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ABSTRACT

This instructional module is designed to teach training managers how to calculate training costs, measure the effectiveness of training, and determine the cost effectiveness of training. It is organized in three parts. Part 1 points out why some training managers are reluctant to determine the cost effectiveness of training. It discusses the need to justify training with documented benefits and provides practical details and examples of how to calculate the direct, indirect, and full costs of training. Part 2 describes four levels of measurement used to determine the effectiveness of training. The need for a cause-and-effect link between a specific organizational problem and a performance deficiency is addressed. The selection of outcomes (benefits) to be baselined before training and tracked after training in order to determine the payback is discussed. Part 3 presents five methods for determining the cost effectiveness of training courses and problems: return on investment, internal rate of return, cost-benefit ratio, bottom-line evaluation, and payback period. In addition to providing details and examples for each of these methods, their advantages and disadvantages are identified and listed in a table. At the end of the module is a practical example to facilitate a skill check on the user's understanding and attainment of the learning objectives. (Contains 12 references.) (YLB)

Determining the Cost Effectiveness of Training

(A Self-Contained Instructional Module)

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DETERMINING THE COST EFFECTIVENESS OF TRAINING

LEARNING OBJECTIVES

Upon successful completion of this module, you will be able to:

1. Determine when to measure and report the cost effectiveness of training
2. Calculate the costs of training
3. Describe four levels of measuring training effectiveness
4. Select the outcomes (benefits) to be measured and link training to those outcomes
5. Compute how much training returns relative to its cost (return on investment)
6. Compute the yield from training based on the internal rate of return
7. Justify training investments based on the cost-benefit ratio
8. Compute the value added from training, using the bottom-line evaluation method
9. Apply the payback period method to determine how long it will take for training to pay for itself
10. Describe the advantages and disadvantages of five different methods of determining cost effectiveness
11. Apply five methods to determine if a training program is cost effective

RATIONALE (purposes)

1. To discuss the need for justifying training expenditures with documented benefits
2. To provide practical details on (a) calculating training costs, (b) measuring the effectiveness of training, and (c) methods used in determining the cost effectiveness of training. These methods provide quantitative evidence that effective training is a worthwhile investment rather than a cost.

While this module focuses on the cost effectiveness of training by private sector organizations, the content is also applicable to training provided by public (government) employers.

INTRODUCTION

Due to intense competition in an era of rapid economic and technological change, employers are closely scrutinizing their spending on workforce training. Increasingly, training departments and human resource professionals are being asked to justify whether training is a worthwhile investment. Training managers would prefer to measure the effectiveness of their courses and programs with data from criterion-referenced tests and feedback questionnaires. However, upper management requires that training be further justified in financial terms which they more readily understand.

This module is organized in three parts. The first part points out why some training managers are reluctant to determine the cost effectiveness of training. It discusses the need to justify training with documented bene... Part 1 also provides practical details and examples of how to calculate the direct, indirect, and full costs of training.

Part 2 describes four levels of measurement used to determine the effectiveness of training. In addition, the need for a cause-and-effect link between a specific organizational problem and a performance deficiency is addressed. The second part of the module also discusses the selection of outcomes (benefits) to be baselined before training and tracked after training in order to determine the payback.

Part 3 of the module presents five methods for determining the cost effectiveness of training courses and programs. The methods described are:

1. Return on investment (ROI)
2. Internal rate of return (IRR)
3. Cost-benefit ratio
4. Bottom-line evaluation
5. Payback period

In addition to providing details and examples for each of these methods, their advantages and disadvantages are identified and listed in a table.

At the end of the module is a practical example to facilitate a skill check on your understanding and attainment of the learning objectives listed on page 1. Although with the completion of this module one will be able to understand cost effectiveness methods, a flowchart is provided in Appendix B which enables one in initially choosing the correct method for determining the cost effectiveness of training. Such a flowchart is useful for application outside the context of this module and at the actual worksite.

Terminology.

- **Cost effectiveness**. The results attained against the costs of time, effort, money, and inconvenience. Cost effectiveness provides a decision making standard in order to accurately allocate resources among competing investments. The criteria for effectiveness are value, worth, and merit.
- **Return on investment (ROI)**. The rate of what something returns to its costs. It is a calculative approach to evaluating a result against the amount of resources invested.
- **Internal rate of return (IRR)**. The yield from a training investment at which discounted costs are equal to discounted benefits.
- **Cost-benefit**. The ratio of projected costs of training to its estimated benefits. It is a useful method for justifying training investments when the benefits attributable to training are difficult to quantify in monetary units.
- **Bottom-line evaluation**. This method shows the value added to each trainee's job performance and the total value added to an organization from training.
- **Payback period**. A method for initial consideration of a questionable training investment. It answers the question, "How long will it take the training to pay for itself?"

Part 1 Training Costs

WHEN TO MEASURE COST EFFECTIVENESS

Organizations traditionally supported training because (a) it showed their attention to employees, and (b) upper management "assumes" that the benefits exceed the costs. In any event, when upper management "believes" that training is operationally critical to the organization's competitive position, there may be little or no demand for cost-effectiveness information.

Therefore, despite the increasing admonishment found in training literature regarding the importance of demonstrating that training is a worthwhile investment, many training managers routinely avoid the use of economic justification. However, when a belief in the value, worth, and merit of training is not part of an underlying business philosophy, reporting the cost effectiveness of training can help the training manager establish credibility and may enhance the organization's willingness to invest additional resources

The single greatest incentive for indicating cost effectiveness of training is its use in **justifying training expenditures with documented benefits**. Uncertainty about continued support for the training function leads to the consideration of cost effectiveness information as a defensive measure -- a way of showing upper management that training is a necessity and not a luxury. Consequently, a growing number of training managers have a desire to **show a return on training investments similar to that of other business investments**. Nevertheless, many lack the knowledge necessary to determine the costs and benefits of training courses and programs (Lombardo, 1989, pp. 60-61).

When asked to report on a training investment, training managers often hesitate to calculate the costs necessary to develop, deliver, and evaluate training, and are reluctant to document and report the benefits such as increased quality, productivity, safety, sales, and so forth. Among the reasons cited for this reluctance are:

1. Lack of reliable cost figures
2. Difficulty in identifying, monitoring, and quantifying training benefits

3. Subjective nature of the assumptions to be made
4. Inability to isolate training's influence on performance improvements from other factors
5. Time and effort involved in calculating the costs and documenting the benefits of training
6. Potential for unfavorable returns on the investment

Notwithstanding these and other reasons, training managers who feel the need to justify training with evidence that the benefits exceed costs will welcome the opportunity to determine the cost effectiveness of training using the methods presented in this module. These methods can provide quantitative evidence that effective training is a worthwhile investment rather than a cost.

CALCULATING THE COSTS OF TRAINING

Costs are incurred in developing, delivering, and evaluating training. These **costs are categorized as direct and indirect**. The **full cost of training** is the sum of all direct and indirect costs.

Often, the training manager will not have access to many of the costs associated with training but must obtain figures or reliable estimates from the organization's payroll, budget, accounting, or comptroller's office. Usually, however, all direct and indirect costs can be accounted for, with little guesswork.

Direct costs. Direct costs are expenses tied specifically to a product (training course or program) (Usry, Hammer, & Matz, 1988, p. 26). Direct personnel costs include the wages and benefits paid to or on behalf of employees involved in training (e.g., trainees and instructors) as well as fees paid for external training services (contractors, consultants, etc.). Also included in direct costs are training development and instructional materials preparation (including production) costs, or the review of materials purchased from a vendor. Other direct costs are materials and supplies, equipment, facilities, travel and per diem.

Organizations generally pay all employee/trainee costs. Training is typically conducted during working hours; consequently, trainees are not available to perform their regular jobs. As a result, every hour which the trainee spends in training costs the organization the equivalent to an hour's wages and benefits for that employee.

In calculating personnel costs, wages and benefits should be considered as a total compensation package. All employer-paid benefits, such as insurance, pensions/profit sharing, tuition assistance, discounts, employee lounges, company cars, time paid but not worked (vacation, sick leave, etc.) which are the most costly, and other contributions are included (Gilley & Eggland, 1989, p. 267). Thus, an employee's hourly wage and the employer-paid benefits package (usually a percentage of wages) are the total compensation package. In the United States, these employer-paid "fringe" benefits average over 40% of direct salary costs (U. S. Chamber of Commerce, 1994, p. 15).

EXAMPLE OF A TOTAL COMPENSATION PACKAGE

The hourly wage for a inspector is $17. In addition, the fringe benefits package costs the employer an additional 30%. The employer's cost for a welder's total daily (8-hour) compensation package is:

$17	x	8 hours	+	30%	x	($17 x 8)	=	$176.80
Hourly wage		Hours per day		Fringe benefits percent		Daily wage		Total daily compensation package

Additionally, employees' time is worth more than their total compensation package because they are also expected to contribute to the organization's profitability. Consequently, there can be a cost of disruption to productivity during training time. This cost becomes more apparent as the number of employees away from their job and the length of training increases. The loss of contribution to the organization's profitability and the disruption of bringing in possible inexperienced personnel for productivity when other employees are in training is opportunity costs. Also, if training is rejected, the net good features (dollar value) of training is the opportunity cost of choosing short-term profitability and production goals.

In order to define these costs, dollar values must be placed upon each individual's contribution to profit and the subsequent results of having inexperienced personnel performing the trainee's normal job duties and the benefits of training. For example, the process of calculating opportunity cost for having training would be the number of trainees multiplied by their average combined individual daily output (obtain from production personnel) which would then be multiplied by their combined contribution to profit percentage. The individual totals for each employee are subsequently added together to provide a total contribution to profit. The contribution to profit percentage is determined by obtaining dollar profit projections from the organization's accounting office and dividing it by the total number of employees of the organization which is then multiplied by 100%. Also, the total

costs of errors made by inexperienced personnel would be subtracted from the total contribution to profit in order to obtain the total opportunity costs for choosing training. Ultimately, the opportunity costs of choosing training and not choosing training are compared in order that the best of the two alternatives is chosen. These opportunity costs are considered in decision making but are not recognized by accounting professionals as bonafide costs of operations (Garrison, 1991, p. 557). However, depending upon the organization, opportunity costs may need to be included in total trainee costs. Thus, the total compensation package is a generally accepted means for calculating trainee costs. The calculation of total trainee costs can be based on the number of trainees, length of training, and total compensation package.

