Feasibility Analysis

Six Tests for Feasibility

So far, we've defined feasibility and feasibility analysis, and we've identified feasibility checkpoints during systems analysis. Feasibility can be viewed from multiple perspectives. Below we present six categories of feasibility tests.

- *Operational feasibility* is a measure of how well a solution meets the identified system requirements to solve the problems and take advantage of the opportunities envisioned for the system.
- *Cultural (or political) feasibility* is a measure of how people feel about a solution and how well it will be accepted in a given organizational climate.
- *Technical feasibility* is a measure of the practicality of a specific technical solution and the availability of technical resources and expertise to implement and maintain it.
- *Schedule feasibility* is a measure of how reasonable the project timetable is.
- *Economic feasibility* is a measure of the cost-effectiveness of a project or solution.
- *Legal feasibility* is a measure of how well a solution can be implemented within existing legal and contractual obligations.

Actually, few systems are infeasible. Instead, different solution options tend to be more or less feasible than others. Let's take a closer look at the four feasibility criteria.

> Operational Feasibility

Operational feasibility is the measure of how well a proposed system solves the problems and takes advantage of the opportunities identified during the scope definition and problem analysis phases and how well it satisfies the system requirements identified in the requirements analysis phase. Operational feasibility also asks if, given what is now known about the problem and the cost of the solution, the problem is still worth solving. The PIECES framework (Chapter 3) can be used as the basis for analyzing the urgency of a problem or the effectiveness of a solution.

operational feasibility a measure of how well a solution meets the identified system requirements to solve the problems and take advantage of the opportunities envisioned for the system.

> Cultural (or Political) Feasibility

This is related to operational feasibility. But where operational feasibility deals more with how well the solution will meet system requirements, **cultural/political feasibility** deals with how the end users feel about the proposed system. You could say that operational feasibility evaluates whether a system *can* work, and cultural/political feasibility asks whether a system *will* work in a given organizational climate.

In an information age, knowledge is power. It is common for an information system to change the structure of how information is routed and controlled, changing to some extent the power structure of the organization. Some users and managers may feel threatened and fight implementation of the system.

Recognize that increasingly the culture of an organization is multicultural. Employees and divisions may have been merged in from different companies with widely varying perspectives on how work should be structured and what information systems should do and not do. With international organizations, the information system must also be accepted by multiple national cultures. The following questions address this concern:

cultural (or political) feasibility a measure of how well the solution will be accepted in a given organizational climate.

- Does management support the system?
- How do the end users feel about their role in the new system?

- What end users or managers may resist or not use the system? Can this problem be overcome? If so, how?
- How will the working environment of the end users change? Can or will end users and management adapt to the change?

> Technical Feasibility

technical feasibility a measure of the practicality of a technical solution and the availability of technical resources and expertise.

Today, very little is technically impossible. Consequently, technical feasibility looks at what is practical and reasonable. Technical feasibility addresses three major issues:

1. Is the proposed technology or solution practical?
2. Do we currently possess the necessary technology?
3. Do we possess the necessary technical expertise?

Is the Proposed Technology or Solution Practical? The technology for any defined solution is normally available. The question is whether that technology is mature enough to be easily applied to our problems. Some firms like to use state-of-the-art technology, but most firms prefer to use mature and proven technology. A mature technology has a larger customer base for obtaining advice concerning problems and improvements.

Do We Currently Possess the Necessary Technology? Assuming the solution's required technology is practical, we must next ask ourselves, Is the technology available in our information systems shop? If the technology is available, we must ask if we have the capacity. For instance, will our current printer be able to handle the new reports and forms required of a new system?

If the answer to either of these questions is no, then we must ask ourselves, Can we get this technology? The technology may be practical and available, and, yes, we need it. But we simply may not be able to afford it at this time. Although this argument borders on economic feasibility, it is truly technical feasibility. If we can't afford the technology, then the alternative that requires the technology is not practical and is technically infeasible!

