PART C

# Financial Analysis Tools

In **Part C** of the Systems Analyst's Toolkit, you will learn how to use financial analysis tools during the planning, analysis, design, implementation, support, and securing of an information system.

## INTRODUCTION

### OBJECTIVES

***When you finish this part of the Toolkit, you will be able to:***

- Define economic feasibility
- Classify costs and benefits into various categories, including tangible or intangible, direct or indirect, fixed or variable, and developmental or operational
- Understand chargeback methods and how they are used
- Use payback analysis to calculate the length of time that it takes for a project to pay for itself
- Use return on investment analysis to measure a project's profitability
- Use present value analysis to determine the value of a future project measured in current dollars

Part C of the Systems Analyst's Toolkit shows you how to use various tools to calculate a project's costs and benefits. As a systems analyst, you need to know how to calculate costs and benefits when you conduct preliminary investigations, evaluate IT projects, and make recommendations to management.

Financial analysis tools are important throughout the systems development life cycle. For example, in Chapter 2 you learn that economic feasibility depends on a comparison of costs and benefits. A project is economically feasible if the future benefits outweigh the estimated costs of developing or acquiring the new system. In Chapter 7, when you analyze development strategies, you apply financial analysis tools and techniques as you examine various options. Then, as Chapter 12 explains, you use these tools again to recognize the end of a system's useful life.

## TOOLKIT INTRODUCTION CASE: Mountain View College Bookstore

**Background:** Wendy Lee, manager of college services at Mountain View College, wants a new information system that will improve efficiency and customer service at the three college bookstores.

In this part of the case, Tina Allen (systems analyst) and David Conroe (student intern) are talking about financial analysis tools and techniques.

**Participants:** Tina and David
**Location:** Mountain View College Cafeteria, during the systems planning phase
**Discussion topics:** Economic feasibility, chargeback methods, cost-benefit classification, payback analysis, return on investment analysis, and net present value analysis

**Tina:** Hi, David. Before we go any further with the preliminary investigation, I wanted to meet with you to discuss financial analysis tools and techniques, and how we will apply them.

**David:** *Fine with me. Where do we start?*

**Tina:** Well, because economic feasibility depends on a project's costs and benefits, the first step is to classify those costs and benefits into specific categories. For example, costs can be tangible or intangible, direct or indirect, fixed or variable, and developmental or operational.

**David:** *Okay, I understand. What do we do after we classify everything?*

**Tina:** Then we use one or more financial analysis tools: payback analysis, return on investment analysis, and net present value analysis. We'll learn how to use them to evaluate the system and compare alternatives. We'll also talk about chargeback methods.

**David:** *What are they?*

**Tina:** A chargeback method is just a way to allocate costs for an IT system. We'll have to talk to Wendy about that. Meanwhile, here's a task list we can work on:

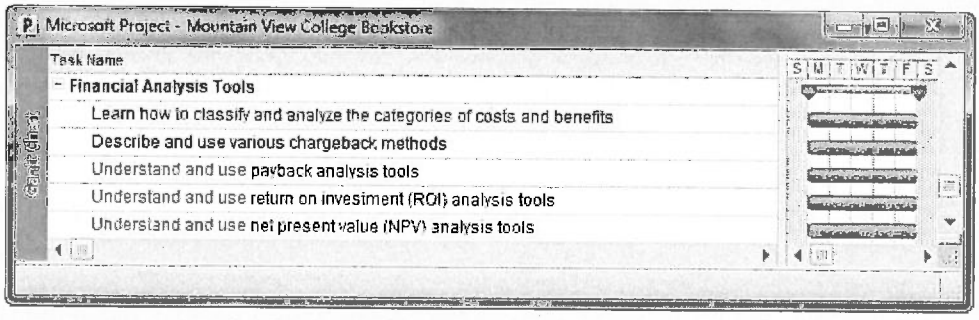



**FIGURE TK C-1** Typical financial analysis tasks.

## Describing Costs and Benefits

As a systems analyst, you must review a project's costs and benefits at the end of each SDLC phase so management can decide whether or not to continue the project. Before you can use the economic analysis tools described in this section of the Toolkit, you must learn how to identify and classify all costs and benefits.

As you learned in Chapter 2, **economic feasibility** means that the projected benefits of the proposed system outweigh the projected costs. When you determine economic feasibility, you must consider the project's benefits compared to the project's **total cost of ownership** (TCO), which includes ongoing support and maintenance costs, as well as acquisition costs.

Figure TK C-2 shows an online TCO analysis tool provided by HP Services. HP stresses the importance of TCO analysis, and points to studies showing that the majority of total IT costs occur *after* the purchase, and that nearly half the costs lie outside the IT

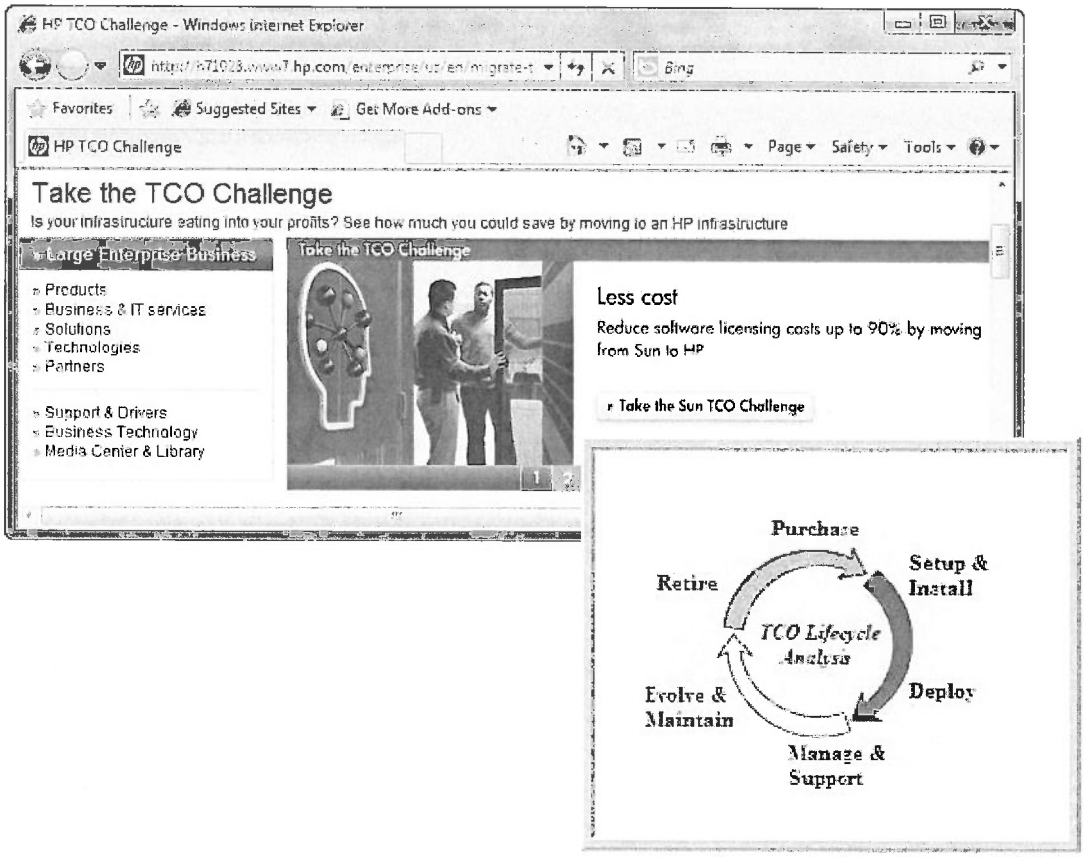



**FIGURE TK C-2** HP Services offers an online TCO analysis tool.

department's budget. HP also cites a study that shows a staggering TCO of $21,000 for a $2,000 PC when all costs are considered over a five-year period. HP noted that the most significant cost factor is user support, including peer-to-peer assistance that rarely is documented or measured.

