CHAPTER 7

The Standard Cost Accounting System
Part 1: Setting Standards

REVIEW QUESTIONS:

7.1 A CAS can be described as a manufacturing process that takes inputs (financial and nonfinancial data) and produces an output (cost accounting information). Some may conceptualize the CAS as a service, but its output is still information. CASs, as well as all manufacturing, merchandising, and service enterprises, use inputs to produce outputs. Some outputs may be tangible and some intangible. Cost accounting information is a tangible output.

The CAS's product is information, and it serves two customers: people within organizations, and the financial accounting system (for people outside organizations). People within organizations need cost management information to budget, control operations, and evaluate performance (both short run and long run). The financial accounting system needs product cost information for valuing ending inventories and COGS.

See the "Let's Talk" box on the next page.

Let's Talk

Some students may answer this question not for cost accounting, but for management accounting. They will probably base their answers on the first paragraph of the chapter's introduction. This chapter presents management accounting as providing a product (management accounting information) to customers (organizational members).

At this point it is important to remind these students that management and cost accounting are different. Cost accounting is a subset of both management and financial accounting systems. This was discussed in Chapter 1, Review Question 1-15 and illustrated in Exhibit 1-8.

7.2 The three differences between CAS and financial accounting outputs result from the CAS's role in serving the management accounting system and internal users.

- When CAS information is used within the firm, no externally imposed rules and procedures are required as is true when preparing financial accounting reports. External users of financial accounting information need assurance that the information presents the firm's performance fairly, i.e., in accordance with GAAP. These externally imposed rules and procedures are necessary because external users do not have access to the firm's data. In contrast, internal users of CAS information can access various databases and LANs to verify information.

The second and third differences result from the different types of internal customers and their needs. People in different specialties within an enterprise need:

- More detailed and specific information than do people outside the firm making investment decisions about the firm as a whole.
- More flexible report and display formats than used in financial accounting reports because many different types of decisions are made within a company.

7.3 Actual costs are required for three reasons:

- Financial reporting use in valuing ending inventories and COGS
- Tax reporting purposes (valuing inventories, COGS, and assets, and determining depreciation).
- Management accounting reports that compare standards to actual costs (cost variance reports discussed in Chapter 8).

7.4 Standard costs are operational goals stated in specific, financial, and quantitative terms. These goals are used to accomplish the enterprise's objectives. Standard costs are used for both short-run and long-range measurement of goal achievement.

As short-run measures, benchmarks, or standards, are needed to compare against actual costs. To measure long-run continuous improvement, trend analysis is performed comparing the change in standard costs over time. For example, the enterprise may set an ideal standard for use in its strategic planning (discussed in Chapter 17). The difference between the ideal standard and the current year's standard is the long-range objective. The change in standard costs from year-to-year measure the year's continuous improvement goal. The short-run difference between this year's standards and actual costs measures the firm's success in achieving its annual goal.

7.5 In modern manufacturing enterprises workers now are required to control the production process, specifically the quality of their production activities and output. Traditionally this has been considered management's responsibility. The separation of production and control resulted from the Scientific Management principles of division-of-labor and task fractionalization.

World-class enterprises are characterized by a commitment to high quality, flexibility, customer service, and the team concept (among others covered in Chapters 1 and 2). Each worker is required to understand, monitor, and control his or her operations, producing a high quality product for the next process. With this perspective, the next process is the customer of the preceding process. Team efforts, information sharing, and flexibility are required to coordinate activities and control operations.

See the "Let's Talk" box on the next page.

Let's Talk

At the conclusion of your discussion, you may wish to ask your students, "What new tasks are required of the modern management accountant?"

- The modern management accountant must become part of the team, freely moving about the organization, in order to understand the customers' needs.
- Customer service is achieved through providing high quality information.
- High quality information possesses the following attributes:
  - Accuracy
  - Relevancy
  - Timeliness
  - Fairness
  - Usability
- ICBISs and their technology platforms support these new tasks, allowing the management accountant to facilitate coordination and information sharing through:
  - Interoperable computer system designs
  - Cooperative and enterprisewide information processing
  - Client/server systems
  - End-user systems featuring computer displays (graphical and report-based)
  - Linking LANs and WANs through downsizing the technology platform.

  (These concepts are discussed in Think-Tank Problem 3.25.)

Hopefully, this question can serve as a springboard for integrating the concepts from Part 1 of the text (world-class enterprises, enabling technologies) with the new role for the modern management accountant.

7.6 All organizational members in world-class enterprises have two decision-making objectives:

- Each person in an organization needs to make good decisions individually. These decisions involve preventive maintenance and quality control activities. These activities are supported by training programs, ICBISs and visual factory control systems, evaluation, and reward systems.
- Each person needs to communicate and coordinate actions with others in the organization who might be affected (a "group" decision-making objective). This is part of the team concept in world-class enterprises. Communication and coordination are required for the flexibility needed to provide customer service.