EXAMPLE OF TRAINEE COSTS

Ten welder trainees are attending a two-day workshop on welding techniques. Each welder has a total daily compensation package, including benefits, of $176.80. The trainee costs associated with their participation in this workshop are:

10	x	2 days	x	$176.80	=	$3,536.00
Number of trainees		Length of training		Total daily compensation		Trainee costs

Just as trainee costs are calculated as a direct personnel cost, so should instructor costs be. However, more may be involved than just the days the instructor commits to delivering training. In addition, preparation time should be added (Deming, 1982, p. 97).

EXAMPLE OF INSTRUCTOR COSTS

An instructor requires 1 day of preparation time for a two-day workshop. The instructor's total daily compensation package rate is $200. The instructor costs associated with this workshop are:

1	x	(2 days	+	1 day)	x	$200	=	$176.80
Number of instructors		Length of training		Length of preparation		Total daily compensation		Total daily compensation package

If an organization contracts for **external training services**, the costs of developing and delivering the training as well as the cost of preparing/producing instructional materials may be lumped together with all other costs the contractor or consultant charges. However, when the training is developed internally, **training development and instructional materials preparation costs** need to be calculated.

Calculation of training development and instructional materials preparation costs can be made based on the time expended by the developer(s) and instructional materials production personnel involved, and on the costs of materials and supplies required in preparing all types of instructional materials, including printed materials, audiovisual media, manipulative aids, etc. A calculation of development and materials preparation costs could look like the following example (Deming, 1982, p. 97).

EXAMPLE OF TRAINING DEVELOPMENT AND INSTRUCTIONAL MATERIALS PREPARATION COSTS

An developer spends 4 days developing a training workshop and an additional 7 days preparing printed instructional materials. No production personnel are involved. The developer's total daily compensation package is rate is $225. The cost of materials and supplies required in preparing instructional materials is $250. The training development and instructional materials preparation costs associated with this workshop are:

1	x	(4 days	+	7 days)	x	$200	+	$250	=	$2,725
Number of developers		Days for training development		Days for materials preparation		Total daily compensation		Cost of materials and supplies		Development and preparation costs

Training development and instructional materials preparation costs can be treated differently than trainee and instructor costs insofar as the training will be repeated. For example, if the cost of developing the training and preparing instructional materials was $2,725 and the workshop was conducted 10 times, then the development and preparation cost assigned to any one workshop would be the total cost ($2,725) divided by the number of workshops (10), or $245 per workshop.

Another way to treat training development and instructional materials preparation costs is to amortize them over the number of trainees. For example, if the development and preparation cost was $2,725 and a total of 150 welders were trained in the 10 workshops, then the cost per trainee would be the total cost ($2,725) divided by the number of trainees (150), or $18.17 per trainee. These simple calculations show that (a) the more times the training

is delivered, and (b) the more welders trained, the more economical the investment in training development and instructional materials preparation will be.

Frequently, training managers purchase "off-the-shelf" instructional materials marketed by a vendor for a number of potential users. The purchase price of instructional materials such as books, modules, video tapes, etc., as well as consumable supplies, such as pencils, paper, chalk, and the like, can be grouped under the heading, **instructional materials costs** (Deming, 1982, p. 97).

Some instructional materials costs are the result of multiplying a per-trainee cost by the number of trainees. For example, if 10 trainees each receive a purchased $30 book, the cumulative total cost is $30 multiplied by 10 trainees, or $300.

EXAMPLE OF INSTRUCTIONAL MATERIALS COSTS

The instructional materials for a paint mixing workshop include books purchased from a vendor, costing a total of $300, and consumable supplies which cost $75. The instructional materials costs associated with this workshop are:

$300	+	$75	=	$375
Purchased instructional materials		Consumable supplies		Instructional materials costs

Training will involve **equipment costs** when machines must be rented or purchased and then maintained. In other instances, training can be scheduled to use equipment available in the organization (Deming, 1982, p. 98). For example, welder training requires the use of a gas tungsten arc pipe welding machine. The machine's usage for training may, for all practical purposes, be cost-free if the training can be scheduled when the machine is idle. More than likely, however, training workshops would be conducted during normal working hours and the existing

pipe welding machine could not be diverted for training purposes. Consequently, a duplicate machine would have to be rented and maintained.

EXAMPLE OF RENTED EQUIPMENT COSTS

The cost of renting a cement mixing machine which is needed for a two-day workshop is $150 per day. In addition, maintenance costs for the rented machine are $10 per day. The equipment costs associated with this workshop are:

2 days	x	($150	+	$10)	=	$320
Length of training		Equipment rental per day		Maintenance cost per day		Rental and maintenance costs of equipment

When equipment is purchased specifically for training, its purchase price can be amortized (written off) over the item's useful life, with yearly maintenance costs added, to find the annual cost. The annual cost is then distributed evenly to all training courses in which the item is used.

EXAMPLE OF PURCHASED EQUIPMENT COSTS

A cement mixing machine was purchased exclusively for training. It cost $24,000 and has an estimated useful life of 10 years. The machine has a yearly maintenance cost of $1,800, and it will be used for 10 workshops per year. The annual equipment cost and cost to each workshop for this machine can be calculated as follows.

($24,000	/	10 years)	+	$1,800	=	$4,200
Purchase price of equipment		Useful life of equipment		Maintenance cost per year		Annual equipment cost

$4,200	/	10	=	$420
Annual equipment cost		Number of workshops		Equipment cost per workshop

If a workshop uses several pieces of rented or purchased equipment, their costs are added together (Carnevale & Schulz, 1990, pp. S-12 & S-13).

Facilities costs are incurred when a training facility is built, shared, or rented. In cases where a building or special structure is built for training use, the cost can be amortized over its functional life, with yearly maintenance costs added (as in the purchase of equipment).

When training is conducted within a facility that is used for other organizational functions as well, then the appropriate fraction of that facility's cost should be billed to training (Deming, 1982, p. 98).

EXAMPLE OF FACILITIES COSTS (sharing a facility)

Organization facilities which are used 10% of the time for training have a yearly cost, including maintenance and building administration, of $18,000. The annual facilities costs associated with the training use of these facilities are:

$18,000	x	10 %	=	$1,800
Yearly cost of facilities, including maintenance and building administration		Percent of time used for training		Annual facilities costs for training

When organization facilities are used only occasionally for training, a daily rate method may be preferable over the percent of use method shown above. To calculate the daily facilities rate, the total annual facilities cost (for all functions) is divided by the number of working days in the year. If the organization in the above example operates 5 days per week, 52 weeks per year (260 days per year), then their daily facilities rate would be $18,000 divided by 260 days, or about $69.23. The daily rate is then multiplied by the number of days the facility is used for training. For example, the facilities cost for a 2-day workshop would be $69.23 multiplied by 2 days, or $138.46. The percent of use method may then be applied to the result, if appropriate.

When the **rent** for a classroom, seminar room, etc. is not a flat fee, total facilities costs for a given workshop are computed by multiplying the daily rental rate by the number of rental days. For example, the total facilities costs for a 2-day welding workshop held in a vocational training center that charges $200 per day for its welding shop would be $200 multiplied by 2 days, or $400.

For on-site training, **travel and per diem costs** are likely to be of little consequence. But for training away from the workplace, they are costly factors.

EXAMPLE OF TRAVEL AND PER DIEM COSTS

Ten cable television technician trainees have traveled to another city for a 2-day workshop. Their employer is paying the $300 airfare and $70 daily per diem to cover meals, lodging, and other living expenses for each trainee. The employer's costs for travel and per diem for the trainees are:

(10	x	2 days	x	$70)	+	(10	x	$300)	=	$4,400
Number of trainees		Length of training		Daily per diem rate		Number of trainees		Round-trip air fare		Travel and per diem costs

<u>Indirect costs</u>. Indirect costs are expenses which cannot be traced to a specific training course or program, but which are necessary for an organization to function. Although indirect costs for training are less visible than direct costs, they are substantial.

Examples of indirect costs include interest on organizational debt, building repairs, utilities, organizational supplies and equipment, administrative and staff support salaries, and expenses for legal, payroll, accounting, and other personnel. Organizations often subdivide such costs into **overhead** and **general and administrative (G & A)** expenses (Carnevale & Schulz, 1990, p. S-10). Overhead and G & A expenses often include some of the same items such as rent, depreciation, and taxes. However, the distinction between the two expenses should be recognized. Overhead expenses are those materials and labor costs which indirectly facilitate the production of a

product (i.e. training course). On the other hand, G & A expenses facilitate the everyday operations of the entire organization. Other items listed under G & A expenses are administrative/office salaries, auditing expenses, legal expenses, collections, telephone & telegraph, stationary and printing, and postage. G & A expenses are termed commercial expenses of the organization and are apart from producing the actual training program (Usry et al., 1988, p. 23).

Consequently, G & A expenses are allocated to all departments, projects, etc. within an organization. The concept of allocation stems from the organization's overall available capital for operations. The organization divides out (allocates) a portion (%) of available operational capital to each department or project. This allocated portion is a department's budget. The budgeted amount is divided by total organization operation capital to obtain the department or project's percent of the overall budget. This budgeted percentage is used as the G & A expense allocation percentage. Total organization G & A expenses can be obtained from the organization's accounting office and multiplied by the allocation percentage to derive the amount of G & A expenses to be included in total indirect costs (Garrison, 1991, p. 699).