Cost-benefit analysis tools also are available from various vendors and organizations, including the Info~Tech Research Group site shown in Figure TK C-3. Info~Tech's free TCO tool provides a three-year planning horizon and graphical output.

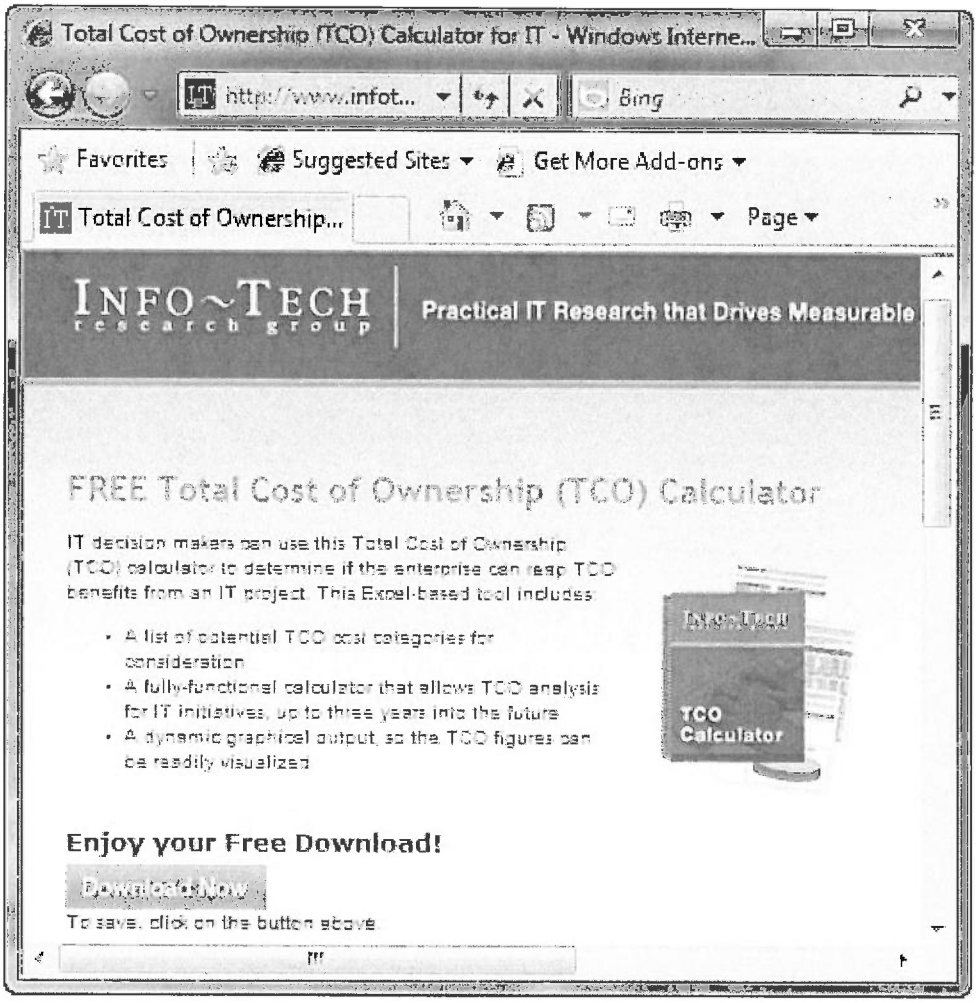



**FIGURE TK C-3** Example of cost-benefit analysis software available on the Web.

Figure TK C-4 on the next page shows a cost-benefit tool that focuses on technology evaluation. The vendor, New Venture Tools, offers a demo version and a step-by-step tutorial.

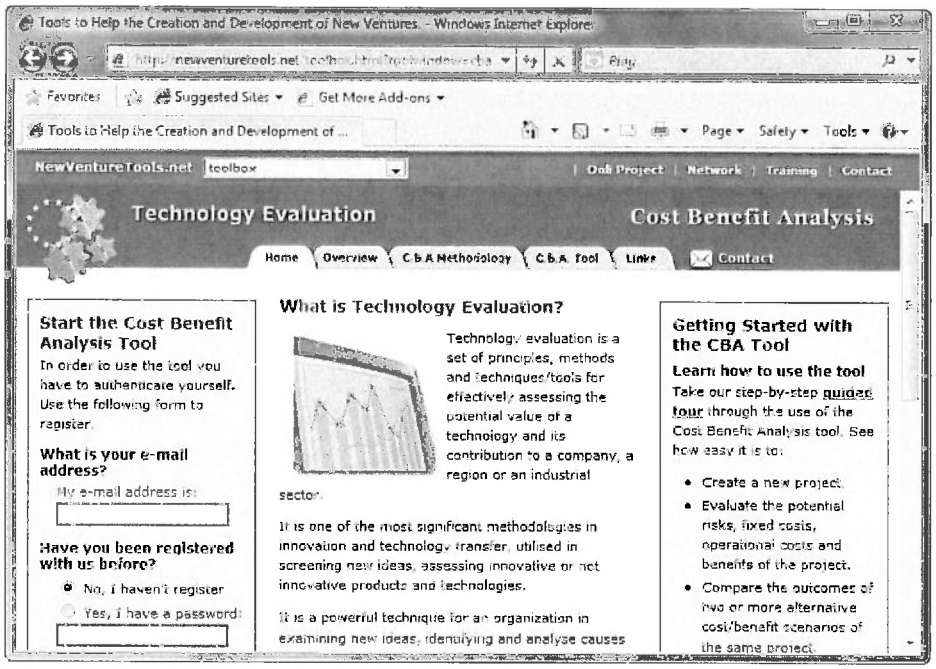



**FIGURE TK C-4** New Venture Tools claims that technology evaluation requires a set of principles, methods, techniques, and tools.

## Cost Classifications

Costs can be classified as tangible or intangible, direct or indirect, fixed or variable, and developmental or operational. **Tangible costs** are costs for which you can assign a specific dollar value. Examples of tangible costs include employee salaries, hardware and software purchases, and office supplies. Tangible costs also include the interest charges that firms must pay when they need to borrow money for working capital or to finance new projects. In times of high interest rates, these costs can be significant and must be considered.

In contrast, **intangible costs** are costs whose dollar value cannot be calculated easily. The cost of customer dissatisfaction, lower employee morale, and reduced information availability are examples of intangible costs.

If the analyst examines an intangible item carefully, however, it sometimes is possible to estimate a dollar value. For example, users might dislike a system because it is difficult to learn. Their dissatisfaction is an intangible cost, but if it translates into an increase in errors that must be corrected, you probably could assign a tangible dollar cost. You should try to work with tangible costs whenever possible.

**Direct costs** are costs that can be associated with the development of a specific system. Examples of direct costs include the salaries of project team members and the purchase of hardware that is used only for the new system. In contrast, **indirect costs**, or **overhead expenses**, cannot be attributed to the development of a particular information system. The salaries of network administrators, copy machine rentals, and insurance expenses are examples of indirect costs.

**Fixed costs** are costs that are relatively constant and do not depend on a level of activity or effort. Many fixed costs recur regularly, such as salaries and hardware rental charges. **Variable costs** are costs that vary depending on the level of activity. The costs of printer paper, supplies, and telephone line charges are examples of variable costs.

**Developmental costs** are incurred only once, at the time the system is developed or acquired. Those costs might include salaries of people involved in systems development, software purchases, initial user training, and the purchase of necessary hardware or

furniture. **Operational costs** are incurred after the system is implemented and continue while the system is in use. Examples of operational costs include system maintenance, ongoing training, annual software license fees, and communications expense.

Some costs apply to more than one category of expenses. For example, overtime pay for clerical staff during the systems analysis phase would be classified as developmental, variable, and direct. A monthly fee for maintaining the company's Web site would be regarded as operational, fixed, and indirect.

