CHAPTER

8

CAPITAL BUDGETING CASH FLOWS

LEARNING GOALS

- LG1 Understand the key motives for capital expenditure and the steps in the capital budgeting process.
- LG2 Define basic capital budgeting terminology.
- LG3 Discuss the major components of relevant cash flows, expansion versus replacement cash flows, sunk costs and opportunity costs, and international capital budgeting and long-term investments.
- LG4 Calculate the initial investment associated with a proposed capital expenditure.
- LG5 Determine relevant operating cash inflows using the income statement format.
- LG6 Find the terminal cash flow.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand capital budgeting cash flows in order to provide revenue, cost, depreciation, and tax data for use both in monitoring existing projects and in developing cash flows for proposed projects.

Information systems: You need to understand capital budgeting cash flows in order to maintain and facilitate the retrieval of cash flow data for both completed and existing projects.

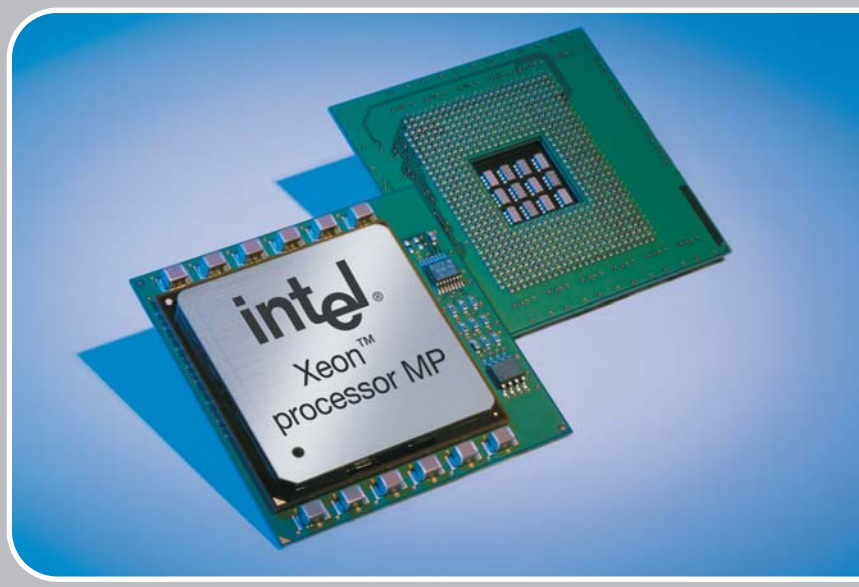
Management: You need to understand capital budgeting cash flows so that you will understand what cash flows are relevant in making decisions about proposals for acquiring additional production facilities, for new products, and for the expansion of existing product lines.

Marketing: You need to understand capital budgeting cash flows so that you can make revenue estimates for proposals for new marketing programs, for new products, and for the expansion of existing product lines.

Operations: You need to understand capital budgeting cash flows so that you can make cost estimates for proposals for the acquisition of new equipment and production facilities.

INTEL

CHIPPING AWAY AT E-BUSINESS INVESTMENT ANALYSIS



It should come as no surprise that **Intel,** the world's largest chip maker and technology pioneer, is also a leader in e-business. Chairman Andy Grove decided in 1998 that Intel would transform itself into a "100 percent e-corporation." Since then, each of the company's new business applications has been based on the Internet or on e-commerce. Leading the Internet initiative was CFO Andy Bryant, whose responsibilities were expanded to include enterprise services.

Bryant was an unlikely choice to lead the company's transformation, because he was skeptical about the value of e-commerce. He quickly changed his tune when he learned that Intel receives over one-quarter of its orders after hours. The flexibility of online ordering added value for customers. Intel has launched more than 300 e-business projects since 1998. In 2001, the company generated 90 percent of its revenue—$31.4 billion—from e-commerce transactions.

Ironically, Bryant's skepticism about e-commerce turned out to be a good thing. He developed methods to analyze e-business proposals to make sure they added value to the company, applying rigorous financial discipline and monitoring returns on investment. "Every project has an ROI," Bryant says. "It isn't always positive, but you still have to measure what you put in and what you get back."

The difficulty comes in deciding what to measure—and how. Like most companies, Intel already had expertise in evaluating new manufacturing facilities and other capital projects. But technology projects also have intangible benefits that aren't easily quantified. One of Bryant's challenges was formalizing financial accountability for e-business applications.

The company's track record has been quite good so far. E-business projects have reduced costs in many areas. For example, an electronic accounts payable (A/P) system was devised to take over many routine transactions so that employees could focus on analysis. Bryant estimates that the present value of this project's cash inflows, less the initial investment, is $8 million. And the company no longer misses opportunities to take advantage of discounts for prompt payments.

Like Intel, every firm must evaluate the costs and returns of projects for expansion, asset replacement or renewal, research and development, advertising, and other areas that require long-term commitments of funds in expectation of future returns. Chapter 8 introduces this process, which is called *capital budgeting,* and explains how to identify the relevant cash outflows and inflows that must be considered in making capital budgeting decisions.

LG1 LG2 8.1 The Capital Budgeting Decision Process

capital budgeting
The process of evaluating and selecting long-term investments that are consistent with the firm's goal of maximizing owner wealth.

Long-term investments represent sizable outlays of funds that commit a firm to some course of action. Consequently, the firm needs procedures to analyze and properly select its long-term investments. It must be able to measure cash flows and apply appropriate decision techniques. As time passes, fixed assets may become obsolete or may require an overhaul; at these points, too, financial decisions may be required. **Capital budgeting** is the process of evaluating and selecting long-term investments that are consistent with the firm's goal of maximizing owner wealth. Firms typically make a variety of long-term investments, but the most common for the manufacturing firm is in *fixed assets,* which include property (land), plant, and equipment. These assets, often referred to as *earning assets,* generally provide the basis for the firm's earning power and value.

Because firms treat capital budgeting (investment) and financing decisions *separately,* Chapters 8 through 10 concentrate on fixed-asset acquisition without regard to the specific method of financing used. We begin by discussing the motives for capital expenditure.

Motives for Capital Expenditure

capital expenditure
An outlay of funds by the firm that is expected to produce benefits over a period of time *greater than* 1 year.

operating expenditure
An outlay of funds by the firm resulting in benefits received *within* 1 year.

A **capital expenditure** is an outlay of funds by the firm that is expected to produce benefits over a period of time *greater than* 1 year. An **operating expenditure** is an outlay resulting in benefits received *within* 1 year. Fixed-asset outlays are capital expenditures, but not all capital expenditures are classified as fixed assets. A $60,000 outlay for a new machine with a usable life of 15 years is a capital expenditure that would appear as a fixed asset on the firm's balance sheet. A $60,000 outlay for advertising that produces benefits over a long period is also a capital expenditure, but would rarely be shown as a fixed asset.[1]

Capital expenditures are made for many reasons. The basic motives for capital expenditures are to expand, replace, or renew fixed assets or to obtain some other, less tangible benefit over a long period. Table 8.1 briefly describes the key motives for making capital expenditures.

Steps in the Process

capital budgeting process
Five distinct but interrelated steps: *proposal generation, review and analysis, decision making, implementation,* and *follow-up.*

The **capital budgeting process** consists of five distinct but interrelated steps.

1. *Proposal generation.* Proposals are made at all levels within a business organization and are reviewed by finance personnel. Proposals that require large outlays are more carefully scrutinized than less costly ones.
2. *Review and analysis.* Formal review and analysis is performed to assess the appropriateness of proposals and evaluate their economic viability. Once the analysis is complete, a summary report is submitted to decision makers.

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1. Some firms do, in effect, capitalize advertising outlays if there is reason to believe that the benefit of the outlay will be received at some future date. The capitalized advertising may appear as a deferred charge such as "deferred advertising expense," which is then amortized over the future. Expenses of this type are often deferred for reporting purposes to increase reported earnings, whereas for tax purposes, the entire amount is expensed to reduce tax liability.

TABLE 8.1 Key Motives for Making Capital Expenditures

Motive	Description
Expansion	The most common motive for a capital expenditure is to expand the level of operations—usually through acquisition of fixed assets. A growing firm often needs to acquire new fixed assets rapidly, as in the purchase of property and plant facilities.
Replacement	As a firm's growth slows and it reaches maturity, most capital expenditures will be made to replace or renew obsolete or worn-out assets. Each time a machine requires a major repair, the outlay for the repair should be compared to the outlay to replace the machine and the benefits of replacement.
Renewal	Renewal, an alternative to replacement, may involve rebuilding, overhauling, or retrofitting an existing fixed asset. For example, an existing drill press could be renewed by replacing its motor and adding a numeric control system, or a physical facility could be renewed by rewiring and adding air conditioning. To improve efficiency, both replacement and renewal of existing machinery may be suitable solutions.
Other purposes	Some capital expenditures do not result in the acquisition or transformation of tangible fixed assets. Instead, they involve a long-term commitment of funds in expectation of a future return. These expenditures include outlays for advertising, research and development, management consulting, and new products. Other capital expenditure proposals—such as the installation of pollution-control and safety devices mandated by the government—are difficult to evaluate because they provide intangible returns rather than clearly measurable cash flows.

3. *Decision making*. Firms typically delegate capital expenditure decision making on the basis of dollar limits. Generally, the board of directors must authorize expenditures beyond a certain amount. Often plant managers are given authority to make decisions necessary to keep the production line moving.
4. *Implementation*. Following approval, expenditures are made and projects implemented. Expenditures for a large project often occur in phases.
5. *Follow-up*. Results are monitored, and actual costs and benefits are compared with those that were expected. Action may be required if actual outcomes differ from projected ones.

Each step in the process is important. Review and analysis and decision making (Steps 2 and 3) consume the majority of time and effort, however. Follow-up (Step 5) is an important but often ignored step aimed at allowing the firm to improve the accuracy of its cash flow estimates continuously. Because of their fundamental importance, this and the following chapters give primary consideration to review and analysis and to decision making.

Basic Terminology

Before we develop the concepts, techniques, and practices related to the capital budgeting process, we need to explain some basic terminology. In addition, we will present some key assumptions that are used to simplify the discussion in the remainder of this chapter and in Chapters 9 and 10.

In Practice

FOCUS ON e-FINANCE Information Technology's Big Byte

Information technology (IT) is one of a company's largest capital expense categories. In the rapidly changing IT environment, managers clamor for the latest hardware and software upgrades to keep IT systems current and improve operational efficiencies. The right IT applications, they claim, can save millions in operating costs. Financial managers, on the other hand, struggle to control capital spending while at the same time approving projects that boost the company's competitive position. Although some of these projects involve the latest hardware and software, many more now focus on leveraging the firm's investment in existing technology by centralizing technology services, integrating the different parts of a company's information systems, and making similar improvements. E-business projects are also on the rise and now account for an average of 15.5 percent of the total IT budget.

With so much at stake in terms of dollars spent and potential benefits, managers must create a business case that justifies the project and shows how it adds value—no easy task. In addition to measuring dollar benefits that appear on the firm's income statement, they must attempt to quantify indirect and qualitative benefits. This may be straightforward for transactional systems, where order volume is a critical measure. But how does the company assign a dollar value to, for example, the increased customer satisfaction generated by a new, easier-to-use interface for its customer information system?

During 2001, declining sales and an uncertain economic future meant companies had to choose IT projects that yielded the greatest return on investment or gave the biggest strategic advantage. Gary Clark, director of corporate IT services at **La-Z-Boy Inc.**, the leading U.S. manufacturer of upholstered furniture, said, "Previously, we would look primarily at high-level issues. Now, we're not only examining the details of a project but also the underlying assumptions and the business case. It's all about cost and results." La-Z-Boy decided to postpone projects related to information security and general business systems but moved ahead with strategic technology projects. For example, analysis of a new payroll and human resources system showed that it should lower costs for the entire organization.

Sources: Shari Caudron, "The Tao of E-Business," *Business Finance* (September 2001), downloaded from *www.businessfinance.com;* Sam Greengard, "IT: Luxury or Necessity?" *Industry Week* (December 1, 2001), downloaded from *www. industryweek.com;* and Ivy McLemore, "High Stakes Game," *Business Finance* (May 1999), downloaded from *www.businessfinance.com.*

Independent versus Mutually Exclusive Projects

independent projects
Projects whose cash flows are unrelated or independent of one another; the acceptance of one *does not eliminate* the others from further consideration.

mutually exclusive projects
Projects that compete with one another, so that the acceptance of one *eliminates* from further consideration all other projects that serve a similar function.