Full cost of training. The final calculation to obtain the full cost of a training course or program is a simple addition problem. **First, direct costs** tied to a course or program **are summed**, including:

1. **Personnel costs** - total compensation packages for employees involved in training, (e.g., trainees and instructors)
2. Fees for **external training services** provided by contractors, consultants, etc.
3. **Training development and instructional materials preparation costs** including production personnel, when involved
4. Costs of **instructional materials** (including consumable supplies) purchased from a vendor
5. Equipment costs
6. Facilities costs
7. Travel and per diem costs

Second, indirect costs are summed, e.g., overhead, and G & A costs. Finally, the totals from the direct and indirect costs are summed to obtain a grand total, the full cost of training.

EXAMPLE OF A FULL COST OF TRAINING CALCULATION

Total direct costs for a 2-day workshop are $10,000. Total indirect costs consist of allocated overhead of $1,560 and allocated G & A expenses of $375. The full cost of training is:

$10,000	+	($1,560 + $375)	=	$11,935
Total direct costs		Total indirect costs		Full cost of training

Conclusion. While calculating the full cost of training is a first and critical step in determining cost effectiveness, monitoring costs is also important to planning and controlling the training budget. In addition, by analyzing costs, training managers are better able to evaluate the proportion of the organization's investment in specific training populations (supervisors, production, maintenance, office workers, etc.), a particular program, course, or topic, and so forth.

This part of the module shows that a training manager can calculate the costs of training, albeit with the help of those who have access to fiscal data. More challenging is the art of collecting evidence of favorable training outcomes, but it too can be done, as the next part of the module shows.

PROGRESS CHECK -- Part 1 -- Training Costs

This progress check will help you determine how well you understand the content covered in Part 1 of this module. If you have difficulty with any of the 13 questions, go back and review the relevant content before continuing. Use a calculator or another sheet of paper for your calculations. Answers to the following questions are provided at the end of this module.

1. Identify the greatest incentive for indicating the cost effectiveness of training.

   _____

2. Name two categories of training costs.

   1. _____

   2. _____

3. Calculate the total daily (8-hour) compensation package for an employee whose hourly wage is $16, and whose fringe benefits package costs his employer an additional 29%.

   Total daily compensation package = _____

4. Calculate the training costs for 12 trainees, with individual total compensation packages of $195 per day, who attend a 5-day training program.

   Total trainee costs = _____

5. Calculate the instructor costs for a 5-day workshop with one instructor who requires 2 additional days for preparation. The instructor's direct salary is $180 per day, with a 30% benefits package.

   Total instructor costs = _____

6. Calculate the training development and instructional materials preparation costs for two developers, with a total daily compensation package cost to the organization of $220 each, and who worked 5 days on developing training and 8 days on preparing instructional materials. The cost of supplies used in preparing the instructional materials was $210.

   Total development and preparation costs = _____

7. The cost of developing training and preparing printed instructional materials for a 5-day seminar was $6,300.

   A. What will be the cost per seminar if it is offered once each month for one year?

      Cost per seminar = _____

PROGRESS CHECK (continued)

B. If the seminar is offered only twice, to a total of 30 trainees (15 in each session), what will be the cost per trainee?

Cost per trainee = _____

8. The employer purchased books and modules for each of 12 trainees, costing a total of $180 per trainee. Paper and pencils, which cost $45 total, were also required. Calculate the total cost of these instructional materials.

Total instructional materials costs = _____

9. Welding Associates rented equipment for a 4-day training program they are conducting. The rental cost for the equipment is $300 per day. Maintenance costs associated with the equipment are $20 per day. What will be the equipment costs for this training program?

Equipment costs = _____

10. Welding Associates is considering purchasing the arc welding machine needed for training. The machine's purchase price is $22,500, and its estimated useful life is 5 years. In addition, yearly maintenance costs for the purchased machine are expected to be $2,100.

A. What will be the total annual cost of the machine?

Total annual equipment cost = _____

B. If Welding Associates uses the machine in a training program offered 12 times per year, what will be the equipment cost for each program?

Equipment cost per training program = _____

11. Welding Associates estimated their total facilities costs, including maintenance, for the current year to be $40,000.

A. If the facilities are used 15% of the time for training, what portion of the facilities costs should be allocated to the training budget?

Facilities costs (for training) = _____

B. If the facilities are used for training 5 days per week, 48 weeks per year (240 days per year), what is the daily facilities rate for the use of these facilities?

Daily facilities rate = _____

PROGRESS CHECK (continued)

12. Six welder-trainees have traveled from their home to another city to attend a 3-day workshop where they will learn to use specialized equipment. Welding Associates agreed to pay each employee's $400 airfare plus a $75 per day for other expenses. Calculate the travel and per diem costs incurred by Welding Associates for this 3-day workshop?

    Travel and per diem costs = _____

13. Welding Associates found their direct costs for a training program to be $17,000. Indirect costs, consisting of allocated overhead and G & A expenses, totaled $2,000. What is Welding Associates' full cost of training?

    Full cost of training = _____

MEASURING THE EFFECTIVENESS OF TRAINING

Kirkpatrick organized the measurement of training effectiveness (value, worth, and merit) into four levels. These levels are listed below, from the easiest to measure (level 1) to the most difficult (level 4). In general, the more levels used to measure a training course or program, the more complete is the evidence of its effectiveness.

- Level 1 -- Measurement of trainees' reactions to the training (feedback)
- Level 2 -- Measurement of knowledge and skills acquired
- Level 3 -- Measurement of trainees' use of their new knowledge and skills on the job
- Level 4 -- Measurement of the organization's return on the training investment

Level 1 information is gathered most often with questionnaires handed out at the end of a course or program or sent to trainees a short time later. At level 2, criterion-referenced tests are used to measure the knowledge and skills acquired. Level 3 ascertains if trainees are applying the newly-acquired knowledge and skills on the job.

Level 4 determines what benefits (increased quality, productivity, sales, etc.) the new knowledge and skills have had on the organization's performance, and their worth in monetary value. At level 4, training managers are asking about the organization's payback (return) on its training investment (Gordon, 1991, pp. 20 & 21).

In most cases, it is possible and feasible to link training outcomes to organizational improvements. Doing so does not require absolute isolation of training's benefits. Rather, it requires evidence that demonstrates training's valuable role (Carnevale & Schulz, 1990, p. S-16). Consequently, arguments about whether a training manager can absolutely separate training's influence on organizational improvements and isolate the impact are not pertinent.

Indisputable proof is difficult to come by, even when a carefully designed study using experimental and control groups is conducted. However, evidence can be collected to show that training was at least a major contributor to a particular operational savings or increase in revenue. Kirkpatrick adds that evidence is all anybody

really wants, anyhow. " . . . Management isn't going to ask, 'Can you prove it?' They'll ask for evidence. And evidence is not all that hard to come by" (Gordon, 1991, p. 23).

The key to collecting evidence of training outcomes is to establish a "causal link" between a specific organizational problem, preferably one to which monetary value can be assigned, and a performance deficiency. This is best done up front, before a training course or program is even developed.

Rejected workpieces in a manufacturing environment provide one example of an organizational problem. How much does the current reject rate cost the organization? Are rejected workpieces the result of a workforce skill deficiency, as opposed to inferior materials or equipment malfunctions? If so, there is a causal link.

After establishing the link between rejected workpieces and a skill deficiency, current reject costs are determined. The accounting office can provide figures for the cost of the materials used in manufacturing the workpiece. When this cost is added to personnel, equipment, and other appropriate manufacturing costs, the total cost of the rejected workpieces can be calculated. If the number of rejected workpieces declines after the workers are trained, the operational saving provides convincing, quantitative evidence that the training provided a return on the investment.

Benefits. By selecting the outcomes or opportunities gained (benefits) to be measured and linking training to those outcomes while holding, to the extent possible, other factors constant, level 4 measurement becomes a relatively simple matter. All training managers have to do is track the outcomes for which baseline measures were gathered before the training, and they will know what the payoff is. Among the most important outcomes (benefits) to be documented are (a) increased quality, productivity, sales, service, safety, and workforce flexibility; (b) reduced operational costs, medical insurance, and worker's compensation claims; and (c) lower absenteeism. Other outcomes, which are more difficult to document and quantify, include the increased stability of the workforce; improved morale, harmony, job satisfaction, and attitude; a lower requirement for supervision; the formation of selection pools for promotion; supervisory skill development; and improved customer relations.

Conclusion. Once training managers learn how to calculate the cost and measure the effectiveness of training, they can begin to describe the benefits from a financial perspective. **Is the training effort producing benefits that are greater than the costs involved? This, ultimately, is what upper management wants to know.**

A variety of methods are available for determining the cost effectiveness of training. Some are complex and cumbersome to use, while others are more suitable for justifying an investment in a new machine for a manufacturing plant, a new way of doing a job, and so forth. The five methods for justifying a training investment presented in Part 3 of this module were selected because they are (a) practical, (b) relatively easy to use, and (c) generally familiar to upper management. It must be pointed out, however, that all five methods have disadvantages. Consequently, none of them should be regarded as a precision tool. Nevertheless, these methods are based on accepted principles and present organized state-of-the-art procedures for determining the cost effectiveness of training courses and programs.

PROGRESS CHECK -- Part 2 -- Training Effectiveness

This progress check will help you determine how well you understand the content covered in Part 2 of this module. If you have difficulty with any of the questions, go back and review the relevant content before continuing. Answers to the following questions are provided at the end of this module.

1. Kirkpatrick noted that the effectiveness and efficiency of training can be measured at four different levels. Briefly describe the four levels.

   1. _____

   _____

   2. _____

   _____

   3. _____

   _____

   4. _____

   _____

2. Is it possible and/or feasible to link training outcomes to organizational improvements without the absolute isolation of training's benefits from the possible contributions of other variables?