7.7 A decision is a choice of actions between two or more problem solution alternatives. A decision is rational if it helps to solve a problem. A problem is the difference between what one wants and what one has.

As an example, consider an accounting student's dilemma. "I really want to understand cost accounting because this knowledge will help me get the job I want (the problem statement). Should I get up early this morning and review Chapter 7 (the decision)? Obviously, the rational decision is to get up early (and review Chapter 7)!

7.8 In cost management, cost variances are problems; the difference between budgeted costs and actual costs. Technically, cost variances are the financial results of operational problems, i.e., the difference between planned and actual profits due to specific problems that occurred during operations.

7.9 Management-by-exception involves focusing attention on one's problems. The basic premise is, "Tell me about my problems. Identify and isolate them for me so that I can correct them, and prevent them in the future."

7.10 Management-by-exception can be implemented inappropriately, inhibiting quality control, continuous improvement, and movement toward world-class status. Implementing this control philosophy requires a balancing act by the management accountant. Only reporting efficiency cost variances to the shop floor can result in a short-run focus on producing quantity at the expense of quality. Attention may not be given to assuring quality and improving on the standards.

As discussed in Chapters 1 and 2, *kaizen*, the philosophy of continuous improvement, is a fundamental characteristic of world-class manufacturing enterprises (WCMs). Instead of assuming the attitude, "I don't need control information about what's going right. I don't need to fix those things. Just tell me what's going wrong.", the WCM shop floor believes nothing is right and everything can be improved. The implication for the modern management accountant is that reports (at least annually) measuring the improvement in standards over time are just as important as short-run reporting about all cost variances (efficiency and effectiveness variances). The long-run focus is especially necessary in planning, and its group decision-making activities. The short-run focus on achieving current standards is important in both operational control and performance evaluation.

Let's Talk

Review Questions 7.10, 11, 12, and 14

The following discussion may "spark" student interest and integrate the concepts involved in these review questions.

Perhaps the most pervasive theme in both management and cost accounting literature during the late 1980s and early 1990s concerned the irrelevance of cost and management accounting with respect to the needs of the organization.

Is this bad product design or inappropriate use of it by our customers? Probably both. SCAS design may not be "bad," but it is outdated. Traditional evaluation and reward systems that primarily (or solely) considered efficiency variances demonstrate an inappropriate use of CAS information.

Part of the product design problem stems from a traditional cost and management accounting paradigm limiting the role of CAS information to planning, controlling, and decision making. Importantly, control is conceptualized as performance evaluation. The premise is that feedback information will motivate goal congruent decisions.

The WCM paradigm is that CAS information serves three uses: planning, daily operational control, and performance evaluation. This leads to the use of variance information along with other financial and nonfinancial performance measures discussed in Part 3 of the text. Implementation of this paradigm in WCMs is leading to a de-emphasis on cost variances in performance evaluation, and an increasing usefulness in planning and daily shop floor control activities.

You may wish to assign some outside readings about the irrelevance problem and expand class discussion to address this serious problem. This discussion can serve as a good lead-in to the remaining topics in Part 2, and for Part 3 of the text.

7.11 The over-emphasis on short-run profits (e.g., minimizing cost variances) is not always in the best interests of the organization. For example, if a production worker is only evaluated with direct labor and materials usage variances, control activities necessary for the organization's survival may not be performed. Preventive maintenance activities may be postponed and/or poor quality output transferred to the next operation. By not performing maintenance and quality control activities, a worker minimizes his or her unfavorable direct labor and materials usage variances, or creates favorable variances.

Rational decisions are always goal congruent (by definition). The issue is whose goals should have precedence. If the evaluation and reward systems create a conflict between individual and organizational goals, these systems are irrational in that they motivate dysfunctional decision-making behaviors.

7.12 Management-by-exception, if used inappropriately, can lead to myopic behaviors on the shop floor. The example in Review Question 7.11 highlights this. The Japanese manufacturing philosophy includes the belief that an exception (problem) is a gem to be discovered. Management-by-exception cannot be the only tool used in evaluation and reward systems, however. World-class enterprises take a proactive control perspective. Examples include reporting machine uptime, vendor performance indices, on-time delivery, and lead time efficiency ratios (see Chapter 11 on activity-based management).

7.13 All organizational members have three decision-making functions:
- Planning (for the future)
- Monitoring and controlling (the present)
- Evaluating (past performance)

7.14 The SCAS's role is to serve both the functional and behavioral facets of responsibility accounting.

The functional side of responsibility accounting:
Organizational members share two decision-making objectives (individual and group, see Review Question 7.6), and three decision-making functions (planning, control, and evaluation, see Review Question 7.13). The specific types of decisions they make, though, depend on their responsibilities. The three responsibility levels (cost, profit, and investment centers) are discussed in Review Question 7.15.