The two most common types of projects are (1) independent projects and (2) mutually exclusive projects. **Independent projects** are those whose cash flows are unrelated or independent of one another; the acceptance of one *does not eliminate* the others from further consideration. **Mutually exclusive projects** are those that have the same function and therefore compete with one another. The acceptance of one *eliminates* from further consideration all other projects that serve a similar function. For example, a firm in need of increased production capacity could obtain it by (1) expanding its plant, (2) acquiring another company, or (3) contracting with another company for production. Clearly, accepting any one option eliminates the need for either of the others.

Unlimited Funds versus Capital Rationing

unlimited funds
The financial situation in which a firm is able to accept all independent projects that provide an acceptable return.

The availability of funds for capital expenditures affects the firm's decisions. If a firm has **unlimited funds** for investment, making capital budgeting decisions is quite simple: All independent projects that will provide an acceptable return can

capital rationing
The financial situation in which a firm has only a fixed number of dollars available for capital expenditures, and numerous projects compete for these dollars.

be accepted. Typically, though, firms operate under **capital rationing** instead. This means that they have only a fixed number of dollars available for capital expenditures and that numerous projects will compete for these dollars. Procedures for dealing with capital rationing are presented in Chapter 10. The discussions that follow here and in the following chapter assume unlimited funds.

Accept–Reject versus Ranking Approaches

accept–reject approach
The evaluation of capital expenditure proposals to determine whether they meet the firm's minimum acceptance criterion.

Two basic approaches to capital budgeting decisions are available. The **accept–reject approach** involves evaluating capital expenditure proposals to determine whether they meet the firm's minimum acceptance criterion. This approach can be used when the firm has unlimited funds, as a preliminary step when evaluating mutually exclusive projects, or in a situation in which capital must be rationed. In these cases, only acceptable projects should be considered.

ranking approach
The ranking of capital expenditure projects on the basis of some predetermined measure, such as the rate of return.

The second method, the **ranking approach,** involves ranking projects on the basis of some predetermined measure, such as the rate of return. The project with the highest return is ranked first, and the project with the lowest return is ranked last. Only acceptable projects should be ranked. Ranking is useful in selecting the "best" of a group of mutually exclusive projects and in evaluating projects with a view to capital rationing.

Conventional versus Nonconventional Cash Flow Patterns

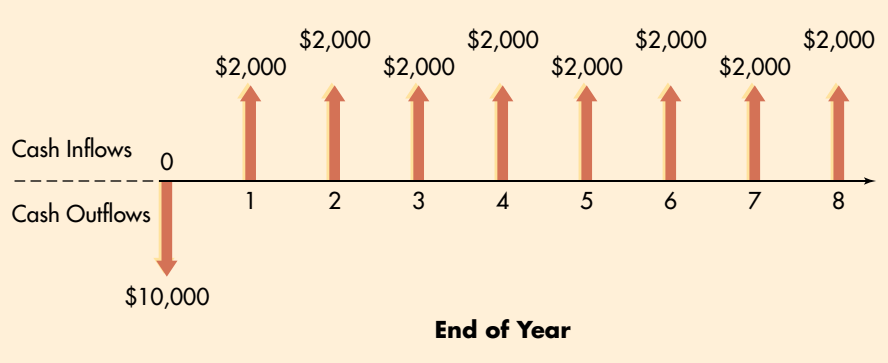
conventional cash flow pattern
An initial outflow followed only by a series of inflows.

Cash flow patterns associated with capital investment projects can be classified as *conventional* or *nonconventional*. A **conventional cash flow pattern** consists of an initial outflow followed only by a series of inflows. For example, a firm may spend $10,000 today and as a result expect to receive equal annual cash inflows (an annuity) of $2,000 each year for the next 8 years, as depicted on the time line in Figure 8.1.[2] A conventional cash flow pattern that provides unequal annual cash inflows is depicted in Figure 8.3 on page 361.

nonconventional cash flow pattern
An initial outflow followed by a series of inflows *and* outflows.

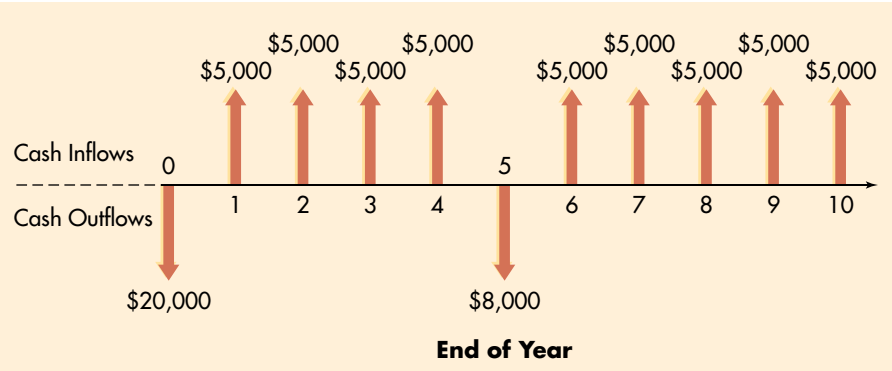
A **nonconventional cash flow pattern** is one in which an initial outflow is followed by a series of inflows *and* outflows. For example, the purchase of a machine

FIGURE 8.1
Conventional Cash Flow
Time line for a conventional cash flow pattern



2. Arrows rather than plus or minus signs are frequently used on time lines to distinguish between cash inflows and cash outflows. Upward-pointing arrows represent cash inflows (positive cash flows), and downward-pointing arrows represent cash outflows (negative cash flows).

FIGURE 8.2
Nonconventional Cash Flow
Time line for a nonconventional cash flow pattern



may require an initial cash outflow of $20,000 and may generate cash inflows of $5,000 each year for 4 years. In the fifth year after purchase, an outflow of $8,000 may be required to overhaul the machine, after which it generates inflows of $5,000 each year for 5 more years. This nonconventional pattern is illustrated on the time line in Figure 8.2.

Difficulties often arise in evaluating projects with nonconventional patterns of cash flow. *The discussions in the remainder of this chapter and in Chapters 9 and 10 are therefore limited to the evaluation of conventional cash flow patterns.*

Review Questions

8–1 What is *capital budgeting?* Do all capital expenditures involve fixed assets? Explain.

8–2 What are the key motives for making capital expenditures? Discuss, compare, and contrast them.

8–3 What are the five steps involved in the capital budgeting process?

8–4 Differentiate between the members of each of the following pairs of capital budgeting terms: (**a**) independent versus mutually exclusive projects; (**b**) unlimited funds versus capital rationing; (**c**) accept–reject versus ranking approaches; and (**d**) conventional versus nonconventional cash flow patterns.

LG3 8.2 The Relevant Cash Flows

relevant cash flows
The *incremental cash outflow (investment) and resulting subsequent inflows* associated with a proposed capital expenditure.

incremental cash flows
The *additional* cash flows—outflows or inflows—expected to result from a proposed capital expenditure.

To evaluate capital expenditure alternatives, the firm must determine the **relevant cash flows.** These are the *incremental cash outflow (investment) and resulting subsequent inflows*. The **incremental cash flows** represent the *additional* cash flows—outflows or inflows—expected to result from a proposed capital expenditure. As noted in Chapter 3, cash flows rather than accounting figures are used, because cash flows directly affect the firm's ability to pay bills and purchase assets. The remainder of this chapter is devoted to the procedures for measuring the relevant cash flows associated with proposed capital expenditures.

Major Cash Flow Components

initial investment
The relevant cash outflow for a proposed project at time zero.

operating cash inflows
The incremental after-tax cash inflows resulting from implementation of a project during its life.

terminal cash flow
The after-tax nonoperating cash flow occurring in the final year of a project. It is usually attributable to liquidation of the project.

The cash flows of any project having the *conventional pattern* can include three basic components: (1) an initial investment, (2) operating cash inflows, and (3) terminal cash flow. All projects—whether for expansion, replacement, renewal, or some other purpose—have the first two components. Some, however, lack the final component, terminal cash flow.

Figure 8.3 depicts on a time line the cash flows for a project. The **initial investment** for the proposed project is $50,000. This is the relevant cash outflow at time zero. The **operating cash inflows,** which are the incremental after-tax cash inflows resulting from implementation of the project during its life, gradually increase from $4,000 in its first year to $10,000 in its tenth and final year. The **terminal cash flow** is the after-tax nonoperating cash flow occurring in the final year of the project. It is usually attributable to liquidation of the project. In this case it is $25,000, received at the end of the project's 10-year life. Note that the terminal cash flow does *not* include the $10,000 operating cash inflow for year 10.

Expansion versus Replacement Cash Flows

Developing relevant cash flow estimates is most straightforward in the case of *expansion decisions*. In this case, the initial investment, operating cash inflows, and terminal cash flow are merely the after-tax cash outflow and inflows associated with the proposed capital expenditure.

Identifying relevant cash flows for *replacement decisions* is more complicated, because the firm must identify the *incremental* cash outflow and inflows that would result from the proposed replacement. The initial investment in the case of replacement is the difference between the initial investment needed to acquire the new asset and any after-tax cash inflows expected from liquidation of

FIGURE 8.3
Cash Flow Components
Time line for major cash flow components

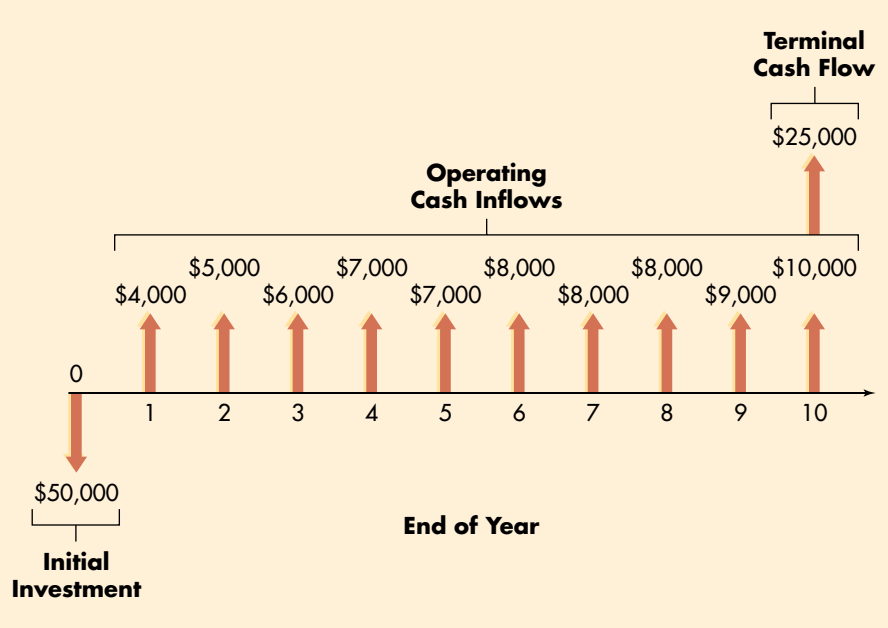
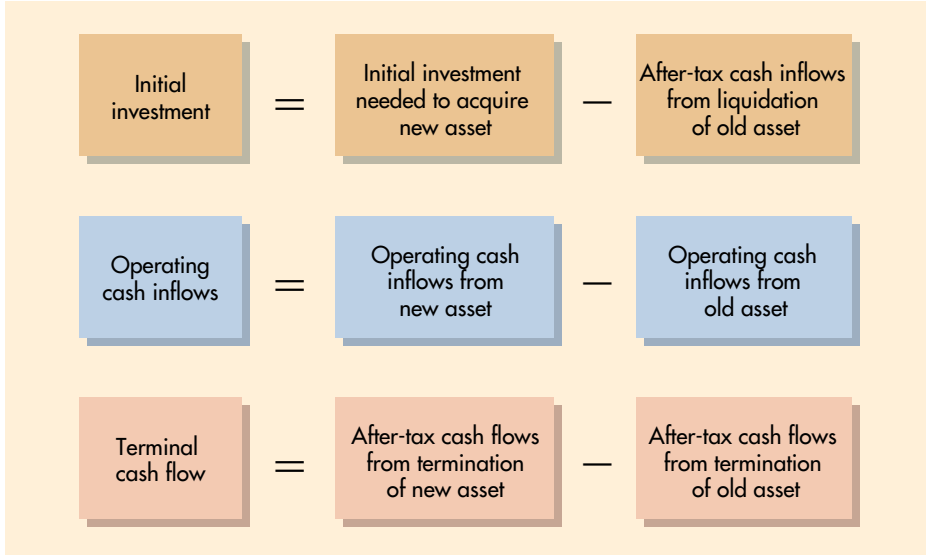


FIGURE 8.4

Relevant Cash Flows for Replacement Decisions
Calculation of the three components of relevant cash flow for a replacement decision



the old asset. The operating cash inflows are the difference between the operating cash inflows from the new asset and those from the old asset. The terminal cash flow is the difference between the after-tax cash flows expected upon termination of the new and the old assets. These relationships are shown in Figure 8.4.