   _____ Yes, it is both possible and feasible.

   _____ It is possible, but not feasible.

   _____ It is feasible, but not possible.

   _____ No, it is neither possible nor feasible.

3. What is the key to collecting evidence of training outcomes?

   _____

   _____

   _____

4. Identify the result of selecting the outcomes to be measured and linking training to those outcomes.

   _____

Part 3 -- Methods Used to Determine the Cost Effectiveness of Training

RETURN ON INVESTMENT (ROI)

ROI is the rate at which training returns what was invested (its cost). It is an indicator of a particular course or program's value, worth, and merit. Of the five methods of determining the cost effectiveness of training presented in this module, the ROI method is probably the most appealing to upper management, since managers are accustomed to thinking in terms of return on investment. However, the ROI method is appropriate only when it is possible to quantify outcomes (benefits) in monetary units (Kearsley, 1982, p. 92).

The following steps must be taken before a ROI report can be prepared:

- Step 1 -- Calculate the direct and indirect costs associated with the training course or program. These costs are then summed to obtain the full cost of training. (See Part 1 of this module for details.)
- Step 2 -- Gather baseline measures for those outcomes to be analyzed in step 3, *before training occurs*. This is the only way to know what changes took place.
- Step 3 -- *Analyze the effects of the training on outcomes (benefits)*, such as increased quality, productivity, sales, service, safety, and workforce flexibility; reduced operational costs, medical insurance and workers' compensation claims; and lower absenteeism; or any other measurable benefit. In order to apply the ROI method, these benefits must be quantified in monetary units.

Once the full cost of training is calculated, and the outcomes have been analyzed, the ROI can be computed. **Training managers should analyze only those outcomes that are accomplished, at least in part, by training.** To create a credible ROI report, training managers must present evidence that is important and believable to upper management.

Two common approaches for expressing the ROI for a training course or program are to consider *operational savings* and *increases in revenue*. For example, the training manager can assess whether an operational cost, such as accidents due to human error, is significantly lower after employees master safety procedures. Basarab (1990) suggested that other categories of operational savings and increases in revenue can occur by less waste, less reworks, less product liability litigation, fewer employee mistakes, and better morale. In this case, the ROI is the rate at which training costs are recovered by a reduction in the number or severity of accidents.

Reductions in accidents positively affect revenue, through lowered health care costs, insurance premiums, disability claims, and increases in productivity through fewer absentee days. Upper management will be impressed with evidence of training's valuable role in achieving both operational savings and increases in revenue. Consequently, they will look more favorable on training as a value-added service instead of just a "nice to have," but dispensable, cost of operation.

To calculate a ROI, total operational savings and increases in revenue resulting from the training are divided by the total cost of training. ROI expressed as a formula is:

$$\frac{\text{Operational savings + increase in revenue}}{\text{Full cost of training}} = \text{ROI}$$

Obviously, any training for which the ROI is greater than one (1.0), the break-even point, is worthwhile, because the benefit derived from the training is greater than its cost (we are getting out more than we put in). However, a ROI of less than 1.0 means that the training investment is greater than the return.

EXAMPLE OF ROI

A safety training program resulted in operational savings through a $35,000 reduction in accident costs/ payments the first year. There was also an annual increase in revenue of $5,000 as a result of fewer absentee days. The full cost of training was $25,000. The program's ROI was:

$$\frac{\$35,000 + \$5,000}{\$25,000} = 1.60 \text{ (or } 160\%)$$

This training program was a worthwhile investment. It returned 160% - the original $25,000 training cost plus an additional $15,000 (60%) in the first year. It will no doubt continue to provide a benefit, even without an additional training investment.

Advantages of the ROI Method

- Provides an indicator of the training's value, worth, and merit
- Easily understood by upper management
- Management will be impressed with a favorable ROI report and will view training as a value-added service

Disadvantages of the ROI Method

- It is appropriate only when it is possible to quantify outcomes (benefits) in monetary units.
- Baseline measures must be gathered for outcomes before training occurs.
- Evidence of operational savings and increases in revenue is available only after the training is conducted. Therefore its application in predicting a favorable return is limited.

Note. The advantages and disadvantages of the ROI method can be easily compared with those of the bottom-line evaluation and payback period methods by referring to Table 1 on pages 45 and 46.

PROGRESS CHECK -- Return on Investment (ROI)

This progress check will help you determine how well you understand the content on the ROI method. If you have difficulty with the questions, go back and review the relevant content before continuing. Use a calculator or another sheet of paper for you calculations. Answers to the following questions are provided at the end of this module.

1. A technical training program is saving your organization $20,000 per year and has increased revenue by $26,000 per year. The full cost of training was $40,000

   A. What was the ROI of this training investment?

   ROI =

   _____

   B. Was this a worthwhile investment?

   Yes _____ No _____

   Why or why not?

   _____

   _____

   _____

   _____

   C. Would your opinion change if you could have invested the $40,000 in a savings fund at a guaranteed 17% annual return instead?

   Yes _____ No _____

   Why or why not?

   _____

   _____

   _____

   _____

   _____

   _____

INTERNAL RATE OF RETURN (IRR)

Internal rate of return is the yield from a training investment. It is the result at which discounted costs are equal to discounted benefits. IRR uses the discounting feature in order to consider the time value of money across the life of training investments. This method can also be used as an initial screening tool for considering a training investment.

The IRR method is determined through the use of a standardized financial present value of an annuity table (See Appendix A). However, information including the cost (investment) of training, the annual cost savings, and presumed useful life of the training are required. This denotes another disadvantage to the IRR method in that the useful life of training is uncertain and often will be assigned arbitrarily. The investment required is divided by the annual cost savings to derive a factor of IRR. Consequently, this factor is found in the present value of annuity table coinciding with the extended life of the training. The corresponding rate is the IRR. Resultingly, the IRR is compared with a pre-determined and acceptable rate of return (cost of capital) established by the organization's upper management. If the rate is less than the organization's required rate then the project is unacceptable. A project should not be considered if it cannot return results greater than the cost of funds to produce it.

The IRR method is somewhat complex with the use of tables and that it requires an interpolation when the factor of IRR falls between specified table rates or is not found in the tables at all. The IRR method limits an organization's ability to adjust for risk on a questionable project. For example, if the IRR resulted in 12% when the required rate of return is 11%, the screening still resides with the specified rate of return. The only way to cover the risk is to raise the required rate of return but this may eliminate some very good investments.

The internal rate of return method is illustrated through the following formula:

$$\frac{\text{Investment in training}}{\text{Annual cost savings}} = \text{IRR Factor*}$$

* Find in Present Value of Annuity Table corresponding to the useful life of the training project. The corresponding rate is the IRR.

EXAMPLE OF IRR

A company is considering an in-house and an out-of-house training program for its computer data entry personnel. The investment required for the in-house training is $15,000. Company managers estimate that with more efficient data entry the training will save $5,000 per year in overtime pay. Also, the useful life of the in-house training is estimated to be 5 years. On the other hand, the out-of-house training program will cost $20,000. The out-of-house program will have a useful life of 6 years while resulting in savings of $4,000 per year. The organizations cost of capital is 10%. Should the company consider either of these programs?

In-house Training:

$$\frac{\$15,000}{\$5,000} = 3.00$$

Referring to the annuity table (See Appendix A) at 5 years, the IRR would be approximately 20%.

Out-of-house Training:

$$\frac{\$20,000}{\$4,000} = 5.00$$

Referring to the annuity table (See Appendix A) at 6 years, the IRR would be approximately 5%. The company should consider the in-house program. Its IRR is 20%, 10% above the organization's required rateof return. Further calculations show that the out-of-house program should not be considered with an IRR of only 5%.

Although the above example, uses the IRR method to make a decision between two types of programs, it should be noted that the IRR can be used to consider one training course or program. As long as the IRR can be determined, it can be compared to the organization's required rate of return.

Advantages of the IRR Method

- Considers the time value of money
- Provides an initial screening for considering training projects

Disadvantages of the IRR Method

- Is considered complex with the use of additional tables and needed interpolation when the factor of IRR falls between specified table rates or is not found in the table
- Limits the organization's ability to accurately adjust for risk
- The useful life of a training project is uncertain and often arbitrarily assigned

Note. The advantages and disadvantages of the IRR method can be easily compared with those of the ROI, cost-benefit ratio, bottom-line evaluation , and payback period methods by referring to Table 1 on pages 45 and 46.

PROGRESS CHECK -- Internal Rate of Return (IRR)

This progress check will help you determine how well you understand the content on the IRR method. If you have difficulty with the questions, go back and review the relevant content before continuing. Use a calculator or another sheet of paper and Appendix A for your calculations. Answers to the following questions are provided at the end of this module.

1. A Diversity training program is estimated to save your organization $21,000 per year in legal expenses and the full cost of the training is going to be $50,000. The useful life of the training is considered to be 10 years. The organization's required rate of return is 20%.

   A. What is the IRR of this training venture?

   IRR =

   _____

   _____

   _____

   B. Is this a worthwhile investment?

   Yes _____ No _____

   Why or why not?

   _____

   _____

   _____

   _____

   C. Would this training be more worthwhile than an out-of-house training program costing $60,000 with a useful life of 5 years and an expected annual savings of $25,000 per year?

   Yes _____ No _____

   Why or why not?

   _____

   _____

   _____

   _____

COST-BENEFIT RATIO

The cost-benefit analysis (ratio) method is used to determine the ratio of the projected full cost of a given course or program to its estimated benefits. This method is especially suitable for justifying training investments when the benefits attributable to training are difficult to quantify in monetary units.

