CHAPTER 16

Planning for Capital Investments

LEARNING OBJECTIVES

After you have mastered the material in this chapter, you will be able to:

1 Explain the time value of money concept and apply it to capital investment decisions.

2 Determine the present value of future cash flows.

3 Determine and interpret the net present value of an investment opportunity.

4 Determine and interpret the internal rate of return of an investment opportunity.

5 Identify cash flows associated with an investment opportunity.

6 Compare capital investment alternatives.

7 Determine the payback period for an investment opportunity.

8 Determine the unadjusted rate of return for an investment opportunity.

9 Conduct a postaudit of a completed investment.

CHAPTER OPENING

The president of EZ Rentals (EZ) is considering expanding the company's rental service business to include LCD projectors that can be used with notebook computers. A marketing study forecasts that renting projectors could generate revenue of $200,000 per year. The possibility of increasing revenue is alluring, but EZ's president has a number of unanswered questions. How much do the projectors cost? What is their expected useful life? Will they have a salvage value? Does EZ have the money to buy them? Does EZ have the technical expertise to support the product? How much will training cost? How long will customer demand last? What if EZ buys the projectors and they become technologically obsolete? How quickly will EZ be able to recover the investment? Are there more profitable ways to invest EZ's funds?

Spending large sums of money that will have long-term effects on company profits makes most managers anxious. What if a cell phone manufacturer spends millions of dollars to build a factory in the United States and its competitors locate their manufacturing facilities in countries that provide cheap labor? The manufacturer's cell phones will be overpriced, but it cannot move overseas because it cannot find a buyer for the factory. What if a pharmaceutical company spends millions of dollars to develop a drug which then fails to receive FDA approval? What if a communications company installs underground cable but satellite transmission steals its market? What if a company buys computer equipment that rapidly becomes technologically obsolete? Although these possibilities may be remote, they can be expensive when they do occur. For example, a recent annual report from Wachovia Bank discloses a $70 million dollar write-off of computer equipment. This chapter discusses some of the analytical techniques companies use to evaluate major investment opportunities.

The Curious Accountant

The August 28, 2009, drawing for the Mega millions multi-state lottery produced two winning tickets. The tickets, which were purchased in California and New York, had an advertised value of $368 million. This amount, however, was based on the assumption that the winners would take their prize as 26 equal annual payments of $14,153,384. If the winnings were taken in this manner, the first payment would be made immediately, and the others would be paid annually over the next 25 years. The winner also had the option of taking an immediate, lump-sum payment of $231 million. With two winning tickets, each winner would receive one-half of these amounts.

Assume that you work as a personal financial planner and that one of your clients held one of the winning lottery tickets. If you think you could invest your client's winnings and earn an annual return of 7 percent, would you advise your client to take the lump-sum payment or the annual payments? Why? (The answer is on page 577.)

CAPITAL INVESTMENT DECISIONS

Purchases of long-term operational assets are **capital investments.** Capital investments differ from stock and bond investments in an important respect. Investments in stocks and bonds can be sold in organized markets such as the New York Stock Exchange. In contrast, investments in capital assets normally can be recovered only by using those assets. Once a company purchases a capital asset, it is committed to that investment for an extended period of time. If the market turns sour, the company is stuck with the consequences. It may also be unable to seize new opportunities because its capital is committed. Business profitability ultimately hinges, to a large extent, on the quality of a few key capital investment decisions.

A capital investment decision is essentially a decision to exchange current cash outflows for the expectation of receiving future cash inflows. For EZ Rentals, purchasing LCD projectors, cash outflows today, provides the opportunity to collect $200,000 per year in rental revenue, cash inflows in the future. Assuming the projectors have useful lives of four years and no salvage value, how much should EZ be willing to pay for the future cash inflows? If you were EZ's president, would you spend $700,000 today to receive $200,000 each year for the next four years? You would give up $700,000 today for the opportunity to receive $800,000 (4 × $200,000) in the future. What if you collect less than $200,000 per year? If revenue is only $160,000 per year, you would lose $60,000 [$700,000 − (4 × $160,000)]. Is $700,000 too much to pay for the opportunity to receive $200,000 per year for four years? If $700,000 is too much, would you spend $600,000? If not, how about $500,000? There is no one right answer to these questions. However, understanding the *time value of money* concept can help you develop a rational response.

Time Value of Money

The **time value of money** concept recognizes that *the present value of a dollar received in the future is less than a dollar.* For example, you may be willing to pay only $0.90 today for a promise to receive $1.00 one year from today. The further into the future the receipt is expected to occur, the smaller is its present value. In other words, one dollar to be received two years from today is worth less than one dollar to be received one year from today. Likewise, one dollar to be received three years from today is less valuable than one dollar to be received two years from today, and so on.

The present value of cash inflows decreases as the time until expected receipt increases for several reasons. First, you could deposit today's dollar in a savings account to earn *interest* that increases its total value. If you wait for your money, you lose the opportunity to earn interest. Second, the expectation of receiving a future dollar carries an element of *risk*. Changed conditions may result in the failure to collect. Finally, *inflation* diminishes the buying power of the dollar. In other words, the longer you must wait to receive a dollar, the less you will be able to buy with it.

When a company invests in capital assets, it sacrifices present dollars in exchange for the opportunity to receive future dollars. Because trading current dollars for future dollars is risky, companies expect compensation before they invest in capital assets. The compensation a company expects is called *return on investment (ROI).* As discussed in Chapter 15, ROI is expressed as a percentage of the investment. For example, the ROI for a $1,000 investment that earns annual income of $100 is 10 percent ($100 ÷ $1,000 = 10%).

Determining the Minimum Rate of Return

To establish the minimum expected *return on investment* before accepting an investment opportunity, most companies consider their cost of capital. To attract capital, companies must provide benefits to their creditors and owners. Creditors expect interest

payments; owners expect dividends and increased stock value. Companies that earn lower returns than their cost of capital eventually go bankrupt; they cannot continually pay out more than they collect. *The* **cost of capital** *represents the* **minimum rate of return** *on investments.* Calculating the cost of capital is a complex exercise which is beyond the scope of this text. It is addressed in finance courses. We discuss how management accountants *use* the cost of capital to evaluate investment opportunities. Companies describe the cost of capital in a variety of ways: the *minimum rate of return,* the *desired rate of return,* the *required rate of return,* the *hurdle rate,* the *cutoff rate,* or the *discount rate.* These terms are used interchangeably throughout this chapter.

✓ **CHECK YOURSELF 16.1**

Study the following cash inflow streams expected from two different potential investments.

	Year 1	Year 2	Year 3	Total
Alternative 1	$2,000	$3,000	$4,000	$9,000
Alternative 2	4,000	3,000	2,000	9,000

Based on visual observation alone, which alternative has the higher present value? Why?

Answer   Alternative 2 has the higher present value. The size of the discount increases as the length of the time period increases. In other words, a dollar received in year 3 has a lower present value than a dollar received in year 1. Because most of the expected cash inflows from Alternative 2 are received earlier than those from Alternative 1, Alternative 2 has a higher present value even though the total expected cash inflows are the same.

CONVERTING FUTURE CASH INFLOWS TO THEIR EQUIVALENT PRESENT VALUES

Given a desired rate of return and the amount of a future cash flow, present value can be determined using algebra. To illustrate, refer to the $200,000 EZ expects to earn the first year it leases LCD projectors.[1] Assuming EZ desires a 12 percent rate of return, what amount of cash would EZ be willing to invest today (present value outflow) to obtain a $200,000 cash inflow at the end of the year (future value)? The answer follows.[2]

LO 2

Determine the present value of future cash flows.

$$\text{Investment} + (0.12 \times \text{Investment}) = \text{Future cash inflow}$$

$$1.12 \text{ Investment} = \$200,000$$

$$\text{Investment} = \$200,000 \div 1.12$$

$$\text{Investment} = \$178,571$$

If EZ invests $178,571 cash on January 1 and earns a 12 percent return on the investment, EZ will have $200,000 on December 31. An investor who is able to earn a 12 percent return on investment is indifferent between having $178,571 now or receiving

---

[1]The following computations assume the $200,000 cash inflow is received on the last day of each year. In actual practice the timing of cash inflows is less precise and present value computations are recognized to be approximate, not exact.

[2]All computations in this chapter are rounded to the nearest whole dollar.

$200,000 one year from now. The two options are equal, as shown in the following mathematical proof:

$$\text{Investment} + (0.12 \times \text{Investment}) = \$200,000$$
$$\$178,571 + (0.12 \times \$178,571) = \$200,000$$
$$\$178,571 + 21,429 = \$200,000$$
$$\$200,000 = \$200,000$$

Present Value Table for Single-Amount Cash Inflows

The algebra illustrated above is used to convert a one-time future receipt of cash to its present value. One-time receipts of cash are frequently called **single-payment,** or **lump-sum,** cash flows. Because EZ desires a 12 percent rate of return, the present value of the first cash inflow is $178,571. We can also determine the present value of a $200,000 single amount (lump sum) at the end of the second, third, and fourth years. Instead of using cumbersome algebraic computations to convert these future values to their present value equivalents, financial analysts frequently use a table of conversion factors to convert future values to their present value equivalents. The table of conversion factors used to convert future values into present values is commonly called a **present value table.**[3] A typical present value table presents columns with different return rates and rows with different periods of time, like Table 1 in the Appendix located at the end of this chapter.

To illustrate using the present value table, locate the conversion factor in Table 1 at the intersection of the 12% column and the one-period row. The conversion factor is 0.892857. Multiplying this factor by the $200,000 expected cash inflow yields $178,571 ($200,000 × 0.892857). This is the same value determined algebraically in the previous section of this chapter. The conversion factors in the present value tables simplify converting future values to present values.

The conversion factors for the second, third, and fourth periods are 0.797194, 0.711780, and 0.635518, respectively. These factors are in the 12% column at rows 2, 3, and 4, respectively. Locate these factors in Table 1 of the Appendix. Multiplying the conversion factors by the future cash inflow for each period produces their present value equivalents, shown in Exhibit 16.1. Exhibit 16.1 indicates that investing $607,470 today at a 12 percent rate of return is equivalent to receiving $200,000 per year for four years. Because EZ Rentals desires to earn (at least) a 12 percent rate of return, the company should be willing to pay up to $607,470 to purchase the LCD projectors.