Actually, all capital budgeting decisions can be viewed as replacement decisions. Expansion decisions are merely replacement decisions in which all cash flows from the old asset are zero. In light of this fact, this chapter focuses primarily on replacement decisions.

Sunk Costs and Opportunity Costs

When estimating the relevant cash flows associated with a proposed capital expenditure, the firm must recognize any *sunk costs* and *opportunity costs*. These costs are easy to mishandle or ignore, particularly when determining a project's incremental cash flows. **Sunk costs** are cash outlays that have already been made (past outlays) and therefore have no effect on the cash flows relevant to the current decision. As a result, *sunk costs should not be included in a project's incremental cash flows.*

sunk costs
Cash outlays that have already been made (past outlays) and therefore have no effect on the cash flows relevant to a current decision.

Opportunity costs are cash flows that could be realized from the best alternative use of an owned asset. They therefore represent cash flows that will *not be realized* as a result of employing that asset in the proposed project. Because of this, any *opportunity costs should be included as cash outflows when one is determining a project's incremental cash flows.*

opportunity costs
Cash flows that could be realized from the best alternative use of an owned asset.

EXAMPLE

Jankow Equipment is considering renewing its drill press X12, which it purchased 3 years earlier for $237,000, by retrofitting it with the computerized control system from an obsolete piece of equipment it owns. The obsolete equipment could be sold today for a high bid of $42,000, but without its computerized control system, it would be worth nothing. Jankow is in the process of estimating the labor

In Practice

FOCUS ON PRACTICE Coors Brews Better Financial Performance

As **Coors Brewing Company** grew from a local brewer to the number-3 national brand, it went on a capital spending spree to add capacity. The firm needed better financial planning, however: Managers did not prepare project cost reports, the company bought top-of-the-line equipment, top management approved projects in spite of unattractive projected returns. By the early 1990s, Coors' financial performance was suffering.

This changed in 1995 when seasoned financial executive Tim Wolf joined Coors as CFO. Wolf quickly identified the need for greater financial discipline in planning and capital budgeting. He implemented more stringent guidelines for capital spending and required business unit managers to develop a sound business case to justify proposed capital expenditures. He also created a partnership between finance and operating departments, which now recognized the key role that finance plays.

The first project to use Wolf's new capital budgeting procedures was a facility to wash and sanitize returnable bottles. Before replacing outdated equipment, managers analyzed the financial implications of six operating scenarios to determine the best alternative: moving the facility to Virginia. Every department that would be affected had input into the facility's design and into estimates of its operating costs. The project team presented the complete business case to Wolf, who spent 6 months asking questions that resulted in cutting over 25 percent from the initial cost estimates. "I think the extra time was well spent," says Wolf. "If you can reduce your capital costs, leverage the benefits, and get them faster, that's the way to run your capital process."

In Wolf's first 3 years at Coors, capital spending dropped significantly, return on invested capital rose from 5.9 percent in 1995 to 8.8 percent in late 1997, and cash flow went from a negative $26 million to a positive $138 million. The company continued to apply its disciplined capital budgeting approach to expansion projects required to meet a large increase in demand. By 2000, return on invested capital was almost 12 percent, and return on equity was almost 13 percent. The result was improved shareholder value as the stock price climbed from $19 in early 1997 to peak at $82 in December 2000; it was trading at about $65 a share in March 2002.

Sources: Stephen Barr, "Coors's New Brew," *CFO* (March 1998), downloaded from *www.cfonet.com; Coors Annual Report, 2000, www.coors.com;* "Coors Reports 13 Percent Rise," *AP Online* (October 25, 2001), downloaded from *Electric Library, ask.elibrary.com;* and John Rebchook, "Coors Building Expanded Distribution Facility off I-70," *Denver Rocky Mountain News* (December 19, 2001), p. 4B.

Hint **Sunk costs and opportunity costs are concepts you must fully understand. Funds already spent are irrelevant to future decisions, but funds given to one project that eliminates the investment returns of another project *are* considered a relevant cost.**

and materials costs of retrofitting the system to drill press X12 and the benefits expected from the retrofit. The $237,000 cost of drill press X12 is a *sunk cost* because it represents an earlier cash outlay. It *would not be included* as a cash outflow when determining the cash flows relevant to the retrofit decision. Although Jankow owns the obsolete piece of equipment, the proposed use of its computerized control system represents an *opportunity cost* of $42,000—the highest price at which it could be sold today. This opportunity cost *would be included* as a cash outflow associated with using the computerized control system.

International Capital Budgeting and Long-Term Investments

Although the same basic capital budgeting principles are used for domestic and international projects, several additional factors must be addressed in evaluating foreign investment opportunities. International capital budgeting differs from the domestic version because (1) cash outflows and inflows occur in a foreign currency, and (2) foreign investments entail potentially significant political risk. Both of these risks can be minimized through careful planning.

Companies face both long-term and short-term *currency risks* related to both the invested capital and the cash flows resulting from it. Long-term currency risk can be minimized by financing the foreign investment at least partly in the local capital markets rather than with dollar-denominated capital from the parent company. This step ensures that the project's revenues, operating costs, and financing costs will be in the local currency. Likewise, the dollar value of short-term, local-currency cash flows can be protected by using special securities and strategies such as futures, forwards, and options market instruments.

Political risks can be minimized by using both operating and financial strategies. For example, by structuring the investment as a joint venture and selecting a well-connected local partner, the U.S. company can minimize the risk of its operations being seized or harassed. Companies also can protect themselves from having their investment returns blocked by local governments by structuring the financing of such investments as debt rather than as equity. Debt-service payments are legally enforceable claims, whereas equity returns (such as dividends) are not. Even if local courts do not support the claims of the U.S. company, the company can threaten to pursue its case in U.S. courts.

foreign direct investment
The transfer of capital, managerial, and technical assets to a foreign country.

In spite of the preceding difficulties, **foreign direct investment,** which involves the transfer of capital, managerial, and technical assets to a foreign country, has surged in recent years. This is evident in the growing market values of foreign assets owned by U.S.-based companies and of foreign direct investment in the United States, particularly by British, Canadian, Dutch, German, and Japanese companies. Furthermore, foreign direct investment by U.S. companies seems to be accelerating.

Review Questions

8–5 Why is it important to evaluate capital budgeting projects on the basis of *incremental cash flows?*

8–6 What three components of cash flow may exist for a given project? How can expansion decisions be treated as replacement decisions? Explain.

8–7 What effect do *sunk costs* and *opportunity costs* have on a project's incremental cash flows?

8–8 How can *currency risk* and *political risk* be minimized when one is making *foreign direct investment?*

8.3 Finding the Initial Investment

The term *initial investment* as used here refers to the relevant cash outflows to be considered when evaluating a prospective capital expenditure. Because our discussion of capital budgeting is concerned only with investments that exhibit conventional cash flows, the initial investment occurs at *time zero*—the time at which the expenditure is made. The initial investment is calculated by subtracting all cash inflows occurring at time zero from all cash outflows occurring at time zero.

The basic format for determining the initial investment is given in Table 8.2. The cash flows that must be considered when determining the initial investment

TABLE 8.2 The Basic Format for Determining Initial Investment

	Installed cost of new asset =
	Cost of new asset
+	Installation costs
−	**After-tax proceeds from sale of old asset =**
	Proceeds from sale of old asset
∓	Tax on sale of old asset
±	**Change in net working capital**
	Initial investment

associated with a capital expenditure are the installed cost of the new asset, the after-tax proceeds (if any) from the sale of an old asset, and the change (if any) in net working capital. Note that if there are no installation costs and the firm is not replacing an existing asset, then the purchase price of the asset, adjusted for any change in net working capital, is equal to the initial investment.

cost of new asset
The net outflow necessary to acquire a new asset.

installation costs
Any added costs that are necessary to place an asset into operation.

installed cost of new asset
The cost of the asset plus its installation costs; equals the asset's depreciable value.

after-tax proceeds from sale of old asset
The difference between the old asset's sale proceeds and any applicable taxes or tax refunds related to its sale.

proceeds from sale of old asset
The cash inflows, net of any *removal* or *cleanup costs*, resulting from the sale of an existing asset.

tax on sale of old asset
Tax that depends on the relationship among the old asset's sale price, initial purchase price, and *book value*, and on existing government tax rules.

Installed Cost of New Asset

As shown in Table 8.2, the installed cost of the new asset is found by adding the cost of the new asset to its installation costs. The **cost of new asset** is the net outflow that its acquisition requires. Usually, we are concerned with the acquisition of a fixed asset for which a definite purchase price is paid. **Installation costs** are any added costs that are necessary to place an asset into operation. The Internal Revenue Service (IRS) requires the firm to add installation costs to the purchase price of an asset to determine its depreciable value, which is expensed over a period of years. The **installed cost of new asset,** calculated by adding the cost of the asset to its installation costs, equals its depreciable value.

After-Tax Proceeds from Sale of Old Asset

Table 8.2 shows that the **after-tax proceeds from sale of old asset** decrease the firm's initial investment in the new asset. These proceeds are the difference between the old asset's sale proceeds and any applicable taxes or tax refunds related to its sale. The **proceeds from sale of old asset** are the net cash inflows it provides. This amount is net of any costs incurred in the process of removing the asset. Included in these *removal costs* are *cleanup costs*, such as those related to removal and disposal of chemical and nuclear wastes. These costs may not be trivial.

The proceeds from the sale of an old asset are normally subject to some type of tax.[3] This **tax on sale of old asset** depends on the relationship among its sale price, initial purchase price, and *book value*, and on existing government tax rules.

3. A brief discussion of the tax treatment of ordinary and capital gains income was presented in Chapter 1.

book value
The strict accounting value of an asset, calculated by subtracting its accumulated depreciation from its installed cost.

Book Value

The **book value** of an asset is its strict accounting value. It can be calculated by using the following equation:

$$\text{Book value} = \text{Installed cost of asset} - \text{Accumulated depreciation} \quad (8.1)$$

EXAMPLE

Hudson Industries, a small electronics company, 2 years ago acquired a machine tool with an installed cost of $100,000. The asset was being depreciated under MACRS using a 5-year recovery period.[4] Table 3.2 (page 100) shows that under MACRS for a 5-year recovery period, 20% and 32% of the installed cost would be depreciated in years 1 and 2, respectively. In other words, 52% (20% + 32%) of the $100,000 cost, or $52,000 (0.52 × $100,000), would represent the accumulated depreciation at the end of year 2. Substituting into Equation 8.1, we get

$$\text{Book value} = \$100{,}000 - \$52{,}000 = \underline{\$48{,}000}$$

The book value of Hudson's asset at the end of year 2 is therefore $48,000.

Basic Tax Rules

Four potential tax situations can occur when an asset is sold. These situations depend on the relationship between the asset's sale price, its initial purchase price, and its book value. The three key forms of taxable income and their associated tax treatments are defined and summarized in Table 8.3. The assumed tax rates used throughout this text are noted in the final column. There are four possible tax situations, which result in one or more forms of taxable income: The

TABLE 8.3 Tax Treatment on Sales of Assets

Form of taxable income	Definition	Tax treatment	Assumed tax rate
Capital gain	Portion of the sale price that is in excess of the initial purchase price.	Regardless of how long the asset has been held, the total capital gain is taxed as ordinary income.	40%
Recaptured depreciation	Portion of the sale price that is in excess of book value and represents a recovery of previously taken depreciation.	All recaptured depreciation is taxed as ordinary income.	40%
Loss on sale of asset	Amount by which sale price is *less than* book value.	If the asset is depreciable and used in business, loss is deducted from ordinary income.	40% of loss is a tax savings
		If the asset is *not* depreciable or is *not* used in business, loss is deductible only against capital gains.	40% of loss is a tax savings

4. For a review of MACRS, see Chapter 3. Under current tax law, most manufacturing equipment has a 7-year recovery period, as noted in Table 3.1. Using this recovery period results in 8 years of depreciation, which unnecessarily complicates examples and problems. To simplify, *manufacturing equipment is treated as a 5-year asset in this and the following chapters.*

asset may be sold (1) for more than its initial purchase price, (2) for more than its book value but less than its initial purchase price, (3) for its book value, or (4) for less than its book value. An example will illustrate.

