Chapter 13

Lecture Notes

Chapter theme: The term **capital budgeting** is used to describe how managers plan significant cash outlays on projects that have long-term implications such as the purchase of new equipment and the introduction of new products. This chapter describes several tools that can be used by managers to help make these types of investment decisions.

 1

1. **Capital budgeting – planning investments**
	1. **Typical capital budgeting** **decisions**
		1. Capital budgeting analysis can be used for any decision that involves an outlay now in order to obtain some future return. Typical capital budgeting decisions include:
			1. **Cost reduction decisions**. Should new equipment be purchased to reduce costs?

 2

* + - 1. **Expansion decisions**. Should a new plant or warehouse be purchased to increase capacity and sales?
			2. **Equipment selection decisions**. Which of several available machines should be purchased?
			3. **Lease or buy decisions**. Should new equipment be leased or purchased?
			4. **Equipment replacement decisions**. Should old equipment be replaced now or later?

#### Types of capital budgeting decisions

* + 1. There are **two main types** of capital budgeting decisions:
			1. **Screening decisions** relate to whether a proposed project passes a preset hurdle.
				1. For example,acompany may have a policy of accepting projects only if they promise a return of 20% on the investment.

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* + - 1. **Preference decisions** relate to selecting among several competing courses of action.
				1. For example, a company may be considering several different machines to replace an existing machine on the assembly line.
		1. In this chapter, we initially discuss ways of making screening decisions. Preference decisions are discussed toward the end of the chapter.

#### The time value of money

* + 1. The time value of money concept recognizes that **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.

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* + 1. The capital budgeting techniques that best recognize the time value of money are those that involve **discounted cash flows** (the concepts of discounting cash flows and using present value tables are explained in greater detail in Appendix 13A).

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1. **Discounted cash flows – the net present value** **method**

*Learning Objective 1: Evaluate the acceptability of an investment project using the net present value method.*

 6

####  Key concepts/assumptions

* + 1. The net present value method compares the present value of a project’s **cash inflows** with the present value of its **cash outflows**. The difference between these two streams of cash flows is called the **net present value.**

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* + 1. The net present value is interpreted as follows:
			1. If the net present value is **positive**, then the project is **acceptable**.

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* + - 1. If the net present value is **zero**, then the project is **acceptable**.
			2. If the net present value is **negative**, then the project is **not acceptable**.
		1. Net present value analysis (as well as the internal rate of return, which will be discussed shortly) **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.

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* + - 1. Examples of **typical cash outflows** that are included in net present value calculations are as shown. Notice the term **working capital** which is defined as current assets less current liabilities.

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*Helpful Hint: The role of working capital in capital budgeting often confuses students. Emphasize that the initial investment in working capital at the beginning of the project for items, such as inventories, is recaptured at the end of the project when working capital is no longer required. Thus, working capital is recognized as a cash outflow at the beginning of the project and a cash inflow at the end of the project.*

* + - 1. Examples of typical cash inflows that are included in net present value calculations are as shown.

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* + 1. The net present value method excludes depreciation for **two reasons:**
			1. First, **depreciation is not a current cash outflow**.

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* + - 1. Second, discounted cash flow methods **automatically** provide for a return of the original investment, thereby making a deduction for depreciation unnecessary. For example:
				1. Assume the facts as shown with respect to **Carver Hospital**.

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* + - * 1. The net present value of the investment is **zero**.

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* + - * 1. 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.

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* + 1. **Two** **simplifying assumptions** are usually made in net present value analysis:
			1. Thefirst assumption is that all cash flows other than the initial investment occur at the **end of periods**.

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* + - 1. The second assumption is that all cash flows generated by an investment project are **immediately reinvested** at a rate of return equal to the discount rate.
		1. A company’s **cost of capital**, defined as the average rate of return a company must pay to its long-term creditors and shareholders for the use of their funds, is usually regarded as the **minimum required rate of return**. When the cost of capital is used as the discount rate, it serves as a **screening device** in net present value analysis.

 17

#### The net present value method: an example

* + 1. Assume the information as shown with respect to **Lester Company**.

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* + - 1. Also assume that at the end of five years the **working capital will be released** and may be used elsewhere.

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* + - 1. Lester Company’s discount rate is **10%**.
			2. **Should the contract be accepted?**
		1. The annual net cash inflow from operations (**$80,000**) is computed as shown.

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* + 1. Since the investments in equipment (**$160,000**) and working capital (**$100,000**) occur immediately, the discounting factor used is **1.000**.