The cost-benefit ratio formula is presented below:

$$\frac{\text{Projected full cost of training}}{\text{Predicted training benefits}} = \text{Cost-benefit ratio}$$

If the cost-benefit ratio is less than one (1.0), the training would be worthwhile, because its benefits exceed its costs. The smaller the ratio, the stronger the justification for training. If the ratio is greater than 1.0, costs exceed benefits and the training may not be justifiable, except when mandated by law (compliance training). However, the unknown factor in using the cost-benefit ratio is the actual ratio of return from the training (Stromsdorfer, 1972, p. 28).

The benefits of many courses and programs, such as supervisory skill development, are not easy to show or quantify. Benefits such as reduced workforce turnover as well as improved morale, harmony, job satisfaction, and attitude are hard to quantify in monetary units, yet they should not be overlooked. No matter how difficult it may seem to put a value on employee turnover, for example, and effort must be made to quantify all benefits for this method to work.

Technically precise and entirely objective monetary information simply is not available on the benefits for some "soft-skills" training. However, the following practical procedure provides appropriate figures for benefits that are difficult to quantify.

Before training is developed and delivered, line managers re asked to estimate the annual operational savings they expect to result for their department. These managers also rate their level of confidence, on a 0 to

100% scale, that the training will be responsible for the savings. Estimated operational savings are then multiplied by the "confidence" percentage to yield a prediction of total cost savings (benefits) from training.

EXAMPLE OF COST-BENEFIT RATIO

A company is considering supervisory skills training for its foremen. The enhancement of supervisory skills is expected to reduce workforce turnover. The line managers have been asked to estimate the annual operational savings they expect as a result of the reduced turnover and to rate their level of confidence that training will be responsible for the savings. They estimated the operational savings (from the reduced turnover) at $100,000, with a confidence rating of 50%. The full cost of the potential training program is projected to be $10,000. The expected cost-benefit ratio for this training investment is:

$$\frac{\$10{,}000}{\$100{,}000 \times 50\%} = 0.20$$

Because the cost-benefit ratio is less than 1.0, the training program is considered worthwhile.

This example is brief, but it illustrates the principles and procedures of the cost-benefit ratio method in providing evidence that this soft-skills course is worthwhile.

Advantages of the Cost-Benefit Ratio Method

- Especially suitable in training situations where the benefits are difficult to quantify in monetary units
- Practical procedure that provides appropriate figures for benefits that are difficult to quantify.
- Shows whether or not training is worthwhile, before the course or program is developed and delivered

Disadvantages of the Cost-Benefit Ratio Method

- The procedure used to predict training benefits in monetary units is subjective.
- Does not account for differences in return rates

Note. The advantages and disadvantages of the cost-benefit ratio method can be easily compared with those of the ROI, IRR, bottom-line evaluation, and payback period methods by referring to Table 1 on pages 45 and 46.

PROGRESS CHECK -- Cost-Benefit Ratio

This progress check will help you determine how well you understand the content on cost-benefit ratio method. If you have difficulty with the questions, go back and review the relevant content before continuing. Use a calculator or another sheet of paper for your calculations. Answers to the following questions are provided at the end of this module.

1. Mr. Whiz predicted that a computer technician training program for two of his employees would result in a total cost savings of $9,000 per year in computer repairs and down-time. He rates his level of confidence, that the training will be responsible for this savings, at 80%. The projected full cost of the technician training is $2,000 per person.

   A. Calculate the cost-benefit ratio for this potential training investment.

   Cost-benefit ratio = _____

   B. Do you think this training would be a worthwhile investment for Mr. Whiz's company?

   Yes _____ No _____

   Why or why not?

   _____

   _____

BOTTOM-LINE EVALUATION METHOD

The bottom-line evaluation method presented here determines the value added from training to each trainee's productivity, and the total value added to the organization by the training course or program. The total value added to the organization is compared to the full cost of training to determine if the training was a worthwhile investment.

This method incorporates two of Kirkpatrick's four levels of measuring effectiveness of training (See Part 2 of this module for a description of all four levels). It collects both level 4 (measurement of the organization's return on the training investment) and level 1(measurement of trainee's reactions to the training) data at the same time. A questionnaire is developed to collect level 4 and level 1 data from trainees after they have applied, back on the job, what they learned in the training.

Trainees indicate their individual opinions of (a) percent of job-time spent performing the task trained (T), (b) pre-training productivity percentages (P1), and (c) post-training productivity percentage (P2). Along with questionnaire responses, other information necessary to perform a bottom-line evaluation includes a list of the tasks performed by the trainees and their total annual compensation packages (S) (Noonan, 1993, p. 41). The bottom-line evaluation method expressed as a formula is:

$$\frac{(S \times T)}{\text{Total annual compensation package}} \times \frac{(P2 - P1)}{\text{Percent of job-time spent performing task trained}} = \frac{\text{Value added by training}}{\text{Percentage change in productivity as a result of training}}$$

The bottom line evaluation method promotes the use of job analysis information in that tasks performed by the employee/trainee must be identified, along with percent of job-time spent on those tasks, in order to calculate per-task compensation (S x T, in the above formula).

Criticisms of the bottom-line evaluation method include: (a) trainee questionnaire responses are subjective perceptions; and (b) potential for biased questionnaire input. However, the calculated value added can be adjusted for bias using statistical methods.

Despite the criticisms, however, this method does promote employee participation in decision making. Employees often feel that they are the best judges of their individual performance improvement following training. The method also appeals to management because it links employees' job task performance with their productivity, by comparing the full cost of the training with the value the organization receives from it.

EXAMPLE OF BOTTOM-LINE EVALUATION

A training program in erecting and dismantling scaffolding was provided to three employees. After the employees returned to their job and applied the knowledge and skill acquired, they were asked to complete a a questionnaire. Each employee supplied information on their perceptions of (a) percent of job-time spent performing the task trained, and (b) pre- and post-training productivity percentages. Each employee's total compensation package, percent of job-time spent performing the task trained, and pre-and post-training productivity percentages are presented in the table below, along with their individual and total value added to the organization as result of the training.

Employee /trainee	Total annual compensation package ($)	Job-time (%) spent performing the task trained	Component pay ($)	Pre-training productivity (%)	Post-training productivity (%)	Productivity gain (%)	Value Added ($)
	(S)	(T)	(D = S x T)	(P1)	(P2)	(G = P2 -P1)	(G x D)
1	$29,000	25%	$7,250	30%	80%	50%	$3,625
2	$30,000	20%	$6,000	40%	90%	50%	$3,000
3	$34,000	15%	$5,100	50%	80%	30%	$1,530
Total Value Added.							$8,155

The total value added to the organization by the training program was $8,155. If the full cost of training was less than $8,155, then the training program was a worthwhile investment.

Advantages of the Bottom-Line Evaluation Method

- Promotes the use of job analysis information
- Promotes employee participation in decision-making
- Appeals to management, because it links job task performance with training and productivity
- The total value added to the organization can be compared to the full cost of training to determine if the training was a worthwhile investment

Disadvantages of the Bottom-Line Evaluation Method

- Questionnaire responses are subjective perceptions by trainees
- Questionnaire data might be biased

Note. The advantages and disadvantages of the bottom-line evaluation method can be easily compared with those of the ROI, IRR, cost-benefit ratio, and payback period methods by consulting Table 1 on pages 45 and 46.

PROGRESS CHECK -- Bottom-Line Evaluation

This progress check will help you determine how well you understand the content on the bottom-line evaluation method. If you have difficulty with the table or questions, go back and review the relevant content before continuing. Use a calculator or another sheet of paper for you calculations. Answers to the following table and questions are provided at the end of this module.

1. A training manager has identified all the tasks performed by each employee within the organization, along with their total compensation packages. The training department is providing a welding training program for the welding department's 4 employees, at a total cost of $4,400. Each employee has a total annual compensation package of $20,000. The training manager would like to present training's value to upper management. The training is delivered and questionnaire results, in table form, are as follows:

Employee /trainee	Total annual compensation package ($)	Job-time (%) spent performing the task trained	Component pay ($)	Pre-training productivity (%)	Post-training productivity (%)	Productivity gain (%)	Value Added ($)
	(S)	(T)	(D = S x T)	(P1)	(P2)	(G = P2 -P1)	(G x D)
1		10%		20%	60%		
2		40%		20%	50%		
3		30%		30%	50%		
4		20%		40%	60%		
Total Value Added.							

A. Complete the table. For each employee, you will need to calculate component pay, productivity gain, and value added. You will also need to calculate the training program's total value added to the organization.

PROGRESS CHECK (continued)

B. Was the training program worthwhile?

Yes _____ No_____

Why or why not?

_____

_____

PAYBACK PERIOD

The fifth method of determining the cost effectiveness of a training investment is called the payback period method. This **forecasting** method answers the question, "How long will it take the training to pay for itself?" **This method should,** however, **be used only as an initial look at a questionable training investment.**

The payback period method does not consider the cost or time value of the money spent and tied up before, during, and after the training until the break-even point is reached. Also, the calculation provides no indication of the degree of benefits to be received. Nevertheless, it does consider some time factors in calculating the payback.

If the payback period is very short, less than one year, for example, then the training course or program is definitely promising and another method, such as ROI, cost-benefit ratio, or bottom-line evaluation, should be used for a closer examination of the training's value, worth, and merit to the organization. If the payback period is very long, 10 years, for example, then there may be no need to consider the training further, depending on the organization's philosophy about the maximum length of time allowed for investment resources to be returned.

The payback period method is represented by the following formula:

$$\frac{\text{Full cost of training}}{\text{Annual operational savings + increase in revenue}} = \text{Payback period (in years)}$$

EXAMPLE OF PAYBACK PERIOD METHOD

A company is considering an all-inclusive clerical training program. The full cost of this training is $10,000. Company managers estimate that improved clerical efficiency resulting from the training will save the organization $1,200 per month ($14,400 per year). Should the company give further consideration to this training?

$$\frac{\$10,000}{\$14,400} = 0.69 \text{ years (about 8.3 months or 36 weeks}$$

Yes, the company should consider the training further. Its payback period is very short, less than one year. Further calculation shows that, if the company's savings estimates are accurate, this investment (a) has a worthwhile cost-benefit ratio of only 0.69, and (b) will return 144% in the first year (the training year).