EXAMPLE

The old asset purchased 2 years ago for $100,000 by Hudson Industries has a current book value of $48,000. What will happen if the firm now decides to sell the asset and replace it? The tax consequences depend on the sale price. Figure 8.5 on page 368 depicts the taxable income resulting from four possible sale prices in light of the asset's initial purchase price of $100,000 and its current book value of $48,000. The taxable consequences of each of these sale prices is described below.

The sale of the asset for more than its initial purchase price If Hudson sells the old asset for $110,000, it realizes a capital gain of $10,000, which is taxed as ordinary income.[5] The firm also experiences ordinary income in the form of **recaptured depreciation,** which is the portion of the sale price that is above book value and below the initial purchase price. In this case there is recaptured depreciation of $52,000 ($100,000 − $48,000). Both the $10,000 capital gain and the $52,000 recaptured depreciation are shown under the $110,000 sale price in Figure 8.5. The taxes on the total gain of $62,000 are calculated as follows:

recaptured depreciation
The portion of an asset's sale price that is above its book value and below its initial purchase price.

	Amount (1)	Rate (2)	Tax [(1) × (2)] (3)
Capital gain	$10,000	0.40	$ 4,000
Recaptured depreciation	52,000	0.40	20,800
Totals	$62,000		$24,800

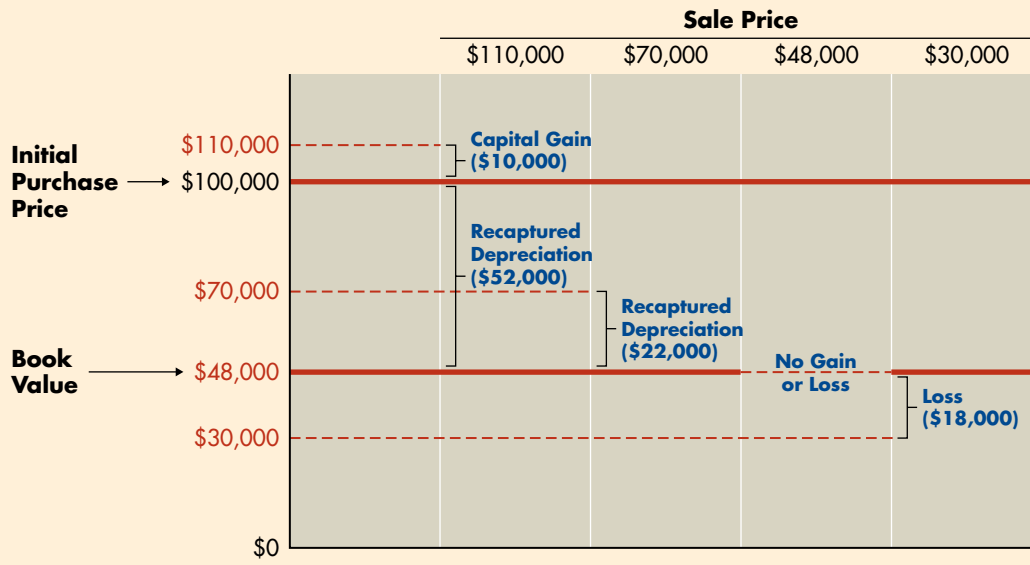
These taxes should be used in calculating the initial investment in the new asset, using the format in Table 8.2. In effect, the taxes raise the amount of the firm's initial investment in the new asset by reducing the proceeds from the sale of the old asset.

The sale of the asset for more than its book value but less than its initial purchase price If Hudson sells the old asset for $70,000, there is no capital gain. However, the firm still experiences a gain in the form of recaptured depreciation of $22,000 ($70,000 − $48,000), as shown under the $70,000 sale price in Figure 8.5. This recaptured depreciation is taxed as ordinary income. Because the firm is assumed to be in the 40% tax bracket, the taxes on the $22,000 gain are $8,800. This amount in taxes should be used in calculating the initial investment in the new asset.

The sale of the asset for its book value If the asset is sold for $48,000, its book value, the firm breaks even. There is no gain or loss, as shown under the $48,000

5. Although the current tax law requires corporate capital gains to be treated as ordinary income, the structure for corporate capital gains is retained under the law to facilitate a rate differential in the likely event of future tax revisions. Therefore, this distinction is made throughout the text discussions.

FIGURE 8.5 **Taxable Income from Sale of Asset**
Taxable income from sale of asset at various sale prices for Hudson Industries



sale price in Figure 8.5. Because *no tax results from selling an asset for its book value,* there is no tax effect on the initial investment in the new asset.

The sale of the asset for less than its book value If Hudson sells the asset for $30,000, it experiences a loss of $18,000 ($48,000 − $30,000), as shown under the $30,000 sale price in Figure 8.5. If this is a depreciable asset used in the business, the loss may be used to offset ordinary operating income. If the asset is *not* depreciable or is *not* used in the business, the loss can be used only to offset capital gains. In either case, the loss will save the firm $7,200 ($18,000 × 0.40) in taxes. And, if current operating earnings or capital gains are not sufficient to offset the loss, the firm may be able to apply these losses to prior or future years' taxes.[6]

Change in Net Working Capital[7]

net working capital
The amount by which a firm's current assets exceed its current liabilities.

Net working capital is the amount by which a firm's current assets exceed its current liabilities. This topic is treated in depth in Chapter 14, but at this point it is important to note that changes in net working capital often accompany capital expenditure decisions. If a firm acquires new machinery to expand its level of operations, it will experience an increase in levels of cash, accounts receivable, inventories, accounts payable, and accruals. These increases result from the need

6. As noted in Chapter 1, the tax law provides detailed procedures for using *tax loss carrybacks/carryforwards*. Application of such procedures to capital budgeting is beyond the scope of this text, and they are therefore ignored in subsequent discussions.

7. Occasionally, this cash outflow is intentionally ignored to enhance the attractiveness of a proposed investment and thereby improve its likelihood of acceptance. Similar intentional omissions and/or overly optimistic estimates are sometimes made to enhance project acceptance. The presence of formal review and analysis procedures should help the firm to ensure that capital budgeting cash flow estimates are realistic and unbiased and that the "best" projects—those that make the maximum contribution to owner wealth—are accepted.

TABLE 8.4 Calculation of Change in Net Working Capital for Danson Company

Current account	Change in balance	
Cash	+$ 4,000	
Accounts receivable	+ 10,000	
Inventories	+ 8,000	
(1) Current assets		+$22,000
Accounts payable	+$ 7,000	
Accruals	+ 2,000	
(2) Current liabilities		+ 9,000
Change in net working capital [(1) − (2)]		+$13,000

for more cash to support expanded operations, more accounts receivable and inventories to support increased sales, and more accounts payable and accruals to support increased outlays made to meet expanded product demand. As noted in Chapter 3, increases in cash, accounts receivable, and inventories are *outflows of cash,* whereas increases in accounts payable and accruals are *inflows of cash.*

change in net working capital
The difference between a change in current assets and a change in current liabilities.

The difference between the change in current assets and the change in current liabilities is the **change in net working capital.** Generally, current assets increase by more than current liabilities, resulting in an increased investment in net working capital. This increased investment is treated as an initial outflow.[8] If the change in net working capital were negative, it would be shown as an initial inflow. The change in net working capital—regardless of whether it is an increase or a decrease—*is not taxable* because it merely involves a net buildup or net reduction of current accounts.

EXAMPLE

Danson Company, a metal products manufacturer, is contemplating expanding its operations. Financial analysts expect that the changes in current accounts summarized in Table 8.4 will occur and will be maintained over the life of the expansion. Current assets are expected to increase by $22,000, and current liabilities are expected to increase by $9,000, resulting in a $13,000 increase in net working capital. In this case, the increase will represent an increased net working capital investment and will be treated as a cash outflow in calculating the initial investment.

Calculating the Initial Investment

A variety of tax and other considerations enter into the initial investment calculation. The following example illustrates calculation of the initial investment according to the format in Table 8.2.[9]

8. When changes in net working capital apply to the initial investment associated with a proposed capital expenditure, they are for convenience assumed to be instantaneous and thereby occurring at time zero. In practice, the change in net working capital will frequently occur over a period of months as the capital expenditure is implemented.

9. Throughout the discussions of capital budgeting, all assets evaluated as candidates for replacement are assumed to be depreciable assets that are directly used in the business, so any losses on the sale of these assets can be applied against ordinary operating income. The decisions are also structured to ensure that the usable life remaining on the old asset is just equal to the life of the new asset; this assumption enables us to avoid the problem of unequal lives, which is discussed in Chapter 10.

EXAMPLE Powell Corporation, a large, diversified manufacturer of aircraft components, is trying to determine the initial investment required to replace an old machine with a new, more sophisticated model. The machine's purchase price is $380,000, and an additional $20,000 will be necessary to install it. It will be depreciated under MACRS using a 5-year recovery period. The present (old) machine was purchased 3 years ago at a cost of $240,000 and was being depreciated under MACRS using a 5-year recovery period. The firm has found a buyer willing to pay $280,000 for the present machine and to remove it at the buyer's expense. The firm expects that a $35,000 increase in current assets and an $18,000 increase in current liabilities will accompany the replacement; these changes will result in a $17,000 ($35,000 − $18,000) *increase* in net working capital. Both ordinary income and capital gains are taxed at a rate of 40%.

The only component of the initial investment calculation that is difficult to obtain is taxes. Because the firm is planning to sell the present machine for $40,000 more than its initial purchase price, a *capital gain* of $40,000 will be realized. The book value of the present machine can be found by using the depreciation percentages from Table 3.2 (page 100) of 20%, 32%, and 19% for years 1, 2, and 3, respectively. The resulting *book value is $69,600* ($240,000 − [(0.20 + 0.32 + 0.19) × $240,000]). An *ordinary gain* of $170,400 ($240,000 − $69,600) in recaptured depreciation is also realized on the sale. The total taxes on the gain are $84,160 [($40,000 + $170,400) × 0.40]. Substituting these amounts into the format in Table 8.2 results in an initial investment of $221,160, which represents the net cash outflow required at time zero.

Installed cost of proposed machine		
Cost of proposed machine	$380,000	
+ Installation costs	20,000	
Total installed cost—proposed (depreciable value)		$400,000
− After-tax proceeds from sale of present machine		
Proceeds from sale of present machine	$280,000	
− Tax on sale of present machine	84,160	
Total after-tax proceeds—present		195,840
+ Change in net working capital		17,000
Initial investment		$221,160

Review Questions

8–9 Explain how each of the following inputs is used to calculate the *initial investment:* (**a**) cost of new asset, (**b**) installation costs, (**c**) proceeds from sale of old asset, (**d**) tax on sale of old asset, and (**e**) change in net working capital.

8–10 How is the *book value* of an asset calculated? What are the three key forms of taxable income?

8–11 What four tax situations may result from the sale of an asset that is being replaced?

8–12 Referring to the basic format for calculating initial investment, explain how a firm would determine the *depreciable value* of the new asset.

8.4 Finding the Operating Cash Inflows

The benefits expected from a capital expenditure or "project" are embodied in its *operating cash inflows*, which are *incremental after-tax cash inflows*. In this section we use the income statement format to develop clear definitions of the terms *after-tax*, *cash inflows*, and *incremental*.

Interpreting the Term *After-Tax*

Benefits expected to result from proposed capital expenditures must be measured on an *after-tax basis*, because the firm will not have the use of any benefits until it has satisfied the government's tax claims. These claims depend on the firm's taxable income, so deducting taxes *before* making comparisons between proposed investments is necessary for consistency when evaluating capital expenditure alternatives.