## Managing Information Systems Costs and Charges

Management wants to know how much an information system costs, so it is important for the systems analyst to understand direct costs, indirect costs, and methods of allocating IT charges within the company.

Direct costs usually are easier to identify and predict than indirect costs. For example, the salaries of project team members and the purchase of hardware, software, and supplies for the new system are direct costs. After a new information system goes into operation, other direct costs might include the lease of system-specific hardware or software.

Many IT department costs cannot be attributed directly to a specific information system or user group. Those indirect costs can include general hardware and software acquisition expenses; facility maintenance, air conditioning, security, rent, insurance, and general supplies; and the salaries of operations, technical support, and information center personnel.

A **chargeback method** is a technique that uses accounting entries to allocate the indirect costs of running the IT department. Most organizations adopt one of four chargeback methods: no charge, a fixed charge, a variable charge based on resource usage, or a variable charge based on volume.

1. **No charge method.** Some organizations treat information systems department indirect expenses as a necessary cost of doing business, and IT services are seen as benefiting the entire company. Thus, indirect IT department costs are treated as general organizational costs and are not charged to other departments. In this case, the information systems department is called a **cost center**, because it generates accounting charges with no offsetting credits for IT services.
2. **Fixed charge method.** With this method, the indirect IT costs are divided among all the other departments in the form of a fixed monthly charge. The monthly charge might be the same for all departments or based on a relatively constant factor such as department size or number of workstations. By using a fixed charge approach, all indirect costs are charged to other departments, and the IT group is regarded as a profit center. A **profit center** is a department that is expected to break even or show a profit. Under the profit center concept, company departments purchase services from the IT department and receive accounting charges that represent the cost of providing the services.
3. **Variable charge method based on resource usage. Resource allocation** is the charging of indirect costs based on the resources used by an information system. The allocation might be based on connect time, server processing time, network resources required, printer use, or a combination of similar factors. **Connect time** is the total time that a user is connected actively to a remote server — some Internet service providers use this as a basis for charges. In a client/server system, **server processing time** is the time that the server actually responds to client requests for processing. The amount a particular department is charged will vary from month to month, depending not only on that department's resource usage, but also on the total resource usage. The IT department is considered a profit center when an organization uses the resource allocation method.

4. **Variable charge method based on volume.** The indirect IT department costs are allocated to other departments based on user-oriented activity, such as the number of transactions or printing volume. As with the resource allocation method, a department's share of the costs varies from month to month, depending on the level of activity. In this case, the IT department is considered a profit center.

### Benefit Classifications

In addition to classifying costs, you must classify the benefits that the company expects from a project. Like costs, benefits can be classified as tangible or intangible, fixed or variable, and direct or indirect. Another useful benefit classification relates to the nature of the benefit: positive benefits versus cost-avoidance benefits. **Positive benefits** increase revenues, improve services, or otherwise contribute to the organization as a direct result of the new information system. Examples of positive benefits include improved information availability, greater flexibility, faster service to customers, higher employee morale, and better inventory management.

In contrast, **cost-avoidance benefits** refer to expenses that would be necessary if the new system were not installed. Examples of cost-avoidance benefits include handling the work with current staff instead of hiring additional people, not having to replace existing hardware or software, and avoiding problems that otherwise would be faced with the current system. Cost-avoidance benefits are just as important as positive benefits, and you must consider both types when performing cost-benefit analysis.

## Cost-Benefit Analysis

**Cost-benefit analysis** is the process of comparing the anticipated costs of an information system to the anticipated benefits. Cost-benefit analysis is performed throughout the SDLC to determine the economic feasibility of an information system project and to compare alternative solutions. Many cost-benefit analysis techniques exist. This section covers discussion of only the three most common methods: payback analysis, return on investment analysis, and present value analysis. Each of the approaches analyzes cost-benefit figures differently, but the objective is the same: to provide reliable information for making decisions.

### VIDEO LEARNING SESSION: Payback Analysis

Video Learning Sessions can help you understand key concepts, practice your skills, and check your work. To access the sessions, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com** and navigate to the **Video Learning Sessions** for this book. This session is about payback analysis. You'll learn how to calculate the payback period for a project and how to use a spreadsheet to determine a project's payback period.

## Payback Analysis

**Payback analysis** is the process of determining how long it takes an information system to pay for itself. The time it takes to recover the system's cost is called the **payback period.** To perform a payback analysis, you carry out the following steps:

1. Determine the initial development cost of the system.
2. Estimate annual benefits.
3. Determine annual operating costs.
4. Find the payback period by comparing total development and operating costs to the accumulated value of the benefits produced by the system.

When you plot the system costs over the potential life of the system, you typically see a curve such as the one shown in Figure TK C-5. After the system is operational, costs decrease rapidly and remain relatively low for a period of time. Eventually, as the system requires more maintenance, costs begin to increase. The period between the beginning of systems operation and the point when operational costs are rapidly increasing is called the **economically useful life** of the system.

**ON THE WEB**

To learn more about payback analysis, visit **scsite.com/** the Management Information Systems CourseMate Web site at **www.cengagebrain.com,** navigate to **On the Web Links** for Toolkit Part C, and locate the Payback Analysis link.

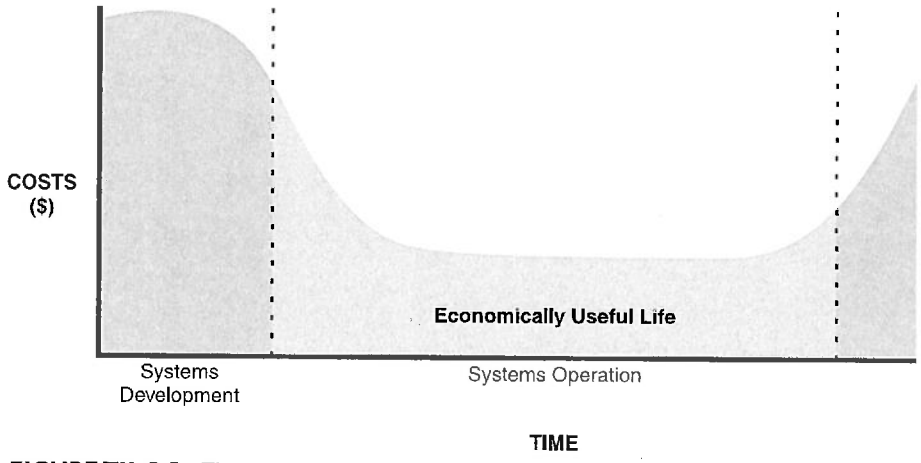



**FIGURE TK C-5** The costs of a typical system vary over time. At the beginning, system costs are high due to initial development expense. Costs then drop during systems operation. Maintenance costs begin to increase until the system reaches the end of its economically useful life. The area between the two dashed lines shows the economically useful life of this system.

When you plot the benefits provided by an information system against time, the resulting curve usually resembles the one shown in the upper graph in Figure TK C-6. Benefits start to appear when the system becomes operational, might increase for a time, and then level off or start to decline.

When conducting a payback analysis, you calculate the time it takes for the accumulated benefits of an information system to equal the accumulated costs of developing and operating the system.

In the lower graph in Figure TK C-6, the cost and benefit curves are plotted together. The dashed line indicates the payback period. Notice that the payback period is not the point when current benefits equal current costs, where the two lines cross. Instead, the payback period compares accumulated costs and benefits. If you graph current costs and benefits, the payback period corresponds to the time at which the areas under the two curves are equal.