Present Value Table for Annuities

The algebra described previously for converting equal lump-sum cash inflows to present value equivalents can be further simplified by adding the present value table factors

EXHIBIT 16.1

Present Value of a $200,000 Cash Inflow to be Received for Four Years

PV	=	FV	×	Present Value Table Factor	=	Present Value Equivalent
Period 1 PV	=	$200,000	×	0.892857	=	$178,571
Period 2 PV	=	200,000	×	0.797194	=	159,439
Period 3 PV	=	200,000	×	0.711780	=	142,356
Period 4 PV	=	200,000	×	0.635518	=	127,104
Total						$607,470

[3]The present value table is based on the formula $[1 \div (1 + r)^n]$ where r equals the rate of return and n equals the number of periods.

together before multiplying them by the cash inflows. The total of the present value table factors in Exhibit 16.1 is 3.037349 (0.892857 + 0.797194 + 0.711780 + 0.635518). Multiplying this **accumulated conversion factor** by the expected annual cash inflow results in the same present value equivalent of $607,470 ($200,000 $\times$ 3.037349). As with lump-sum conversion factors, accumulated conversion factors can be calculated and organized in a table with *columns* for different rates of return and *rows* for different periods of time. Table 2 in the Appendix is a present value table of accumulated conversion factors. Locate the conversion factor at the intersection of the 12% column and the fourth time-period row. The factor at this intersection is 3.037349, confirming that the accumulated conversion factors represent the sum of the single-payment conversion factors.

The conversion factors in Table 2 apply to annuities. An **annuity** is a series of cash flows that meets three criteria: (1) equal payment amounts; (2) equal time intervals between payments; and (3) a constant rate of return. For EZ Rentals, the expected cash inflows from renting LCD projectors are all for equivalent amounts ($200,000); the expected intervals between cash inflows are equal lengths of time (one year); and the rate of return for each inflow is constant at 12 percent. The series of expected cash inflows from renting the projectors is therefore an annuity. The present value of an annuity table can be used only if all of these conditions are satisfied.

The present value of an annuity table (Table 2) simplifies converting future cash inflows to their present value equivalents. EZ Rentals can convert the cash inflows as shown in Exhibit 16.1, using four conversion factors, multiplying each conversion factor by the annual cash inflow (four multiplications), and adding the resulting products. In contrast, EZ can recognize that the series of payments is an annuity, which requires multiplying a single conversion factor from Table 2 by the amount of the annuity payment. Regardless of the conversion method, the result is the same (a present value of $607,470). Recall that EZ can also make the conversion using algebra. The table values are derived from algebraic formulas. The present value tables reduce the computations needed to convert future values to present values.

Software Programs That Calculate Present Values

Software programs offer an even more efficient means of converting future values into present value equivalents. These programs are frequently built into handheld financial calculators and computer spreadsheet programs. As an example, we demonstrate the procedures used in a Microsoft Excel spreadsheet.

An Excel spreadsheet offers a variety of financial functions, one of which converts a future value annuity into its present value equivalent. This present value function uses the syntax *PV(rate,nper,pmt)* in which *rate* is the desired rate of return, *nper* is the number of periods, and *pmt* is the amount of the payment (periodic cash inflow). To convert a future value annuity into its present value equivalent, provide the function with the appropriate amounts for the rate, number of periods, and amount of the annuity (cash inflows) into a spreadsheet cell. Press the Enter key and the present value equivalent appears in the spreadsheet cell.

The power of the spreadsheet to perform computations instantly is extremely useful for answering what-if questions. Exhibit 16.2 demonstrates this power by providing spreadsheet conversions for three different scenarios. The first scenario demonstrates the annuity assumptions for EZ Rentals, providing the present value equivalent ($607,470) of a four-year cash inflow of $200,000 per year at a 12 percent rate of interest. The present value is a *negative* number. This format indicates that an initial $607,470 *cash outflow* is required to obtain the four-year series of cash inflows. The present value equivalent in Scenario 2 shows the present value if the annuity assumptions reflect a 14 percent, rather than 12 percent, desired rate of return. The present value equivalent in Scenario 3 shows the present value if the annuity assumptions under Scenario 1 are changed to reflect annual cash inflows of $300,000, rather than $200,000. A wide range of scenarios could be readily considered by changing any or all the variables in the spreadsheet function. In each case, the computer does the calculations, giving the manager more time to analyze the data rather than compute it.

EXHIBIT 16.2

Microsoft Excel Spreadsheet Present Value Function

	B
2	PV(rate,nper,pmt)
4	Scenario 1
5	PV(0.12,4,200000)
6	($607,470)
8	Scenario 2
9	PV(0.14,4,200000)
10	($582,742)
12	Scenario 3
13	PV(0.12,4,300000)
14	($911,205)

Although software is widely used in business practice, the diversity of interfaces used by different calculators and spreadsheet programs makes it unsuitable for textbook presentations. This text uses the present value tables in the Appendix in the text illustrations and the end-of-chapter exercises and problems. If you use software to solve these problems, your answers will be the same. All these tools—formulas, conversion tables, software—are based on the same mathematical principles and will produce the same results.

Ordinary Annuity Assumption

All the conversion methods described above assume the cash inflows occur at the *end* of each accounting period. This distribution pattern is called an **ordinary annuity.**[4] In practice, cash inflows are likely to be received throughout the period, not just at the end. For example, EZ Rentals is likely to collect cash revenue from renting projectors each month rather than in a single lump-sum receipt at the end of each of the four years. Companies frequently use the ordinary annuity assumption in practice because it simplifies time value of money computations. Because capital investment decisions are necessarily based on uncertain projections about future cash inflows, the lives of investment opportunities, and the appropriate rates of return, achieving pinpoint accuracy is impossible. Sacrificing precision for simplicity by using the ordinary annuity assumption is a reasonable trade-off in the decision-making process.

Reinvestment Assumption

The present value computations in the previous sections show that investing $607,470 today at a 12 percent rate of return is equivalent to receiving four individual $200,000 payments at the end of four successive years. Exhibit 16.3 illustrates that a cash inflow of $200,000 per year is equivalent to earning a 12 percent rate of return on a $607,470 investment.[5]

---

[4]When equal cash inflows occur at the *beginning* of each accounting period, the distribution is called an *annuity due.* Although some business transactions are structured as annuities due, they are less common than ordinary annuities. This text focuses on the ordinary annuity assumption.

[5]Exhibit 16.3 is analogous to an amortization table for a long-term note with equal payments of principal and interest.

EXHIBIT 16.3

Cash Flow Classifications for EZ's Investment in Projectors

Time Period	(a) Investment Balance During the Year	(b) Annual Cash Inflow	(c) Return on Investment (a × 0.12)	(d) Recovered Investment (b − c)	(e) Year-End Investment Balance (a − d)
1	$607,470	$200,000	$ 72,896	$127,104	$480,366
2	480,366	200,000	57,644	142,356	338,010
3	338,010	200,000	40,561	159,439	178,571
4	178,571	200,000	21,429	178,571	0
Totals		$800,000	$192,530	$607,470	

It is customary to assume that the desired rate of return includes the effects of *compounding.*[6] Saying an investment is "earning the desired rate of return" assumes the cash inflows generated by the investment are reinvested at the desired rate of return. In this case, we are assuming that EZ will reinvest the $200,000 annual cash inflows in other investments that will earn a 12 percent return.

TECHNIQUES FOR ANALYZING CAPITAL INVESTMENT PROPOSALS

Managers can choose from among numerous analytical techniques to help them make capital investment decisions. Each technique has advantages and disadvantages. A manager may apply more than one technique to a particular proposal to take advantage of more information. Because most companies have computer capabilities that include a variety of standard capital budgeting programs, applying different techniques to the same proposal normally requires little extra effort. Limiting analysis to only one tool could produce biased results. Obtaining more than one perspective offers substantial benefit.

Net Present Value

By using the present value conversion techniques described earlier, EZ Rentals' management determined it would be willing to invest $607,470 today (present value) to obtain a four-year, $200,000 future value annuity cash inflow. The $607,470 investment is *not* the cost of the LCD projectors, it is the amount EZ is willing to pay for them. The projectors may cost EZ Rentals more or less than their present value. To determine whether EZ should invest in the projectors, management must compare the present value of the future cash inflows ($607,470) to the cost of the projectors (the current cash outflow required to purchase them). Subtracting the cost of the investment from the present value of the future cash inflows determines the **net present value** of the investment opportunity. A positive net present value indicates the investment will yield a rate of return higher than 12 percent. A negative net present value means the return is less than 12 percent.

LO 3

Determine and interpret the net present value of an investment opportunity.

[6]*Compounding* refers to reinvesting investment proceeds so the total amount of invested capital increases, resulting in even higher returns. For example, assume $100 is invested at a 10 percent compounded annual rate of return. At the end of the first year, the investment yields a $10 return ($100 × 0.10). The $10 return plus any recovered investment is reinvested so that the total amount of invested capital at the beginning of the second year is $110. The return for the second year is $11 ($110 × 0.10). All funds are reinvested so that the return for the third year is $12.10 [($110 + $11) × 0.10].

To illustrate, assume EZ can purchase the projectors for $582,742. Assuming the desired rate of return is 12 percent, EZ should buy them. The net present value of the investment opportunity is computed as follows.

Present value of future cash inflows	$607,470
Cost of investment (required cash outflow)	(582,742)
Net present value	$ 24,728

The positive net present value suggests the investment will earn a rate of return in excess of 12 percent (if cash flows are indeed $200,000 each year). Because the projected rate of return is higher than the desired rate of return, this analysis suggests EZ should accept the investment opportunity. Based on the above analysis we are able to establish the following decision rule.

> **Net present value decision rule:** If the net present value is equal to or greater than zero, accept the investment opportunity.

✓ CHECK YOURSELF 16.2

To increase productivity, Wald Corporation is considering the purchase of a new machine that costs $50,000. Wald expects using the machine to increase annual net cash inflows by $12,500 for each of the next five years. Wald desires a minimum annual rate of return of 10 percent on the investment. Determine the net present value of the investment opportunity and recommend whether Wald should acquire the machine.

Answer

Present value of future cash flows = Future cash flow × Table 2 factor ($n = 5$, $r = 10\%$)

Present value of future cash flows = $12,500 × 3.790787 = $47,385

Net present value = PV of future cash flows − Cost of machine

Net present value = $47,385 − $50,000 = ($2,615)

The negative net present value indicates the investment will yield a rate of return below the desired rate of return. Wald should not acquire the new machine.

Internal Rate of Return

The net present value method indicates EZ's investment in the projectors will provide a return in excess of the desired rate, but it does not provide the actual rate of return to expect from the investment. If EZ's management team wants to know the rate of return to expect from investing in the projectors, it must use the *internal rate of return method.* The **internal rate of return** is the rate at which the present value of cash inflows equals the cash outflows. It is the rate that will produce a zero net present value. For EZ Rentals, the internal rate of return can be determined as follows. First, compute the *present value table factor* for a $200,000 annuity that would yield a $582,742 present value cash outflow (cost of investment).