Interpreting the Term *Cash Inflows*

All benefits expected from a proposed project must be measured on a *cash flow basis*. Cash inflows represent dollars that can be spent, not merely "accounting profits." A simple accounting technique for converting after-tax net profits into operating cash inflows was given in Equation 3.1 on page 102. The basic calculation requires adding depreciation and any other *noncash charges* (amortization and depletion) deducted as expenses on the firm's income statement back to net profits after taxes. Because depreciation is commonly found on income statements, it is the only noncash charge we consider.

EXAMPLE Powell Corporation's estimates of its revenue and expenses (excluding depreciation), with and without the proposed new machine described in the preceding example, are given in Table 8.5. Note that both the expected usable life of the proposed machine and the remaining usable life of the present machine are 5 years. The amount to be depreciated with the proposed machine is calculated by

TABLE 8.5 Powell Corporation's Revenue and Expenses (Excluding Depreciation) for Proposed and Present Machines

With proposed machine			With present machine		
Year	Revenue (1)	Expenses (excl. depr.) (2)	Year	Revenue (1)	Expenses (excl. depr.) (2)
1	$2,520,000	$2,300,000	1	$2,200,000	$1,990,000
2	2,520,000	2,300,000	2	2,300,000	2,110,000
3	2,520,000	2,300,000	3	2,400,000	2,230,000
4	2,520,000	2,300,000	4	2,400,000	2,250,000
5	2,520,000	2,300,000	5	2,250,000	2,120,000

TABLE 8.6 Depreciation Expense for Proposed and Present Machines for Powell Corporation

Year	Cost (1)	Applicable MACRS depreciation percentages (from Table 3.2) (2)	Depreciation [(1) × (2)] (3)
With proposed machine			
1	$400,000	20%	$ 80,000
2	400,000	32	128,000
3	400,000	19	76,000
4	400,000	12	48,000
5	400,000	12	48,000
6	400,000	5	20,000
Totals		100%	$400,000
With present machine			
1	$240,000	12% (year-4 depreciation)	$28,800
2	240,000	12 (year-5 depreciation)	28,800
3	240,000	5 (year-6 depreciation)	12,000
4	Because the present machine is at the end of the third year of its cost recovery at the time the analysis is performed, it has only the final 3 years of depreciation (as noted above) still applicable.		0
5			0
6			0
Total			$69,600[a]

[a]The total $69,600 represents the book value of the present machine at the end of the third year, as calculated in the preceding example.

summing the purchase price of $380,000 and the installation costs of $20,000. The proposed machine is to be depreciated under MACRS using a 5-year recovery period.[10] The resulting depreciation on this machine for each of the 6 years, as well as the remaining 3 years of depreciation (years 4, 5, and 6) on the present machine, are calculated in Table 8.6.[11]

The operating cash inflows in each year can be calculated by using the income statement format shown in Table 8.7. Substituting the data from Tables 8.5 and 8.6 into this format and assuming a 40% tax rate, we get Table 8.8. It demonstrates the calculation of operating cash inflows for each year for both the proposed and the present machine. Because the proposed machine is depreciated over 6 years, the analysis must be performed over the 6-year period to capture fully the tax effect of its year-6 depreciation. The resulting operating cash inflows are shown in the final row of Table 8.8 for each machine. The $8,000 year-6 cash inflow for the proposed machine results solely from the tax benefit of its year-6 depreciation deduction.

10. As noted in Chapter 3, it takes $n + 1$ years to depreciate an n-year class asset under current tax law. Therefore, MACRS percentages are given for each of 6 years for use in depreciating an asset with a 5-year recovery period.

11. It is important to recognize that although both machines will provide 5 years of use, the proposed new machine will be depreciated over the 6-year period, whereas the present machine, as noted in the preceding example, has been depreciated over 3 years and therefore has remaining only its final 3 years (years 4, 5, and 6) of depreciation (12%, 12%, and 5%, respectively, under MACRS).

TABLE 8.7 Calculation of Operating Cash Inflows Using the Income Statement Format

Revenue
− Expenses (excluding depreciation)
Profits before depreciation and taxes
− Depreciation
Net profits before taxes
− Taxes
Net profits after taxes
+ Depreciation
Operating cash inflows

TABLE 8.8 Calculation of Operating Cash Inflows for Powell Corporation's Proposed and Present Machines

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
With proposed machine						
Revenue[a]	$2,520,000	$2,520,000	$2,520,000	$2,520,000	$2,520,000	$ 0
− Expenses (excl. depr.)[b]	2,300,000	2,300,000	2,300,000	2,300,000	2,300,000	0
Profits before depr. and taxes	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 0
− Depreciation[c]	80,000	128,000	76,000	48,000	48,000	20,000
Net profits before taxes	$ 140,000	$ 92,000	$ 144,000	$ 172,000	$ 172,000	−$20,000
− Taxes (rate = 40%)	56,000	36,800	57,600	68,800	68,800	− 8,000
Net profits after taxes	$ 84,000	$ 55,200	$ 86,400	$ 103,200	$ 103,200	−$12,000
+ Depreciation[c]	80,000	128,000	76,000	48,000	48,000	20,000
Operating cash inflows	$ 164,000	$ 183,200	$ 162,400	$ 151,200	$ 151,200	$ 8,000
With present machine						
Revenue[a]	$2,200,000	$2,300,000	$2,400,000	$2,400,000	$2,250,000	$ 0
− Expenses (excl. depr.)[b]	1,990,000	2,110,000	2,230,000	2,250,000	2,120,000	0
Profits before depr. and taxes	$ 210,000	$ 190,000	$ 170,000	$ 150,000	$ 130,000	$ 0
− Depreciation[c]	28,800	28,800	12,000	0	0	0
Net profits before taxes	$ 181,200	$ 161,200	$ 158,000	$ 150,000	$ 130,000	$ 0
− Taxes (rate = 40%)	72,480	64,480	63,200	60,000	52,000	0
Net profits after taxes	$ 108,720	$ 96,720	$ 94,800	$ 90,000	$ 78,000	$ 0
+ Depreciation[c]	28,800	28,800	12,000	0	0	0
Operating cash inflows	$ 137,520	$ 125,520	$ 106,800	$ 90,000	$ 78,000	$ 0

[a]From column 1 of Table 8.5.
[b]From column 2 of Table 8.5.
[c]From column 3 of Table 8.6.

Interpreting the Term *Incremental*

The final step in estimating the operating cash inflows for a proposed project is to calculate the *incremental (relevant)* cash inflows. Incremental operating cash inflows are needed, because our concern is *only* with the change in operating cash inflows that result from the proposed project.

EXAMPLE

Table 8.9 demonstrates the calculation of Powell Corporation's incremental (relevant) operating cash inflows for each year. The estimates of operating cash inflows developed in Table 8.8 are given in columns 1 and 2. Column 2 values represent the amount of operating cash inflows that Powell Corporation will receive if it does not replace the present machine. If the proposed machine replaces the present machine, the firm's operating cash inflows for each year will be those shown in column 1. Subtracting the present machine's operating cash inflows from the proposed machine's operating cash inflows, we get the incremental operating cash inflows for each year, shown in column 3. These cash flows represent the amounts by which each respective year's cash inflows will increase as a result of the replacement. For example, in year 1, Powell Corporation's cash inflows would increase by $26,480 if the proposed project were undertaken. Clearly, these are the relevant inflows to be considered when evaluating the benefits of making a capital expenditure for the proposed machine.[12]

TABLE 8.9 Incremental (Relevant) Operating Cash Inflows for Powell Corporation

	Operating cash inflows		
Year	Proposed machine[a] (1)	Present machine[a] (2)	Incremental (relevant) [(1) − (2)] (3)
1	$164,000	$137,520	$26,480
2	183,200	125,520	57,680
3	162,400	106,800	55,600
4	151,200	90,000	61,200
5	151,200	78,000	73,200
6	8,000	0	8,000

[a]From final row for respective machine in Table 8.8.

12. The following equation can be used to calculate more directly the incremental cash inflow in year t, ICI_t.

$$ICI_t = [\Delta PBDT_t \times (1 - T)] + (\Delta D_t \times T)$$

where

$\Delta PBDT_t$ = change in profits before depreciation and taxes [revenues − expenses (excl. depr.)] in year t

ΔD_t = change in depreciation expense in year t

T = firm's marginal tax rate

Applying this formula to the Powell Corporation data given in Tables 8.5 and 8.6 for year 3, we get the following values of variables:

$$\Delta PBDT_3 = (\$2,520,000 - \$2,300,000) - (\$2,400,000 - \$2,230,000)$$
$$= \$220,000 - \$170,000 = \$50,000$$

Review Questions

8–13 How does depreciation enter into the calculation of operating cash inflows?

8–14 How are the incremental (relevant) *operating cash inflows* that are associated with a replacement decision calculated?

8.5 Finding the Terminal Cash Flow

Terminal cash flow is the cash flow resulting from termination and liquidation of a project at the end of its economic life. It represents the after-tax cash flow, exclusive of operating cash inflows, that occurs in the final year of the project. When it applies, this flow can significantly affect the capital expenditure decision. Terminal cash flow can be calculated for replacement projects by using the basic format presented in Table 8.10.

Proceeds from Sale of Assets

The proceeds from sale of the new and the old asset, often called "salvage value," represent the amount *net of any removal or cleanup costs* expected upon termination of the project. For replacement projects, proceeds from both the new asset and the old asset must be considered. For expansion and renewal types of capital expenditures, the proceeds from the old asset are zero. Of course, it is not unusual for the value of an asset to be zero at the termination of a project.

TABLE 8.10 The Basic Format for Determining Terminal Cash Flow

	After-tax proceeds from sale of new asset =
	Proceeds from sale of new asset
∓	Tax on sale of new asset
−	**After-tax proceeds from sale of old asset =**
	Proceeds from sale of old asset
∓	Tax on sale of old asset
±	**Change in net working capital**
	Terminal cash flow

$\Delta D_3 = \$76{,}000 - \$12{,}000 = \$64{,}000$

$T = 0.40$

Substituting into the equation yields

$$ICI_3 = [\$50{,}000 \times (1 - 0.40)] + (\$64{,}000 \times 0.40)$$
$$= \$30{,}000 + \$25{,}600 = \underline{\$55{,}600}$$

The $55,600 of incremental cash inflow for year 3 is the same value as that calculated for year 3 in column 3 of Table 8.9.

Taxes on Sale of Assets

Earlier we calculated the tax on sale of old asset (as part of finding the initial investment). Similarly, taxes must be considered on the terminal sale of both the new and the old asset for replacement projects and on only the new asset in other cases. The tax calculations apply whenever an asset is sold for a value different from its book value. If the net proceeds from the sale are expected to exceed book value, a tax payment shown as an *outflow* (deduction from sale proceeds) will occur. When the net proceeds from the sale are less than book value, a tax rebate shown as a cash *inflow* (addition to sale proceeds) will result. For assets sold to net exactly book value, no taxes will be due.

Change in Net Working Capital

When we calculated the initial investment, we took into account any change in net working capital that is attributable to the new asset. Now, when we calculate the terminal cash flow, the change in net working capital represents the reversion of any initial net working capital investment. Most often, this will show up as a cash inflow due to the reduction in net working capital; with termination of the project, the need for the increased net working capital investment is assumed to end.[13] Because the net working capital investment is in no way consumed, the amount recovered at termination will equal the amount shown in the calculation of the initial investment.[14] Tax considerations are not involved.

Calculating the terminal cash flow involves the same procedures as those used to find the initial investment. In the following example, the terminal cash flow is calculated for a replacement decision.

EXAMPLE

Continuing with the Powell Corporation example, assume that the firm expects to be able to liquidate the new machine at the end of its 5-year usable life to net $50,000 after paying removal and cleanup costs. The old machine can be liquidated at the end of the 5 years to net $0 because it will then be completely obsolete. The firm expects to recover its $17,000 net working capital investment upon termination of the project. Both ordinary income and capital gains are taxed at a rate of 40%.

From the analysis of the operating cash inflows presented earlier, we can see that the proposed (new) machine will have a book value of $20,000 (equal to the year-6 depreciation) at the end of 5 years. The present (old) machine will be fully depreciated and therefore have a book value of zero at the end of the 5 years. Because the sale price of $50,000 for the proposed (new) machine is below its initial installed cost of $400,000 but greater than its book value of $20,000, taxes will have to be paid only on the recaptured depreciation of $30,000 ($50,000 sale proceeds − $20,000 book value). Applying the ordinary tax rate of 40% to this $30,000 results in a tax of $12,000 (0.40 × $30,000) on the sale of the proposed machine. Its after-tax sale proceeds would therefore equal $38,000 ($50,000 sale

13. As noted earlier, the change in net working capital is for convenience assumed to occur instantaneously—in this case, on termination of the project. In actuality, it may take a number of months for the original increase in net working capital to be worked down to zero.

