN FUTURE CASH FLOWS

Example: Assume that a company is considering buying automated equipment that would have a 10-year useful life. The company uses a 10% discount rate. It is difficult to estimate the dollar value of the potential benefits from automation (for example, higher rates of output and higher quality). Suppose that when these difficult-to-estimate benefits are excluded, the equipment shows a negative net present value of $491,600. However, that does not mean the investment should not be made. The difficult-to-measure benefits may be large enough to offset this negative net present value.

Net present value (negative).....	$(491,600)
Present value factor for a 10% annuity over 10 periods...	6.145

$$\text{Required annual value of the difficult-to-measure benefits} = \frac{\text{Negative net present value to be offset}}{\text{Present value factor}}$$

$$= \frac{\$491,600}{6.145} = \$80,000$$

If the difficult-to-measure benefits from the new equipment are worth at least $80,000 per year, the machine should be purchased.

To verify this, suppose these benefits are worth exactly $80,000 per year. The present value of these benefits would be $80,000 × 6.145 = $491,600. This is precisely enough to offset the negative net present value of $491,600 when the difficult-to-measure benefits are not included. Therefore, if these benefits are worth more than $80,000 per year, the net present value of the project, *including the difficult-to-measure benefits*, would be positive.

RANKING INVESTMENT PROJECTS

A company may not have enough funds to launch all of the acceptable projects after all of the unacceptable projects have been screened out. Preference decisions are concerned with ranking the acceptable projects to determine which should be funded.

INTERNAL RATE OF RETURN

When using the internal rate of return method to rank competing investment projects, the preference rule is: The higher the internal rate of return, the more desirable the project.

NET PRESENT VALUE

The net present value of one investment project should not be compared directly to the net present value of another investment project unless the projects require equal investments.

EXAMPLE: Dexter Company is considering two investment projects, as shown below:

	Project A	*Project B*
Investment required.....	$(600,000)	$(300,000)
Present value of cash inflows.....	690,000	380,000
Net present value.....	$ 90,000	$ 80,000

Although Project A has a higher net present value than Project B, the projects are not strictly comparable because they require different investments.

RANKING INVESTMENT PROJECTS (continued)

The project profitability index permits comparisons of different sized projects.

$$\text{Project profitability index} = \frac{\text{Net present value of the project}}{\text{Investment required by the project}}$$

$$\text{Project A: } \frac{\$90{,}000}{\$600{,}000} = 0.15$$

$$\text{Project B: } \frac{\$80{,}000}{\$300{,}000} = 0.27$$

Project B will generate $0.27 of profit (in terms of net present value) for each dollar of investment, whereas Project A will generate only $0.15 of profit for each dollar of investment. Thus, if investment funds are limited, Project B is more desirable than Project A.

When using the net present value method to rank competing investment projects, the preference rule is: The higher the profitability index, the more desirable the project.

OTHER CAPITAL BUDGETING METHODS

Two other popular methods of making capital budgeting decisions do not involve discounting cash flows. They are the payback method and the simple rate of return method.

THE PAYBACK METHOD

- The payback period is the length of time that it takes for an investment to fully recoup its initial cost out of the cash receipts that it generates.
- The basic premise of the payback method is that the quicker the cost of an investment can be recovered, the better the investment is.
- The payback method is most appropriate when considering projects whose useful lives are short and unpredictable.
- The payback period is expressed in years. When the same cash flow occurs every year, the following formula can be used:

$$\text{Payback period} = \frac{\text{Investment required}}{\text{Annual net cash inflow}}$$

THE PAYBACK METHOD (continued)

EXAMPLE: Myers Company wants to install an espresso bar in place of several coffee vending machines in one of its stores. The company estimates that incremental annual revenues and expenses associated with the espresso bar would be:

Sales		$100,000
Variable expenses		30,000
Contribution margin		70,000
Fixed expenses:		
Insurance	$ 9,000	
Salaries	26,000	
Depreciation	15,000	50,000
Net operating income		$ 20,000

Equipment for the espresso bar would cost $150,000 and have a 10-year life. The old vending machines could be sold now for a $10,000 salvage value. The company requires a payback of 5 years or less on all investments.

Net operating income (above)	$20,000
Add: Noncash deduction for depreciation	15,000
Annual net cash inflow	$35,000

Investment in the espresso bar	$150,000
Deduct: Salvage value of old machines	10,000
Investment required	$140,000

$$\text{Payback period} = \frac{\text{Invesment required}}{\text{Annual net cash inflow}}$$

$$= \frac{\$140,000}{\$35,000} = 4.0 \text{ years}$$

SIMPLE RATE OF RETURN METHOD

Unlike other capital budgeting methods, the simple rate of return focuses on accounting net income instead of on cash flows. The formula is:

$$\text{Simple rate of return} = \frac{\text{Annual incremental revenue} - \text{Annual incremental expenses}}{\text{Initial investment}}$$

Note that incremental revenue and incremental expenses are not necessarily the same as incremental cash inflows and outflows. For example, depreciation should be included as part of incremental expenses, but not as part of incremental cash outflows.

EXAMPLE: Refer to the data for Myers Company on the preceding page. What is the simple rate of return on the espresso bar?