Present value table factor × $200,000 = $582,742

Present value table factor = $582,742 ÷ $200,000

Present value table factor = 2.91371

Second, because the expected annual cash inflows represent a four-year annuity, scan Table 2 in the Appendix at period $n = 4$. Try to locate the table factor 2.91371. The

rate listed at the top of the column in which the factor is located is the internal rate of return. Turn to Table 2 and determine the internal rate of return for EZ Rentals before you read further. The above factor is in the 14 percent column. The difference in the table value (2.913712) and the value computed here (2.91371) is not significant. If EZ invests $582,742 in the projectors and they produce a $200,000 annual cash flow for four years, EZ will earn a 14 percent rate of return on the investment.

The *internal rate of return* may be compared with a *desired rate of return* to determine whether to accept or reject a particular investment project. Assuming EZ desires to earn a minimum rate of return of 12 percent, the preceding analysis suggests it should accept the investment opportunity because the internal rate of return (14 percent) is higher than the desired rate of return (12 percent). An internal rate of return below the desired rate suggests management should reject a particular proposal. The desired rate of return is sometimes called the *cutoff rate* or the *hurdle rate.* To be accepted, an investment proposal must provide an internal rate of return higher than the hurdle rate, cutoff rate, or desired rate of return. These terms are merely alternatives for the *cost of capital.* Ultimately, to be accepted, an investment must provide an internal rate of return higher than a company's cost of capital. Based on the above analysis we are able to establish the following decision rule.

> **Internal rate of return decision rule:** If the internal rate of return is equal to or greater than the desired rate of return, accept the investment opportunity.

TECHNIQUES FOR MEASURING INVESTMENT CASH FLOWS

The EZ Rentals example represents a simple capital investment analysis. The investment option involved only one cash outflow and a single annuity inflow. Investment opportunities often involve a greater variety of cash outflows and inflows. The following section of this chapter discusses different types of cash flows encountered in business practice.

LO 5

Identify cash flows associated with an investment opportunity.

Cash Inflows

Cash inflows generated from capital investments come from *four basic sources.* As in the case of EZ Rentals, the most common source of cash inflows is incremental revenue. **Incremental revenue** refers to the *additional* cash inflows from operating activities generated by using additional capital assets. For example, a taxi company expects revenues from taxi fares to increase if it purchases additional taxicabs. Similarly, investing in new apartments should increase rent revenue; opening a new store should result in additional sales revenue.

A second type of cash inflow results from *cost savings.* Decreases in cash outflows have the same beneficial effect as increases in cash inflows. Either way, a firm's cash position improves. For example, purchasing an automated computer system may enable a company to reduce cash outflows for salaries. Similarly, relocating a manufacturing facility closer to its raw materials source can reduce cash outflows for transportation costs.

An investment's *salvage value* provides a third source of cash inflows. Even when one company has finished using an asset, the asset may still be useful to another company. Many assets are sold after a company no longer wishes to use them. The salvage value represents a one-time cash inflow obtained when a company terminates an investment.

Companies can also experience a cash inflow through a *reduction in the amount of* **working capital** needed to support an investment. A certain level of working capital is required to support most business investments. For example, a new retail store outlet requires cash, receivables, and inventory to operate. When an investment is terminated, the decrease in the working capital commitment associated with the investment normally results in a cash inflow.

Cash Outflows

Cash outflows fall into *three primary categories.* One category consists of outflows for the *initial investment.* Managers must be alert to all the cash outflows connected with purchasing a capital asset. The purchase price, transportation costs, installation costs, and training costs are examples of typical cash outflows related to an initial investment.

A second category of cash outflows may result from *increases in operating expenses.* If a company increases output capacity by investing in additional equipment, it may experience higher utility bills, labor costs, and maintenance expenses when it places the equipment into service. These expenditures increase cash outflows.

Third, *increases in working capital* commitments result in cash outflows. Frequently, investments in new assets must be supported by a certain level of working capital. For example, investing in a copy machine requires spending cash to maintain a supply of paper and toner. Managers should treat an increased working capital commitment as a cash outflow in the period the commitment occurs.

Exhibit 16.4 lists the cash inflows and outflows discussed above. The list is not exhaustive but does summarize the most common cash flows businesses experience.

EXHIBIT 16.4

Typical Cash Flows Associated With Capital Investments

Inflows	Outflows
1. Incremental revenue	1. Initial investment
2. Cost savings	2. Incremental expenses
3. Salvage values	3. Working capital commitments
4. Recovery of working capital	

TECHNIQUES FOR COMPARING ALTERNATIVE CAPITAL INVESTMENT OPPORTUNITIES

The management of Torres Transfer Company is considering two investment opportunities. One alternative, involving the purchase of new equipment for $80,000, would enable Torres to modernize its maintenance facility. The equipment has an expected useful life of five years and a $4,000 salvage value. It would replace existing equipment that had originally cost $45,000. The existing equipment has a current book value of $15,000 and a trade-in value of $5,000. The old equipment is technologically obsolete but can operate for an additional five years. On the day Torres purchases the new equipment, it would also pay the equipment manufacturer $3,000 for training costs to teach employees to operate the new equipment. The modernization has two primary advantages. One, it will improve management of the small parts inventory. The company's accountant believes that by the end of the first year, the carrying value of the small parts inventory could be reduced by $12,000. Second, the modernization is expected to increase efficiency, resulting in a $21,500 reduction in annual operating expenses.

The other investment alternative available to Torres is purchasing a truck. Adding another truck would enable Torres to expand its delivery area and increase revenue. The truck costs $115,000. It has a useful life of five years and a $30,000 salvage value. Operating the truck will require the company to increase its inventory of supplies, its petty cash account, and its accounts receivable and payable balances. These changes would add $5,000 to the company's working capital base immediately upon buying the truck. The working capital cash outflow is expected to be recovered at the end of the truck's useful life. The truck is expected to produce $69,000 per year in additional revenues. The driver's salary and other operating expenses are expected to be $32,000 per year. A major overhaul costing $20,000 is expected to be required at the end of the third year of operation. Assuming Torres desires to earn a rate of return of 14 percent, which of the two investment alternatives should it choose?

Net Present Value

Begin the analysis by calculating the net present value of the two investment alternatives. Exhibit 16.5 shows the computations. Study this exhibit. Each alternative is analyzed using three steps. Step 1 requires identifying all cash inflows; some may be annuities, and others may be lump-sum receipts. In the case of Alternative 1, the cost

EXHIBIT 16.5

Net Present Value Analysis

	Amount	×	Conversion Factor	=	Present Value
Alternative 1: Modernize Maintenance Facility					
Step 1: Cash inflows					
1. Cost savings	$21,500	×	3.433081*	=	$ 73,811
2. Salvage value	4,000	×	0.519369†	=	2,077
3. Working capital recovery	12,000	×	0.877193‡	=	10,526
Total					$ 86,414
Step 2: Cash outflows					
1. Cost of equipment					
($80,000 cost—$5,000 trade-in)	$75,000	×	1.000000§	=	$ 75,000
2. Training costs	3,000	×	1.000000§	=	3,000
Total					$ 78,000
Step 3: Net present value					
Total present value of cash inflows					$ 86,414
Total present value of cash outflows					(78,000)
Net present value					$ 8,414
Alternative 2: Purchase Delivery Truck					
Step 1: Cash inflows					
1. Incremental revenue	$69,000	×	3.433081*	=	$236,883
2. Salvage value	30,000	×	0.519369†	=	15,581
2. Working capital recovery	5,000	×	0.519369†	=	2,597
Total					$255,061
Step 2: Cash outflows					
1. Cost of truck	$115,000	×	1.000000§	=	$115,000
2. Working capital increase	5,000	×	1.000000§	=	5,000
3. Increased operating expense	32,000	×	3.433081*	=	109,859
4. Major overhaul	20,000	×	0.674972§§	=	13,499
Total					$243,358
Step 3: Net present value					
Total present value of cash inflows					$255,061
Total present value of cash outflows					(243,358)
Net present value					$ 11,703

*Present value of annuity table 2, $n = 5$, $r = 14\%$.
†Present value of single payment table 1, $n = 5$, $r = 14\%$.
‡Present value of single payment table 1, $n = 1$, $r = 14\%$.
§Present value at beginning of period 1.
§§Present value of single payment table 1, $n = 3$, $r = 14\%$.

saving is an annuity, and the inflow from the salvage value is a lump-sum receipt. Once the cash inflows have been identified, the appropriate conversion factors are identified and the cash inflows are converted to their equivalent present values. Step 2 follows the same process to determine the present value of the cash outflows. Step 3 subtracts the present value of the outflows from the present value of the inflows to determine the net present value. The same three-step approach is used to determine the net present value of Alternative 2.

With respect to Alternative 1, the original cost and the book value of the existing equipment are ignored. As indicated in a previous chapter, these measures represent *sunk costs;* they are not relevant to the decision. The concept of relevance applies to long-term capital investment decisions just as it applies to short-term special decisions. To be relevant to a capital investment decision, costs or revenues must involve different present and future cash flows for each alternative. Because the historical cost of the old equipment does not differ between the alternatives, it is not relevant.

Because the *net present value* of each investment alternative is *positive,* either investment will generate a return in excess of 14 percent. Which investment is the more favorable? The data could mislead a careless manager. Alternative 2 might seem the better choice because it has a greater present value than Alternative 1 ($11,703 vs. $8,414). Net present value, however, is expressed in *absolute dollars*. The net present value of a more costly capital investment can be greater than the net present value of a smaller investment even though the smaller investment earns a higher rate of return.

To compare different size investment alternatives, management can compute a **present value index** by dividing the present value of cash inflows by the present value of cash outflows. *The higher the ratio, the higher the rate of return per dollar invested in the proposed project.* The present value indices for the two alternatives Torres Transfer Company is considering are as follows.

$$\text{Present value index for Alternative 1} = \frac{\text{Present value of cash inflows}}{\text{Present value of cash outflows}} = \frac{\$86{,}414}{\$78{,}000} = 1.108$$

$$\text{Present value index for Alternative 2} = \frac{\text{Present value of cash inflows}}{\text{Present value of cash outflows}} = \frac{\$255{,}061}{\$243{,}358} = 1.048$$

Management can use the present value indices to rank the investment alternatives. In this case, Alternative 1 yields a higher return than Alternative 2.

Internal Rate of Return

Management can also rank investment alternatives using the internal rate of return for each investment. Generally, *the higher the internal rate of return, the more profitable the investment.* We previously demonstrated how to calculate the internal rate of return for an investment that generates a simple cash inflow annuity. The computations are significantly more complex for investments with uneven cash flows. Recall that the internal rate of return is the rate that produces a zero net present value. Manually computing the rate that produces a zero net present value is a tedious trial-and-error process. You must first estimate the rate of return for a particular investment, then calculate the net present value. If the calculation produces a negative net present value, you try a lower estimated rate of return and recalculate. If this calculation produces a positive net present value, the actual internal rate of return lies between the first and second estimates. Make a third estimate and once again recalculate the net present value, and so on. Eventually you will determine the rate of return that produces a net present value of zero.