14. In practice, the full net working capital investment may not be recovered. This occurs because some accounts receivable may not be collectible and some inventory will probably be obsolete, and so their book values cannot be fully realized.

proceeds − $12,000 taxes). Because the present machine would net $0 at termination and its book value would be $0, no tax would be due on its sale. Its after-tax sale proceeds would therefore equal $0. Substituting the appropriate values into the format in Table 8.10 results in the terminal cash inflow of $55,000.

	After-tax proceeds from sale of proposed machine		
	Proceeds from sale of proposed machine	$50,000	
−	Tax on sale of proposed machine	12,000	
	Total after-tax proceeds—proposed		$38,000
−	**After-tax proceeds from sale of present machine**		
	Proceeds from sale of present machine	$ 0	
∓	Tax on sale of present machine	0	
	Total after-tax proceeds—present		0
+	**Change in net working capital**		17,000
	Terminal cash flow		$55,000

Review Question

8–15 Explain how the *terminal cash flow* is calculated for replacement projects.

8.6 Summarizing the Relevant Cash Flows

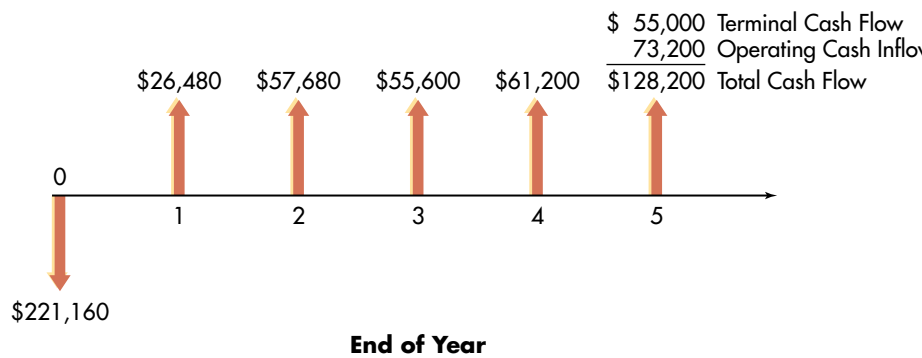
Hint Capital expenditures are critical to a firm's success, and these funds are usually limited. Because of this, the process of determining cash flows should be finely tuned so that it is both objective and realistic.

The initial investment, operating cash inflows, and terminal cash flow together represent a project's *relevant cash flows*. These cash flows can be viewed as the incremental after-tax cash flows attributable to the proposed project. They represent, in a cash flow sense, how much better or worse off the firm will be if it chooses to implement the proposal.

EXAMPLE

The relevant cash flows for Powell Corporation's proposed replacement expenditure can now be shown graphically, on a time line. Note that because the new asset is assumed to be sold at the end of its 5-year usable life, the year-6 incremental operating cash inflow calculated in Table 8.9 has no relevance; the terminal cash flow effectively replaces this value in the analysis. As the following time line shows, the relevant cash flows follow a *conventional cash flow pattern*.

Time line for Powell Corporation's relevant cash flows with the proposed machine



Techniques for analyzing conventional cash flow patterns to determine whether to undertake a proposed capital investment are discussed in Chapter 9.

Review Question

8–16 Diagram and describe the three components of the *relevant cash flows* for a capital budgeting project.

SUMMARY

FOCUS ON VALUE

A key responsibility of financial managers is to review and analyze proposed investment decisions in order to make sure that only those that contribute positively to the value of the firm are undertaken. Utilizing a variety of tools and techniques, financial managers estimate the cash flows that a proposed investment will generate and then apply appropriate decision techniques to assess the investment's impact on the firm's value. The most difficult and important aspect of this capital budgeting process is developing good estimates of the relevant cash flows.

The relevant cash flows are the incremental after-tax cash flows resulting from a proposed investment. These estimates represent the cash flow benefits that are likely to accrue to the firm as a result of implementing the investment. By applying to the cash flows decision techniques that capture time value of money and risk factors, the financial manager can estimate the impact the investment will have on the firm's share price. Clearly, only those investments that can be expected to increase the stock price should be undertaken. Consistent application of capital budgeting procedures to proposed long-term investments should therefore allow the firm to **maximize its stock price.**

REVIEW OF LEARNING GOALS

LG1 **Understand the key motives for capital expenditure and the steps in the capital budgeting process.** Capital budgeting is the process used to evaluate and select capital expenditures consistent with the firm's goal of maximizing owner wealth. Capital expenditures are long-term investments made to expand, replace, or renew fixed assets or to obtain some less tangible benefit. The capital budgeting process includes five distinct but interrelated steps: proposal generation, review and analysis, decision making, implementation, and follow-up.

LG2 **Define basic capital budgeting terminology.** Capital expenditure proposals may be independent or mutually exclusive. Typically, firms have only limited funds for capital investments and must ration them among carefully selected projects. Two basic approaches to capital budgeting decisions are

the accept–reject approach and the ranking approach. Conventional cash flow patterns consist of an initial outflow followed by a series of inflows; any other pattern is nonconventional.

LG3 **Discuss the major components of relevant cash flows, expansion versus replacement cash flows, sunk costs and opportunity costs, and international capital budgeting and long-term investments.** The relevant cash flows for capital budgeting decisions are the initial investment, the operating cash inflows, and the terminal cash flow. For replacement decisions, these flows are found by determining the difference between the cash flows of the new asset and the old asset. Expansion decisions are viewed as replacement decisions in which all cash flows from the old asset are zero. When estimating relevant cash flows, one should ignore sunk costs, and opportunity costs should be included as cash outflows. In international capital budgeting, currency risks and political risks can be minimized through careful planning.

LG4 **Calculate the initial investment associated with a proposed capital expenditure.** The initial investment is the initial outflow required, taking into account the installed cost of the new asset, the after-tax proceeds from the sale of the old asset, and any change in net working capital. Finding the after-tax proceeds from sale of the old asset, which reduces the initial investment, involves cost, depreciation, and tax data. The book value of an asset is its accounting value, which is used to determine what taxes are owed as a result of its sale. Any of three forms of taxable income—capital gain, recaptured depreciation, or a loss—can result from sale of an asset. The form of taxable income that applies depends on whether the asset is sold for (1) more than its initial purchase price, (2) more than book value but less than what was initially paid, (3) book value, or (4) less than book value. The change in net working capital is the difference between the change in current assets and the change in current liabilities expected to accompany a given capital expenditure.

LG5 **Determine relevant operating cash inflows using the income statement format.** The operating cash inflows are the incremental after-tax cash inflows expected to result from a project. The income statement format involves adding depreciation back to net profits after taxes and gives the operating cash inflows associated with the proposed and present projects. The relevant (incremental) cash inflows are the difference between the operating cash inflows of the proposed project and those of the present project.

LG6 **Find the terminal cash flow.** The terminal cash flow represents the after-tax cash flow, exclusive of operating cash inflows, that is expected from liquidation of a project. It is calculated by finding the difference between the after-tax proceeds from sale of the new and the old asset at project termination and then adjusting this difference for any change in net working capital. Sale price and depreciation data are used to find the taxes and the after-tax sale proceeds on the new and old assets. The change in net working capital typically represents the reversion of any initial net working capital investment.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG4

ST 8–1 Book value, taxes, and initial investment Irvin Enterprises is considering the purchase of a new piece of equipment to replace the current equipment. The new equipment costs $75,000 and requires $5,000 in installation costs. It will be depreciated under MACRS using a 5-year recovery period. The old piece of equipment was purchased 4 years ago for an installed cost of $50,000; it was being depreciated under MACRS using a 5-year recovery period. The old equipment can be sold today for $55,000 net of any removal or cleanup costs. As a result of the proposed replacement, the firm's investment in net working capital is expected to increase by $15,000. The firm pays taxes at a rate of 40% on both

ordinary income and capital gains. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

a. Calculate the book value of the old piece of equipment.
b. Determine the taxes, if any, attributable to the sale of the old equipment.
c. Find the initial investment associated with the proposed equipment replacement.

LG4 LG5 LG6

ST 8–2 Determining relevant cash flows A machine currently in use was originally purchased 2 years ago for $40,000. The machine is being depreciated under MACRS using a 5-year recovery period; it has 3 years of usable life remaining. The current machine can be sold today to net $42,000 after removal and cleanup costs. A new machine, using a 3-year MACRS recovery period, can be purchased at a price of $140,000. It requires $10,000 to install and has a 3-year usable life. If the new machine is acquired, the investment in accounts receivable will be expected to rise by $10,000, the inventory investment will increase by $25,000, and accounts payable will increase by $15,000. *Profits before depreciation and taxes* are expected to be $70,000 for each of the next 3 years with the old machine and to be $120,000 in the first year and $130,000 in the second and third years with the new machine. At the end of 3 years, the market value of the old machine will equal zero, but the new machine could be sold to net $35,000 before taxes. Both ordinary corporate income and capital gains are subject to a 40% tax. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

a. Determine the initial investment associated with the proposed replacement decision.
b. Calculate the incremental operating cash inflows for years 1 to 4 associated with the proposed replacement. (*Note:* Only depreciation cash flows must be considered in year 4.)
c. Calculate the terminal cash flow associated with the proposed replacement decision. (*Note:* This is at the end of year 3.)
d. Depict on a time line the relevant cash flows found in parts **a, b,** and **c** that are associated with the proposed replacement decision, assuming that it is terminated at the end of year 3.

PROBLEMS

LG1

8–1 Classification of expenditures Given the following list of outlays, indicate whether each is normally considered a *capital* or an *operating* expenditure. Explain your answers.

a. An initial lease payment of $5,000 for electronic point-of-sale cash register systems.
b. An outlay of $20,000 to purchase patent rights from an inventor.
c. An outlay of $80,000 for a major research and development program.
d. An $80,000 investment in a portfolio of marketable securities.
e. A $300 outlay for an office machine.
f. An outlay of $2,000 for a new machine tool.
g. An outlay of $240,000 for a new building.
h. An outlay of $1,000 for a marketing research report.

LG2 **8–2 Basic terminology** A firm is considering the following three separate situations.

Situation A Build either a small office building or a convenience store on a parcel of land located in a high-traffic area. Adequate funding is available, and both projects are known to be acceptable. The office building requires an initial investment of $620,000 and is expected to provide operating cash inflows of $40,000 per year for 20 years. The convenience store is expected to cost $500,000 and to provide a growing stream of operating cash inflows over its 20-year life. The initial operating cash inflow is $20,000, and it will increase by 5% each year.

Situation B Replace a machine with a new one that requires a $60,000 initial investment and will provide operating cash inflows of $10,000 per year for the first 5 years. At the end of year 5, a machine overhaul costing $20,000 will be required. After it is completed, expected operating cash inflows will be $10,000 in year 6; $7,000 in year 7; $4,000 in year 8; and $1,000 in year 9, at the end of which the machine will be scrapped.

Situation C Invest in any or all of the four machines whose relevant cash flows are given in the following table. The firm has $500,000 budgeted to fund these machines, all of which are known to be acceptable. Initial investment for each machine is $250,000.

	Operating cash inflows			
Year	Machine 1	Machine 2	Machine 3	Machine 4
1	$ 50,000	$70,000	$65,000	$90,000
2	70,000	70,000	65,000	80,000
3	90,000	70,000	80,000	70,000
4	− 30,000	70,000	80,000	60,000
5	100,000	70,000	− 20,000	50,000

For each situation, indicate:
a. Whether the projects involved are independent or mutually exclusive.
b. Whether the availability of funds is unlimited or capital rationing exists.
c. Whether accept–reject or ranking decisions are required.
d. Whether each project's cash flows are conventional or nonconventional.