Do We Possess the Necessary Technical Expertise? This consideration of technical feasibility is often forgotten during feasibility analysis. Even if a company has the technology, that doesn't mean it has the skills required to properly apply that technology. For instance, a company may have a database management system (DBMS). However, the analysts and programmers available for the project may not know that DBMS well enough to properly apply it. True, all information systems professionals can learn new technologies; however, that learning curve will impact the technical feasibility of the project—specifically, it will impact the schedule.

> Schedule Feasibility

schedule feasibility a measure of how reasonable a project timetable is.

Given the available technical expertise, are the project deadlines reasonable—that is, what is the **schedule feasibility** of the project? Some projects are initiated with specific deadlines. It is necessary to determine whether the deadlines are mandatory or desirable. For instance, a project to develop a system to meet new government reporting regulations may have a deadline that coincides with when the new reports must be initiated. Penalties associated with missing such a deadline may make meeting it mandatory. If the deadlines are desirable rather than mandatory, the analyst can propose alternative schedules.

It is preferable (unless the deadline is absolutely mandatory) to deliver a properly functioning information system two months late than to deliver an error-prone, useless information system on time! While missing deadlines can be problematic, developing inadequate systems can be disastrous. It's a choice between the lesser of two evils.

> Economic Feasibility

The bottom line in many projects is **economic feasibility.** During the early phases of the project, economic feasibility analysis amounts to little more than judging whether the possible benefits of solving the problem are worthwhile. Costs are practically impossible to estimate at that stage because the end user's requirements and alternative technical solutions have not been identified. However, as soon as specific requirements and solutions have been identified, the analyst can weigh the costs and benefits of each alternative. This is called a cost-benefit analysis. Cost-benefit analysis is discussed later in this chapter.

economic feasibility a measure of the cost-effectiveness of a project or solution.

> Legal Feasibility

Information systems have a legal impact. First of all, there are copyright restrictions. For any system that includes purchased components, one has to make sure that the license agreements are not violated. For one thing this means installing only licensed copies. But license agreements and copy protection can also restrict how you integrate the data and processes with other parts of the system. If you are working with contract programmers, the ownership of the program source code and nondisclosure agreements have to be worked out in advance.

Union contracts can add constraints to the information system on how workers are paid and how their work is monitored. Legal requirements for financial reporting must be met. System requirements for sharing data with partners could even run up against antitrust laws. Finally, many information systems today are international in scope. Some countries mandate where data on local employees and local transactions must be stored and processed. Countries differ on the number of hours that make up a workweek or how long employees break for lunch.

legal feasibility is a measure of how well a solution can be implemented within existing legal and contractual obligations.

> The Bottom Line

We have now discussed the fact that any alternative solution can be evaluated according to six criteria: operational, cultural/political, technical, schedule, economic, and legal feasibility. How does an analyst pick the best solution? It's not easy. Operational and economic issues often conflict. For example, the solution that provides the best operational impact for end users may also be the most expensive and, therefore, the least economically feasible. The final decision can be made only by sitting down with end users, reviewing the data, and choosing the best overall alternative.

Cost-Benefit Analysis Techniques

Economic feasibility has been defined as a cost-benefit analysis. How can costs and benefits be estimated? How can those costs and benefits be compared to determine economic feasibility? Most schools offer complete courses on these subjects—courses on financial management, financial decision analysis, and engineering economics and analysis. This section presents an overview of the techniques.

> How Much Will the System Cost?

Costs fall into two categories. There are costs associated with developing the system, and there are costs associated with operating a system. The former can be estimated from the outset of a project and should be refined at the end of each phase of the

project. The latter can be estimated only after specific computer-based solutions have been defined. Let's take a closer look at the costs of information systems.