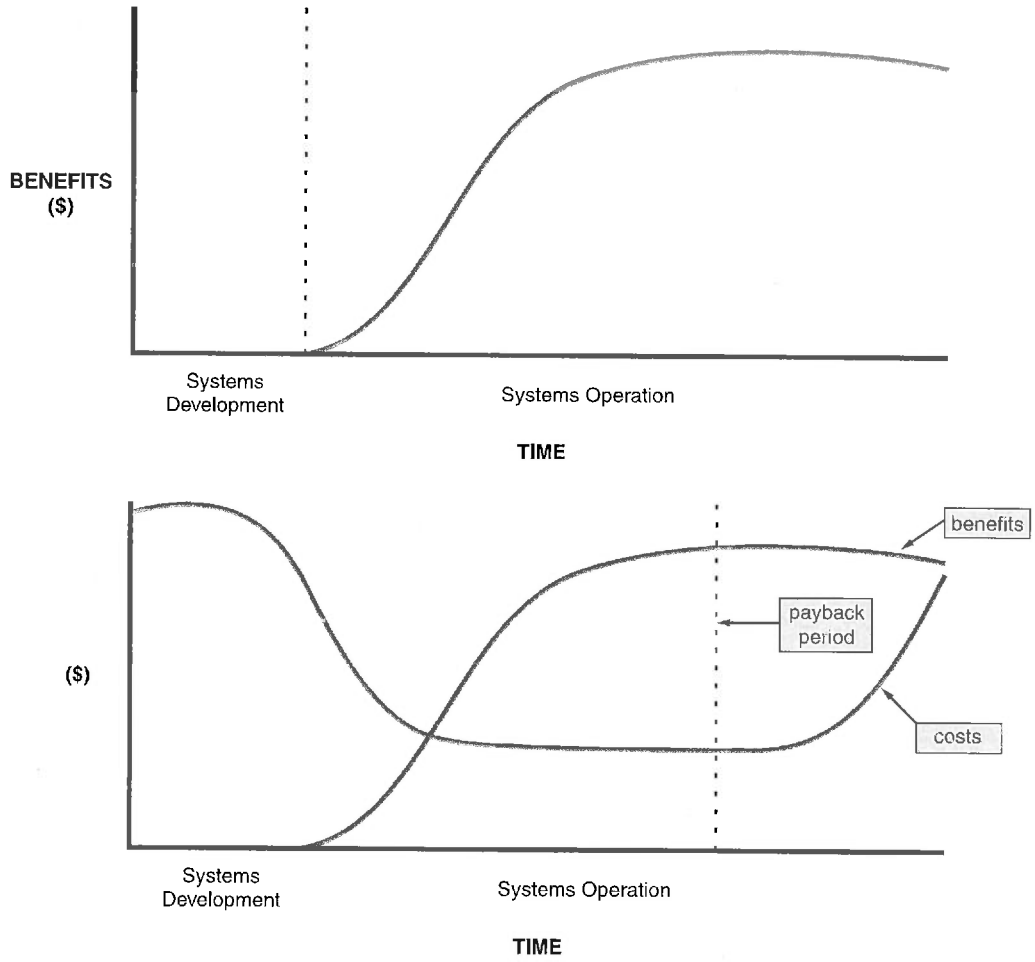



**FIGURE TK C-6** Benefits of an information system change over time, as shown in the upper graph. The lower graph shows costs and benefits plotted on the same graph. The dashed line indicates the payback period, when accumulated benefits equal accumulated costs.

Figure TK C-7 contains two cost-benefit tables. The tables show the anticipated annual costs, cumulative costs, annual benefits, and cumulative benefits for two information systems projects. Year 0 (zero) corresponds to the year in which systems development begins. The development of Project A takes less than one year, so some benefits are realized in Year 0. Systems development for Project B requires more than one year, so the benefits do not begin until some time in Year 1.

In Project A, by the end of Year 4, the cumulative costs are $135,700, which slightly exceeds the $132,000 cumulative benefits. By the end of Year 5, however, the cumulative benefits of $171,000 far exceed the cumulative costs, which are $157,700. Therefore, at some point in time during Year 5, the accumulated costs and benefits are equal, and the payback period is established. In Project B, a similar situation exists. By the end of Year 4, Project B's cumulative costs are $191,000, which is greater than the cumulative benefits of $156,000. At some point during Year 5, cumulative benefits will exceed cumulative costs, and the system will have paid for itself.

If more specific information is available regarding the timing of costs and benefits during a year, you can calculate the payback period more precisely. Another approach is to create a chart that shows the exact point when cumulative benefits exceed cumulative costs, which is explained in the following section.

Some managers are critical of payback analysis because it places all the emphasis on early costs and benefits and ignores the benefits received after the payback period. Even if the benefits for Project B in Year 6 soared as high as $500,000, the payback period for

**PAYBACK ANALYSIS EXAMPLES**

PROJECT A:

| YEAR | COSTS | CUMULATIVE COSTS | BENEFITS | CUMULATIVE BENEFITS |
|---|---|---|---|---|
| 0 | 60,000 | 60,000 | 3,000 | 3,000 |
| 1 | 17,000 | 77,000 | 28,000 | 31,000 |
| 2 | 18,500 | 95,500 | 31,000 | 62,000 |
| 3 | 19,200 | 114,700 | 34,000 | 96,000 |
| 4 | 21,000 | 135,700 | 36,000 | 132,000 |
| 5 | 22,000 | 157,700 | 39,000 | 171,000 |
| 6 | 23,300 | 181,000 | 42,000 | 213,000 |

PROJECT B:

| YEAR | COSTS | CUMULATIVE COSTS | BENEFITS | CUMULATIVE BENEFITS |
|---|---|---|---|---|
| 0 | 80,000 | 80,000 | — | — |
| 1 | 40,000 | 120,000 | 6,000 | 6,000 |
| 2 | 25,000 | 145,000 | 26,000 | 32,000 |
| 3 | 22,000 | 167,000 | 54,000 | 86,000 |
| 4 | 24,000 | 191,000 | 70,000 | 156,000 |
| 5 | 26,500 | 217,500 | 82,000 | 238,000 |
| 6 | 30,000 | 247,500 | 92,000 | 330,000 |

**FIGURE TK C-7** Payback analysis data for two information systems proposals: Project A and Project B.

that project still occurs during the fifth year of operation. In defense of payback analysis, the earlier cost and benefit predictions usually are more certain. In general, the further out in time that you extend your projections, the more unsure your forecast will be. Thus, payback analysis uses the most reliable of your cost and benefit estimates.

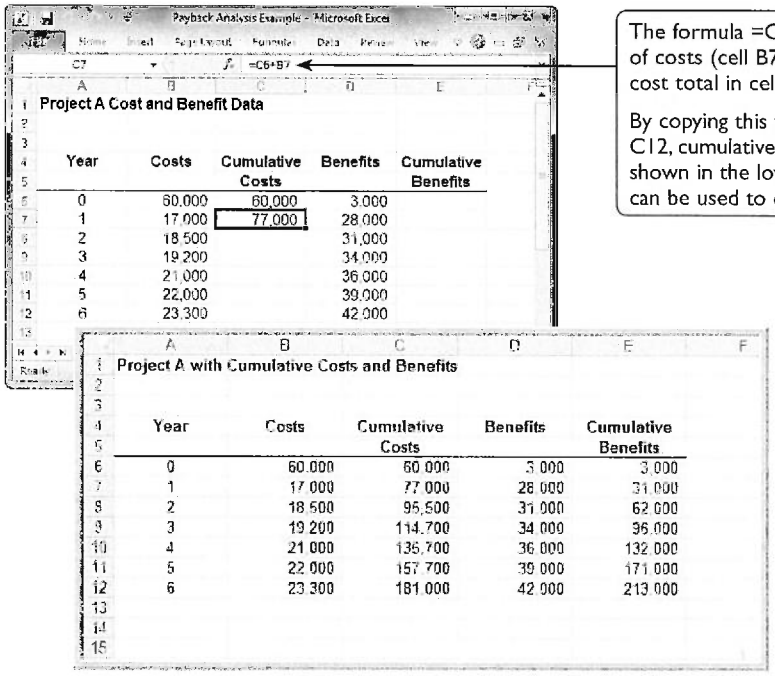
Payback analysis rarely is used to compare or rank projects because later benefits are ignored. You would never decide that Project A is better than Project B simply because the payback period for A is less than that for B; considering all the costs and all the benefits when comparing projects makes more sense.