LG3 **8–3 Relevant cash flow pattern fundamentals** For each of the following projects, determine the *relevant cash flows,* classify the cash flow pattern, and depict the cash flows on a time line.

a. A project that requires an initial investment of $120,000 and will generate annual operating cash inflows of $25,000 for the next 18 years. In each of the 18 years, maintenance of the project will require a $5,000 cash outflow.

b. A new machine with an installed cost of $85,000. Sale of the old machine will yield $30,000 after taxes. Operating cash inflows generated by the replacement will exceed the operating cash inflows of the old machine by $20,000 in each year of a 6-year period. At the end of year 6, liquidation of the new machine will yield $20,000 after taxes, which is $10,000 greater

than the after-tax proceeds expected from the old machine had it been retained and liquidated at the end of year 6.

c. An asset that requires an initial investment of $2 million and will yield annual operating cash inflows of $300,000 for each of the next 10 years. Operating cash outlays will be $20,000 for each year except year 6, when an overhaul requiring an additional cash outlay of $500,000 will be required. The asset's liquidation value at the end of year 10 is expected to be $0.

LG3 **8–4 Expansion versus replacement cash flows** Edison Systems has estimated the cash flows over the 5-year lives for two projects, A and B. These cash flows are summarized in the following table.

	Project A	Project B
Initial investment	$40,000	$12,000[a]
Year	Operating cash inflows	
1	$10,000	$ 6,000
2	12,000	6,000
3	14,000	6,000
4	16,000	6,000
5	10,000	6,000

[a]After-tax cash inflow expected from liquidation.

a. If project A were actually a *replacement* for project B and if the $12,000 initial investment shown for project B were the after-tax cash inflow expected from liquidating it, what would be the relevant cash flows for this replacement decision?

b. How can an *expansion decision* such as project A be viewed as a special form of a replacement decision? Explain.

LG3 **8–5 Sunk costs and opportunity costs** Masters Golf Products, Inc., spent 3 years and $1,000,000 to develop its new line of club heads to replace a line that is becoming obsolete. In order to begin manufacturing them, the company will have to invest $1,800,000 in new equipment. The new clubs are expected to generate an increase in operating cash inflows of $750,000 per year for the next 10 years. The company has determined that the existing line could be sold to a competitor for $250,000.

a. How should the $1,000,000 in development costs be classified?

b. How should the $250,000 sale price for the existing line be classified?

c. Depict all of the known relevant cash flows on a time line.

LG3 **8–6 Sunk costs and opportunity costs** Covol Industries is developing the relevant cash flows associated with the proposed replacement of an existing machine tool with a new, technologically advanced one. Given the following costs related to the proposed project, explain whether each would be treated as a *sunk cost* or an *opportunity cost* in developing the relevant cash flows associated with the proposed replacement decision.

a. Covol would be able to use the same tooling, which had a book value of $40,000, on the new machine tool as it had used on the old one.
b. Covol would be able to use its existing computer system to develop programs for operating the new machine tool. The old machine tool did not require these programs. Although the firm's computer has excess capacity available, the capacity could be leased to another firm for an annual fee of $17,000.
c. Covol would have to obtain additional floor space to accommodate the larger new machine tool. The space that would be used is currently being leased to another company for $10,000 per year.
d. Covol would use a small storage facility to store the increased output of the new machine tool. The storage facility was built by Covol 3 years earlier at a cost of $120,000. Because of its unique configuration and location, it is currently of no use to either Covol or any other firm.
e. Covol would retain an existing overhead crane, which it had planned to sell for its $180,000 market value. Although the crane was not needed with the old machine tool, it would be used to position raw materials on the new machine tool.

LG4 **8–7 Book value** Find the book value for each of the assets shown in the following table, assuming that MACRS depreciation is being used. *(Note:* See Table 3.2 on page 100 for the applicable depreciation percentages.)

Asset	Installed cost	Recovery period (years)	Elapsed time since purchase (years)
A	$ 950,000	5	3
B	40,000	3	1
C	96,000	5	4
D	350,000	5	1
E	1,500,000	7	5

LG4 **8–8 Book value and taxes on sale of assets** Troy Industries purchased a new machine 3 years ago for $80,000. It is being depreciated under MACRS with a 5-year recovery period using the percentages given in Table 3.2 on page 100. Assume 40% ordinary and capital gains tax rates.
a. What is the book value of the machine?
b. Calculate the firm's tax liability if it sold the machine for each of the following amounts: $100,000; $56,000; $23,200; and $15,000.

LG4 **8–9 Tax calculations** For each of the following cases, describe the various taxable components of the funds received through sale of the asset, and determine the total taxes resulting from the transaction. Assume 40% ordinary and capital gains tax rates. The asset was purchased 2 years ago for $200,000 and is being depreciated under MACRS using a 5-year recovery period. (See Table 3.2 on page 100 for the applicable depreciation percentages.)
a. The asset is sold for $220,000.
b. The asset is sold for $150,000.
c. The asset is sold for $96,000.
d. The asset is sold for $80,000.

LG4 **8–10 Change in net working capital calculation** Samuels Manufacturing is considering the purchase of a new machine to replace one they feel is obsolete. The firm has total current assets of $920,000 and total current liabilities of $640,000. As a result of the proposed replacement, the following *changes* are anticipated in the levels of the current asset and current liability accounts noted.

Account	Change
Accruals	+ $ 40,000
Marketable securities	0
Inventories	− 10,000
Accounts payable	+ 90,000
Notes payable	0
Accounts receivable	+ 150,000
Cash	+ 15,000

a. Using the information given, calculate the change, if any, in net working capital that is expected to result from the proposed replacement action.
b. Explain why a change in these current accounts would be relevant in determining the initial investment for the proposed capital expenditure.
c. Would the change in net working capital enter into any of the other cash flow components that make up the relevant cash flows? Explain.

LG4 **8–11 Calculating initial investment** Vastine Medical, Inc., is considering replacing its existing computer system, which was purchased 2 years ago at a cost of $325,000. The system can be sold today for $200,000. It is being depreciated using MACRS and a 5-year recovery period (see Table 3.2, page 100). A new computer system will cost $500,000 to purchase and install. Replacement of the computer system would not involve any change in net working capital. Assume a 40% tax rate on ordinary income and capital gains.
a. Calculate the book value of the existing computer system.
b. Calculate the after-tax proceeds of its sale for $200,000.
c. Calculate the initial investment associated with the replacement project.

LG4 **8–12 Initial investment—Basic calculation** Cushing Corporation is considering the purchase of a new grading machine to replace the existing one. The existing machine was purchased 3 years ago at an installed cost of $20,000; it was being depreciated under MACRS using a 5-year recovery period. (See Table 3.2 on page 100 for the applicable depreciation percentages.) The existing machine is expected to have a usable life of at least 5 more years. The new machine costs $35,000 and requires $5,000 in installation costs; it will be depreciated using a 5-year recovery period under MACRS. The existing machine can currently be sold for $25,000 without incurring any removal or cleanup costs. The firm pays 40% taxes on both ordinary income and capital gains. Calculate the *initial investment* associated with the proposed purchase of a new grading machine.

LG4 **8–13 Initial investment at various sale prices** Edwards Manufacturing Company is considering replacing one machine with another. The old machine was pur-

chased 3 years ago for an installed cost of $10,000. The firm is depreciating the machine under MACRS, using a 5-year recovery period. (See Table 3.2 on page 100 for the applicable depreciation percentages.) The new machine costs $24,000 and requires $2,000 in installation costs. The firm is subject to a 40% tax rate on both ordinary income and capital gains. In each of the following cases, calculate the initial investment for the replacement.

a. Edwards Manufacturing Company (EMC) sells the old machine for $11,000.
b. EMC sells the old machine for $7,000.
c. EMC sells the old machine for $2,900.
d. EMC sells the old machine for $1,500.


8–14 Calculating initial investment DuPree Coffee Roasters, Inc., wishes to expand and modernize its facilities. The installed cost of a proposed computer-controlled automatic-feed roaster will be $130,000. The firm has a chance to sell its 4-year-old roaster for $35,000. The existing roaster originally cost $60,000 and was being depreciated using MACRS and a 7-year recovery period (see Table 3.2 on page 100). DuPree pays taxes at a rate of 40% on ordinary income and capital gains.

a. What is the book value of the existing roaster?
b. Calculate the after-tax proceeds of the sale of the existing roaster.
c. Calculate the change in net working capital using the following figures:

Anticipated Changes in Current Assets and Current Liabilities

Accruals	−$20,000
Inventory	+ 50,000
Accounts payable	+ 40,000
Accounts receivable	+ 70,000
Cash	0
Notes payable	+ 15,000

d. Calculate the initial investment associated with the proposed new roaster.

8–15 Depreciation A firm is evaluating the acquisition of an asset that costs $64,000 and requires $4,000 in installation costs. If the firm depreciates the asset under MACRS, using a 5-year recovery period (see Table 3.2 on page 100 for the applicable depreciation percentages), determine the depreciation charge for each year.



8–16 Incremental operating cash inflows A firm is considering renewing its equipment to meet increased demand for its product. The cost of equipment modifications is $1.9 million plus $100,000 in installation costs. The firm will depreciate the equipment modifications under MACRS, using a 5-year recovery period. (See Table 3.2 on page 100 for the applicable depreciation percentages.) Additional sales revenue from the renewal should amount to $1.2 million per year, and additional operating expenses and other costs (excluding depreciation) will

amount to 40% of the additional sales. The firm has an ordinary tax rate of 40%. (*Note:* Answer the following questions for each of the next 6 *years*.)

a. What incremental earnings before depreciation and taxes will result from the renewal?

b. What incremental earnings after taxes will result from the renewal?

c. What incremental operating cash inflows will result from the renewal?

8–17 **Incremental operating cash inflows—Expense reduction** Miller Corporation is considering replacing a machine. The replacement will reduce operating expenses (that is, increase revenues) by $16,000 per year for each of the 5 years the new machine is expected to last. Although the old machine has zero book value, it can be used for 5 more years. The depreciable value of the new machine is $48,000. The firm will depreciate the machine under MACRS using a 5-year recovery period (see Table 3.2 on page 100 for the applicable depreciation percentages) and is subject to a 40% tax rate on ordinary income. Estimate the incremental operating cash inflows generated by the replacement. (*Note:* Be sure to consider the depreciation in year 6.)

8–18 **Incremental operating cash inflows** Strong Tool Company has been considering purchasing a new lathe to replace a fully depreciated lathe that will last 5 more years. The new lathe is expected to have a 5-year life and depreciation charges of $2,000 in year 1; $3,200 in year 2; $1,900 in year 3; $1,200 in both year 4 and year 5; and $500 in year 6. The firm estimates the revenues and expenses (excluding depreciation) for the new and the old lathes to be as shown in the following table. The firm is subject to a 40% tax rate on ordinary income.

	New lathe		Old lathe	
Year	Revenue	Expenses (excl. depr.)	Revenue	Expenses (excl. depr.)
1	$40,000	$30,000	$35,000	$25,000
2	41,000	30,000	35,000	25,000
3	42,000	30,000	35,000	25,000
4	43,000	30,000	35,000	25,000
5	44,000	30,000	35,000	25,000

a. Calculate the operating cash inflows associated with each lathe. (*Note:* Be sure to consider the depreciation in year 6.)

b. Calculate the incremental (relevant) operating cash inflows resulting from the proposed lathe replacement.

c. Depict on a time line the incremental operating cash inflows calculated in part **b.**

8–19 **Determining operating cash inflows** Scenic Tours, Inc., is a provider of bus tours throughout the New England area. The corporation is considering the replacement of 10 of its older buses. The existing buses were purchased 4 years ago at a total cost of $2,700,000 and are being depreciated using MACRS and a 5-year recovery period (see Table 3.2, page 100). The new buses would have larger passenger capacity and better fuel efficiency as well as lower maintenance

costs. The total cost for 10 new buses is $3,000,000. Like the older buses, the new ones would be depreciated using MACRS and a 5-year recovery period. Scenic is taxed at a rate of 40% on ordinary income and capital gains. The following table presents revenues and cash expenses for the proposed purchase as well as the present fleet. Use all of the information given to calculate operating cash inflows for the proposed and present buses.