The costs of developing an information system can be classified according to the phase in which they occur. Systems development costs are usually onetime costs that will not recur after the project has been completed. Many organizations have standard cost categories that must be evaluated. In the absence of such categories, the following list should help:

- *Personnel costs*—The salaries of systems analysts, programmers, consultants, data entry personnel, computer operators, secretaries, and the like, who work on the project make up the personnel costs. Because many of these individuals spend time on many projects, their salaries should be prorated to reflect the time spent on the projects being estimated.
- *Computer usage*—Computer time will be used for one or more of the following activities: programming, testing, conversion, word processing, maintaining a project dictionary, prototyping, loading new data files, and the like. If a computing center charges for usage of computer resources such as disk storage or report printing, the cost should be estimated.
- *Training*—If computer personnel or end users have to be trained, the training courses may incur expenses. Packaged training courses may be charged out on a flat fee per site, a student fee (such as $395 per student), or an hourly fee (such as $75 per class hour).
- *Supply, duplication, and equipment costs.*
- *Cost of any new computer equipment and software.*

Sample development costs for a typical solution are displayed in Figure 11-2. When analysts are estimating development costs, it is important that money be set aside for the possibility that a system will incur costs after it is operating. The lifetime benefits must recover both the developmental and the operating costs. Unlike system development costs, operating costs tend to recur throughout the lifetime of the system. The costs of operating a system over its useful lifetime can be classified as fixed or variable.

fixed cost a cost that occurs at a regular interval and at a relatively fixed rate.

Fixed costs occur at regular intervals but at relatively fixed rates. Examples of fixed operating costs include:

- Lease payments and software license payments.
- Prorated salaries of information systems operators and support personnel (although salaries tend to rise, the rise is gradual and tends not to change dramatically from month to month).

variable cost a cost that occurs in proportion to some usage factor.

Variable costs occur in proportion to some usage factor. Examples include:

- Costs of computer usage (e.g., CPU time used, terminal connect time used, storage used), which vary with the workload.
- Supplies (e.g., preprinted forms, printer paper used, punched cards, floppy disks, magnetic tapes, and other expendables), which vary with the workload.
- Prorated overhead costs (e.g., utilities, maintenance, and telephone service), which can be allocated throughout the lifetime of the system using standard techniques of cost accounting.

Sample operating cost estimates for a solution are also displayed in Figure 11-2.

> What Benefits Will the System Provide?

Benefits normally increase profits or decrease costs, both highly desirable characteristics of a new information system. As much as possible, benefits should be quantified in dollars and cents; they should also be classified as tangible or intangible.

tangible benefit a benefit that can be easily quantified.

Tangible benefits are those that can be easily quantified. Tangible benefits are usually measured in terms of monthly or annual savings or of profit to the firm. For example, consider the following scenario:

Estimated Costs for Client-Server System Alternative

DEVELOPMENT COSTS

Personnel:

2	Systems Analysts (400 hours/ea $50.00/hr)	$40,000
4	Programmer/Analysts (250 hours/ea $35.00/hr)	$35,000
1	GUI Designer (200 hours/ea $40.00/hr)	$8,000
1	Telecommunications Specialist (50 hours/ea $50.00/hr)	$2,500
1	System Architect (100 hours/ea $50.00/hr)	$5,000
1	Database Specialist (15 hours/ea $45.00/hr)	$675
1	System Librarian (250 hours/ea $15.00/hr)	$3,750

Expenses:

4	Smalltalk training registration ($3,500.00/student)	$14,000

New Hardware & Software:

1	Development Server	$18,700
1	Server software (operating system, misc.)	$1,500
1	DBMS server software	$7,500
7	DBMS client software ($950.00 per client)	$6,650
	Total Development Costs:	$143,275

PROJECTED ANNUAL OPERATING COSTS

Personnel:

2	Programmer/Analysts (125 hours/ea $35.00/hr)	$8,750
1	System Librarian (20 hours/ea $15.00/hr)	$300

Expenses:

1	Maintenance Agreement for server	$995
1	Maintenance Agreement for server DBMS software	$525
	Preprinted forms (15,000/year @ .22/form)	$3,300
	Total Projected Annual Costs:	**$13,870**

FIGURE 11-2 Costs for a Proposed Systems Solution

While processing student housing applications, we discover that considerable data is being redundantly typed and filed. An analysis reveals that the same data is typed seven times, requiring an average of 44 additional minutes of clerical work per application. The office processes 1,500 applications per year. That means a total of 66,000 minutes or 1,100 hours of redundant work per year. If the average salary of a secretary is $15 per hour, the cost of this problem and the benefit of solving the problem is $16,500 per year.