Even with its drawbacks, payback analysis is popular. Many business organizations establish a minimum payback period for approved projects. If company policy requires a project to begin paying for itself within three years, then neither project in Figure TK C-7 would be approved, though both are economically feasible because total benefits exceed total costs.

## Using a Spreadsheet to Compute Payback Analysis

You can use a spreadsheet to record and calculate accumulated costs and benefits, as shown in Figure TK C-8 on the next page. The first step is to design the worksheet and label the rows and columns. After entering the cost and benefit data for each year, you enter the formulas. For payback analysis, you will need a formula to display cumulative totals, year by year. For example, the first year in the cumulative costs column is the same as Year 0 costs, so the formula in cell C6 is =B6. The cumulative cost total for the second year is Year 0 cumulative total + Year 1 costs, so the formula for cell C7 is =C6+B7, and so on. The first worksheet shows the initial layout and the second worksheet shows the finished spreadsheet.

After you verify that the spreadsheet operates properly, you can create a line chart that displays the cumulative costs, benefits, and payback period, which is identified by the intersection of the cost and benefit lines, as shown in Figure TK C-9 on the next page.

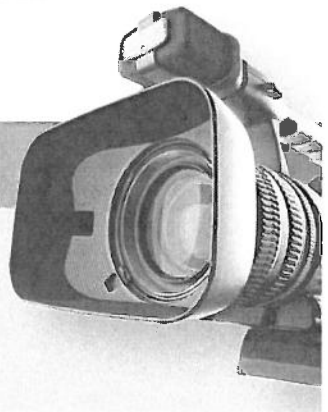



The formula =C6+B7 adds an additional year of costs (cell B7) to the running, or cumulative, cost total in cell C6.

By copying this formula into cells C8 through C12, cumulative costs totals can be obtained, as shown in the lower screen. The same method can be used to calculate cumulative benefits.

**FIGURE TK C-8** A Microsoft Excel worksheet displays payback analysis data for Project A in the upper screen. When cumulative cost and benefit formulas are entered, the finished worksheet in the lower screen appears.

## VIDEO LEARNING SESSION: RETURN ON INVESTMENT



Video Learning Sessions can help you understand key concepts, practice your skills, and check your work. To access the sessions, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com** and navigate to the **Video Learning Sessions** for this book. This session is about return on investment (ROI) analysis. You'll learn how to calculate ROI for a project and how to use a spreadsheet to determine a project's return on investment.

**ON THE WEB**

To learn more about return on investment analysis, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part C, and locate the Return on Investment Analysis link.

## Return on Investment Analysis

**Return on investment (ROI)** is a percentage rate that measures profitability by comparing the total net benefits (the return) received from a project to the total costs (the investment) of the project. ROI is calculated as follows:

ROI = (total benefits – total costs) / total costs

Return on investment analysis considers costs and benefits over a longer time span than payback analysis. ROI calculations usually are based on total costs and benefits for a period of five to seven years. For example, Figure TK C-10 shows the ROI calculations for Project A and Project B. The ROI for Project A is 17.7%, and the ROI for Project B is 33.3%.

In many organizations, projects must meet or exceed a minimum ROI. This minimum ROI can be an estimate of the return the organization would receive from investing its money in other investment opportunities such as treasury bonds, or it can be a higher rate that the company requires for all new projects. If a company requires a minimum ROI of 15%, for example, then both Projects A and B would meet the criterion.

You also can use ROI for ranking projects. If Projects A and B represent two different proposed solutions for a single information systems project, then the solution represented

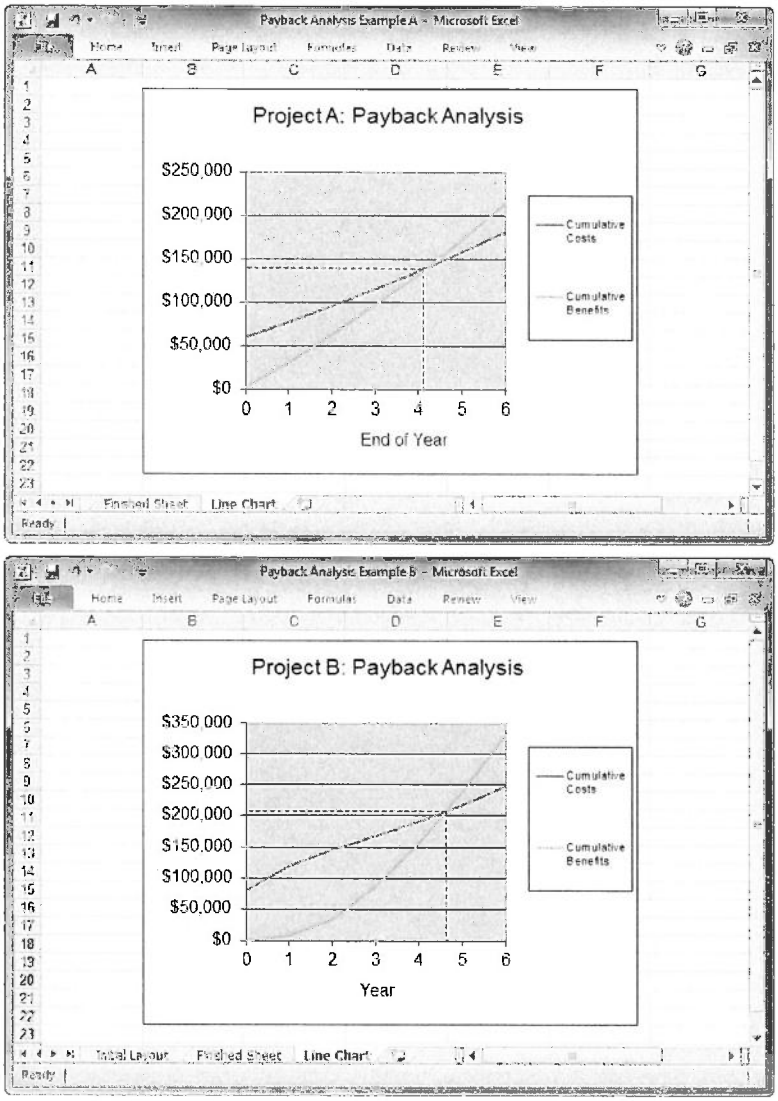



**FIGURE TK C-9** Microsoft Excel can be used to show the payback period by creating a chart of cumulative costs and benefits. Note that Project A has a shorter payback period than Project B.

by Project B is better than the Project A solution. If Projects A and B represent two different information systems projects, and if the organization has sufficient resources to pursue only one of the two projects, then Project B is the better choice.

Critics of return on investment analysis raise two points. First, ROI measures the overall rate of return for the total period, and annual return rates can vary considerably. Two projects with the same ROI might not be equally desirable if the benefits of one project occur significantly earlier than the benefits of the other project. The second criticism is that the ROI technique ignores the timing of the costs and benefits. This concept is called the time value of money, and is explained in the section on the present value analysis method.