The behavioral side of responsibility accounting:
If the responsibility accounting system is to function properly in its motivational role, it must be accepted by the people being evaluated. For acceptance to result, employees need to internalize the company's goals as their own. Proper motivation also requires a reward system that they believe will allow them to satisfy their individual needs if they make decisions in the best interest of the firm (goal congruent behavior). To receive these rewards, firms need to evaluate performance. This creates five criteria for the responsibility accounting system that are discussed in Review Question 7.16.

7.15 The three functional responsibility levels of management:

- Cost center employees have the responsibility for planning, controlling and evaluating decisions about activities that create costs.
- Profit center managers are one step above cost center managers in the firm's hierarchy. These managers have an added level of responsibility. In addition to controlling costs, they also are responsible for generating revenues.
- Investment center managers can be considered as the top management in a firm. The new level of responsibility added here is over investment decisions.

7.16 The five behavioral criteria for a high quality responsibility accounting system include:

• *The planning criterion*	Participative budgeting for internalizing the enterprise's goals.
• *The operational control criterion*	Decision usefulness through timely and relevant information.
• *The short-run performance evaluation criterion*	Management-by-exception through reporting cost variances and nonfinancial proactive measures (see Review Question 7.12).
• *The long-run performance evaluation criterion*	Continuous improvement through reporting the change in standards over time.
• *The performance evaluation criterion*	Workers must be empowered to control the activities they are responsible for.

7.17 Control requires that people in the organization are properly motivated to take actions leading to the firm's goals. The responsibility accounting system is only one part of the overall control system. The motivation to control operations comes from employees knowing that they will receive acceptable rewards for making goal congruent decisions. This is the role of the reward system.

To successfully motivate them to accept the organization's goals as their own, the budgeting process must communicate the firm's goals and allow the employees to participate in setting the standards used in their performance evaluations. The accounting system must also evaluate performance in a way that is acceptable to the people being evaluated. This requires that performance be evaluated against the standards set, and that the employees are only being evaluated over those activities they control. The motivation to control operations comes from employees accepting the legitimacy of the planning and evaluation components of the responsibility accounting system, that they see as linked to an adequate reward system.

7.18 Competence, confidentiality, integrity and objectivity are important ethical considerations in designing a high quality SCAS.

- If the management accountant is ethically competent, responsibility accounting systems will be based on participative budgeting, distinguish between controllable and uncontrollable costs, and report variances in an understandable and useful way.
- Because this is confidential financial information, the management accountant has an ethical responsibility to maintain that confidentiality. Information should not be used for personal gain, at the expense of the firm.
- Integrity implies avoiding actual or apparent conflicts of interest professionally, or as a member of the enterprise. Controllability over standards and variances in reporting are important considerations when designing the CAS.
- Objectivity requires disclosing the information needed by employees to make goal congruent decisions (completeness and fairness).

7.19 Standard cost and components definitions:

- A standard cost is the budgeted cost of a particular input item (cost element) used in making one unit of a product or in providing a particular service. Standard price multiplied by standard quantity equals standard cost.
- A standard price is the budgeted price for a cost element.
- A standard quantity is the budgeted amount of an input needed to make one unit of a product or to provide a particular service.

7.20 Each cost element has a standard cost. The sum of all inputs' standard costs is the standard absorptive manufacturing cost (SAMC) for the product. The SAMC is based on absorption costing because it includes a standard cost for fixed overhead.

7.21 Five benefits of a standard cost card:

- In individual and group planning decisions, attention is focused on each component of the standard cost (price and quantity).
- In performance evaluation, standard costs provide the benchmarks for measuring cost overruns.
- Both evaluation and control activities are promoted through reporting variances to those responsible who have control over the activities that created the variances.
- Profit center managers, knowing the standard absorptive manufacturing cost of a product, have a better idea of the adequacy of its planned sales price and its profit.
- Cost accountants can use standard costs to more efficiently run the cost accounting system.

7.22 Calculating the standard cost of paper-related products for a welfare case:

	Standard price	Standard quantity	Standard cost
File folders (net delivered purchase price per box of 100 = $10.00)	$0.100 each	3 folders	$0.30
File folder clips (2 per folder, box of 100 = $5.00)	$0.050 each	6 clips	$0.30
Index cards (8 for different card files at $0.50 per 100)	$0.005 each	8 files	$0.04
Note paper (50 sheet pad = $0.75)	$0.015/sheet	100 sheets	$1.50
FDA and state forms (50 sheet pad = $2.00)	$0.040/form	2 forms	$0.08
Photocopies of documents	$0.05/copy	20 copies	$1.00
Standard cost of paper-related products			$3.22

7.23 No, they can be useful in service organizations such as in justifying increased funding for a welfare agency. The Review Question 7.22 example illustrates the paper forms costs. More significantly, the standard costs for all the direct labor-related activities, including the form preparation, verification, error correction, filing and storage activities, can provide a more complete picture of the real costs of manually processing the average welfare client's case file.