Alternatively, tangible benefits might be measured in terms of unit cost savings or profit. For instance, an alternative inventory valuation scheme may reduce inventory carrying cost by $0.32 per unit of inventory. Some examples of tangible benefits are listed in the margin.

TANGIBLE BENEFITS

Fewer Processing Errors
Increased Throughput
Decreased Response Time
Elimination of Job Steps
Increased Sales
Reduced Credit Losses
Reduced Expenses

Other benefits are intangible. **Intangible benefits** are those that are believed to be difficult or impossible to quantify. Unless these benefits are at least identified, it is entirely possible that many projects would not be feasible. Examples of intangible benefits are listed in the margin on the next page.

INTANGIBLE BENEFITS

Improved Customer Goodwill
Improved Employee Morale
Better Service to Community
Better Decision Making

intangible benefit a benefit that is believed to be difficult or impossible to quantify.

Unfortunately, if a benefit cannot be quantified, it is difficult to accept the validity of an associated cost-benefit analysis that is based on incomplete data. Some analysts dispute the existence of intangible benefits. They argue that all benefits are quantifiable; some are just more difficult to quantify than others. Suppose, for example, that improved customer goodwill is listed as a possible intangible benefit. Can we quantify goodwill? You might try the following analysis:

1. What is the result of customer ill will? The customer will submit fewer (or no) orders.
2. To what degree will a customer reduce orders? A user may find it difficult to specifically quantify this impact, but you could try to have the end user estimate the possibilities (or invent an estimate to which the end user can react). For instance:
   a. There is a 50 percent (.50) chance that the regular customer would send a few orders—fewer than 10 percent of all its orders—to competitors to test their performance.
   b. There is a 20 percent (.20) chance that the regular customer would send as many as half its orders (.50) to competitors, particularly those orders we are historically slow to fulfill.
   c. There is a 10 percent (.10) chance that a regular customer would send us an order only as a last resort. That would reduce that customer's normal business with us to 10 percent of its current volume (90 percent, or .90, loss).
   d. There is a 5 percent (.05) chance that a regular customer would choose not to do business with us at all (100 percent or 1.00 loss).
3. We can calculate an estimated business loss as follows:

$$\begin{aligned} \text{Loss} = .50 &\times \\ &+ .20 \times (.50 \text{ loss of business}) \\ &+ .10 \times (.90 \text{ loss of business}) \\ &+ .05 \times (1.00 \text{ loss of business}) \\ &= .29 \\ &= 29\% \text{ statistically estimated loss of business} \end{aligned}$$

4. If the average customer does $40,000 per year of business, then we can expect to lose 29 percent, or $11,600, of that business. If we have 500 customers, this can be expected to amount to a total of $5,800,000.
5. Present this analysis to management, and discuss it as a starting point for quantifying the benefit. (.10 loss of business)

> Is the Proposed System Cost-Effective?

There are three popular techniques for assessing economic feasibility, also called *cost-effectiveness:* payback analysis, return on investment, and net present value.

The choice of techniques should consider the audiences that will use them. Virtually all managers who have come through business schools are familiar with all three techniques. One concept that should be applied to each technique is the adjustment of cost and benefits to reflect the time value of money.

The Time Value of Money A concept shared by all three techniques is the **time value of money**—a dollar today is worth more than a dollar one year from now. You could invest that dollar today and, through accrued interest, have more than one dollar a year from now. Thus, you'd rather have that dollar today than in one year. That's why your creditors want you to pay your bills promptly—they can't invest what they don't have. The same principle can be applied to costs and benefits *before* a cost-benefit analysis is performed.

