Capital Budgeting Decisions

Chapter 13

Typical Capital Budgeting Decisions

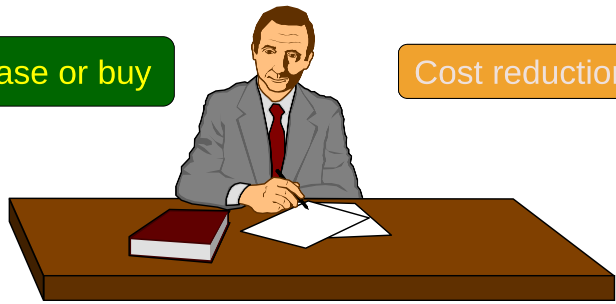
Plant expansion

Equipment selection

Equipment replacement

Lease or buy

Cost reduction

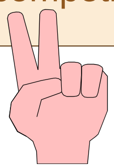


Typical Capital Budgeting Decisions

Capital budgeting tends to fall into two broad categories.

1. **Screening decisions.** Does a proposed project meet some preset standard of acceptance?

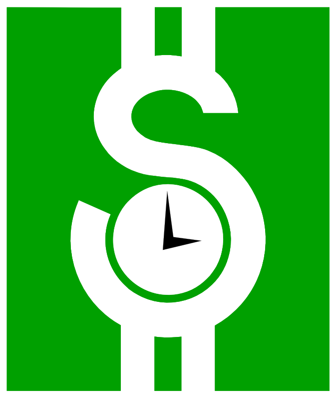
2. **Preference decisions.** Selecting from among several competing courses of action.



Time Value of Money

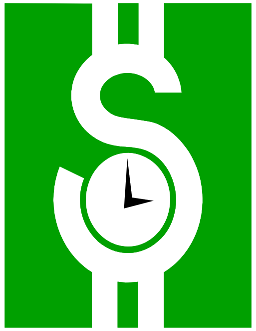
A dollar today is worth more than a dollar a year from now.

Therefore, projects that promise earlier returns are preferable to those that promise later returns.



The Mathematics of Interest

A dollar received today is worth more than a dollar received a year from now because you can put it in the bank today and have more than a dollar a year from now.



The Mathematics of Interest – An Example

Future Value of Money

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

F = the balance at the end of the period **n**.
P = the amount invested now.
r = the rate of interest per period.
n = the number of periods.

The Mathematics of Interest – An Example

Assume a bank pays 8% interest on a $100 deposit made today. How much will the $100 be worth in one year?

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

$$F_1 = \$100(1 + .08)^1$$

$$F_1 = \$108.00$$

Compound Interest – An Example

What if the $108 was left in the bank for a second year? How much would the original $100 be worth at the end of the second year?

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

F = the balance at the end of the period **n**.
P = the amount invested now.
r = the rate of interest per period.
n = the number of periods.

Compound Interest – An Example

$$F_2 = \$100(1 + .08)^2$$

$$F_2 = \$116.64$$

The interest that is paid in the second year on the interest earned in the first year is known as compound interest.

Computation of Present Value

An investment can be viewed in two ways—its future value or its present value.

Let's look at a situation where the future value is known and the present value is the unknown.

Present Value – An Example

Present Value of Money

$$P = \frac{F_n}{(1 + r)^n}$$

F = the balance at the end of the period **n**.
P = the amount invested now.
r = the rate of interest per period.
n = the number of periods.

Present Value – An Example

If a bond will pay \$100 in two years, what is the present value of the \$100 if an investor can earn a return of 12% on investments?

$$P = \frac{\$100}{(1 + .12)^2}$$

$$P = \$79.72$$

This process is called discounting. We have discounted the \$100 to its present value of \$79.72. The interest rate used to find the present value is called the discount rate.

Present Value – An Example

Let's verify that if we put $79.72 in the bank today at 12% interest that it would grow to $100 at the end of two years.