Many calculators and spreadsheet programs are designed to make these computations. We illustrate the process with a Microsoft Excel spreadsheet. Excel uses the syntax *IRR (values, guess)* in which *values* refers to cells that specify the cash flows for which you want to calculate the internal rate of return and *guess* is a number you estimate is close to the actual internal rate of return (IRR). The IRRs for the two investment alternatives available to Torres Transfer Company are shown in Exhibit 16.6. Study this exhibit. Excel requires netting cash outflows against cash inflows for each period in which both outflows and inflows are expected. For your convenience, we have labeled the net cash flows in the spreadsheet. Labeling is not necessary to execute the IRR function. The entire function, including values and guess, can be entered into a single cell of the spreadsheet. Persons familiar with spreadsheet programs learn to significantly simplify the input required.

The IRR results in Exhibit 16.6 confirm the ranking determined using the present value index. Alternative 1 (modernize maintenance facility), with an internal rate of return of 18.69 percent, ranks above Alternative 2 (purchase a truck) with an internal rate of return of 17.61 percent, even though Alternative 2 has a higher net present value (see Exhibit 16.5). Alternative 2, however, still may be the better investment option, depending on the amount available to invest. Suppose Torres has $120,000 of available funds to invest. Because Alternative 1 requires an initial investment of only $78,000, $42,000 ($120,000 − $78,000) of capital will not be invested. If Torres has no other investment
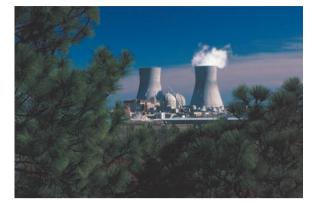
REALITY BYTES

Developing proficiency with present value mathematics is usually the most difficult aspect of capital budgeting for students taking their first managerial accounting course. In real-world companies, the most difficult aspect of capital budgeting is forecasting cash flows for several years into the future. Consider the following capital budgeting project.

In 1965 representatives from the Georgia Power Company visited Ms. Taylor's fifth grade class to tell her students about the Edwin I. Hatch Nuclear Plant that was going to be built nearby. One of the authors of this text was a student in that class.

In 1966 construction began on the first unit of the plant, and the plant started producing electricity in 1975. The next year, 10 years after hearing the presentation in his fifth grade class, the author worked on construction of the second unit of the plant during the summer before his senior year of college. This second unit began operations in 1978.

In its 2009 annual report, the Southern Company, which is now the major owner of the plant, stated that the Hatch plant is expected to operate until 2038, and that decommissioning of the plant will continue until 2061. The cost to construct both units of the plant was $934 million. The estimated cost to dismantle and decommission the plant is over $1 billion.

It seems safe to assume that the students in Ms. Taylor's fifth grade class were not among the first to hear about the power company's plans for the Hatch plant. Thus, we can reasonably conclude that the life of this capital project will be over 100 years, from around 1960 until 2061.

Try to imagine that you were assigned the task of predicting the cash inflows and outflows for a project that was expected to last 100 years. Clearly, mastering present value mathematics would not be your biggest worry.

EXHIBIT 16.6

Microsoft Excel Spreadsheet Internal Rate of Return Function

opportunities for this $42,000, the company would be better off investing the entire $120,000 in Alternative 2 ($115,000 cost of truck + $5,000 working capital increase). Earning 17.61 percent on a $120,000 investment is better than earning 18.69 percent on a $78,000 investment with no return on the remaining $42,000. Management accounting requires exercising judgment when making decisions.

Relevance and the Time Value of Money

Suppose you have the opportunity to invest in one of two capital projects. Both projects require an immediate cash outflow of $6,000 and will produce future cash inflows of $8,000. The only difference between the two projects is the timing of the inflows. The receipt schedule for both projects follows.

Year	Project 1	Project 2
1	$3,500	$2,000
2	3,000	2,000
3	1,000	2,000
4	500	2,000
Total	$8,000	$8,000

Because both projects cost the same and produce the same total cash inflows, they may appear to be equal. Whether you select Project 1 or Project 2, you pay $6,000 and receive $8,000. Because of the time value of money, however, Project 1 is preferable to Project 2. To see why, determine the net present value of both projects, assuming a 10 percent desired rate of return.

Computation of Net Present Value for Project 1 and Project 2

Net Present Value for Project 1

Period	Cash Inflow	×	Conversion Factor Table 1, $r = 10\%$	=	Present Value
1	$3,500	×	0.909091	=	$ 3,182
2	3,000	×	0.826446	=	2,479
3	1,000	×	0.751315	=	751
4	500	×	0.683013	=	342
Present value of future cash inflows					6,754
Present value of cash outflow					(6,000)
Net present value Project 1					$ 754

Net Present Value for Project 2

	Cash Inflow Annuity	×	Conversion Factor Table 2, $r = 10\%$, $n = 4$		
Present value of cash inflow	$2,000	×	3.169865		$ 6,340
Present value of cash outflow					(6,000)
Net present value Project 2					$ 340

The net present value of Project 1 ($754) exceeds the net present value of Project 2 ($340). The timing as well as the amount of cash flows has a significant impact on capital investment returns. Recall that to be relevant, costs or revenues must differ between alternatives. Differences in the timing of cash flow payments or receipts are also relevant for decision-making purposes.

Answers to **The Curious Accountant**

ment option is simple; it is the $115.5 [$231 ÷ 2] million the lottery is prepared to pay each of the winners now. The present value of the annuity option must be calculated, and it consists of two parts. The first of the 26 payments of $7,076,692 will be paid immediately, so it is worth $7,076,692 today. The remaining 25 payments will occur at one-year intervals, so their present value is computed as:

$$\$7,076,692 \times 11.653583^* = \$82,468,818$$

Adding $7,076,692 to $82,468,818 yields a present value of $89,545,510, which is a lot less than $115.5 million. This suggests your client should take the lump-sum payment. Of course, the risk of the lottery not making its annual payments is very low. There is a greater risk that a financial planner may not find investments to earn a 7% annual return, so the winner would have to consider his or her tolerance for risk before making a final decision.

In the case of these particular lottery winners, one chose the lump-sum payment and the other chose the annuity.

*This factor is not included in the tables at the end of the chapter, so it is provided here for the purposes of this illustration.

Tax Considerations

The previous examples have ignored the effect of income taxes on capital investment decisions. Taxes affect the amount of cash flows generated by investments. To illustrate, assume Wu Company purchases an asset that costs $240,000. The asset has a four-year useful life, no salvage value, and is depreciated on a straight-line basis. The asset generates cash revenue of $90,000 per year. Assume Wu's income tax rate is 40 percent. What is the net present value of the asset, assuming Wu's management desires to earn a 10 percent rate of return after taxes? The first step in answering this question is to calculate the annual cash flow generated by the asset, as shown in Exhibit 16.7.

EXHIBIT 16.7

Determining Cash Flow from Investment

	Period 1	Period 2	Period 3	Period 4
Cash revenue	$90,000	$90,000	$90,000	$90,000
Depreciation expense (noncash)	(60,000)	(60,000)	(60,000)	(60,000)
Income before taxes	30,000	30,000	30,000	30,000
Income tax at 40%	(12,000)	(12,000)	(12,000)	(12,000)
Income after tax	18,000	18,000	18,000	18,000
Depreciation add back	60,000	60,000	60,000	60,000
Annual cash inflow	$78,000	$78,000	$78,000	$78,000

Because recognizing depreciation expense does not require a cash payment (cash is paid when assets are purchased, not when depreciation is recognized), depreciation expense must be added back to after-tax income to determine the annual cash inflow. Once the cash flow is determined, the net present value is computed as shown here.

Cash flow annuity	×	Conversion factor Table 2, $r = 10\%$, $n = 4$	=	Present value cash inflows	−	Present value cash outflows	=	Net present value
$78,000	×	3.169865	=	$247,249	−	$240,000	=	$7,249

The depreciation sheltered some of the income from taxation. Income taxes apply to income after deducting depreciation expense. Without depreciation expense, income taxes each year would have been $36,000 ($90,000 × 0.40) instead of $12,000 ($30,000 × 0.40). The $24,000 difference ($36,000 − $12,000) is known as a *depreciation tax shield.* The amount of the depreciation tax shield can also be computed by multiplying the depreciation expense by the tax rate ($60,000 × 0.40 = $24,000).

Because of the time value of money, companies benefit by maximizing the depreciation tax shield early in the life of an asset. For this reason, most companies calculate depreciation expense for tax purposes using the *modified accelerated cost recovery system (MACRS)* permitted by tax law rather than using straight-line depreciation. MACRS recognizes depreciation on an accelerated basis, assigning larger amounts of depreciation in the early years of an asset's useful life. The higher depreciation charges result in lower amounts of taxable income and lower income taxes. In the later years of an asset's useful life, the reverse is true, and lower depreciation charges result in higher taxes. Accelerated depreciation does not allow companies to avoid paying taxes but to delay them. The longer companies can delay paying taxes, the more cash they have available to invest.

TECHNIQUES THAT IGNORE THE TIME VALUE OF MONEY

LO 7

Determine the payback period for an investment opportunity.

Several techniques for evaluating capital investment proposals ignore the time value of money. Although these techniques are less accurate, they are quick and simple. When investments are small or the returns are expected within a short time, these techniques are likely to result in the same decisions that more sophisticated techniques produce.

Payback Method

The **payback method** is simple to apply and easy to understand. It shows how long it will take to recover the initial cash outflow (the cost) of an investment. The formula for computing the payback period, measured in years, is as follows.

Payback period = Net cost of investment ÷ Annual net cash inflow

To illustrate, assume Winston Cleaners can purchase a new ironing machine that will press shirts in half the time of the one currently used. The new machine costs $100,000 and will reduce labor cost by $40,000 per year over a four-year useful life. The payback period is computed as follows.

Payback period = $100,000 ÷ $40,000 = 2.5 years

Interpreting Payback

Generally, investments with shorter payback periods are considered better. Because the payback method measures only investment recovery, not profitability, however, this conclusion can be invalid when considering investment alternatives. To illustrate, assume Winston Cleaners also has the opportunity to purchase a different machine that costs $100,000 and provides an annual labor savings of $40,000. However, the second

machine will last for five instead of four years. The payback period is still 2.5 years ($100,000 ÷ $40,000), but the second machine is a better investment because it improves profitability by providing an additional year of cost savings. The payback analysis does not measure this difference between the alternatives.

Unequal Cash Flows

The preceding illustration assumed Winston's labor cost reduction saved the same amount of cash each year for the life of the new machine. The payback method requires adjustment when cash flow benefits are unequal. Suppose a company purchases a machine for $6,000. The machine will be used erratically and is expected to provide incremental revenue over the next five years as follows.