 21

* + 1. The present value factor for an annuity of $1 for five years at 10% is **3.791**. Therefore, the present value of the annual net cash inflows is **$303,280**.

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* + 1. The present value factor of $1 for three years at 10% is **0.751**. Therefore, the present value of the cost of relining the equipment in three years is **$22,530**.

 23

* + 1. The present value factor of $1 for five years at 10% is **0.621**. Therefore, the present value of the salvage value of the equipment is **$3,105**.

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* + 1. The net present value of the investment opportunity is **$85,955**. Since the net present value is positive, it suggests making the investment.

 25

*Quick Check – net present value calculations*

26-28

1. **Discounted cash flows – the internal rate of return** **method**

*Learning Objective 2: Evaluate the acceptability of an investment project using the internal rate of return method.*

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#### Key concepts

* + 1. The **internal rate of return** is the rate of return promised by an investment project over its useful life. It is sometimes referred to as the **yield** on a project.
		2. The internal rate of return is the discount rate that will result in a **net present value of zero**.

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* + 1. This technique works very well if a project’s cash flows are identical every year. If the cash flows are not identical every year a **trial-and-error process** can be used to find the internal rate of return.
		2. If the internal rate of return is **equal to or greater than** the minimum **required rate of return**, then the project is **acceptable**. If it is **less than** the required rate of return, then the project is **rejected**.

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* + 1. When using internal rate of return, the cost of capital acts as a **hurdle rate** that a project must clear for acceptance.

#### Internal rate of return – an example

* + 1. Assume the facts as shown with respect to the **Decker Company**.

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* + 1. Since the cash flows are the **same every year**, the equation shown can be used to compute the appropriate present value factor of **5.216**.

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* + 1. Using the present value of an annuity of $1 table, the internal rate of return is equal to **14%**.

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* + 1. If Decker’s minimum required rate of return is **equal to or greater** than 14%, then the machine should be purchased.

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36-37

*Quick Check – internal rate of return calculations*

#### Comparing the net present value and internal rate of return methods

* + 1. The net present value method offers **two important advantages** over the internal rate of return method.

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* + - 1. The net present value method is often **simpler to use**.
			2. The internal rate of return method makes a **questionable assumption**—that cash inflows can be reinvested at the internal rate of return.
				1. If the internal rate of return is high, this assumption may be **unrealistic**. It is more realistic to assume that the cash flows can be **reinvested at the discount rate**, which is the underlying assumption of the net present value method.

 39

1. **Expanding the net present value method**

#### We will now expand the net present value method to include two alternatives and the concept of relevant costs. The net present value method can be used to compare competing investment projects in two ways—the total cost approach and the incremental cost approach.

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#### The total cost approach – an example

* + 1. Assume that **White Co.** has two alternatives—**remodel** an old car wash or remove the old car wash and **replace** it with a new one.

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* + - 1. The company uses a discount rate of **10%**.
			2. The net annual cash inflows are **$60,000** for the new car wash and **$45,000** for the old car wash.
		1. In addition, assume that the information as shown relates to the **installation of a new washer**.

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* + 1. The net present value of installing a new washer is **$83,202**.

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* + 1. If White chooses to remodel the existing washer, the remodeling costs would be **$175,000** and the cost to replace the brushes at the end of six years would be **$80,000**.

 44

* + 1. The net present value of remodeling the old washer is **$56,405**.

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* + 1. While both projects yield a positive net present value, the net present value of the new washer alternative is **$26,797 higher** than the remodeling alternative.

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#### The incremental cost approach – continuing with the example

* + 1. Under the incremental cost approach, only those cash flows that **differ** between the remodeling and replacing alternatives are considered.

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* + 1. The differential cash flows between the alternatives are as shown. Notice, the net present value of **$26,797** is **identical** to the answer derived from the total cost approach.

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*Helpful Hint: Any decision always has at least two alternatives. Often one of these alternatives is the status quo. In problems evaluating a single project, the incremental-cost approach is usually used. The incremental costs and benefits of the project relative to the status quo are the focus of the analysis.*

*Quick Check – total cost and incremental cost approaches*

49-50

#### Least cost decisions

* + 1. In decisions where **revenues are not directly involved**, managers should choose the alternative that has the **least total cost** from a present value perspective.

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* + 1. **Home Furniture Company – an example** (we will analyze this decision using the **total-cost approach**.
			1. Assume the following:

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* + - * 1. Home Furniture Company is trying to decide whether to **overhaul** an old delivery truck or **purchase** a new one.
				2. The company uses a discount rate of **10%**.
			1. The information pertaining to the old and new trucks is as shown.