	Year 1	*Year 2*
Beginning balance	**$ 79.72**	**$ 89.29**
Interest @ 12%	**9.57**	**10.71**
Ending balance	**$ 89.29**	**$ 100.00**

If $79.72 is put in the bank today and earns 12%, it will be worth $100 in two years.

Present Value – An Example

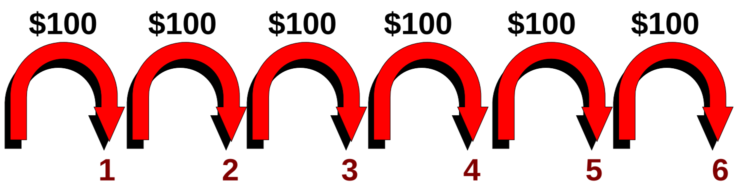
$100 × 0.797 = $79.70 present value

	Rate		
Periods	**10%**	**12%**	**14%**
1	**0.909**	**0.893**	**0.877**
2	**0.826**	**0.797**	**0.769**
3	**0.751**	**0.712**	**0.675**
4	**0.683**	**0.636**	**0.592**
5	**0.621**	**0.567**	**0.519**

Present value factor of $1 for 2 periods at 12%.

Present Value of a Series of Cash Flows

An investment that involves a series of identical cash flows at the end of each year is called an annuity.



Present Value of a Series of Cash Flows – An Example

Lacey Inc. purchased a tract of land on which a $60,000 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%?

Present Value of a Series of Cash Flows – An Example

We could solve the problem like this . . .

Present Value of an Annuity of $1			
Periods	10%	12%	14%
1	0.909	0.893	0.877
2	1.736	1.690	1.647
3	2.487	2.402	2.322
4	3.170	3.037	2.914
5	3.791	3.605	3.433

$60,000 × 3.605 = $216,300

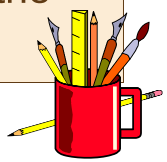
Time Value of Money

The capital budgeting techniques that best recognize the time value of money are those that involve discounted cash flows.

The Net Present Value Method

To determine net present value we . . .

- Calculate the present value of cash inflows,
- Calculate the present value of cash outflows,
- Subtract the present value of the outflows from the present value of the inflows.



The Net Present Value Method

If the Net Present Value is . . .	Then the Project is . . .
Positive . . .	Acceptable because it promises a return greater than the required rate of return.
Zero . . .	Acceptable because it promises a return equal to the required rate of return.
Negative . . .	Not acceptable because it promises a return less than the required rate of return.

The Net Present Value Method

Net present value analysis emphasizes cash flows and not accounting net income.

The reason is that accounting net income is based on accruals that ignore the timing of cash flows into and out of an organization.

Typical Cash Outflows

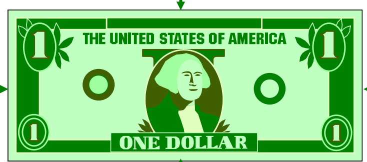
Repairs and maintenance

Working capital

Initial investment

Incremental operating costs

Typical Cash Inflows



Salvage value

Release of working capital

Reduction of costs

Incremental revenues

Recovery of the Original Investment

Depreciation is not deducted in computing the present value of a project because . . .

- It is not a current cash outflow.
- Discounted cash flow methods automatically provide for a return of the original investment.

Recovery of the Original Investment

- Carver Hospital is considering the purchase of an attachment for its X-ray machine.

No investments are to be made unless they have an annual return of at least 10%.

Will we be allowed to invest in the attachment?