2009	2010	2011	2012	2013
$3,000	$1,000	$2,000	$1,000	$500

Based on this cash inflow pattern, what is the payback period? There are two acceptable solutions. One accumulates the incremental revenue until the sum equals the amount of the original investment.

Year	Annual Amount	Cumulative Total
2009	$3,000	$3,000
2010	1,000	4,000
2011	2,000	6,000

This approach indicates the payback period is three years.

A second solution uses an averaging concept. The average annual cash inflow is determined. This figure is then used in the denominator of the payback equation. Using the preceding data, the payback period is computed as follows.

1. Compute the average annual cash inflow.

$$2009\ +\ 2010\ +\ 2011\ +\ 2012\ +2013 =\ \text{Total}\ \div 5 = \text{Average}$$
$$\$3,000 + \$1,000 + \$2,000 + \$1,000 + \$500 = \$7,500 \div 5 =\ \$1,500$$

2. Compute the payback period.

$$\frac{\text{Net cost of investment}} {}\ \div\ \frac{\text{Average annual net cash inflow}}{} = 6,000 \div 1,500 = 4\ \text{years}$$

The average method is useful when a company purchases a number of similar assets with differing cash return patterns.

Unadjusted Rate of Return

The **unadjusted rate of return** method is another common evaluation technique. Investment cash flows are not adjusted to reflect the time value of money. The unadjusted rate of return is sometimes called the *simple rate of return.* It is computed as follows.

$$\frac{\text{Unadjusted}}{\text{rate of return}} = \frac{\text{Average incremental increase in annual net income}}{\text{Net cost of original investment}}$$

To illustrate computing the unadjusted rate of return, assume The Dining Table, Inc., is considering establishing a new restaurant that will require a $2,000,000 original investment. Management anticipates operating the restaurant for 10 years before significant

LO 8

Determine the unadjusted rate of return for an investment opportunity.

renovations will be required. The restaurant is expected to provide an average after-tax return of $280,000 per year. The unadjusted rate of return is computed as follows.

$$\text{Unadjusted rate of return} = \$280,000 \div \$2,000,000 = 14\% \text{ per year}$$

The accuracy of the unadjusted rate of return suffers from the failure to recognize the recovery of invested capital. With respect to a depreciable asset, the capital invest-ment is normally recovered through revenue over the life of the asset. To illustrate, as-sume we purchase a $1,000 asset with a two-year life and a zero salvage value. For simplicity, ignore income taxes. Assume the asset produces $600 of cash revenue per year. The income statement for the first year of operation appears as follows.

Revenue	$ 600
Depreciation expense	(500)
Net income	$ 100

What is the amount of invested capital during the first year? First, a $1,000 cash out-flow was used to purchase the asset (the original investment). Next, we collected $600 of cash revenue of which $100 was a *return on investment* (net income) and $500 was a **recov-ery of investment.** As a result, $1,000 was invested in the asset at the beginning of the year and $500 was invested at the end of the year. Similarly, we will recover an additional $500 of capital during the second year of operation, leaving zero invested capital at the end of the second year. Given that the cash inflows from revenue are collected somewhat evenly over the life of the investment, the amount of invested capital will range from a beginning balance of $1,000 to an ending balance of zero. On average, we will have $500 invested in the asset (the midpoint between $1,000 and zero). The average investment can be deter-mined by dividing the total original investment by 2 ($1,000 ÷ 2 = $500). The unadjusted rate of return based on average invested capital can be calculated as follows.

$$\frac{\text{Unadjusted rate of return}}{\text{(Based on average investment)}} = \frac{\text{Average incremental increase in annual net income}}{\text{Net cost of original investment} \div 2}$$

$$= \frac{\$100}{\$1,000 \div 2} = 20\%$$

To avoid distortions caused by the failure to recognize the recovery of invested capital, the unadjusted rate of return should be based on the *average investment* when working with investments in depreciable assets.

✓ CHECK YOURSELF 16.3

EZ Rentals can purchase a van that costs $24,000. The van has an expected useful life of three years and no salvage value. EZ expects rental revenue from the van to be $12,000 per year. Determine the payback period and the unadjusted rate of return.

Answer

Payback = Cost of the investment ÷ Annual cash inflow

Payback = $24,000 ÷ $12,000 = 2 years

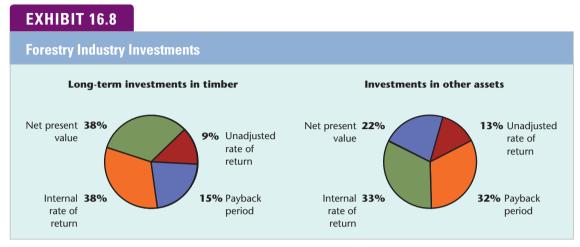**Unadjusted rate of return = Net income ÷ Average cost of the investment**

Revenue	$12,000	
Depreciation expense	(8,000)	[$24,000 ÷ 3 years]
Net income	$ 4,000	

Unadjusted rate of return = $4,000 ÷ ($24,000 ÷ 2) = 33.33%

Real-World Reporting Practices

In a recent study, researchers found that companies in the forest products industry use discounted cash flow techniques more frequently when the capital project being considered is a long-term timber investment. The use of techniques that ignore the time value of money increased when other shorter-term capital investment projects were being considered. Exhibit 16.8 shows the researchers' findings.

EXHIBIT 16.8

Forestry Industry Investments

Long-term investments in timber

Net present value **38%**
9% Unadjusted rate of return
Internal rate of return **38%**
15% Payback period

Investments in other assets

Net present value **22%**
13% Unadjusted rate of return
Internal rate of return **33%**
32% Payback period

Data Source: J. Bailes, J. Nielsen, and S. Lawton, "How Forest Product Companies Analyze Capital Budgets," *Management Accounting,* October 1998, pp. 24–30.

POSTAUDITS

The analytical techniques for evaluating capital investment proposals depend highly on estimates of future cash flows. Although predictions cannot be perfectly accurate, gross miscalculations can threaten the existence of an organization. For example, optimistic projections of future cash inflows that do not materialize will lead to investments that do not return the cost of capital. Managers must take their projections seriously. A postaudit policy can encourage managers to carefully consider their capital investment decisions. A **postaudit** is conducted at the completion of a capital investment project, using the same analytical technique that was used to justify the original investment. For example, if an internal rate of return was used to justify approving an investment project, the internal rate of return should be computed in the postaudit. In the postaudit computation, *actual* rather than estimated cash flows are used. Postaudits determine whether the expected results were achieved.

Postaudits should focus on continuous improvement rather than punishment. Managers who are chastised for failing to achieve expected results might become overly cautious when asked to provide estimates for future projects. Being too conservative can create problems as serious as those caused by being too optimistic. Managers can err two ways with respect to capital investment decisions. First, a manager might accept a project that should have been rejected. This mistake usually stems from excessively optimistic future cash flow projections. Second, a manager might reject a project that should have been accepted. These missed opportunities are usually the result of underestimating future cash flows. A too cautious manager can become unable to locate enough projects to fully invest the firm's funds.

Idle cash earns no return. If projects continue to outperform expectations, managers are probably estimating future cash flows too conservatively. If projects consistently fail to live up to expectations, managers are probably being too optimistic in their projections of future cash flows. Either way, the company suffers. The goal of a postaudit is to provide feedback that will help managers improve the accuracy of future cash flow projections, maximizing the quality of the firm's capital investments.

LO 9

Conduct a postaudit of a completed investment.

A Look Back <<

Capital expenditures have a significant, long-term effect on profitability. They usually involve major cash outflows that are recovered through future cash inflows. The most common cash inflows include incremental revenue, operating cost savings, salvage value, and working capital releases. The most common outflows are the initial investment, increases in operating expenses, and working capital commitments.

Several techniques for analyzing the cash flows associated with capital investments are available. The techniques can be divided into two categories: (1) techniques that use time value of money concepts and (2) techniques that ignore the time value of money. Generally, techniques that ignore the time value of money are less accurate but simpler and easier to understand. These techniques include the *payback method* and the *unadjusted rate of return method*.

The techniques that use time value of money concepts are the *net present value method* and the *internal rate of return method*. These methods offer significant improvements in accuracy but are more difficult to understand. They may involve tedious computations and require using experienced judgment. Computer software and programmed calculators that ease the tedious computational burden are readily available to most managers. Furthermore, the superiority of the techniques justifies learning how to use them. These methods should be used when investment expenditures are larger or when cash flows extend over a prolonged time period.

APPENDIX

TABLE 1   Present Value of $1

n	4%	5%	6%	7%	8%	9%	10%	12%	14%	16%	20%
1	0.961538	0.952381	0.943396	0.934579	0.925926	0.917431	0.909091	0.892857	0.877193	0.862069	0.833333
2	0.924556	0.907029	0.889996	0.873439	0.857339	0.841680	0.826446	0.797194	0.769468	0.743163	0.694444
3	0.888996	0.863838	0.839619	0.816298	0.793832	0.772183	0.751315	0.711780	0.674972	0.640658	0.578704
4	0.854804	0.822702	0.792094	0.762895	0.735030	0.708425	0.683013	0.635518	0.592080	0.552291	0.482253
5	0.821927	0.783526	0.747258	0.712986	0.680583	0.649931	0.620921	0.567427	0.519369	0.476113	0.401878
6	0.790315	0.746215	0.704961	0.666342	0.630170	0.596267	0.564474	0.506631	0.455587	0.410442	0.334898
7	0.759918	0.710681	0.665057	0.622750	0.583490	0.547034	0.513158	0.452349	0.399637	0.353830	0.279082
8	0.730690	0.676839	0.627412	0.582009	0.540269	0.501866	0.466507	0.403883	0.350559	0.305025	0.232568
9	0.702587	0.644609	0.591898	0.543934	0.500249	0.460428	0.424098	0.360610	0.307508	0.262953	0.193807
10	0.675564	0.613913	0.558395	0.508349	0.463193	0.422411	0.385543	0.321973	0.269744	0.226684	0.161506
11	0.649581	0.584679	0.526788	0.475093	0.428883	0.387533	0.350494	0.287476	0.236617	0.195417	0.134588
12	0.624597	0.556837	0.496969	0.444012	0.397114	0.355535	0.318631	0.256675	0.207559	0.168463	0.112157
13	0.600574	0.530321	0.468839	0.414964	0.367698	0.326179	0.289664	0.229174	0.182069	0.145227	0.093464
14	0.577475	0.505068	0.442301	0.387817	0.340461	0.299246	0.263331	0.204620	0.159710	0.125195	0.077887
15	0.555265	0.481017	0.417265	0.362446	0.315242	0.274538	0.239392	0.182696	0.140096	0.107927	0.064905
16	0.533908	0.458112	0.393646	0.338735	0.291890	0.251870	0.217629	0.163122	0.122892	0.093041	0.054088
17	0.513373	0.436297	0.371364	0.316574	0.270269	0.231073	0.197845	0.145644	0.107800	0.080207	0.045073
18	0.493628	0.415521	0.350344	0.295864	0.250249	0.211994	0.179859	0.130040	0.094561	0.069144	0.037561
19	0.474642	0.395734	0.330513	0.276508	0.231712	0.194490	0.163508	0.116107	0.082948	0.059607	0.031301
20	0.456387	0.376889	0.311805	0.258419	0.214548	0.178431	0.148644	0.103667	0.072762	0.051385	0.026084