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* + - 1. The net present value of buying a new truck is (**$32, 883**). The net present value of overhauling the old truck is (**$42,255**).

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* + - * 1. Notice **both numbers are negative because there is no revenue involved** – this is a **least cost** decision.
			1. The net present value in favor of purchasing the new truck is **$9,372**.

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56-57

*Quick Check – least cost decisions*

1. **Uncertain cash flows**

*Learning Objective 3: Evaluate an investment project that has uncertain cash flows.*

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#### Handling the complication of uncertain future cash flows – an example

* + 1. Assume that all of the cash flows related to an investment in a supertanker have been estimated except for its salvage value in 20 years.

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* + - 1. Using a discount rate of **12%**, management has determined that the net present value of all the cash flows except the salvage value is a **negative $1.04 million**.
			2. This negative net present value will be offset by the salvage value of the supertanker.
			3. **How large would the salvage value need to be to make this investment attractive**?
		1. The equation shown can be used to determine that if the salvage value of the supertanker is **at least $10 million**, the net present value of the investment would be positive and therefore acceptable.

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* + - 1. While the salvage value is not known with certainty, the $10 million dollar figure offers **a useful reference point** for making the decision.

#### Real options

* + 1. The analysis in this chapter has assumed that an investment **cannot be postponed** and that, once started, nothing can be done to **alter** the course of the project.
		2. The ability to **delay** the start of a project, to **expand** it if conditions are favorable, and to **cut losses** if they are unfavorable adds value to many investments.

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* + 1. The value of these options can be quantified using what is called **real options analysis**, which is beyond the scope of the book.
1. **Preference decisions – the ranking of investment projects**

*Learning Objective 4: Rank investment projects in order of preference.*

 62

#### Background

* + 1. Recall that when considering investment opportunities, managers must make two types of decisions – screening decisions and preference decisions.

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* + - 1. **Screening decisions**, which come first, pertain to whether or not some proposed investment is acceptable.
			2. **Preference decisions,** which come after screening decisions, attempt to rank acceptable alternatives from the most to least appealing.
				1. Preference decisions need to be made because the number of acceptable investment alternatives usually **exceeds** the amount of available funds.

 63

#### Internal rate of return method

* + 1. 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**.

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#### Net present value method

* + 1. The net present value of one project **cannot be directly compared** to the net present value of another project **unless the investments are equal**.

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* + 1. In the case of unequal investments, a **project** **profitability index** can be computed as shown. Notice:
			1. The project profitability indexes for investments A and B are **0.01** and 0**.20**, respectively.

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* + - 1. The higher the project profitability index, the more desirable the project. Therefore, **investment B is more desirable than investment A**.
			2. Since in this type of situation, **the constrained resource is the limited funds available for investment**, the project profitability index is similar to the contribution margin per unit of the constrained resource discussed in an earlier chapter.

 66

1. **Other approaches to capital budgeting decisions**

#### This section focuses on two other methods of making capital budgeting decisions – the payback method and the simple rate of return. The payback method will be discussed first followed by the simple rate of return method.

 67

#### The payback method

*Learning Objective 5: Determine the payback period for an investment.*

 68

* + 1. **Key concepts**
			1. The payback method focuses on the **payback period**, which is the length of time that it takes for a project to **recoup its initial cost** out of the cash receipts that it generates.

 69

* + - 1. When the annual net cash inflow is **the same every year**, the formula for computing the payback period is as shown.
		1. **The Daily Grind – an example**
			1. Assume the management of the **Daily Grind** wants to install an espresso bar in its restaurant.

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* + - * 1. The cost of the espresso bar is **$140,000** and it has a **10-year life**.
				2. The bar will generate annual net cash inflows of **$35,000**.

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* + - * 1. Management requires a payback period of **five years or less**.
				2. **What is the payback period on the espresso bar**?
			1. The payback period is **4.0 years**. Therefore, management would choose to invest in the bar.

 71

72-73

*Quick Check – the payback method*

* + 1. **Evaluation of the payback method**
			1. **Criticisms**

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* + - * 1. A shorter payback period **does not** always mean that one investment is more desirable than another.
				2. The payback method **ignores cash flows after the payback period**, thus it has no inherent mechanism for highlighting differences in useful life between investments.

 74

* + - * 1. The payback method **does not consider the time value of money**.