Advantage of the Payback Period Method

- Provides a quick initial look at a potential training investment.
- Answers the question, "How long will it take the training to pay for itself?'

Disadvantage of the Payback Period Method

- Should be used only as an initial screening tool. If the payback period is short, then another method (ROI, IRR, cost-benefit ratio, or bottom-line evaluation) must be used to examine the training's value, worth, and merit to the organization
- Does not consider the cost or time value of the money spent and tied up before, during, and after the training until the break-even point is reached
- Does not indicate the size of benefits from the training program

Note. The advantages and disadvantages of the payback period method can be easily compared with those of the ROI and bottom-line evaluation methods by consulting Table 1 on the following pages.

Table 1. Advantages and Disadvantages of Methods for Determining the Cost Effectiveness of Training

Method	Advantages	Disadvantages
ROI	Provides an indicator of the training's value, worth, and merit Easily understood by upper management Management will be impressed with a favorable ROI report and will view training as a value-added service	Appropriate only when it is possible to quantify outcomes (benefits) in monetary units Baseline measures must be gathered for outcomes before training occurs Evidence of operational savings and increases in revenue is available only after the training is conducted Therefore, ROI's application in predicting a favorable return is limited.
IRR	Considers the time value of money Provides an initial screening for considering training projects	Is considered complex with the use of additional tables and needed interpolation when the factor of IRR falls between specified table rates or is not found in the table Limits the organization ability to accurately adjust for risk The useful life of a training project is uncertain and often arbitrarily assigned
Cost-benefit ratio	Especially suitable in training situations where the benefits are difficult to quantify in monetary units Practical procedure that provides appropriate figures for benefits that are difficult to quantify Shows whether or not training is worthwhile before the course or program is developed and delivered	The procedure used to predict training benefits in monetary units is subjective Does not account for differences in return rates

Table 1. (continued)

Method	Advantages	Disadvantages
Bottom-line evaluation	Promotes the use of job analysis information Promotes employee participation in decision-making Appeals to management, because it links job task performance with training and productivity The total value added to the organization can be compared to the full cost of training to determine if the training was a worthwhile investment	Questionnaire responses are subjective perceptions by trainees Questionnaire data might be biased
Payback period	Provides a quick initial look at a potential training investment Answers the question "How long will it take the training to pay for itself?"	Should be used only as an initial screening tool. If the payback period is short, then another method must be used to examine the training's value, worth, and merit to the organization Does not consider the cost or time value of spent and tied up before, during, and after till the break-even point is reached Does not indicate the size of the benefits raining program

PROGRESS CHECK -- Payback Period

The progress check will help you determine how well you understand the content on payback period method. If you have difficulty with the questions, go back and review the relevant content before continuing. Use a calculator or another sheet of paper for you calculations. Answers to the following questions are provided at the end of this module.

1. Fixit Company is considering a training workshop for 12 employees. The total cost of the training workshop (for all 12 employees) is $9,000. The training manager has estimated that the additional training would enable the company to increase its revenue by $5,000 per year. He has decided that if the payback period was no more than 2 years, then he would give further consideration to the workshop.

   A. Calculate the payback period for this potential training investment.

   Payback period = _____

   B. Should the training manager consider the training workshop further?

   Yes _____ No _____

   Why or why not?

   _____

   _____

   _____

PRACTICAL EXAMPLE SKILL CHECK

Background information. The training manager for the Camel Company had no interest in or idea how to determine the cost effectiveness of training. Consequently, he avoided the use of economic justification, and upper management came to view training as a cost of doing business. During an economic downturn, most of the training staff was cut as a result of "down-sizing." As a result, the training manager decided that he had better learn how to justify training as a worthwhile investment he wanted to keep his job.

The training manager's first effort was to establish a "causal link" between a specific organizational problem and a performance deficiency. Finally, he had to provide evidence, in monetary units, that training was a worthwhile investment for the company.

Because the general manager of the Camel Company was accustomed to making decisions based on return on investment (ROI) reports, the training manager chose this method to justify the cost effectiveness of training.

I. List the three steps the training manager must take before preparing a return on investment report for the general manager.

1. _____

_____

2. _____

_____

3. _____

_____

PRACTICAL EXAMPLE SKILL CHECK (continued)

II. The following is a list of outcomes that could be measured. To prepare a **credible ROI report**, the evidence presented to the general manager should be described in which of the following terms? Place an X in front of those outcomes (benefits) which would provide convincing evidence that training was worthwhile investment.

_____ 1. How those trained thought the training went

_____ 2. Any increase in operational savings attributable to the training

_____ 3. Any slight reduction in absenteeism attributable to the training

_____ 4. How efficient the trainees' supervisors thought the training program was

_____ 5. Increased revenue attributable enhanced proficiency of the workers after training

_____ 6. Suggestions for improving/deleting parts of the training, derived from the training exit survey

_____ 7. Enhanced workforce flexibility

_____ 8. Reduced medical claims attributable to safety awareness from the training program

_____ 9. Any increase in revenue attributable to the training

_____ 10. Company executives' feelings about the training program

_____ 11. Reduced operational costs

III. List the advantages and disadvantages of two other methods that the training manager could use to determine the cost effectiveness of training.

Method	Advantages	Disadvantages

PRACTICAL EXAMPLE SKILL CHECK (continued)

IV. Ten employees in the maintenance department went through a one-week (40 hour) training program. The training cost were as follows:

COST ITEM	AMOUNT
Workers' total weekly compensation package (10 workers)	$ 8,500
Trainer's total weekly compensation package (2 trainers)	$ 4,200
Training development and instructional materials preparation	$ 1,000
Purchased instructional materials and consumable supplies	$ 450
Equipment rental	$ 1,000
Allocated facilities costs ($70 per day)	$ 350
Overhead and G & A expenses (total)	$ 500
Full cost of training	$16,000

Actual benefits of the program were difficult to quantify. However, the benefit item amounts listed on the next page were found by (a) taking figures for each item from the 12 monthly periods before the training; (b) then obtaining an average of the 12 figures for each item reported, and (c) calculating each item's average monthly benefit (the difference between the item average and the figure for the same item after training); and (d) annualizing the resulting monthly benefit (by multiplying by 12).

PRACTICAL EXAMPLE SKILL CHECK (continued)

IV. (continued)

Benefit item	**Annualize benefit amount from training**
Operational costs (reduced)	$ 9,600
Productivity (increased)	$13,200
Absenteeism (decreased)	$ 3,000
Quality (improved)	$ 2,400
Total annual benefit	$28,200

After applying, back on the job, what they learned in training, the employees/trainees completed a questionnaire. The response data indicated that, on average,

(1) 35% of their job-time was spent performing the task trained

(2) Their productivity in performing the trained task improved 28% as a direct result of the training.

Using the information given (in item IV), and the payback period method, how long before the break-even point for this training was reached? Show all calculations.

Payback period = _____

_____

PRACTICAL EXAMPLE SKILL CHECK (continued)

V. Continuing with the information from item IV, and using the ROI, IRR, cost-benefit ratio, and bottom-line evaluation methods, determine if this training should be continued or terminated Describe your rationale. Use the following criteria: "Any activity in which the organization is involved, including any department within the organization, should add appreciably to our goal of 11.5% increase (20% return) in total annual revenue over the next five years." (from Camel Company's *Vision, Values, and Goals* statement.)

ROI = _____

IRR = _____

Cost-benefit ratio (using calculated costs and benefits) = _____

Bottom-line evaluation (total value added) = _____

_____

_____

Determination:

Continue with the training _____ Terminate with the training _____

Rationale:

_____

_____

_____

_____

_____

_____

References

Basarab, D. J. (1990). Calculating the return on training investment. Evaluation Practice, 11, 177-185.

Carnevale, A. P., & Schulz, E. R. (1990). Return on investment: Accounting for training. Training and Development Journal, 32(3), S-1 - S-32.

Deming, B. S. (1982). Calculating the cost of training. In B. S. Deming (Eds.), Evaluating Job-Related Training (pp. 96-102). Englewood, NJ: Prentice-Hall.

Garrison, R. H. (1991). Managerial accounting. (6th ed.). Homewood, IL: Irwin.

Gilley, J. W., & Eggland, S. A. (1989). The benefits and cost of HRD. Principles of human resource development (pp. 266-282). Reading, MA: Addison-Wesley.

Gordon, J. (1991, August). Measuring the 'goodness' of training. Training, 28, 19-25.

Kearsley, G. (1982). Costs, benefits, and productivity in training systems. Reading, MA: Addison-Wesley.

Lombardo, C. A. (1989). Do the benefits of training justify the costs? Training and Development Journal, 43, 60-64.

Noonan, J.V. (1993, December). How to escape corporate America's basement. Training, 30, 39-42.

Stromsdorfer, E. W. (1972). Review and synthesis of cost effectiveness studies of vocational and technical education. Columbus: Ohio State University, Center for Vocational Technical Education. (ERIC Document Reproduction Service No. ED 066 554)

U. S. Chamber of Commerce. (1994). Employee benefits. Washington, DC: Author.

Usry, M.F., Hammer, L.H. & Matz, A. (1988). Cost accounting planning and control (9th ed.). Cincinnati, OH: South Western.

PROGRESS CHECK FEEDBACK --

Part 1 - Training Costs (pp. 17-19)

1. Identify the greatest incentive for indicating the cost effectiveness of training.

   Justifying training expenditures with documented benefits (p. 4)

2. Name two categories of training costs.

   1. *direct costs*
   2. *indirect costs*

3. Calculate the total daily (8-hour) compensation package for an employee whose hourly wage is $16, and whose fringe benefits package costs his employer and additional 29%.