TABLE 2		Present Value of an Annuity of $1									
n	4%	5%	6%	7%	8%	9%	10%	12%	14%	16%	20%
1	0.961538	0.952381	0.943396	0.934579	0.925926	0.917431	0.909091	0.892857	0.877193	0.862069	0.833333
2	1.886095	1.859410	1.833393	1.808018	1.783265	1.759111	1.735537	1.690051	1.646661	1.605232	1.527778
3	2.775091	2.723248	2.673012	2.624316	2.577097	2.531295	2.486852	2.401831	2.321632	2.245890	2.106481
4	3.629895	3.545951	3.465106	3.387211	3.312127	3.239720	3.169865	3.037349	2.913712	2.798181	2.588735
5	4.451822	4.329477	4.212364	4.100197	3.992710	3.889651	3.790787	3.604776	3.433081	3.274294	2.990612
6	5.242137	5.075692	4.917324	4.766540	4.622880	4.485919	4.355261	4.111407	3.888668	3.684736	3.325510
7	6.002055	5.786373	5.582381	5.389289	5.206370	5.032953	4.868419	4.563757	4.288305	4.038565	3.604592
8	6.732745	6.463213	6.209794	5.971299	5.746639	5.534819	5.334926	4.967640	4.638864	4.343591	3.837160
9	7.435332	7.107822	6.801692	6.515232	6.246888	5.995247	5.759024	5.328250	4.946372	4.606544	4.030967
10	8.110896	7.721735	7.360087	7.023582	6.710081	6.417658	6.144567	5.650223	5.216116	4.833227	4.192472
11	8.760477	8.306414	7.886875	7.498674	7.138964	6.805191	6.495061	5.937699	5.452733	5.028644	4.327060
12	9.385074	8.863252	8.383844	7.942686	7.536078	7.160725	6.813692	6.194374	5.660292	5.197107	4.439217
13	9.985648	9.393573	8.852683	8.357651	7.903776	7.486904	7.103356	6.423548	5.842362	5.342334	4.532681
14	10.563123	9.898641	9.294984	8.745468	8.244237	7.786150	7.366687	6.628168	6.002072	5.467529	4.610567
15	11.118387	10.379658	9.712249	9.107914	8.559479	8.060688	7.606080	6.810864	6.142168	5.575456	4.675473
16	11.652296	10.837770	10.105895	9.446649	8.851369	8.312558	7.823709	6.973986	6.265060	5.668497	4.729561
17	12.165669	11.274066	10.477260	9.763223	9.121638	8.543631	8.021553	7.119630	6.372859	5.748704	4.774634
18	12.659297	11.689587	10.827603	10.059087	9.371887	8.755625	8.201412	7.249670	6.467420	5.817848	4.812195
19	13.133939	12.085321	11.158116	10.335595	9.603599	8.905115	8.364920	7.365777	6.550369	5.877455	4.843496
20	13.590326	12.462210	11.469921	10.594014	9.818147	9.128546	8.513564	7.469444	6.623131	5.928841	4.869580

A step-by-step audio-narrated series of slides is provided on the text website at www.mhhe.com/edmondssurvey3e.

www.mhhe.com/edmondssurvey3e

SELF-STUDY REVIEW PROBLEM

The CFO of Advo Corporation is considering two investment opportunities. The expected future cash inflows for each opportunity follow.

	Year 1	Year 2	Year 3	Year 4
Project 1	$144,000	$147,000	$160,000	$178,000
Project 2	204,000	199,000	114,000	112,000

Both investments require an initial payment of $400,000. Advo's desired rate of return is 16 percent.

Required

a. Compute the net present value of each project. Which project should Advo adopt based on the net present value approach?

b. Based on the payback approach (incremental revenue summation method) which project should Advo adopt?

Solution to Requirement a

Project 1

	Cash Inflows		Table Factor*		Present Value
Year 1	$144,000	×	0.862069	=	$124,138
Year 2	147,000	×	0.743163	=	109,245
Year 3	160,000	×	0.640658	=	102,505
Year 4	178,000	×	0.552291	=	98,308
PV of cash inflows					434,196
Cost of investment					(400,000)
Net present value					$ 34,196

*Table 1, n = 1 through 4, r = 16%

Project 2

	Cash Inflows		Table Factor*		Present Value
Year 1	$204,000	×	0.862069	=	$175,862
Year 2	199,000	×	0.743163	=	147,889
Year 3	114,000	×	0.640658	=	73,035
Year 4	112,000	×	0.552291	=	61,857
PV of cash inflows					458,643
Cost of investment					(400,000)
Net present value					$ 58,643

*Table 1, n = 1 through 4, r = 16%

Advo should adopt Project 2 because it has a greater net present value.

Solution to Requirement b

Cash Inflows	Project 1	Project 2
Year 1	$144,000	$204,000
Year 2	147,000	199,000
Total	$291,000	$403,000

By the end of the second year, Project 2's cash inflows have more than paid for the cost of the investment. In contrast, Project 1 still falls short of investment recovery by $109,000 ($400,000 − $291,000). Advo should adopt Project 2 because it has a shorter payback period.

KEY TERMS

Accumulated conversion factor 567
Annuity 567
Capital investments 564
Cost of capital 565
Incremental revenue 571
Internal rate of return 571

Minimum rate of return 565
Net present value 569
Ordinary annuity 568
Payback method 578
Postaudit 581
Present value index 574
Present value table 566

Recovery of investment 580
Single-payment (lump-sum) 566
Time value of money 564
Unadjusted rate of return 579
Working capital 571

QUESTIONS

1. What is a capital investment? How does it differ from an investment in stocks or bonds?

2. What are three reasons that cash is worth more today than cash to be received in the future?

3. "A dollar today is worth more than a dollar in the future." "The present value of a future dollar is worth less than one dollar." Are these two statements synonymous? Explain.

4. Define the term *return on investment.* How is the return normally expressed? Give an example of a capital investment return.

5. How does a company establish its minimum acceptable rate of return on investments?

6. If you wanted to have $500,000 one year from today and desired to earn a 10 percent return, what amount would you need to invest today? Which amount has more value, the amount today or the $500,000 a year from today?

7. Why are present value tables frequently used to convert future values to present values?

8. Define the term *annuity.* What is one example of an annuity receipt?

9. How can present value "what-if" analysis be enhanced by using software programs?

10. Receiving $100,000 per year for five years is equivalent to investing what amount today at 14 percent? Provide a mathematical formula to solve this problem, assuming use of a present value annuity table to convert the future cash flows to their present value equivalents. Provide the expression for the Excel spreadsheet function that would perform the present value conversion.

11. Maria Espinosa borrowed $15,000 from the bank and agreed to repay the loan at 8 percent annual interest over four years, making payments of $4,529 per year. Because part of the bank's payment from Ms. Espinosa is a recovery of the original investment, what assumption must the bank make to earn its desired 8 percent compounded annual return?

12. Two investment opportunities have positive net present values. Investment A's net present value amounts to $40,000 while B's is only $30,000. Does this mean that A is the better investment opportunity? Explain.

13. What criteria determine whether a project is acceptable under the net present value method?

14. Does the net present value method provide a measure of the rate of return on capital investments?

15. Which is the best capital investment evaluation technique for ranking investment opportunities?

16. Paul Henderson is a manager for Spark Company. He tells you that his company always maximizes profitability by accepting the investment opportunity with the highest internal rate of return. Explain to Mr. Henderson how his company may improve profitability by sometimes selecting investment opportunities with lower internal rates of return.

17. What is the relationship between desired rate of return and internal rate of return?

18. What typical cash inflow and outflow items are associated with capital investments?

19. "I always go for the investment with the shortest payback period." Is this a sound strategy? Why or why not?

20. "The payback method cannot be used if the cash inflows occur in unequal patterns." Do you agree or disagree? Explain.

21. What are the advantages and disadvantages associated with the unadjusted rate of return method for evaluating capital investments?

22. How do capital investments affect profitability?

23. What is a postaudit? How is it useful in capital budgeting?

MULTIPLE-CHOICE QUESTIONS

Multiple-choice questions are provided on the text website at www.mhhe.com/edmondssurvey3e

EXERCISES

All applicable Exercises are available with McGraw-Hill's
Connect Accounting.

Exercise 16-1   *Identifying cash inflows and outflows*   **LO 5**

Required

Indicate which of the following items will result in cash inflows and which will result in cash outflows. The first one is shown as an example.

Item	Type of Cash Flow
a. Initial investment	Outflow
b. Salvage values	
c. Recovery of working capital	
d. Incremental expenses	
e. Working capital commitments	
f. Cost savings	
g. Incremental revenue	

LO 1, 2

Exercise 16-2 *Determining the present value of a lump-sum future cash receipt*

Stan Sweeney turned 20 years old today. His grandfather established a trust fund that will pay Mr. Sweeney $80,000 on his next birthday. However, Stan needs money today to start his college education. His father is willing to help and has agreed to give Stan the present value of the future cash inflow, assuming a 10 percent rate of return.

Required

a. Use a present value table to determine the amount of cash that Stan Sweeney's father should give him.

b. Use an algebraic formula to prove that the present value of the trust fund (the amount of cash computed in Requirement *a*) is equal to its $80,000 future value.

LO 1, 2

Exercise 16-3 *Determining the present value of a lump-sum future cash receipt*

Marsha Bittner expects to receive a $600,000 cash benefit when she retires five years from today. Ms. Bittner's employer has offered an early retirement incentive by agreeing to pay her $360,000 today if she agrees to retire immediately. Ms. Bittner desires to earn a rate of return of 12 percent.

Required

a. Assuming that the retirement benefit is the only consideration in making the retirement decision, should Ms. Bittner accept her employer's offer?

b. Identify the factors that cause the present value of the retirement benefit to be less than $600,000.

LO 1, 2

Exercise 16-4 *Determining the present value of an annuity*

The dean of the School of Natural Science is trying to decide whether to purchase a copy machine to place in the lobby of the building. The machine would add to student convenience, but the dean feels compelled to earn an 8 percent return on the investment of funds. Estimates of cash inflows from copy machines that have been placed in other university buildings indicate that the copy machine would probably produce incremental cash inflows of approximately $15,000 per year. The machine is expected to have a three-year useful life with a zero salvage value.