Some of the costs of a system will be accrued after implementation. Additionally, all benefits of the new system will be accrued in the future. Before cost-benefit analysis, these costs should be brought back to current dollars. An example should clarify the concept.

Suppose we are going to realize a benefit of $20,000 two years from now. What is the current dollar value of that $20,000 benefit? If the current return on investments is running about 10 percent, an investment of $16,528 today would give us our $20,000 in two years (we'll show you how to calculate this later). Therefore, the current value of the estimated benefit is $16,528—that is, we'd rather have $16,528 today than the promise of $20,000 two years from now.

Because projects are often compared against other projects that have different lifetimes, time-value analysis techniques have become the preferred cost-benefit methods for most managers. By time-adjusting costs and benefits, you can improve the following cost-benefit techniques.

Payback Analysis The **payback analysis** technique is a simple and popular method for determining if and when an investment will pay for itself. Because system development costs are incurred long before benefits begin to accrue, it will take some time for the benefits to overtake the costs. After implementation, you will incur additional operating expenses that must be recovered. Payback analysis determines how much time will elapse before accrued benefits overtake accrued and continuing costs. This period of time is called the **payback period.**

payback analysis a technique for determining if and when an investment will pay for itself.

payback period the period of time that will elapse before accrued benefits overtake accrued costs.

In Figure 11-3 we see an information system that will be developed at a cost of $418,040. The estimated net operating costs for each of the next six years are also recorded in the table. The estimated net benefits over the same six operating years are also shown. What is the payback period?

First, we need to adjust the costs and benefits for the time value of money (that is, adjust them to current dollar values). Here's how: The present value of a dollar in year *n* depends on something typically called a **discount rate.** The discount rate is a percentage similar to interest rates that you earn on your savings account. In most cases the discount rate for a business is the **opportunity cost** of being able to invest money in other projects, including the possibility of investing in the stock market, money market funds, bonds, and the like. Alternatively, a discount rate could represent

	A	B	C	D	E	F	G	H	I
4	Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
5	Development cost:	($418,040)							
6	Operation & maintenance cost:		($15,045)	($16,000)	($17,000)	($18,000)	($19,000)	($20,000)	
7	Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567	0.507	
8	Time-adjusted costs (adjusted to present value):	($418,040)	($13,435)	($12,752)	($12,104)	($11,448)	($10,773)	($10,140)	
9	Cumulative time-adjusted costs over lifetime:	($418,040)	($431,475)	($444,227)	($456,331)	($467,779)	($478,552)	($488,692)	
10									
11	Benefits derived from operation of new system:	$0	$150,000	$170,000	$190,000	$210,000	$230,000	$250,000	
12	Discount factors for 12%:	1.000	$0.893	$0.797	$0.712	$0.636	$0.567	$0.507	
13	Time-adjusted benefits (current of present value):	$0	$133,950	$135,490	$135,280	$133,560	$130,410	$126,750	
14	Cumulative time-adjusted benefits over lifetime:	$0	$133,950	$269,440	$404,720	$538,280	$668,690	$795,440	
15		0	1	2	3	4	5	6	
16	Cumulative lifetime time-adjusted costs + benefits:	($418,040)	($297,525)	($174,787)	($51,611)	$70,501	$190,138	$306,748	
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									

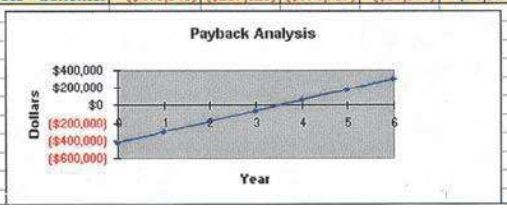

FIGURE 11-3
Payback Analysis for a Project

FIGURE 11-4 Partial Table For Present Value Of A Dollar

Periods	8%	9%	10%	11%	12%	13%	14%
1	0.926	0.917	0.909	0.901	0.893	0.885	0.877
2	0.857	0.842	0.826	0.812	0.797	0.783	0.769
3	0.794	0.772	0.751	0.731	0.712	0.693	0.675
4	0.735	0.708	0.683	0.659	0.636	0.613	0.592
5	0.681	0.650	0.621	0.593	0.567	0.543	0.519
6	0.630	0.596	0.564	0.535	0.507	0.480	0.456
7	0.583	0.547	0.513	0.482	0.452	0.425	0.400
8	0.540	0.502	0.467	0.434	0.404	0.376	0.351

what the company considers an acceptable return on its investments. This number can be learned by asking any financial manager, officer, or comptroller.

present value the current value of a dollar at any time in the future.