   Total daily compensation package = *(16 x 8 hours) + (29% x $16 x 8 hours) =$165.12*

4. Calculate the training costs for 12 trainees, with individual total compensation packages of $195 per day, who attend a 5-day training program.

   Total trainee costs = *12 trainees x 5 days x $195 = $11,700*

5. Calculate the instructor costs for a 5-day workshop with one instructor who requires 2 additional days for preparation. The instructor's direct salary is $180 per day, with a 30% fringe benefits package.

   Total instructor costs = *1 instructor x (5 + 2 days) x [$180 + ($180 x 30%)] = $1,638*

6. Calculate the training development and instructional materials preparation costs for two developers, with a total daily compensation package cost to the organization of $220 each, and who worked 5 days on developing training and 8 days on preparing instructional materials. The cost of materials and supplies used in preparing the instructional materials was $210.

   Total development and preparation costs = *[2 developers x (8 + 5 days) x $220] + $210 = $5,930*

7. The cost of developing training and preparing instructional materials for a 5-day seminar was $6,300.

   A. What will be the cost per seminar if it is offered once each month for one year?

   Cost per seminar = *$6,300/ 12 times offered = $525*

PROGRESS CHECK FEEDBACK -- Part 1 - Training Costs (continued)

B. If the seminar is offered only twice, to a total of 30 trainees (15 in each session), what will be the cost per trainee?

Cost per trainee = *$6,300/ 10 = $630*

8. The employer purchased books and modules for each of 12 trainees, costing a total of $180 per trainee. Paper and pencils, which cost $45 total, were also required. Calculate the total cost of these instructional materials.

Total instructional materials costs = *($180 x 12 trainees) + $45 = $2,205*

9. Welding Associates rented equipment for a 4-day training program they are conducting. The rental cost for the equipment is $300 per day. Maintenance costs associated with the equipment are $20 per day. What will be the equipment costs for this training program?

Equipment costs = *4 days x ($300 + $20) = $1,280*

10. Welding Associates is considering purchasing the arc welding machine needed for training. The machine's purchase price is $22,500, and its estimated useful life is 5 years. In addition, yearly maintenance costs for the purchased machine are expected to be $2,100.

A. What will be the total annual cost of the machine?

Total annual equipment cost = *($22,500/5 years) + $2,100 = $6,600*

B. If Welding Associates uses the machine in a training program offered 12 times per year, what will be the equipment cost for each program?

Equipment cost per training program = *$6,600 annual cost/12 times offered = $550*

11. Welding Associates estimated their total facilities costs, including maintenance, for the current year to be $40,000.

A. If the facilities are used 15% of the time for training, what portion of the facilities costs should be allocated to the training budget?

Facilities costs (for training) = *$40,000 x 15% = $6,000*

B. If the facilities are used for training 5 days per week, 48 weeks per year *[5 days x 48 weeks = 240 days per year]*, What is the daily facilities rate for the use of these facilities?

Daily facilities rate = *$40,000/240 days = $166.67*

PROGRESS CHECK FEEDBACK -- Part 1 - Training Costs (continued)

12. Six welders will travel from their home to another city to attend a 3-day workshop where they will learn to use specialized equipment. Welding Associates agreed to pay each employee's $400 airfare plus $75 per day for other expenses. Calculate the travel and per diem costs incurred by Welding Associates for this 3-day workshop?

    Travel and per diem costs = *(6 welders x 3 days x $75) + (6 x $400 air fare) = $3,750*

13. Welding Associates found their full direct costs for a training program to be $17,000. Indirect costs, consisting of allocated overhead and G & A expenses, totaled $2,000. What was Welding Associates' full cost of training?

    Full cost of training = *$17,000 + $2,000 = $19,000*

PROGRESS CHECK FEEDBACK --

Part 2 - Training Effectiveness (p. 23)

1. Kirkpatrick noted that the effectiveness and efficiency of training can be measured at four different levels. Briefly describe the four levels.

   1. *(See page 20)*

   2.

   3.

   4.

2. Is it possible and/or feasible to link training outcomes to organizational improvements without the absolute isolation of training's benefits form the possible contributions of other variables?

   __X__ Yes, it is both possible and feasible. *(p. 20)*

   _____ It is possible, but not feasible.

   _____ It is feasible, but not possible.

   _____ No, it is neither possible nor feasible.

3. What is the key to collecting evidence of training outcomes?

   Establish a causal link between a specific organizational problem, preferably a problem to which monetary value can be assigned, and a performance deficiency. (p. 21)

4. Identify the result of selecting the outcomes to be measured and linking training to those outcomes.

   Level 4 measurement becomes a relatively simple matter. (p. 21)

PROGRESS CHECK FEEDBACK --

Return on Investment (ROI) (p. 28)

1. A technical training program is saving your organization $20,000 per year and has increased revenue by $26,000 per year. The full cost of training was $40,000

   A. What was the ROI of this training investment?

   ROI =

   ($20,000 + $26,000)/ $40,000 = 1.15 or 115%

   B. Was this a worthwhile investment?

   Yes _X_ No _____

   Why or why not?

   The ROI is greater than one (1.0), the break-even point. The training investment is returning 115% per year. The first year, this is the original training investment plus an additional $6,000 (or 15%). The training will no doubt continue to provide a benefit, even without additional investment.

   C. Would your opinion change if you could have invested the $40,000 in a savings fund at a guaranteed 17% annual return instead?

   Yes _____ No _X_

   Why or why not?

   In the first year, the 17% return on savings would be better than the 15% return from the training investment. However, the training investment will no doubt continue to provide a return without an additional investment.

PROGRESS CHECK FEEDBACK --

Internal Rate of Return (IRR) (p. 32)

1. A Diversity training program is estimated to save your organization $21,000 per year in legal expenses and the full cost of the training is going to be $50,000. The useful life of the training is considered to be 10 years. The organization's required rate of return is 20%.

   A. What is the IRR of this training venture?

   IRR =

   $50,000/$21,000 = 2.38; Using Appendix A at 10 years, 2.414 is the lowest IRR found in the table and it falls under the category of a 40% IRR; if 2.38 is rounded, it can be interpolated that the IRR of this training is 40%

   B. Is this a worthwhile investment?

   Yes X No _____

   Why or why not?

   This training will return 40% and it is 20% above the organization's required rate of return of 20%.

   C. Would this training be more worthwhile than an out-of-house training program costing 60,000 with a useful life of 5 years and an expected annual savings of $25,000?

   Yes _____ No X

   Why or why not?

   $60,000/$25,000 = 2.4; Using Appendix A at 5 years, a factor of 2.436 is found which can be equated with the IRR factor of 2.4 and corresponds to an IRR of 30%; This training would not be as worthwhile as the training in part A because it doesn't have as high of an IRR.

PROGRESS CHECK FEEDBACK –

Cost-Benefit Ratio (p. 36)

1. Mr. Whiz predicted that a computer technician training program for two of his employees would result in a total cost savings of $9,000 per year in computer repairs and down-time. He rates his level of confidence, that the training will be responsible for this savings, at 80%. The projected full cost of the technician training is $2,000 per person.

   A. Calculate the cost-benefit ratio for this potential training investment.

   Cost-benefit ratio = *(2 trainees x $2,000)/ ($9,000 x 80%) = 0.556*

   B. Do you think this training would be a worthwhile investment for Mr. Whiz's company?

   Yes X No _____

   Why or why not?

   The cost-benefit ratio of this potential training investment is less than one (1.0).

PROGRESS CHECK FEEDBACK --

Bottom-Line Evaluation (pp. 41-42)

1. A training manager has identified all the tasks performed by each employee within the organization, along with their total compensation packages. The training department is providing a welding training program for the welding department's 4 employees, at a total cost of $4,400. Each employee has a total annual compensation package of $20,000. The training manager would like to present training's value to upper management. The training is delivered and questionnaire results, in table form, are as follows:

Employee /trainee	Total annual compensation package ($)	Job-time (%) spent performing the task trained	Component pay ($)	Pre-training productivity (%)	Post-training productivity (%)	Productivity gain (%)	Value Added ($)
	(S)	(T)	(D = S x T)	(P1)	(P2)	(G = P2 -P1)	(G x D)
1	$20,000	10%	$2,000	20%	60%	40%	$ 800
2	$20,000	40%	$8,000	20%	50%	30%	$2,400
3	$20,000	30%	$6,000	30%	50%	20%	$1,200
4	$20,000	20%	$4,000	40%	60%	20%	$ 800
Total Value Added.							$5,200

A. Complete the table. For each employee, you will need to calculate component pay, productivity gain, and value added. You will also need to calculate the training program's total value added to the organization.

PROGRESS CHECK (continued)

B. Was the training program worthwhile?

Yes__X__ No _____

Why or why not?

The value added to the organization by the training ($5,200) was greater than the training investment ($4,400).

PROGRESS CHECK FEEDBACK --

Payback Period (p. 47)

1. Fixit Company is considering a training workshop for 12 employees. The total cost of the training workshop (for all 12 employees) is $9,000. The training manager has estimated that the additional training would enable the company to increase its revenue by $5,000 per year. He has decided that if the payback period was no more than 2 years, then he would give further consideration to the workshop.

   A. Calculate the payback period for this potential training investment.

   Payback period = *$9,000/ $5,000 = 1.8 years*

   B. Should the training manager consider the training workshop further?

   Yes__X__ No _____

   Why or why not?

   The payback period was less than the training manager's cut-off of 2 years.

PRACTICAL EXAMPLE SKILL CHECK FEEDBACK (pp. 48-52)

I. List the three steps the training manager must take before he can prepare a return on investment report for the general manager.