*Helpful Hint: Ask students to choose between two options that each require an initial investment of $4,000. Option A returns $1,000 at the end of each four years; option B returns $4,000 at the end of the fourth year. Under the payback method, options A and B are equally preferable. Note, however, that option A is better, since the cash flows come earlier. Now add that in year 5, option A will produce an additional cash inflow of $5,000 but that option B will never generate another dollar after the fourth year. Repeat the question of preference of option A or B using only the payback method. The payback method ignores the time value of money and does not measure profitability; it just measures the time required to recapture the original investment.*

* + - 1. **Strengths**
				1. It can serve as a **screening tool** to help identify which investment proposals are in the “ballpark.”
				2. It can aid companies that are **“cash poor”** in identifying investments that will recoup cash investments quickly.

 75

* + - * 1. It can help companies that compete in industries **where products become obsolete rapidly** to identify products that will recoup their initial investment quickly.
		1. **Payback and uneven cash flows**
			1. 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**.

 76

* + - 1. 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**.

 77

#### The simple rate of return method

*Learning Objective 6: Compute the simple rate of return for an investment.*

 78

* + 1. **Key concepts**
			1. The **simple rate of return method** (also known as the **accounting rate of return** or the **unadjusted rate of return**) does not focus on cash flows, rather it focuses on **accounting net operating income**.

 79

* + - 1. The equation for computing the simple rate of return is as shown.
		1. **The Daily Grind – an example**
			1. Assume the management of the **Daily Grind** wants to install an espresso bar in its restaurant.
				1. The cost of the espresso bar is **$140,000** and it has a **10-year life**.

 80

* + - * 1. The espresso bar will generate incremental revenues of **$100,000** and incremental expenses of **$65,000** including depreciation.
				2. **What is the simple rate of return on this project?**
			1. The simple rate of return is **25%**.

 81

* + 1. **Criticism of the simple rate of return**

 82

* + - 1. **It does not consider the time value of money**.
			2. The simple rate of return **fluctuates from year to year** when used to evaluate projects that do not have constant annual incremental revenues and expenses.

82

* + - * 1. The same project may appear desirable in some years and undesirable in others.
1. **Postaudit of investment projects**

#### A postaudit is a follow-up after the project has been completed to see whether or not expected results were actually realized.

 83

* + 1. The data used in a postaudit analysis should be **actual observed data** rather than estimated data.
1. **Appendix 13A: the concept of present value (Slide #84 is the title slide for this appendix)**

*Learning Objective 7: Understand present value concepts and the use of present value tables.*

 85

#### The mathematics of interest

* + 1. 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.

 86

* + 1. **An example**

 87

* + - 1. Assume a bank pays **8%** interest on a $100 deposit made today.
			2. **How much will the $100 be worth in one year**?
			3. The equation needed to answer this question is as shown, where:
				1. F = the ending balance.

 87

* + - * 1. P = the amount invested now.
				2. r= the rate of interestper period.
				3. n *=* the number of periods.
			1. Solving this equation, the answer is **$108**.
			2. The $100 outlay is called the **present value** of the $108 amount to be received in one year. It is also known as the **discounted value** of the future $108 receipt.

 88

* + 1. **Compound interest – the example continued**
			1. **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?

 89

* + - 1. The equation needed to answer this question is as shown, where:
				1. F = the ending balance.
				2. P *=* theamount invested now*.*
				3. r = the rate of interest per period.
				4. n = the number of periods.
			2. Solving this equation, the answer is **$116.64**.
				1. The interest that is paid in the second year on the interest earned in the first year is known as **compound interest**.

 90

#### Computation of present value

* + 1. An investment can be viewed in two ways – its **future value** or its **present value**. In the example just completed, the present value was known and the future value was the unknown that we computed. **Let’s look at the opposite situation** – the future value is known and the present value is the unknown that we must compute.

 91

* + 1. **Present value – an example**
			1. Assume a bond will pay **$100** in two years. If an investor can earn **12%** on their investments, **what is the present value of the bond**?

 92

* + - 1. The equation needed to answer this question is as shown, where:
				1. F = the ending balance.
				2. P *=* theamount invested now*.*
				3. r = the rate of interest per period.
				4. n = the number of periods.
			2. Solving this equation, *P* = **$79.72**.
				1. 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**.

 93

* + - 1. We can verify, as shown on the slide, that if we put **$79.72** in the bank today at **12%** interest, it would grow to **$100** at the end of two years.

 94

* + - 1. **We can also use the present value of $1 table from Appendix 13B-1** to verify the accuracy of the $79.72 figure.

 95

* + - * 1. An excerpt of the appropriate table is as shown.
				2. The appropriate present value factor is **0.797** and the present value is **$79.72**.