Annual incremental revenue	$100,000
Annual incremental expenses	$80,000
Initial investment.....	$140,000

$$\text{Simple rate of return} = \frac{\$100{,}000 - \$80{,}000}{\$140{,}000} = 14.3\%$$

The simple rate of return method ignores the time value of money.

INCOME TAXES IN CAPITAL BUDGETING: AFTER-TAX COST (Appendix 13C)

A cash expense net of its tax effect is known as an after-tax cost.

EXAMPLE: Suppose a company puts on a training program that costs $40,000. What is the after-tax cost of the training program?

	No Training Program	*With Training Program*
Sales	$250,000	$250,000
Less expenses:		
Salaries, insurance, other	150,000	150,000
Training program	0	40,000
Total expenses	150,000	190,000
Taxable income	$100,000	$ 60,000
Income taxes (30%)	$ 30,000	$ 18,000

Before-tax cost of the training program	$40,000
Less reduction in taxes ($30,000 – $18,000)	12,000
After-tax cost of the training program	$28,000

The following formula shows the after-tax cost of a tax-deductible cash expense:

$$\begin{aligned}\text{After-tax cost} &= (1 - \text{Tax rate}) \times \text{Cash expense} \\ &= (1 - 0.30) \times \$40{,}000 \\ &= \$28{,}000\end{aligned}$$

INCOME TAXES IN CAPITAL BUDGETING: AFTER-TAX BENEFIT

A cash receipt net of its tax effects is known as an after-tax benefit. The formula to compute the after-tax benefit from any taxable cash receipt is:

$$\text{After-tax benefit} = (1 - \text{Tax rate}) \times \text{Cash receipt}$$

EXAMPLE: A company receives $80,000 per year from subleasing part of its office space. If the tax rate is 30%, what is the after-tax benefit?

$$\text{After-tax benefit} = (1 - 0.30) \times \$80{,}000 = \$56{,}000$$

Tax-deductible cash expenses can be deducted from taxable cash receipts and the difference multiplied by (1 – Tax rate) to find the net after-tax cash flow.

EXAMPLE: A Company can invest in a project that would provide cash receipts of $400,000 per year. Cash operating expenses would be $280,000 per year. If the tax rate is 30%, what is the after-tax net cash inflow each year from the project?

Annual cash receipts	$400,000
Annual cash operating expenses	280,000
Annual net cash inflow before taxes	$120,000
Multiply by (1 – 0.30)	× 0.70
Annual after-tax net cash inflow	$ 84,000

INCOME TAXES IN CAPITAL BUDGETING: DEPRECIATION TAX SHIELD

Although depreciation is not a cash flow, it does have an impact on income taxes. Depreciation deductions shield revenues from taxation (called a depreciation tax shield) and thereby reduce tax payments.

EXAMPLE: Consider the impact of a $60,000 depreciation expense on a company's income taxes:

	Without Depreciation Deduction	*With Depreciation Deduction*
Sales	$500,000	$500,000
Less expenses:		
Cash operating expenses	340,000	340,000
Depreciation expense		60,000
Total expenses	340,000	400,000
Taxable income	$160,000	$100,000
Income taxes (30%)	$ 48,000	$ 30,000

The depreciation deduction reduces the company's income taxes by $18,000.

The tax savings provided by the depreciation tax shield can be computed using the following formula:

$$\begin{aligned}\text{Tax savings} &= \text{Tax rate} \times \text{Depreciation deduction} \\ &= 0.30 \times \$60{,}000 \\ &= \$18{,}000\end{aligned}$$

EXAMPLE

The concepts of after-tax cost, after-tax benefit and depreciation tax shield are integrated in the following example:

EXAMPLE: Martin Company has an investment opportunity that would involve the following cash flows:

Cost of new equipment	$400,000
Working capital required	$80,000
Annual net cash receipts for 8 years....	$100,000
Equipment repairs in 4 years	$40,000
Salvage value of equipment.....	$50,000

The following additional information is available:

- Equipment's estimated useful life: 8 years
- For tax purposes, the equipment would be depreciated over 8 years using the straight-line method and assuming zero salvage value.*
- After-tax cost of capital: 10%
- Income tax rate: 30%

*This is a considerable simplification.

ANALYSIS OF THE PROJECT

	Year(s)	*(1) Amount*	*(2) Tax Effect*	After-Tax *Cash Flows (1) × (2)*	*10% Factor*	*Present Value*
Cost of new equipment.....	Now	$(400,000)	—	$(400,000)	1.000	$(400,000)
Working capital needed.....	Now	$(80,000)	—	$(80,000)	1.000	(80,000)
Annual net cash receipts.....	1-8	$100,000	1-0.30	$70,000	5.335	373,450
Equipment repairs	4	$(40,000)	1-0.30	$(28,000)	0.683	(19,124)
Depreciation deductions.....	1-8	$50,000	0.30	$15,000	5.335	80,025
Salvage value of equipment	8	$50,000	1-0.30	$35,000	0.467	16,345
Release of working capital...	8	$80,000	—	$80,000	0.467	37,360
Net present value						$ 8,056