**ROI ANALYSIS EXAMPLES**

**PROJECT A:**

$$\text{ROI} = \frac{\text{Total Benefits} - \text{Total Costs}}{\text{Total Costs}} = \frac{213{,}000 - 181{,}000}{181{,}000} = 17.7\%$$

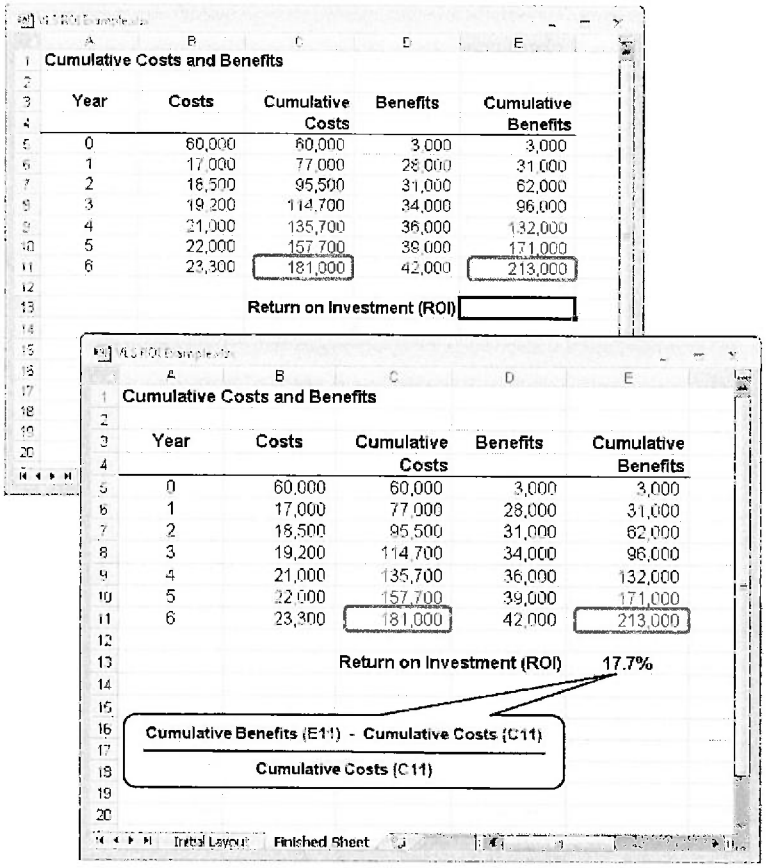
← ROI for Project A

**PROJECT B:**

$$\text{ROI} = \frac{\text{Total Benefits} - \text{Total Costs}}{\text{Total Costs}} = \frac{330{,}000 - 247{,}500}{247{,}500} = 33.3\%$$

← ROI for Project B

**FIGURE TK C-10** Return on investment analysis for Project A and Project B shown in Figure TK C-7 on page 677.



Cumulative Costs and Benefits

| Year | Costs | Cumulative Costs | Benefits | Cumulative Benefits |
|---|---|---|---|---|
| 0 | 60,000 | 60,000 | 3,000 | 3,000 |
| 1 | 17,000 | 77,000 | 28,000 | 31,000 |
| 2 | 18,500 | 95,500 | 31,000 | 62,000 |
| 3 | 19,200 | 114,700 | 34,000 | 96,000 |
| 4 | 21,000 | 135,700 | 36,000 | 132,000 |
| 5 | 22,000 | 157,700 | 39,000 | 171,000 |
| 6 | 23,300 | 181,000 | 42,000 | 213,000 |

Return on Investment (ROI) 17.7%

Cumulative Benefits (E11) - Cumulative Costs (C11)
Cumulative Costs (C11)

Initial Layout | Finished Sheet

**FIGURE TK C-11** Sample worksheets showing ROI formula and analysis.

## Using a Spreadsheet to Compute ROI

You also can use spreadsheet programs to calculate the ROI. To do so for Project A, first set up the worksheet and enter the cost and benefit data. You can use cumulative columns (as you did in payback analysis) but you also will need two overall totals (one for costs and one for benefits), as shown in Figure TK C-11.

The last step is to add a formula to calculate the ROI percentage rate, which is displayed in cell E13 in Figure TK C-11. As stated previously, the ROI calculation is total benefits minus total costs, divided by total costs. Therefore, the formula that displays the ROI percentage in cell E13 is = (E11–C11)/C11.

A major advantage of using a spreadsheet is if your data changes, you can modify your worksheet and calculate a new result instantly.

A spreadsheet can be a powerful tool when combined with an ROI template. Hall Consulting and Research offers several free ROI templates, as shown in Figure TK C-12.

## VIDEO LEARNING SESSION: PRESENT VALUE ANALYSIS

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**ON THE WEB**

To learn more about present value analysis, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part C, and locate the Present Value Analysis link.

## Present Value Analysis

A dollar you have today is worth more than a dollar you do not receive until one year from today. If you have the dollar now, you can invest it and it will grow in value. For example, would you rather have $100 right now or a year from now? The answer should be obvious. If you receive the $100 now, you can invest it in a mutual fund that has an annual return of 8%. One year from now, you will have $108 instead of $100.

You might decide to approach ROI from a different direction. For example, instead of asking, "How much will my $100 be worth a year from now?" you can ask, "How much do I need to invest today, at 8%, in order to have $100 a year from now?" This concept is known as the **time value of money**, as shown in Figure TK C-13, and it is the basis of the technique called **present value analysis.**

The present value of a future dollar is the amount of money that, when invested today at a specified interest rate, grows to exactly one dollar at a certain point in the future. The specified interest rate is called the discount rate. In present value analysis, a company uses a discount rate that represents the rate of return if the money is put into relatively risk-free investments, such as bonds, instead of being invested in the project.

Most companies require a rate of return that is higher than the discount rate because of the degree of risk in any project compared with investing in a bond. Companies often reject projects that seem attractive because the risk is not worth the potential reward.

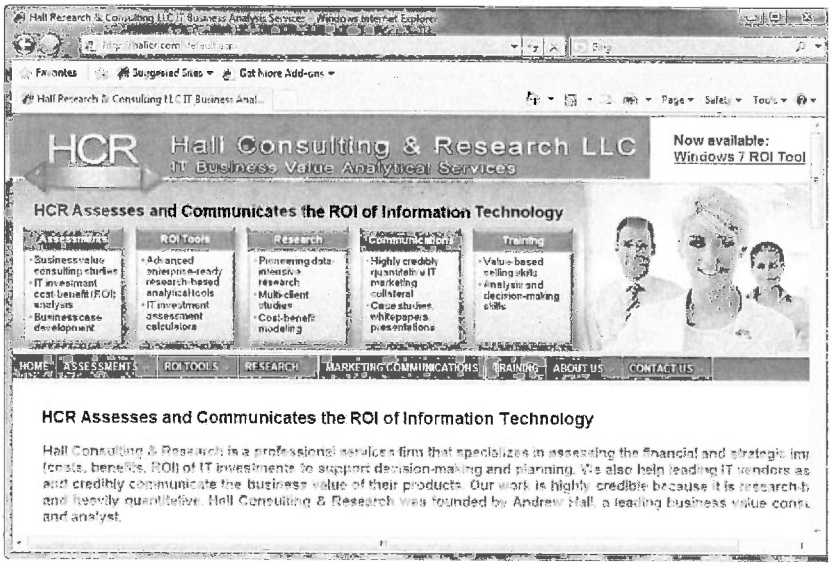



**FIGURE TK C-12** Hall Consulting and Research offers ROI information and templates.

To help you perform present value analysis, adjustment factors for various interest rates and numbers of years are calculated and printed in tables called **present value tables**. Figure TK C-13 shows a portion of a present value table, including values for 10 years at various discount rates.

| PERIODS | 6% | 8% | 10% | 12% | 14% |
|---|---|---|---|---|---|
| 1 | 0.943 | 0.926 | 0.909 | 0.893 | 0.877 |
| 2 | 0.890 | 0.857 | 0.826 | 0.797 | 0.769 |
| 3 | 0.840 | 0.794 | 0.751 | 0.712 | 0.675 |
| 4 | 0.792 | 0.735 | 0.683 | 0.636 | 0.592 |
| 5 | 0.747 | 0.681 | 0.621 | 0.567 | 0.519 |
| 6 | 0.705 | 0.630 | 0.564 | 0.507 | 0.456 |
| 7 | 0.665 | 0.583 | 0.513 | 0.452 | 0.400 |
| 8 | 0.627 | 0.540 | 0.467 | 0.404 | 0.351 |
| 9 | 0.592 | 0.500 | 0.424 | 0.361 | 0.308 |
| 10 | 0.558 | 0.463 | 0.386 | 0.322 | 0.270 |

**FIGURE TK C-13** Portion of a present value table showing adjustment factors for various time periods and discount rates. Values in the table are calculated using the formula shown in the text. Notice how the factors decrease as time and percentages increase.