Recovery of the Original Investment

Item	Year(s)	Amount of Cash Flow	10% Factor	Present Value of Cash Flows
Initial investment (outflow)	Now	(3,170)	1.000	(3,170)
Annual cash inflows	1-4	$ 1,000	3.170	$ 3,170
Net present value				$ -0-

Present Value of $1			
Periods	10%	12%	14%
1	0.909	0.893	0.877
2	1.736	1.690	1.647
3	2.487	2.402	2.322
4	3.170	3.037	2.914
5	3.791	3.605	3.433

Present value of an annuity of $1 table

Recovery of the Original Investment

Year	(1) Investment Outstanding during the year	(2) Cash Inflow	(3) Return on Investment (1) × 10%	(4) Recovery of Investment during the year (2) - (3)	(5) Unrecovered Investment at the end of the year (1) - (4)
1	$ 3,170	$ 1,000	$ 317	$ 683	$ 2,487
2	2,487	1,000	249	751	1,736
3	1,736	1,000	173	827	909
4	909	1,000	91	909	0
Total investment recovered				$ 3,170	

This implies that the cash inflows are sufficient to recover the $3,170 initial investment (therefore depreciation is unnecessary) and to provide exactly a 10% return on the investment.

Two Simplifying Assumptions

Two simplifying assumptions are usually made in net present value analysis:

All cash flows other than the initial investment occur at the end of periods.

All cash flows generated by an investment project are immediately reinvested at a rate of return equal to the discount rate.

Choosing a Discount Rate

- The firm's cost of capital is usually regarded as the minimum required rate of return.
- The cost of capital is the average rate of return the company must pay to its long-term creditors and stockholders for the use of their funds.

The Net Present Value Method

Lester Company has been offered a five year contract to provide component parts for a large manufacturer.

Cost and revenue information	
Cost of special equipment	$160,000
Working capital required	100,000
Relining equipment in 3 years	30,000
Salvage value of equipment in 5 years	5,000
Annual cash revenue and costs:	
Sales revenue from parts	750,000
Cost of parts sold	400,000
Salaries, shipping, etc.	270,000

The Net Present Value Method

At the end of five years the working capital will be released and may be used elsewhere by Lester.

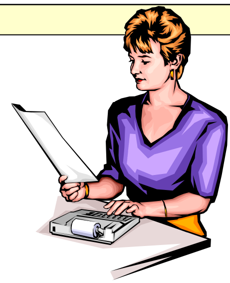
Lester Company uses a discount rate of 10%.

Should the contract be accepted?

The Net Present Value Method

Annual net cash inflow from operations

Sales revenue	$ 750,000
Cost of parts sold	(400,000)
Salaries, shipping, etc.	(270,000)
Annual net cash inflows	$ 80,000



The Net Present Value Method

	Years	Cash Flows	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)
Salvage value of equip.	5	5,000	0.621	3,105
Working capital released	5	100,000	0.621	62,100
Net present value				$ 85,955

Accept the contract because the project has a positive net present value.

Internal Rate of Return Method

- The internal rate of return is the rate of return promised by an investment project over its useful life. It is computed by finding the discount rate that will cause the net present value of a project to be zero.
- It works very well if a project's cash flows are identical every year. If the annual cash flows are not identical, a trial and error process must be used to find the internal rate of return.

Internal Rate of Return Method

General decision rule . . .

If the Internal Rate of Return is . . .	Then the Project is . . .
Equal to or greater than the minimum required rate of return . . .	Acceptable.
Less than the minimum required rate of return . . .	Rejected.

When using the internal rate of return, the cost of capital acts as a hurdle rate that a project must clear for acceptance.

Internal Rate of Return Method

- Decker Company can purchase a new machine at a cost of $104,320 that will save $20,000 per year in cash operating costs.
- The machine has a 10-year life.

Internal Rate of Return Method

Future cash flows are the same every year in this example, so we can calculate the internal rate of return as follows:

$$\text{PV factor for the internal rate of return} = \frac{\text{Investment required}}{\text{Annual net cash flows}}$$

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

Internal Rate of Return Method

Using the present value of an annuity of $1 table . . .

Find the 10-period row, move across until you find the factor 5.216. Look at the top of the column and you find a rate of 14%.