96-97

*Quick Check – present value calculations*

#### Present value of a series of cash flows

* + 1. Although some investments involve a single sum to be received (or paid) at a single point in the future, other investments involve a **series of identical cash flows** known as an **annuity**.

 98

* + 1. **Lacey Inc. – an example**
			1. Assume Lacey Inc. purchased a tract of land on which a **$60,000** payment will be due **each of the next five years**.

 99

* + - 1. What is the present value of this stream of cash payments when the discount rate is 12%?
			2. **Appendix 13B-2 contains a present value of an annuity of $1 table**. An excerpt from this table is as shown.

 100

* + - 1. The appropriate present value factor is **3.605**. The present value is **$216,300**.

 101-102

*Quick Check – present value of an annuity calculations*

1. **Appendix 13C: income taxes in capital budgeting decisions (Slide #103 is a title slide for this appendix)**

*Learning Objective 8: Include income taxes in a capital budgeting analysis.*

 104

#### Simplifying assumptions

* + 1. **Taxable income equals net income** as computed for financial reports.

 105

* + 1. The tax rate is a **flat percentage** of taxable income.

#### The concept of after-tax cost

* + 1. An expenditure net of its tax effect is known as **after-tax cost**.

 106

* + - 1. The **equation** for determining the after-tax cost of any tax-deductible cash expense is as shown.
		1. **After tax-cost – an example**
			1. Assume a company with a **30% tax rate** is contemplating investing in a training program that will cost **$60,000 per year**.

 107

* + - 1. The aforementioned equation can be used to determine that the after-tax cost of the training program is **$42,000**.
			2. The answer can also be determined by calculating the taxable income and income tax for **two alternatives** – without the training program and with the training program. Notice:
				1. The after-tax cost of the training program is the same – **$42,000**.

 108

* + 1. The amount of net cash inflow realized from a taxable cash receipt after income tax effects have been considered is known as the **after-tax benefit**.

 109

* + - 1. The **equation** for determining the after-tax benefit of any taxable cash receipt is as shown.

*Helpful Hint: Ask students to think of examples of nontaxable cash receipts. For example, the release of working capital at the end of an investment project would not be a taxable cash inflow. Other examples include proceeds from loans, the sale of stock, and the sale of fixed assets at their book value.*

#### Depreciation tax shield

* + 1. While depreciation is not a cash flow, **it does affect the taxes that must be paid** and therefore has an indirect effect on a company’s cash flows.

 110

* + - 1. When depreciation deductions shield revenues from taxation, they are generally referred to as a **depreciation tax shield**.
			2. The **equation** for calculating the tax savings from a depreciation tax shield is as shown.

*Helpful Hint: Remind students that when an asset is purchased, a cash outflow occurs. Depreciation is just the allocation of that purchase price over some estimated life.*

* + 1. **Depreciation tax shield – an example**
			1. Assume that a company has:
				1. Annual cash sales and cash operating expenses of **$500,000** and **$310,000**, respectively.

 111

* + - * 1. A depreciable asset, with no salvage value, on which the annual straight-line depreciation expense is **$90,000**.
				2. A **30%** tax rate.
			1. The aforementioned equation can be used to calculate the depreciation tax shield of **$27,000**.

 112

* + - 1. The answer can also be determined by calculating the taxable income and income tax for **two alternatives** – without the depreciation deduction and with the depreciation deduction. Notice:

 113

* + - * 1. The depreciation tax shield is the same – **$27,000**.

#### Example of income taxes and capital budgeting

* + 1. **Holland Company** owns the mineral rights to land that has a deposit of ore. The company is deciding whether to purchase equipment and open a mine on the property. The mine would be depleted and closed in **10 years** and the equipment would be sold for its salvage value.

 114

* + - 1. Pertinent financial information is as shown.
			2. Holland’s after-tax cost of capital is **12%** and its tax rate is **30%**.

 115

* + - 1. **Should Holland open a mine on the property**?
		1. The **first step** is to compute the net annual cash receipts (**$80,000**) from operating the mine.

 116

* + 1. The **second step** is to identify all relevant cash flows as shown. Notice:

 117

* + - 1. Holland uses **straight-line depreciation, assuming no salvage value**, to compute depreciation deductions for tax purposes.
		1. The **third step** is to translate the relevant cash flows to after-tax cash flows as shown.

 118

* + 1. The **fourth step** is to discount all cash flows to their present value as shown. Notice:

 119

* + - 1. The net present value of the project is **$24,744**.