Let's say the discount rate for our sample company is 12 percent. The current value, actually called the **present value,** of a dollar at any time in the future can be calculated using the following formula:

$$PV_n = 1/(1 + i)^n$$

where PV_n is the present value of \$1.00 n years from now and i is the discount rate. Therefore, the present value of a dollar two years from now is

$$PV_2 = 1/(1 + .12)^2 = 0.797$$

Earlier we stated that a dollar today is worth more than a dollar a year from now. But it looks as if it is worth less. This is an illusion. The present value is interpreted as follows. If you have 79.7 cents today, it is better than having 79.7 cents two years from now. How much better? Exactly 20.3 cents better since that 79.7 cents would grow into one dollar in two years (assuming our 12 percent discount rate).

To determine the present value of any cost or benefit in year 2, you simply multiply 0.797 times the estimated cost or benefit. For example, the estimated operating expense in year 2 is \$16,000. The present value of this expense is \$16,000 × 0.797, or \$12,752 (rounded up). Fortunately, you don't have to calculate discount factors. There are tables similar to the partial one shown in Figure 11-4 that show the present value of a dollar for different time periods and discount rates. Simply multiply this number times the estimated cost or benefit to get the present value of that cost or benefit. More detailed versions of this table can be found in many accounting and finance books as well as in spreadsheet functions.

Better still, most spreadsheets include built-in functions for calculating the present value of any cash flow, be it cost or benefit. All the examples in this module were done with Microsoft *Excel.* The same tables can be prepared with *Lotus 1-2-3.* The beauty of a spreadsheet is that once the rows, columns, and functions have been set up, you simply enter the costs and benefits and let the spreadsheet discount the numbers to present value. (In fact, you can also program the spreadsheet to perform the cost-benefit analysis.)

In Figure 11-3, notice that we have brought all costs and benefits for our example back to present value. Also notice that the discount rate for year 0 is 1.000. Why? The present value of a dollar in year 0 is exactly \$1. In other words, if you hold a dollar today, it is worth exactly \$1.

Now that we've discounted the costs and benefits, we can complete our payback analysis. Look at the cumulative lifetime costs and benefits. The lifetime costs are gradually increasing over the six-year period because operating costs are being incurred. But also notice that the lifetime benefits are accruing at a much faster pace.

Lifetime benefits will overtake the lifetime costs between years 3 and 4. By charting the cumulative lifetime time-adjusted costs and benefits, we can estimate that the break-even point (when Costs + Benefits = 0) will occur approximately 3.5 years after the system begins operating.

Is this information system a good or bad investment? It depends. Many companies have a payback period guideline for all investments. In the absence of such a guideline, you need to determine a reasonable guideline before you determine the payback period. Suppose that the guideline states that all investments must have a payback period less than or equal to four years. Because our example has a payback period of 3.5 years, it is a good investment. If the payback period for the system were greater than four years, the information system would be a bad investment.

It should be noted that you can perform payback analysis without time-adjusting the costs and benefits. The result, however, would show a 2.8-year payback that looks more attractive than the 3.5-year payback that we calculated. Thus, non-time-adjusted paybacks tend to be overly optimistic and misleading.