Periods	10%	12%	14%
1	0.909	0.893	0.877
2	1.736	1.690	1.647
. . .	. . .	. . .	. . .
9	5.759	5.328	4.946
10	6.145	5.650	5.216

Internal Rate of Return Method

- Decker Company can purchase a new machine at a cost of $104,320 that will save $20,000 per year in cash operating costs.
- The machine has a 10-year life.

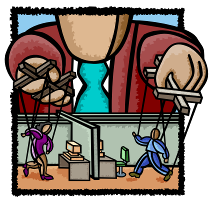
The internal rate of return on this project is 14%.

If the internal rate of return is equal to or greater than the company's required rate of return, the project is acceptable.

Expanding the Net Present Value Method

To compare competing investment projects we can use the following net present value approaches:

1. Total-cost
2. Incremental cost



The Total-Cost Approach

White Company has two alternatives:

1. remodel an old car wash or,
2. remove the old car wash and install a new one.

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

The Total-Cost Approach

If White installs a new washer . . .

Cost	$ 300,000
Productive life	10 years
Salvage value	$ 7,000
Replace brushes at the end of 6 years	$ 50,000
Salvage of old equip.	$ 40,000

Let's look at the present value of this alternative.

The Total-Cost Approach

Install the New Washer

	Year	Cash Flows	10% Factor	Present Value
Initial investment	Now	$ (300,000)	1.000	$ (300,000)
Replace brushes	6	(50,000)	0.564	(28,200)
Annual net cash inflows	1-10	60,000	6.145	368,700
Salvage of old equipment	Now	40,000	1.000	40,000
Salvage of new equipment	10	7,000	0.386	2,702
Net present value				$ 83,202

If we install the new washer, the investment will yield a positive net present value of $83,202.

The Total-Cost Approach

If White remodels the existing washer . . .

Remodel costs	$175,000
Replace brushes at the end of 6 years	80,000

Let's look at the present value of this second alternative.

The Total-Cost Approach

Remodel the Old Washer

	Year	Cash Flows	10% Factor	Present Value
Initial investment	Now	$ (175,000)	1.000	$ (175,000)
Replace brushes	6	(80,000)	0.564	(45,120)
Annual net cash inflows	1-10	45,000	6.145	276,525
Net present value				$ 56,405

If we remodel the existing washer, we will produce a positive net present value of $56,405.

The Total-Cost Approach

Both projects yield a positive net present value.

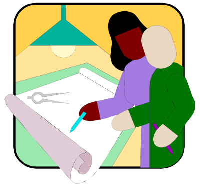
	Present Value
Invest in new washer	$ 83,202
Remodel existing washer	56,405
In favor of new washer	$ 26,797

However, investing in the new washer will produce a higher net present value than remodeling the old washer.

The Incremental-Cost Approach

Under the incremental-cost approach, only those cash flows that differ between the two alternatives are considered.

Let's look at an analysis of the White Company decision using the incremental-cost approach.



The Incremental-Cost Approach

	Year	Cash Flows	10% Factor	Present Value
Incremental investment	Now	$(125,000)	1.000	$(125,000)
Incremental cost of brushes	6	$ 30,000	0.564	16,920
Increased net cash inflows	1-10	15,000	6.145	92,175
Salvage of old equipment	Now	40,000	1.000	40,000
Salvage of new equipment	10	7,000	0.386	2,702
Net present value				$ 26,797

We get the same answer under either the total-cost or incremental-cost approach.

Least Cost Decisions

In decisions where revenues are not directly involved, managers should choose the alternative that has the least total cost from a present value perspective.

Let's look at the Home Furniture Company.

Home Furniture Company is trying to decide whether to overhaul an old delivery truck now or purchase a new one.

The company uses a discount rate of 10%.

Least Cost Decisions

Here is information about the trucks . . .