	Year					
	1	2	3	4	5	6
With the proposed new buses						
Revenue	$1,850,000	$1,850,000	$1,830,000	$1,825,000	$1,815,000	$1,800,000
− Expenses (excl. depreciation)	460,000	460,000	468,000	472,000	485,000	500,000
With the present buses						
Revenue	$1,800,000	$1,800,000	$1,790,000	$1,785,000	$1,775,000	$1,750,000
− Expenses (excl. depreciation)	500,000	510,000	520,000	520,000	530,000	535,000

8–20 **Terminal cash flow—Various lives and sale prices** Looner Industries is currently analyzing the purchase of a new machine that costs $160,000 and requires $20,000 in installation costs. Purchase of this machine is expected to result in an increase in net working capital of $30,000 to support the expanded level of operations. The firm plans to depreciate the machine under MACRS using a 5-year recovery period (see Table 3.2 on page 100 for the applicable depreciation percentages) and expects to sell the machine to net $10,000 before taxes at the end of its usable life. The firm is subject to a 40% tax rate on both ordinary and capital gains income.

a. Calculate the terminal cash flow for a usable life of (1) 3 years, (2) 5 years, and (3) 7 years.

b. Discuss the effect of usable life on terminal cash flows using your findings in part **a.**

c. Assuming a 5-year usable life, calculate the terminal cash flow if the machine were sold to net (1) $9,000 or (2) $170,000 (before taxes) at the end of 5 years.

d. Discuss the effect of sale price on terminal cash flow using your findings in part **c.**

8–21 **Terminal cash flow—Replacement decision** Russell Industries is considering replacing a fully depreciated machine that has a remaining useful life of 10 years with a newer, more sophisticated machine. The new machine will cost $200,000 and will require $30,000 in installation costs. It will be depreciated under MACRS using a 5-year recovery period (see Table 3.2 on page 100 for the applicable depreciation percentages). A $25,000 increase in net working capital will be required to support the new machine. The firm's managers plans to evaluate the potential replacement over a 4-year period. They estimate that the old machine could be sold at the end of 4 years to net $15,000 before taxes; the new machine at the end of 4 years will be worth $75,000 before taxes. Calculate the terminal cash flow at the end of year 4 that is relevant to the proposed purchase of the new machine. The firm is subject to a 40% tax rate on both ordinary and capital gains income.

LG4 LG5 LG6 **8–22 Relevant cash flows for a marketing campaign** Marcus Tube, a manufacturer of high-quality aluminum tubing, has maintained stable sales and profits over the past 10 years. Although the market for aluminum tubing has been expanding by 3% per year, Marcus has been unsuccessful in sharing this growth. To increase its sales, the firm is considering an aggressive marketing campaign that centers on regularly running ads in all relevant trade journals and exhibiting products at all major regional and national trade shows. The campaign is expected to require an *annual* tax-deductible expenditure of $150,000 over the next 5 years. Sales revenue, as shown in the income statement for 2003 (below), totaled $20,000,000. If the proposed marketing campaign is not initiated, sales are expected to remain at this level in each of the next 5 years, 2004–2008. With the marketing campaign, sales are expected to rise to the levels shown in the accompanying table for each of the next 5 years; cost of goods sold is expected to remain at 80% of sales; general and administrative expense (exclusive of any marketing campaign outlays) is expected to remain at 10% of sales; and annual depreciation expense is expected to remain at $500,000. Assuming a 40% tax rate, find the relevant cash flows over the next 5 years associated with the proposed marketing campaign.

Marcus Tube
Income Statement
for the Year Ended December 31, 2003

Sales revenue		$20,000,000
Less: Cost of goods sold (80%)		16,000,000
Gross profits		$ 4,000,000
Less: Operating expenses		
General and administrative expense (10%)	$2,000,000	
Depreciation expense	500,000	
Total operating expense		2,500,000
Net profits before taxes		$ 1,500,000
Less: Taxes (rate = 40%)		600,000
Net profits after taxes		$ 900,000

Marcus Tube
Sales Forecast

Year	Sales revenue
2004	$20,500,000
2005	21,000,000
2006	21,500,000
2007	22,500,000
2008	23,500,000

LG4 LG5 **8–23 Relevant cash flows—No terminal value** Central Laundry and Cleaners is considering replacing an existing piece of machinery with a more sophisticated machine. The old machine was purchased 3 years ago at a cost of $50,000, and this amount was being depreciated under MACRS using a 5-year recovery period. The machine has 5 years of usable life remaining. The new machine that is being considered costs $76,000 and requires $4,000 in installation costs. The new machine would be depreciated under MACRS using a 5-year recovery period. The firm can currently sell the old machine for $55,000 without incurring any removal or cleanup costs. The firm pays a tax rate of 40% on both ordinary income and capital gains. The revenues and expenses (excluding depreciation) associated with the new and the old machine for the next 5 years are given in the table below. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

Year	New machine		Old machine	
	Revenue	Expenses (excl. depr.)	Revenue	Expenses (excl. depr.)
1	$750,000	$720,000	$674,000	$660,000
2	750,000	720,000	676,000	660,000
3	750,000	720,000	680,000	660,000
4	750,000	720,000	678,000	660,000
5	750,000	720,000	674,000	660,000

a. Calculate the initial investment associated with replacement of the old machine by the new one.
b. Determine the incremental operating cash inflows associated with the proposed replacement. (*Note:* Be sure to consider the depreciation in year 6.)
c. Depict on a time line the relevant cash flows found in parts **a** and **b** associated with the proposed replacement decision.

LG4 LG5 LG6

8–24 Integrative—Determining relevant cash flows Lombard Company is contemplating the purchase of a new high-speed widget grinder to replace the existing grinder. The existing grinder was purchased 2 years ago at an installed cost of $60,000; it was being depreciated under MACRS using a 5-year recovery period. The existing grinder is expected to have a usable life of 5 more years. The new grinder costs $105,000 and requires $5,000 in installation costs; it has a 5-year usable life and would be depreciated under MACRS using a 5-year recovery period. Lombard can currently sell the existing grinder for $70,000 without incurring any removal or cleanup costs. To support the increased business resulting from purchase of the new grinder, accounts receivable would increase by $40,000, inventories by $30,000, and accounts payable by $58,000. At the end of 5 years, the existing grinder is expected to have a market value of zero; the new grinder would be sold to net $29,000 after removal and cleanup costs and before taxes. The firm pays taxes at a rate of 40% on both ordinary income and capital gains. The estimated *profits before depreciation and taxes* over the 5 years for both the new and the existing grinder are shown in the following table. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

Year	Profits before depreciation and taxes	
	New grinder	Existing grinder
1	$43,000	$26,000
2	43,000	24,000
3	43,000	22,000
4	43,000	20,000
5	43,000	18,000

a. Calculate the initial investment associated with the replacement of the existing grinder by the new one.
b. Determine the incremental operating cash inflows associated with the proposed grinder replacement. (*Note:* Be sure to consider the depreciation in year 6.)
c. Determine the terminal cash flow expected at the end of year 5 from the proposed grinder replacement.
d. Depict on a time line the relevant cash flows associated with the proposed grinder replacement decision.

LG4 LG5 LG6

8–25 **Integrative—Determining relevant cash flows** Atlantic Drydock is considering replacing an existing hoist with one of two newer, more efficient pieces of equipment. The existing hoist is 3 years old, cost $32,000, and is being depreciated under MACRS using a 5-year recovery period. Although the existing hoist has only 3 years (years 4, 5, and 6) of depreciation remaining under MACRS, it has a remaining usable life of 5 years. Hoist A, one of the two possible replacement hoists, costs $40,000 to purchase and $8,000 to install. It has a 5-year usable life and will be depreciated under MACRS using a 5-year recovery period. The other hoist, B, costs $54,000 to purchase and $6,000 to install. It also has a 5-year usable life and will be depreciated under MACRS using a 5-year recovery period.

Increased investments in net working capital will accompany the decision to acquire hoist A or hoist B. Purchase of hoist A would result in a $4,000 increase in net working capital; hoist B would result in a $6,000 increase in net working capital. The projected *profits before depreciation and taxes* with each alternative hoist and the existing hoist are given in the following table.

	Profits before depreciation and taxes		
Year	With hoist A	With hoist B	With existing hoist
1	$21,000	$22,000	$14,000
2	21,000	24,000	14,000
3	21,000	26,000	14,000
4	21,000	26,000	14,000
5	21,000	26,000	14,000

The existing hoist can currently be sold for $18,000 and will not incur any removal or cleanup costs. At the end of 5 years, the existing hoist can be sold to net $1,000 before taxes. Hoists A and B can be sold to net $12,000 and $20,000 before taxes, respectively, at the end of the 5-year period. The firm is subject to a 40% tax rate on both ordinary income and capital gains. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

a. Calculate the initial investment associated with each alternative.
b. Calculate the incremental operating cash inflows associated with each alternative. *(Note:* Be sure to consider the depreciation in year 6.)
c. Calculate the terminal cash flow at the end of year 5 associated with each alternative.
d. Depict on a time line the relevant cash flows associated with each alternative.

CHAPTER 8 CASE

Developing Relevant Cash Flows for Clark Upholstery Company's Machine Renewal or Replacement Decision

Bo Humphries, chief financial officer of Clark Upholstery Company, expects the firm's *net profits after taxes* for the next 5 years to be as shown in the following table.

Year	Net profits after taxes
1	$100,000
2	150,000
3	200,000
4	250,000
5	320,000

Bo is beginning to develop the relevant cash flows needed to analyze whether to renew or replace Clark's *only* depreciable asset, a machine that originally cost $30,000, has a current book value of zero, and can now be sold for $20,000. *(Note:* Because the firm's only depreciable asset is fully depreciated—its book value is zero—its expected net profits after taxes equal its operating cash inflows.) He estimates that at the end of 5 years, the existing machine can be sold to net $2,000 before taxes. Bo plans to use the following information to develop the relevant cash flows for each of the alternatives.

Alternative 1 Renew the existing machine at a total depreciable cost of $90,000. The renewed machine would have a 5-year usable life and would be depreciated under MACRS using a 5-year recovery period. Renewing the machine would result in the following projected revenues and expenses (excluding depreciation):

Year	Revenue	Expenses (excl. depreciation)
1	$1,000,000	$801,500
2	1,175,000	884,200
3	1,300,000	918,100
4	1,425,000	943,100
5	1,550,000	968,100

The renewed machine would result in an increased investment in net working capital of $15,000. At the end of 5 years, the machine could be sold to net $8,000 before taxes.

Alternative 2 Replace the existing machine with a new machine that costs $100,000 and requires installation costs of $10,000. The new machine would have a 5-year usable life and would be depreciated under MACRS using a 5-

year recovery period. The firm's projected revenues and expenses (excluding depreciation), if it acquires the machine, would be as follows:

Year	Revenue	Expenses (excl. depreciation)
1	$1,000,000	$764,500
2	1,175,000	839,800
3	1,300,000	914,900
4	1,425,000	989,900
5	1,550,000	998,900

The new machine would result in an increased investment in net working capital of $22,000. At the end of 5 years, the new machine could be sold to net $25,000 before taxes.

The firm is subject to a 40% tax on both ordinary income and capital gains. As noted, the company uses MACRS depreciation. (See Table 3.2 on page 100 for the applicable depreciation percentages.)

Required

a. Calculate the initial investment associated with each of Clark Upholstery's alternatives.
b. Calculate the incremental operating cash inflows associated with each of Clark's alternatives. (*Note:* Be sure to consider the depreciation in year 6.)
c. Calculate the terminal cash flow at the end of year 5 associated with each of Clark's alternatives.
d. Use your findings in parts **a, b,** and **c** to depict on a time line the relevant cash flows associated with each of Clark Upholstery's alternatives.
e. Solely on the basis of your comparison of their relevant cash flows, which alternative appears to be better? Why?

WEB EXERCISE

Go to the Web site *www.reportgallery.com*. Click on **Reports**, at the top of the page, navigate to the listing for Intel Corp., and click on **Annual Report**. This takes you to an investor relations page; select the most recent annual report. Answer the following questions using information in various report sections, such as **Intel Facts and Figures**, **Financial Summary**, **Consolidated Balance Sheets**, and **Consolidated Statements of Cash Flow**. (These may change from year to year and may be listed in the left navigation bar.)

1. How much did Intel spend on capital expenditures for each of the past 5 years?
2. Did capital expenditures increase or decrease?
3. Is Intel's capital spending consistent or erratic?

4. What were the major uses of capital spending for the most recent 2 years?
5. What were the account balances for property, plant, and equipment (PP&E) for the most recent 2 years (found on the *Consolidated Balance Sheets*)?
6. What percent of PP&E does Intel replace every year? (*Hint:* For a rough estimate, divide capital expenditures for a year by that year's PP&E balance.)
7. Select *one* of the following companies, and use the *Reportgallery* site to access its annual report. Research its capital spending patterns and compare them to Intel's.
   a. Abbot Laboratories
   b. Southwest Airlines
   c. Ford Motor Company

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.