To use a present value table, you locate the value in the column with the appropriate discount rate and the row for the appropriate number of years. For example, to calculate the present value of $1 at 12% for five years, you look down the 12% column in Figure TK C-13 until you reach the row representing five years. The table value is 0.567. To determine what the present value of $3,000 will be in five years with a discount rate of 12%, multiply the present value factor from the table by the dollar amount; that is, PV = $3,000 × 0.567 = $1,701.

Many finance and accounting books contain comprehensive present value tables, or you can obtain this information on the Internet, as shown in Figure TK C-14.

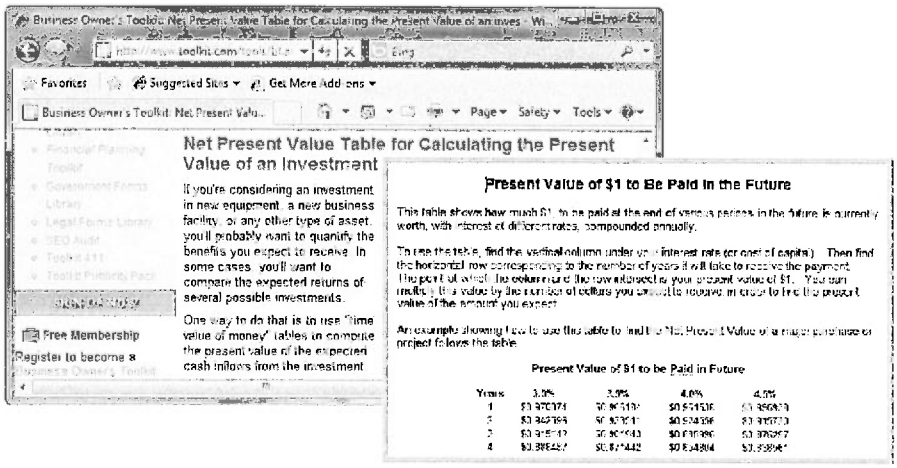



**FIGURE TK C-14** The Business Owner's Toolkit site provides valuable information, such as these present value tables.

To perform present value analysis, you must time-adjust the cost and benefit figures. First, you multiply each of the projected

**ON THE WEB**

To learn more about the time value of money, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part C, and locate The Time Value of Money link.

benefits and costs by the proper present value factor, which depends on when the cost will be incurred or the benefit will be received. The second step is to sum all the time-adjusted benefits and time-adjusted costs. Then, you calculate the **net present value** (NPV) of the project, which is the total present value of the benefits minus the total present value of the costs. Figure TK C-15 shows the calculation of net present value for two sample projects.

In theory, any project with a positive NPV is economically feasible because the project will produce a larger return than would be achieved by investing the same amount of money in a discount rate investment. Remember that risks are associated with any project, however, and management typically insists on a substantially higher return for high-risk projects. For example, both projects in Figure TK 3-16 have positive net present values and appear economically worthwhile.

Suppose, however, that you knew one of the projects had a 90% probability of achieving its goals, while the other project had only a 70% chance. To be attractive, the project with the higher risk would have to offer a corresponding higher reward. Chapter 3 explains how project managers evaluate risks. Figure 3-33 on page 122 shows a matrix that includes various combinations of risk probability and impact.

Net present value also can be used to compare and rank projects. All things being equal, the project with the highest net present value is the best investment. Figure TK C-15 shows that Project B is a better investment than Project A because it has a higher net present value.

**NET PRESENT VALUE EXAMPLES**

PROJECT A:

| | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Total |
|---|---|---|---|---|---|---|---|---|
| Benefits: | 3,000 | 28,000 | 31,000 | 34,000 | 36,000 | 39,000 | 42,000 | |
| Present Value Factor (12%): | 1.000 | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 | 0.507 | |
| Present Value: | 3,000 | 25,004 | 24,707 | 24,208 | 22,896 | 22,113 | 21,294 | 143,222 |
| Costs: | 60,000 | 17,000 | 18,500 | 19,200 | 21,000 | 22,000 | 23,300 | |
| Present Value Factor (12%): | 1.000 | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 | 0.507 | |
| Present Value: | 60,000 | 15,181 | 14,745 | 13,670 | 13,356 | 12,474 | 11,813 | 141,239 |
| Net Present Value: | | | | | net present value of Project A → | | | 1,983 |

PROJECT B:

| | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Total |
|---|---|---|---|---|---|---|---|---|
| Benefits: | — | 6,000 | 26,000 | 54,000 | 70,000 | 82,000 | 92,000 | |
| Present Value Factor (12%): | — | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 | 0.507 | |
| Present Value: | — | 5,358 | 20,722 | 38,448 | 44,520 | 46,494 | 46,644 | 202,186 |
| Costs: | 80,000 | 40,000 | 25,000 | 22,000 | 24,000 | 26,500 | 30,000 | |
| Present Value Factor (12%): | 1.000 | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 | 0.507 | |
| Present Value: | 80,000 | 35,720 | 19,925 | 15,664 | 15,264 | 15,026 | 15,210 | 196,809 |
| Net Present Value: | | | | | net present value of Project B → | | | 5,377 |

**FIGURE TK C-15** Net present value analysis for Project A and Project B.

Present value analysis provides solutions to the shortcomings of payback analysis and return on investment analysis. Unlike payback analysis, present value analysis considers all the costs and benefits, and not just the earlier values. In addition, present value analysis takes into account the timing of costs and benefits, so their values can be adjusted by the discount rate that provides a common yardstick and recognizes the time value of money. Even so, companies often use all three methods to get more input for making decisions. Sometimes a project will score higher on one method of analysis and lower on another.

## Using a Spreadsheet to Calculate Present Value

There are two ways to calculate present value using a spreadsheet program such as Microsoft Excel. You can enter the discount adjustment factors from an external table, and use a simple formula to apply the factors. However, many analysts find it easier to use a built-in NPV formula that handles the calculations. The two methods are described in the following sections. The example shows costs and benefits for a proposed information system with a one-year development period, a three-year useful life, and a 6% discount rate.

**USING EXTERNAL FACTORS** The first method is to create a spreadsheet similar to the one in Figure TK C-16. Starting with the estimated benefits, you would enter adjustment factors in cells C6, D6, and E6. Then you would create formulas in cells C7, D7, and E7 that multiply the three factors times the dollar amounts for each year, with a total shown in column F. You would do the same thing for the estimated costs. Finally, when you subtract total costs from total benefits, the net present value for the proposed system displays in cell F13.