Old Truck	
Overhaul cost now	$ 4,500
Annual operating costs	10,000
Salvage value in 5 years	250
Salvage value now	9,000

New Truck	
Purchase price	$ 21,000
Annual operating costs	6,000
Salvage value in 5 years	3,000

Least Cost Decisions

Buy the New Truck

	Year	Cash Flows	10% Factor	Present Value
Purchase price	Now	$ (21,000)	1.000	$ (21,000)
Annual operating costs	1-5	(6,000)	3.791	(22,746)
Salvage value of old truck	Now	9,000	1.000	9,000
Salvage value of new truck	5	3,000	0.621	1,863
Net present value				(32,883)

Keep the Old Truck

	Year	Cash Flows	10% Factor	Present Value
Overhaul cost	Now	$ (4,500)	1.000	$ (4,500)
Annual operating costs	1-5	(10,000)	3.791	(37,910)
Salvage value of old truck	5	250	0.621	155
Net present value				(42,255)

Least Cost Decisions

Home Furniture should purchase the new truck.

Net present value of costs associated with purchase of new truck	$(32,883)
Net present value of costs associated with overhauling existing truck	(42,255)
Net present value in favor of purchasing the new truck	$ 9,372

Preference Decision – The Ranking of Investment Projects

Screening Decisions

Pertain to whether or not some proposed investment is acceptable; these decisions come first.

Preference Decisions

Attempt to rank acceptable alternatives from the most to least appealing.

Internal Rate of Return Method

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 Method

The net present value of one project cannot be directly compared to the net present value of another project unless the investments are equal.

Ranking Investment Projects

Project profitability index = Net present value of the project / Investment required

	Project A	Project B
Net present value (a)	$ 1,000	$ 1,000
Investment required (b)	$ 10,000	$ 5,000
Profitability index (a) ÷ (b)	0.10	0.20

The higher the profitability index, the more desirable the project.

Other Approaches to Capital Budgeting Decisions

Other methods of making capital budgeting decisions include:

1. **The Payback Method.**
2. **Simple Rate of Return.**

The Payback Method

The payback period is the length of time that it takes for a project to recover its initial cost out of the cash receipts that it generates.

When the annual net cash inflow is the same each year, this formula can be used to compute the payback period:

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

The Payback Method

Management at The Daily Grind wants to install an espresso bar in its restaurant that

1. Costs $140,000 and has a 10-year life.
2. Will generate annual net cash inflows of $35,000.

Management requires a payback period of 5 years or less on all investments.

What is the payback period for the espresso bar?

The Payback Method

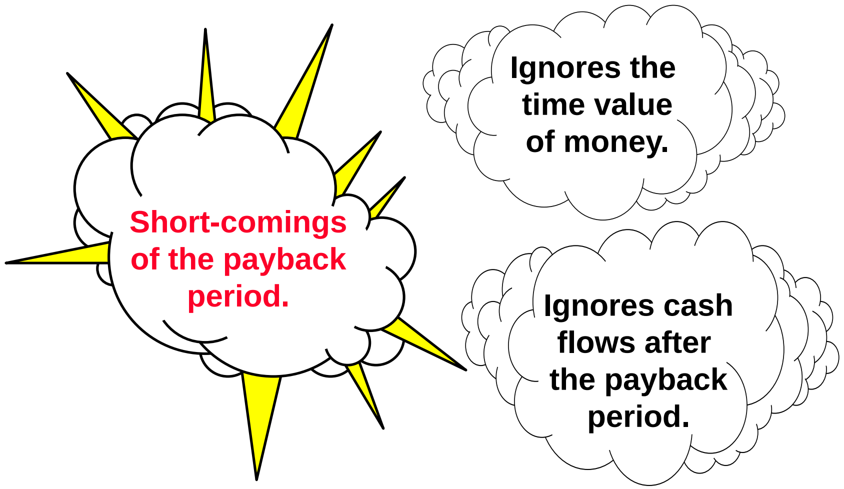
$$\text{Payback period} = \frac{\text{Investment required}}{\text{Annual net cash inflow}}$$