Required

a. Use Present Value Table 1 in the chapter's Appendix to determine the maximum amount of cash the dean should be willing to pay for a copy machine.

b. Use Present Value Table 2 in the chapter's Appendix to determine the maximum amount of cash the dean should be willing to pay for a copy machine.

c. Explain the consistency or lack of consistency in the answers to Requirements *a* and *b*.

LO 3

Exercise 16-5 *Determining net present value*

Metro Shuttle Inc. is considering investing in two new vans that are expected to generate combined cash inflows of $28,000 per year. The vans' combined purchase price is $91,000. The expected life and salvage value of each are four years and $21,000, respectively. Metro Shuttle has an average cost of capital of 14 percent.

Required

a. Calculate the net present value of the investment opportunity.

b. Indicate whether the investment opportunity is expected to earn a return that is above or below the cost of capital and whether it should be accepted.

Exercise 16-6   *Determining net present value*

Dimitry Chernitsky is seeking part-time employment while he attends school. He is considering purchasing technical equipment that will enable him to start a small training services company that will offer tutorial services over the Internet. Dimitry expects demand for the service to grow rapidly in the first two years of operation as customers learn about the availability of the Internet assistance. Thereafter, he expects demand to stabilize. The following table presents the expected cash flows.

Year of Operation	Cash Inflow	Cash Outflow
2012	$13,500	$ 9,000
2013	19,500	12,000
2014	21,000	12,600
2015	21,000	12,600

In addition to these cash flows, Mr. Chernitsky expects to pay $21,000 for the equipment. He also expects to pay $3,600 for a major overhaul and updating of the equipment at the end of the second year of operation. The equipment is expected to have a $1,500 salvage value and a four-year useful life. Mr. Chernitsky desires to earn a rate of return of 8 percent.

Required

(Round computations to the nearest whole penny.)

a. Calculate the net present value of the investment opportunity.
b. Indicate whether the investment opportunity is expected to earn a return that is above or below the desired rate of return and whether it should be accepted.

Exercise 16-7   *Using present value index*

Alonso Company has a choice of two investment alternatives. The present value of cash inflows and outflows for the first alternative is $90,000 and $84,000, respectively. The present value of cash inflows and outflows for the second alternative is $220,000 and $213,000, respectively.

Required

a. Calculate the net present value of each investment opportunity.
b. Calculate the present value index for each investment opportunity.
c. Indicate which investment will produce the higher rate of return.

Exercise 16-8   *Determining the internal rate of return*

Irving Manufacturing Company has an opportunity to purchase some technologically advanced equipment that will reduce the company's cash outflow for operating expenses by $1,280,000 per year. The cost of the equipment is $6,186,530.56. Irving expects it to have a 10-year useful life and a zero salvage value. The company has established an investment opportunity hurdle rate of 15 percent and uses the straight-line method for depreciation.

Required

a. Calculate the internal rate of return of the investment opportunity.
b. Indicate whether the investment opportunity should be accepted.

Exercise 16-9   *Using the internal rate of return to compare investment opportunities*

Hulsey and Wright (H&W) is a partnership that owns a small company. It is considering two alternative investment opportunities. The first investment opportunity will have a five-year useful life, will cost $9,335.16, and will generate expected cash inflows of $2,400 per year. The second investment is expected to have a useful life of three years, will cost $6,217.13, and will generate expected cash inflows of $2,500 per year. Assume that H&W has the funds available to accept only one of the opportunities.

Required

a. Calculate the internal rate of return of each investment opportunity.
b. Based on the internal rates of return, which opportunity should H&W select?
c. Discuss other factors that H&W should consider in the investment decision.

LO 1, 2, 5, 6

Exercise 16-10   *Determining the cash flow annuity with income tax considerations*

To open a new store, Alpha Tire Company plans to invest $240,000 in equipment expected to have a four-year useful life and no salvage value. Alpha expects the new store to generate annual cash revenues of $315,000 and to incur annual cash operating expenses of $195,000. Alpha's average income tax rate is 30 percent. The company uses straight-line depreciation.

Required

Determine the expected annual net cash inflow from operations for each of the first four years after Alpha opens the new store.

LO 5

Exercise 16-11   *Evaluating discounted cash flow techniques*

Rita Hendrix is angry with Bill Shaw. He is behind schedule developing supporting material for tomorrow's capital budget committee meeting. When she approached him about his apparent lackadaisical attitude in general and his tardiness in particular, he responded, "I don't see why we do this stuff in the first place. It's all a bunch of estimates. Who knows what future cash flows will really be? I certainly don't. I've been doing this job for five years, and no one has ever checked to see if I even came close at these guesses. I've been waiting for marketing to provide the estimated cash inflows on the projects being considered tomorrow. But, if you want my report now, I'll have it in a couple of hours. I can make up the marketing data as well as they can."

Required

Does Mr. Shaw have a point? Is there something wrong with the company's capital budgeting system? Write a brief response explaining how to improve the investment evaluation system.

LO 7

Exercise 16-12   *Determining the payback period*

Sky Airline Company is considering expanding its territory. The company has the opportunity to purchase one of two different used airplanes. The first airplane is expected to cost $18,000,000; it will enable the company to increase its annual cash inflow by $6,000,000 per year. The plane is expected to have a useful life of five years and no salvage value. The second plane costs $36,000,000; it will enable the company to increase annual cash flow by $9,000,000 per year. This plane has an eight-year useful life and a zero salvage value.

Required

a. Determine the payback period for each investment alternative and identify the alternative Sky should accept if the decision is based on the payback approach.

b. Discuss the shortcomings of using the payback method to evaluate investment opportunities.

LO 7

Exercise 16-13   *Determining the payback period with uneven cash flows*

Melton Company has an opportunity to purchase a forklift to use in its heavy equipment rental business. The forklift would be leased on an annual basis during its first two years of operation. Thereafter, it would be leased to the general public on demand. Melton would sell it at the end of the fifth year of its useful life. The expected cash inflows and outflows follow.

Year	Nature of Item	Cash Inflow	Cash Outflow
2012	Purchase price		$72,000
2012	Revenue	$30,000	
2013	Revenue	30,000	
2014	Revenue	21,000	
2014	Major overhaul		9,000
2015	Revenue	18,000	
2016	Revenue	14,400	
2016	Salvage value	9,600	

Required

a. Determine the payback period using the accumulated cash flows approach.

b. Determine the payback period using the average cash flows approach.

Exercise 16-14   *Determining the unadjusted rate of return*

Lilly Painting Company is considering whether to purchase a new spray paint machine that costs $4,000. The machine is expected to save labor, increasing net income by $600 per year. The effective life of the machine is 15 years according to the manufacturer's estimate.

Required

a. Determine the unadjusted rate of return based on the average cost of the investment.
b. What is the predominant shortcoming of using the unadjusted rate of return to evaluate investment opportunities?

Exercise 16-15   *Computing the payback period and unadjusted rate of return for one investment opportunity*

Foy Rentals can purchase a van that costs $60,000; it has an expected useful life of three years and no salvage value. Foy uses straight-line depreciation. Expected revenue is $30,000 per year.

Required

a. Determine the payback period.
b. Determine the unadjusted rate of return based on the average cost of the investment.

PROBLEMS

All applicable Problems are available with McGraw-Hill's *Connect Accounting*.

Problem 16-16   *Using present value techniques to evaluate alternative investment opportunities*

eXcel

Fast Delivery is a small company that transports business packages between New York and Chicago. It operates a fleet of small vans that moves packages to and from a central depot within each city and uses a common carrier to deliver the packages between the depots in the two cities. Fast recently acquired approximately $6 million of cash capital from its owners, and its president, Don Keenon, is trying to identify the most profitable way to invest these funds.

CHECK FIGURES
a. NPV of the vans investment: $100,811.42
b. NPV index of the trucks investment: 1.126

Clarence Roy, the company's operations manager, believes that the money should be used to expand the fleet of city vans at a cost of $720,000. He argues that more vans would enable the company to expand its services into new markets, thereby increasing the revenue base. More specifically, he expects cash inflows to increase by $280,000 per year. The additional vans are expected to have an average useful life of four years and a combined salvage value of $100,000. Operating the vans will require additional working capital of $40,000, which will be recovered at the end of the fourth year.

In contrast, Patricia Lipa, the company's chief accountant, believes that the funds should be used to purchase large trucks to deliver the packages between the depots in the two cities. The conversion process would produce continuing improvement in operating savings with reductions in cash outflows as the following.

Year 1	Year 2	Year 3	Year 4
$160,000	$320,000	$400,000	$440,000

The large trucks are expected to cost $800,000 and to have a four-year useful life and a $80,000 salvage value. In addition to the purchase price of the trucks, up-front training costs are expected to amount to $16,000. Fast Delivery's management has established a 16 percent desired rate of return.

Required

a. Determine the net present value of the two investment alternatives.
b. Calculate the present value index for each alternative.
c. Indicate which investment alternative you would recommend. Explain your choice.

Problem 16-17   *Using the payback period and unadjusted rate of return to evaluate alternative investment opportunities*

Louis Gallo owns a small retail ice cream parlor. He is considering expanding the business and has identified two attractive alternatives. One involves purchasing a machine that would enable Mr. Gallo to offer frozen yogurt to customers. The machine would cost $8,100 and has an expected useful life of three years with no salvage value. Additional annual cash revenues and cash operating expenses associated with selling yogurt are expected to be $5,940 and $900, respectively.

Alternatively, Mr. Gallo could purchase for $10,080 the equipment necessary to serve cappuccino. That equipment has an expected useful life of four years and no salvage value. Additional annual cash revenues and cash operating expenses associated with selling cappuccino are expected to be $8,280 and $2,430, respectively.

Income before taxes earned by the ice cream parlor is taxed at an effective rate of 20 percent.

Required

a. Determine the payback period and unadjusted rate of return (use average investment) for each alternative.

b. Indicate which investment alternative you would recommend. Explain your choice.

Problem 16-18   *Using net present value and internal rate of return to evaluate investment opportunities*

Veronica Tanner, the president of Tanner Enterprises, is considering two investment opportunities. Because of limited resources, she will be able to invest in only one of them. Project A is to purchase a machine that will enable factory automation; the machine is expected to have a useful life of four years and no salvage value. Project B supports a training program that will improve the skills of employees operating the current equipment. Initial cash expenditures for Project A are $100,000 and for Project B are $40,000. The annual expected cash inflows are $31,487 for Project A and $13,169 for Project B. Both investments are expected to provide cash flow benefits for the next four years. Tanner Enterprise's cost of capital is 8 percent.