Return-on-Investment Analysis The **return-on-investment (ROI) analysis** technique compares the lifetime profitability of alternative solutions or projects. The ROI for a solution or project is a percentage rate that measures the relationship between the amount the business gets back from an investment and the amount invested. The lifetime ROI for a potential solution or project is calculated as follows:

return-on-investment (ROI) analysis a technique that compares the lifetime profitability of alternative solutions.

$$\text{Lifetime ROI} = (\text{Estimated lifetime benefits} - \text{Estimated lifetime costs}) / \text{Estimated lifetime costs}$$

Let's calculate the lifetime ROI for the same systems solution we used in our discussion of payback analysis. Once again, all costs and benefits should be time-adjusted over a period of six years. The time-adjusted costs and benefits were presented in rows 9 and 16 of Figure 11-3. The estimated lifetime benefits minus estimated lifetime costs equal

$$\$795{,}440 - \$488{,}692 = \$306{,}748$$

Therefore, the lifetime ROI is

$$\text{Lifetime ROI} = \$306{,}748/\$488{,}692 = .628 = 63\%$$

This is a lifetime ROI, *not* an annual ROI. Simple division by the lifetime of the system (63 ÷ 6) yields an average ROI of 10.5 percent per year. This solution can be compared with alternative solutions. The solution offering the highest ROI is the best alternative. However, as was the case with payback analysis, the business may set a minimum acceptable ROI for all investments. If none of the alternative solutions meets or exceeds that minimum standard, then none of the alternatives is economically feasible. Once again, spreadsheets can greatly simplify ROI analysis through their built-in financial analysis functions.

As with payback analysis, we could have calculated the ROI without time-adjusting the costs and benefits. This would, however, result in a misleading 129.4 percent lifetime or a 21.6 percent annual ROI. Consequently, we recommend time-adjusting all costs and benefits to current dollars.

Net Present Value The **net present value** of an investment alternative is considered the preferred cost-benefit technique by many managers, especially those who have substantial business schooling. Once again, you initially determine the costs and benefits for each year of the system's lifetime. And once again, we need to adjust all the costs and benefits back to present dollar values.

net present value an analysis technique that compares the annual discounted costs and benefits of alternative solutions.

Figure 11-5 illustrates the net present value technique. Costs are represented by negative cash flows, while benefits are represented by positive cash flows. We have brought all costs and benefits for our example back to present value. Notice again that the discount rate for year 0 (used to accumulate all development costs) is 1.000 because the present value of a dollar in year 0 is exactly $1.

FIGURE 11-5

Net Present Value Analysis for a Project

	A	B	C	D	E	F	G	H	I	J
1	Net Present Value Analysis for Client-Server System Alternative									
2	(Numbers rounded to nearest $1)									
3										
4	Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total	
5	Development cost:	($418,040)								
6	Operation & maintenance cost:		($15,045)	($16,000)	($17,000)	($18,000)	($19,000)	($20,000)		
7	Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567	0.507		
8	Present value of annual costs:	($418,040)	($13,435)	($12,752)	($12,104)	($11,448)	($10,773)	($10,140)		
9	Total present value of lifetime costs:								($488,692)	
10										
11	Benefits derived from operation of new	$0	$150,000	$170,000	$190,000	$210,000	$230,000	$250,000		
12	Discount factors for 12%:	1.000	$0.893	$0.797	$0.712	$0.636	$0.567	$0.507		
13	Present value of annual benefits:	$0	$133,950	$135,490	$135,280	$133,560	$130,410	$126,750		
14	Total present value of lifetime benefits:								$795,440	
15										
16	NET PRESENT VALUE OF THIS ALTERNATIVE:								$306,748	
17										

After discounting all costs and benefits, subtract the sum of the discounted costs from the sum of the discounted benefits to determine the net present value. If it is positive, the investment is good. If negative, the investment is bad. When comparing multiple solutions or projects, the one with the highest positive net present value is the best investment. (This works even if the alternatives have different lifetimes!) In our example the solution being evaluated yields a net present value of $306,748. This means that if we invest $306,748 at 12 percent for six years, we will make the same profit that we'd make by implementing this information systems solution. This is a good investment provided no other alternative has a net present value greater than $306,748.

Once again, spreadsheets can greatly simplify net present value analysis through their built-in financial analysis functions.