$$\text{Payback period} = \frac{\$140{,}000}{\$35{,}000}$$

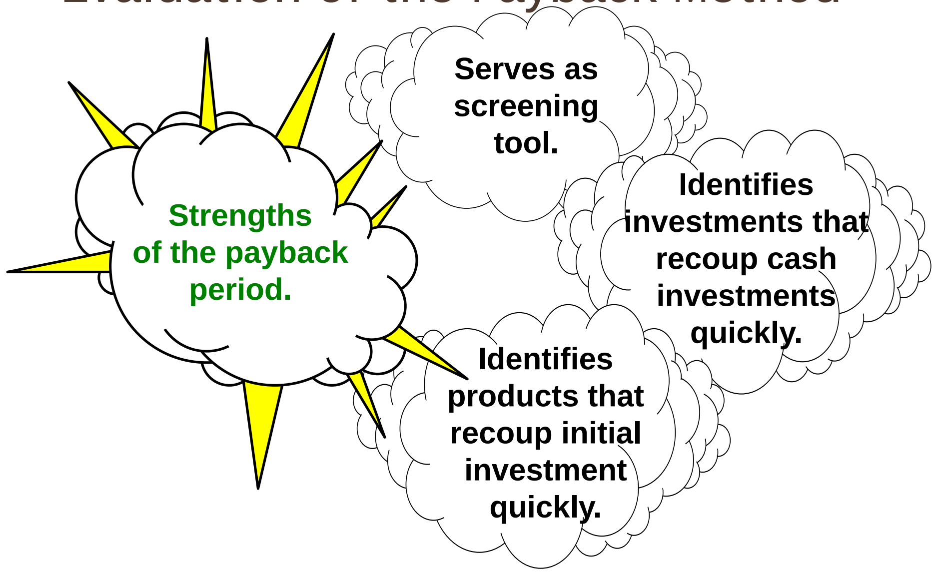
$$\text{Payback period} = 4.0 \text{ years}$$

According to the company's criterion, management would invest in the espresso bar because its payback period is less than 5 years.

Evaluation of the Payback Method



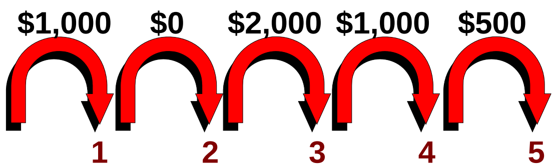
Evaluation of the Payback Method



Payback and Uneven Cash Flows

When the cash flows associated with an investment project change from year to year, the payback formula introduced earlier cannot be used.

Instead, the un-recovered investment must be tracked year by year.



For example, if a project requires an initial investment of $4,000 and provides uneven net cash inflows in years 1-5 as shown, the investment would be fully recovered in year 4.

Simple Rate of Return Method

Does not focus on cash flows -- rather it focuses on accounting net operating income.

The following formula is used to calculate the simple rate of return:

$$\text{Simple rate of return} = \frac{\text{Annual incremental net operating income}}{\text{Initial investment}^{*}}$$

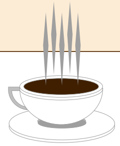
***Should be reduced by any salvage from the sale of the old equipment**

Simple Rate of Return Method

Management of The Daily Grind wants to install an espresso bar in its restaurant that:

1. Cost $140,000 and has a 10-year life.
2. Will generate incremental revenues of $100,000 and incremental expenses of $65,000 including depreciation.

What is the simple rate of return on the investment project?



Simple Rate of Return Method

$$\text{Simple rate of return} = \frac{\$35,000}{\$140,000} = 25\%$$

Criticism of the Simple Rate of Return

Short-comings of the simple rate of return.

Ignores the time value of money.

The same project may appear desirable in some years and undesirable in other years.

End of Chapter 13