Required

a. Compute the net present value of each project. Which project should be adopted based on the net present value approach?

b. Compute the approximate internal rate of return of each project. Which one should be adopted based on the internal rate of return approach?

c. Compare the net present value approach with the internal rate of return approach. Which method is better in the given circumstances? Why?

Problem 16-19   *Using net present value and payback period to evaluate investment opportunities*

Bruce Graham saved $250,000 during the 25 years that he worked for a major corporation. Now he has retired at the age of 50 and has begun to draw a comfortable pension check every month. He wants to ensure the financial security of his retirement by investing his savings wisely and is currently considering two investment opportunities. Both investments require an initial payment of $187,500. The following table presents the estimated cash inflows for the two alternatives.

	Year 1	Year 2	Year 3	Year 4
Opportunity #1	$ 55,625	$ 58,750	$78,750	$101,250
Opportunity #2	102,500	108,750	17,500	15,000

Mr. Graham decides to use his past average return on mutual fund investments as the discount rate; it is 8 percent.

Required

a. Compute the net present value of each opportunity. Which should Mr. Graham adopt based on the net present value approach?

b. Compute the payback period for each project. Which should Mr. Graham adopt based on the payback approach?
c. Compare the net present value approach with the payback approach. Which method is better in the given circumstances?

Problem 16-20   *Effects of straight-line versus accelerated depreciation on an investment decision*

Zito Electronics is considering investing in manufacturing equipment expected to cost $184,000. The equipment has an estimated useful life of four years and a salvage value of $24,000. It is expected to produce incremental cash revenues of $96,000 per year. Zito has an effective income tax rate of 30 percent and a desired rate of return of 12 percent.

Required

a. Determine the net present value and the present value index of the investment, assuming that Zito uses straight-line depreciation for financial and income tax reporting.
b. Determine the net present value and the present value index of the investment, assuming that Zito uses double-declining-balance depreciation for financial and income tax reporting.
c. Why do the net present values computed in Requirements *a* and *b* differ?
d. Determine the payback period and unadjusted rate of return (use average investment), assuming that Zito uses straight-line depreciation.
e. Determine the payback period and unadjusted rate of return (use average investment), assuming that Zito uses double-declining-balance depreciation. (Note: Use average annual cash flow when computing the payback period and average annual income when determining the unadjusted rate of return.)
f. Why are there no differences in the payback periods or unadjusted rates of return computed in Requirements *d* and *e*?

Problem 16-21   *Applying the net present value approach with and without tax considerations*

Paxton Kingsley, the chief executive officer of Kingsley Corporation, has assembled his top advisers to evaluate an investment opportunity. The advisers expect the company to pay $400,000 cash at the beginning of the investment and the cash inflow for each of the following four years to be the following.

Year 1	Year 2	Year 3	Year 4
$84,000	$96,000	$120,000	$184,000

Mr. Kingsley agrees with his advisers that the company should use the discount rate (required rate of return) of 12 percent to compute net present value to evaluate the viability of the proposed project.

Required

a. Compute the net present value of the proposed project. Should Mr. Kingsley approve the project?
b. Wilma Pate, one of the advisers, is wary of the cash flow forecast and she points out that the advisers failed to consider that the depreciation on equipment used in this project will be tax deductible. The depreciation is expected to be $80,000 per year for the four-year period. The company's income tax rate is 30 percent per year. Use this information to revise the company's expected cash flow from this project.
c. Compute the net present value of the project based on the revised cash flow forecast. Should Mr. Kingsley approve the project?

Problem 16-22   *Comparing internal rate of return with unadjusted rate of return*

Walker Auto Repair Inc. is evaluating a project to purchase equipment that will not only expand the company's capacity but also improve the quality of its repair services. The board of directors requires all capital investments to meet or exceed the minimum requirement of a 10 percent rate

of return. However, the board has not clearly defined the rate of return. The president and controller are pondering two different rates of return: unadjusted rate of return and internal rate of return. The equipment, which costs $100,000, has a life expectancy of five years. The increased net profit per year will be approximately $7,000, and the increased cash inflow per year will be approximately $27,700.

Required

a. If it uses the unadjusted rate of return (use average investment) to evaluate this project, should the company invest in the equipment?
b. If it uses the internal rate of return to evaluate this project, should the company invest in the equipment?
c. Which method is better for this capital investment decision?

Problem 16-23   *Postaudit evaluation*

Ernest Jones is reviewing his company's investment in a cement plant. The company paid $15,000,000 five years ago to acquire the plant. Now top management is considering an opportunity to sell it. The president wants to know whether the plant has met original expectations before he decides its fate. The company's discount rate for present value computations is 8 percent. Expected and actual cash flows follow.

	Year 1	Year 2	Year 3	Year 4	Year 5
Expected	$3,300,000	$4,920,000	$4,560,000	$4,980,000	$4,200,000
Actual	2,700,000	3,060,000	4,920,000	3,900,000	3,600,000

Required

a. Compute the net present value of the expected cash flows as of the beginning of the investment.
b. Compute the net present value of the actual cash flows as of the beginning of the investment.
c. What do you conclude from this postaudit?

ANALYZE, THINK, COMMUNICATE

ATC 16-1   **Business Application Case**   *Home remodeling decision*

Karen and Steve Catrow want to replace the windows in the older house they purchased recently. The company they have talked to about doing the work claims that new windows will reduce the couple's heating and cooling costs by around 30 percent. The Catrows have heard from real estate agents that they will get back 70 percent of the cost of the new windows when they sell their house. The new windows will cost $30,000.

The heating and cooling costs for the Catrow's house average around $5,000 per year, and they expect to stay in this house for 10 years. To pay for the windows they would have to withdraw the money from a mutual fund that has earned an average annual return of 4 percent over the past few years.

Required

a. From a financial planning perspective alone, determine whether or not the Catrows should purchase the replacement windows. Show supporting computations.
b. (Requirement *b* can be solved only with Excel, or similar software, or with a financial calculator.) Karen and Steve are not sure their mutual fund will continue to earn 4 percent annually over the next 10 years; therefore, they want to know the minimum return their fund would need to earn to make the new windows financially acceptable. Compute the internal rate of return for the replacement windows.
c. Identify some of the nonfinancial factors the couple may wish to consider in addition to the financial aspects of the decision above.

ATC 16-2   Group Assignment   *Net present value*

Espada Real Estate Investment Company (EREIC) purchases new apartment complexes, establishes a stable group of residents, and then sells the complexes to apartment management companies. The average holding time is three years. EREIC is currently investigating two alternatives.

1. EREIC can purchase Harding Properties for $4,500,000. The complex is expected to produce net cash inflows of $360,000, $502,500, and $865,000 for the first, second, and third years of operation, respectively. The market value of the complex at the end of the third year is expected to be $5,175,000.
2. EREIC can purchase Summit Apartments for $3,450,000. The complex is expected to produce net cash inflows of $290,000, $435,000, and $600,000 for the first, second, and third years of operation, respectively. The market value of the complex at the end of the third year is expected to be $4,050,000.

EREIC has a desired rate of return of 12 percent.

Required

a. Divide the class into groups of four or five students per group and then divide the groups into two sections. Assign Task 1 to the first section and Task 2 to the second section.

Group Tasks

(1) Calculate the net present value and the present value index for Harding Properties.

(2) Calculate the net present value and the present value index for Summit Apartments.

b. Have a spokesperson from one group in the first section report the amounts calculated by the group. Make sure that all groups in the section have the same result. Repeat the process for the second section. Have the class as a whole select the investment opportunity that EREIC should accept given that the objective is to produce the higher rate of return.

c. Assume that EREIC has $4,500,000 to invest and that any funds not invested in real estate properties must be invested in a certificate of deposit earning a 5 percent return. Would this information alter the decision made in Requirement *b*?

d. This requirement is independent of Requirement *c*. Assume there is a 10 percent chance that the Harding project will be annexed by the city of Hoover, which has an outstanding school district. The annexation would likely increase net cash flows by $37,500 per year and would increase the market value at the end of year 3 by $300,000. Would this information change the decision reached in Requirement *b*?

ATC 16-3   Research Assignment   *Capital Expenditures at the Archer Daniels Midland Company*

Obtain Archer Daniels Midland Company's (ADM) Form 10-K for the fiscal year ending on June 30, 2006 and 2009. To obtain the Form 10-K you can use the EDGAR system following the instructions in Appendix A, or it can be found under the "Investor Relations" link on the company's website at www.admworld.com/naen. Read the "General Development of Business" under the "Item I. Business" section of the 2006 10-K, and the Statement of Cash Flows and Note 15 of the 2009 10-K.

Required

a. What major plant expansions did ADM announce during 2006? How much does ADM estimate these expansions will cost?

b. How much did ADM spend on investing activities in its 2009 and 2008 fiscal years?

c. Where did ADM get the cash used to make these investments?

d. How much of ADM's investments in new property, plant, and equipment was related to its "corn processing" segment in 2009 and 2008?

ATC 16-4   Writing Assignment   *Limitations of capital investment techniques*

Webb Publishing Company is evaluating two investment opportunities. One is to purchase an Internet company with the capacity to open new marketing channels through which Webb can sell its books. This opportunity offers a high potential for growth but involves significant risk.

Indeed, losses are projected for the first three years of operation. The second opportunity is to purchase a printing company that would enable Webb to better control costs by printing its own books. The potential savings are clearly predictable but would make a significant change in the company's long-term profitability.

Required

Write a response discussing the usefulness of capital investment techniques (net present value, internal rate of return, payback, and unadjusted rate of return) in making a choice between these two alternative investment opportunities. Your response should discuss the strengths and weaknesses of capital budgeting techniques in general. Furthermore, it should include a comparison between techniques based on the time value of money versus those that are not.

ATC 16-5   Ethical Dilemma   *Postaudit*

Gaines Company recently initiated a postaudit program. To motivate employees to take the program seriously, Gaines established a bonus program. Managers receive a bonus equal to 10 percent of the amount by which actual net present value exceeds the projected net present value. Victor Holt, manager of the North Western Division, had an investment proposal on his desk when the new system was implemented. The investment opportunity required a $250,000 initial cash outflow and was expected to return cash inflows of $90,000 per year for the next five years. Gaines' desired rate of return is 10 percent. Mr. Holt immediately reduced the estimated cash inflows to $70,000 per year and recommended accepting the project.

Required

a. Assume that actual cash inflows turn out to be $91,000 per year. Determine the amount of Mr. Holt's bonus if the original computation of net present value were based on $90,000 versus $70,000.

b. Is Mr. Holt's behavior in violation of any of the standards of ethical conduct in Exhibit 10.17 of Chapter 10?

c. Speculate about the long-term effect the bonus plan is likely to have on the company.

d. Recommend how to compensate managers in a way that discourages gamesmanship.