1. *Calculate the direct and indirect costs associated with the training. Then add these costs to obtain the full cost of training.*

2. *Baseline those outcomes to be analyzed in step 3.*

3. *Analyze the effects of training on the outcomes (benefits).*

PRACTICAL EXAMPLE SKILL CHECK FEEDBACK (continued)

II. The following is a list of outcomes that could be measured. To prepare a **credible ROI report**, the evidence presented to the general manager should be described in which of the following terms? Place an X in front of those outcomes (benefits) which would provide convincing evidence that training was worthwhile investment.

_____ 1. How those trained thought the training went

__X__ 2. Any increase in operational savings attributable to the training

_____ 3. Any slight reduction in absenteeism attributable to the training

_____ 4. How efficient the trainees' supervisors thought the training program was

__X__ 5. Increased revenue attributable enhanced proficiency of the workers after training

_____ 6. Suggestions for improving/deleting parts of the training, derived from the training exit survey

_____ 7. Enhanced workforce flexibility

_____ 8. Reduced medical claims attributable to safety awareness from the training program

__X__ 9. Any increase in revenue attributable to the training

_____10. Company executives' feelings about the training program

__X__11. Reduced operational costs

III. List the advantages and disadvantages of two other methods that the training manager could use to determine the cost effectiveness of training.

Method	Advantages	Disadvantages

(See Table 1, pages 45 and 46)

PRACTICAL EXAMPLE SKILL CHECK FEEDBACK (continued)

IV. Ten employees in the maintenance department went through a one-week (40 hour) training program. The training cost were as follows:

COST ITEM	AMOUNT
Workers' total weekly compensation package (10 workers)	$ 8,500
Trainer's total weekly compensation package (2 trainers)	$ 4,200
Training development and instructional materials preparation	$ 1,000
Purchased instructional materials and consumable supplies	$ 450
Equipment rental	$ 1,000
Allocated facilities costs ($70 per day)	$ 350
Overhead and G & A expenses (total)	$ 500
Full cost of training	$16,000

Actual benefits of the program were difficult to quantify. However, the benefit item amounts listed on the next page were found by (a) taking figures for each item from the 12 monthly periods before the training; (b) then obtaining an average of the 12 figures for each item reported, and (c) calculating each item's average monthly benefit (the difference between the item average and the figure for the same item after training); and (d) annualizing the resulting monthly benefit (by multiplying by 12).

PRACTICAL EXAMPLE SKILL CHECK FEEDBACK (continued)

IV. (continued)

Benefit item	**Annualize benefit amount from training**
Operational costs (reduced)	$ 9,600
Productivity (increased)	$13,200
Absenteeism (decreased)	$ 3,000
Quality (improved)	$ 2,400
Total annual benefit	$28,200

After applying, back on the job, what they learned in training, the employees/trainees completed a questionnaire. The response data indicated that, on average,

(1) 35% of their job-time was spent performing the task trained

(2) Their productivity in performing the trained task improved 28% as a direct result of the training.

Using the information given (in item IV), and the payback period method, how long before the break-even point for this training was reached? Show all calculations.

Payback period = *$16,000/ $28,200 = 0.57 years (about 6.8 months or 29.5 weeks)*

PRACTICAL EXAMPLE SKILL CHECK FEEDBACK (continued)

V. Continuing with the information from item IV, and using the ROI, IRR, cost-benefit ratio, and bottom-line evaluation methods, determine if this training should be continued or terminated Describe your rationale. Use the following criteria: "Any activity in which the organization is involved, including any department within the organization, should add appreciably to our goal of 11.5% increase (20% return) in total annual revenue over the next five years." (from Camel Company's *Vision, Values, and Goals* statement.)

ROI = *$28,200/ $16,000 = 1.76 or 176%*

IRR = *$16,000/$28,200 = 0.57; Using Appendix A and searching for 0.57 at 5 years, the lowest IRR factor is 2.035; It can be interpolated that the training will return more than 40%.*

Cost-benefit ratio (using calculated costs and benefits) = *$16,000/ $28,200 = .057*

Bottom-line evaluation (total value added) = *[($8,500 x 52 weeks) x 35% job-time on task] x 28% improvement = $43,316*

Determination:

Continue with the training __X__ Terminate with the training _____

Rationale:

The training returns the training investment plus an additional 76% in the first year, far more than the stipulated 11.5% annual return.

The IRR is more than 20% more than the organization's required rate of return.

The cost-benefit ratio is well below one (1.0).

The value added to the organization by the training is more than 2 times greater than the training investment.

APPENDICES

Appendix A

Present Value of an Annuity Chart for Calculating IRR

Present Value of an Annuity of $1 in Arrears: $P_n = \frac{1}{r}\left[1 - \frac{1}{(1+r)^n}\right]$

Periods	4%	5%	6%	8%	10%	12%	14%	16%	18%	20%	22%	24%	26%	28%	30%	40%
1	0.962	0.952	0.943	0.926	0.909	0.893	0.877	0.862	0.847	0.833	0.820	0.806	0.794	0.781	0.769	0.714
2	1.886	1.859	1.833	1.783	1.736	1.690	1.647	1.605	1.566	1.528	1.492	1.457	1.424	1.392	1.361	1.224
3	2.775	2.723	2.673	2.577	2.487	2.402	2.322	2.246	2.174	2.106	2.042	1.981	1.923	1.868	1.816	1.589
4	3.630	3.546	3.465	3.312	3.170	3.037	2.914	2.798	2.690	2.589	2.494	2.404	2.320	2.241	2.166	1.879
5	4.452	4.330	4.212	3.993	3.791	3.605	3.433	3.274	3.127	2.991	2.864	2.745	2.635	2.532	2.436	2.035
6	5.242	5.076	4.917	4.623	4.355	4.111	3.889	3.685	3.498	3.326	3.167	3.020	2.885	2.759	2.643	2.168
7	6.002	5.786	5.582	5.206	4.868	4.564	4.288	4.039	3.812	3.605	3.416	3.242	3.083	2.937	2.802	2.263
8	6.733	6.463	6.210	5.747	5.335	4.968	4.639	4.344	4.078	3.837	3.619	3.421	3.241	3.076	2.925	2.331
9	7.435	7.108	6.802	6.247	5.759	5.328	4.946	4.607	4.303	4.031	3.786	3.566	3.366	3.184	3.019	2.379
10	8.111	7.722	7.360	6.710	6.145	5.650	5.216	4.833	4.494	4.192	3.923	3.682	3.465	3.269	3.092	2.414
11	8.760	8.306	7.887	7.139	6.495	5.988	5.453	5.029	4.656	4.327	4.035	3.776	3.544	3.335	3.147	2.438
12	9.385	8.863	8.384	7.536	6.814	6.194	5.660	5.197	4.793	4.439	4.127	3.851	3.606	3.387	3.190	2.456
13	9.986	9.394	8.853	7.904	7.103	6.424	5.842	5.342	4.910	4.533	4.203	3.912	3.656	3.427	3.223	2.468
14	10.563	9.899	9.295	8.244	7.367	6.628	6.002	5.468	5.008	4.611	4.265	3.962	3.695	3.459	3.249	2.477
15	11.118	10.380	9.712	8.559	7.606	6.811	6.142	5.575	5.092	4.675	4.315	4.001	3.726	3.483	3.268	2.484
16	11.652	10.838	10.106	8.851	7.824	6.974	6.265	5.669	5.162	4.730	4.357	4.033	3.751	3.503	3.283	2.489
17	12.166	11.274	10.477	9.122	8.022	7.120	6.373	5.749	5.222	4.775	4.391	4.059	3.771	3.518	3.295	2.492
18	12.659	11.690	10.828	9.372	8.201	7.250	6.467	5.818	5.273	4.812	4.419	4.080	3.786	3.529	3.304	2.494
19	13.134	12.085	11.158	9.604	8.365	7.366	6.550	5.877	5.316	4.844	4.442	4.097	3.799	3.539	3.311	2.496
20	13.590	12.462	11.470	9.818	8.514	7.469	6.623	5.929	5.353	4.870	4.460	4.110	3.808	3.546	3.316	2.497
21	14.029	12.821	11.764	10.017	8.649	7.562	6.687	5.973	5.384	4.891	4.476	4.121	3.816	3.551	3.320	2.498
22	14.451	13.163	12.042	10.201	8.772	7.645	6.743	6.011	5.410	4.909	4.488	4.130	3.822	3.556	3.323	2.498
23	14.857	13.489	12.303	10.371	8.883	7.718	6.792	6.044	5.432	4.925	4.499	4.137	3.827	3.559	3.325	2.499
24	15.247	13.799	12.550	10.529	8.985	7.784	6.835	6.073	5.451	4.937	4.507	4.143	3.831	3.562	3.327	2.499
25	15.622	14.094	12.783	10.675	9.077	7.843	6.873	6.097	5.467	4.948	4.514	4.147	3.834	3.564	3.329	2.499
26	15.983	14.375	13.003	10.810	9.161	7.896	6.906	6.118	5.480	4.956	4.520	4.151	3.837	3.566	3.330	2.500
27	16.330	14.643	13.211	10.935	9.237	7.943	6.935	6.936	5.492	4.964	4.525	4.154	3.839	3.567	3.331	2.500
28	16.663	14.898	13.406	11.051	9.307	7.984	6.961	6.152	5.502	4.970	4.528	4.157	3.840	3.568	3.331	2.500
29	16.984	15.141	13.591	11.158	9.370	8.022	6.983	6.166	5.510	4.975	4.531	4.159	3.841	3.569	3.332	2.500
30	17.292	15.373	13.765	11.258	9.427	8.055	7.003	6.177	5.517	4.979	4.534	4.160	3.842	3.569	3.332	2.500
40	19.793	17.159	15.046	11.925	9.779	8.244	7.105	6.234	5.548	4.997	4.544	4.166	3.846	3.571	3.333	2.500

Note. Reprinted from Managerial accounting, by R.H. Garrison, 1991, p. 633.

Appendix B

Flowchart for Choosing a Method for Determining Cost Effectiveness

Flowchart for Choosing a Method for Determining Cost Effectiveness