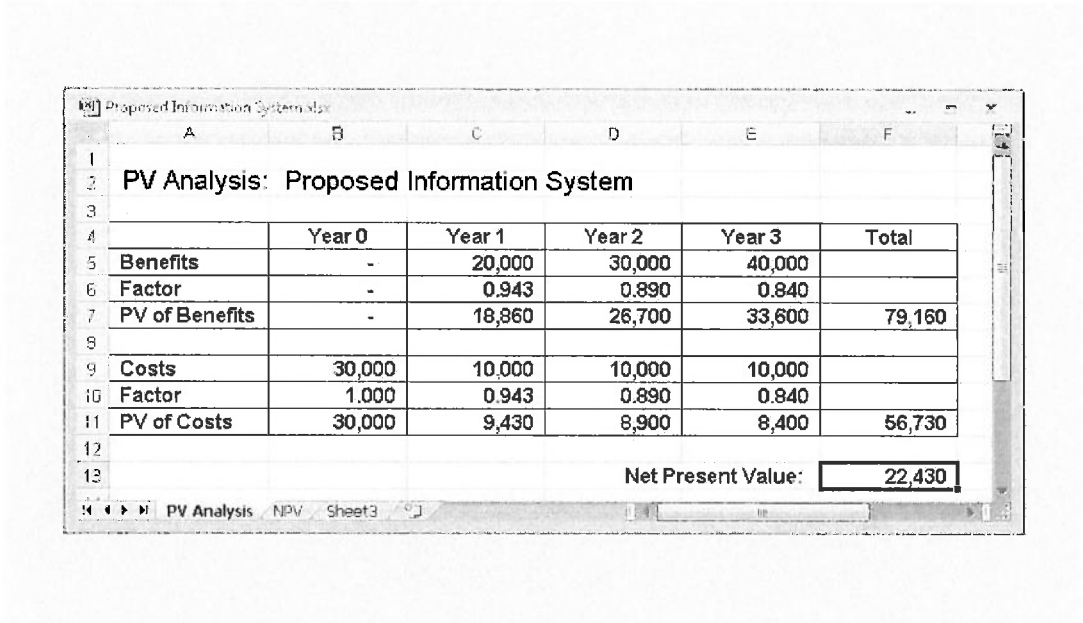
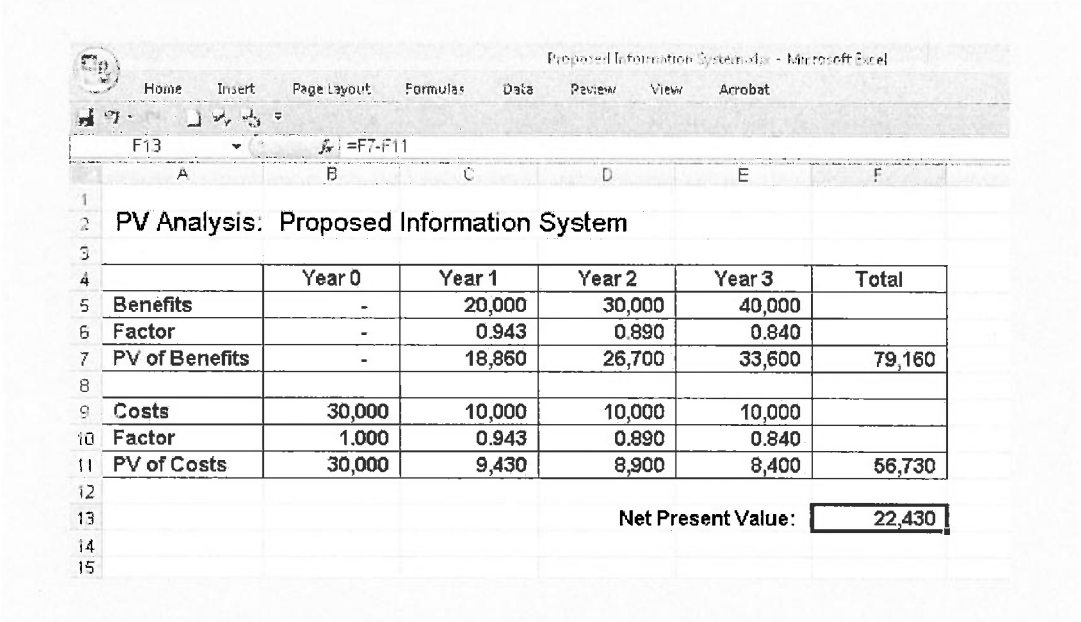



**FIGURE TK C-16** This sample spreadsheet shows how you can use external discount factors and formulas to calculate present value.

**USING A BUILT-IN FORMULA** The second method uses a built-in spreadsheet function to calculate present value. You enter the amounts, the discount rate, and number of time periods, and the program does the rest. Using this approach, you perform four steps, starting with the benefits.

1. First, create a spreadsheet with cost and benefit data arranged similar to Figure TK C-17. You will enter the NPV functions in column I.
2. Next, select cell I5, and click the Function button on the formula bar. Select the NPV function, and you will be prompted to enter a rate. You are using a 6% discount rate, so enter .06.
3. Now enter the three benefit amounts: 20,000 for Value 1, 30,000 for Value 2, and 40,000 for Value 3.
4. When you click OK, a net present value appears in cell I5. Now follow the same method to enter the cost amounts, subtract costs from benefits, and the net present value displays in cell I8. Notice there is a slight difference in the two methods because Excel uses more decimal places. The difference is not significant.




PV Analysis: Proposed Information System

| | Year 0 | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|---|
| Benefits | - | 20,000 | 30,000 | 40,000 | |
| Factor | - | 0.943 | 0.890 | 0.840 | |
| PV of Benefits | - | 18,860 | 26,700 | 33,600 | 79,160 |
| | | | | | |
| Costs | 30,000 | 10,000 | 10,000 | 10,000 | |
| Factor | 1.000 | 0.943 | 0.890 | 0.840 | |
| PV of Costs | 30,000 | 9,430 | 8,900 | 8,400 | 56,730 |
| | | | | | |
| | | | | Net Present Value: | 22,430 |

**FIGURE TK C-17** This sample spreadsheet shows how you can use a built-in NPV function to calculate present value.

## Toolkit Summary

As a systems analyst, you must be concerned with economic feasibility throughout the SDLC, and especially during the systems planning and systems analysis phases. A project is economically feasible if the anticipated benefits exceed the expected costs. When you review a project, you work with various feasibility and cost analysis tools.

You must classify project costs as tangible or intangible, direct or indirect, fixed or variable, and developmental or operational. Tangible costs are those that have a specific dollar value, whereas intangible costs involve items that are difficult to measure in dollar terms, such as employee dissatisfaction. Direct costs can be associated with a particular information system, while indirect costs refer to overhead expenses that cannot be allocated to a specific project. Fixed costs remain the same regardless of activity levels, while variable costs are affected by the degree of system activity. Developmental costs are one-time systems development expenses, while operational costs continue during the systems operation and use phase.

Every company must decide how to charge or allocate information systems costs and the chargeback method. Common chargeback approaches are no charge, a fixed charge, a variable charge based on resource usage, or a variable charge based on volume.

Some companies use a no charge approach because IT services benefit the overall organization. This method treats the IT group for accounting purposes as a cost center that offers services without charge. In contrast, if management imposes charges on other departments, the IT department is regarded as a profit center that sells services that otherwise would have to be purchased from outside the company.

You also must classify system benefits. Many benefit categories are similar to costs: tangible or intangible, fixed or variable, and direct or indirect. Benefits also can be classified as positive benefits that result in direct dollar savings or cost-avoidance benefits that allow the firm to avoid costs that they would otherwise have incurred.

Cost-benefit analysis involves three common approaches: payback analysis, return on investment (ROI) analysis, and present value analysis. You can use spreadsheet programs to help you work with those tools.

Payback analysis determines the time it takes for a system to pay for itself, which is called the payback period. In payback analysis, you compare total development and operating costs to total benefits. The payback period is the point at which accumulated benefits equal accumulated costs. A disadvantage of this method is that payback analysis analyzes only costs and benefits incurred at the beginning of a system's useful life.

Return on investment (ROI) analysis measures a system by comparing total net benefits (the return) to total costs (the investment). The result is a percentage figure that represents a rate of return that the system offers as a potential investment. Many organizations set a minimum ROI that all projects must match or exceed and use ROI to rank several projects. Although ROI provides additional information compared with payback analysis, ROI expresses only an overall average rate of return that might not be accurate for a given time period. Also, ROI does not recognize the time value of money.

Present value analysis adjusts the value of future costs and benefits to account for the time value of money. By measuring all future costs and benefits in current dollars, you can compare systems more accurately and consistently. Present value analysis uses mathematical factors that you can derive or look up in published tables. You also can use a spreadsheet function to calculate present value. Many companies use present value analysis to evaluate and rank projects.