7.24 The average welfare case worker's standard direct labor rate is:

Budgeted gross wage rate	$9.00/hr
Add payroll burden and fringe benefits (10 1/3% and 23% respectively)	3.00/hr
Standard price for direct labor	$12.00/hr

7.25 An output specification is the amount of an input item (cost element) that must be in the **completed product** for it to be salable.

A standard quantity, though, is the amount of that input that should be placed into the production process **at the beginning**, so that the output specification quantity is in the completed product.

7.26 Standard quantity equals output specification divided by (1 - Normal input loss percentage). For direct materials, normal input loss is budgeted scrap. See the next question for normal input loss related to direct labor.

7.27 Paid time equals downtime plus productive time. Normal input loss ("downtime") also exists for labor. Examples of downtime include: break time, setup, clean up, and discussing problems. The direct labor time used in actually making a product (or providing a service) can be labeled "productive time" (also called process time).

7.28 Ideal standards are based on the best performance possible under existing operating conditions and with existing equipment. For direct labor, an ideal standard quantity does not include setup and cleanup time, and may or may not include inspection or bathroom time. These normally are included in practical standards.

7.29 Practical standards can support a high quality CAS in four ways:

- Employees are motivated by practical standards if they participate in setting them. Often, they will put forth their best efforts to achieve tight, but attainable, standards.
- Practical standards indicate abnormal variances in costs.
- They can also be used in estimating and planning, whereas ideal standards do not allow for normal efficiencies and therefore may result in unrealistic estimating and planning data.
- Variances from practical standards provide information about how well operations are improving, as well as measuring how effectively and efficiently present operations are being carried out.

7.30 Factors to consider when setting standards include:

- What is an acceptable level of performance corresponding to management's goals? Standards may be simply those used last year if management is satisfied with that level of performance. For WCMs seeking to continuously improve operations, each year's standards may be based on some reduction factor from last year's standards.
- The tightest standards are ideal standards. These are based on people and equipment working at peak efficiency 100 percent of the time, with no waste. Ideal standards may not motivate goal congruent performance, though, if workers do not believe they can be achieved. For example, if the equipment is old and poorly maintained, workers will not accept performance evaluations based on no downtime due to machine breakdowns.
- Standards that are too loose may contribute to low productivity, laziness, and turnover caused by the lack of a challenging work environment.
- Practical standards are tight but within the achievable range of most employees. They are difficult enough that when attained employees feel as though something of value has been accomplished.
- Whether ideal or practical standards are used, the modern management accountant needs to report improvements in productivity. With ideal standards, the change in variances over time measures the movement toward the theoretic optimum. Reporting the change (reduction) in standard quantities and costs as nonvalue-added activities are eliminated from them over time also will provide the same type of information to management when practical standards are used.

7.31 Ideal standards are set as goals toward which employees work for continuous improvement, a concept of world-class manufacturing. Variances from ideal standards probably always will be unfavorable, but continuous improvement will result in these variances becoming smaller over time. The use of ideal standards forces worker and management attention on ultimate goals. By "putting ideal standards constantly in front of" employees, they may be motivated to find new and better methods in support of continuous improvement.

Practical standards may demand too little because such standards can be based more on the past than the future. Certain inefficiencies may be built into the standards. Idle capacity, setup times, material movement, inspection, and other nonvalue-added activities are costs these managers really don't want to include in a standard cost system. A standard cost system that includes nonvalue-added activities may mean that the existence of such waste is never questioned.

7.32 Inefficiencies in production that cause normal scrap are usually included in a practical direct materials standard quantity.

- Improperly maintained machinery, a lack of proper tools, and/or insufficient training can cause scrap.
- The source of materials (vendors) can also cause scrap if materials need to be specially cut, formed, and the like, because optimally designed materials are not available.
- The quality of the materials received is a significant factor in budgeting scrap within the practical standard quantity's normal input loss.

7.33 Learning how to do the job better usually results in doing it faster, at least over the short run. As experience increases, the amount of productive time needed to make a product goes down. Learning curve analysis attempts to develop a formula to measure the amount of learning that can be expected, and the reduction in the standard direct labor quantity over time as tasks are repeated. Learning affects the output specification for direct labor. It does not affect the normal input loss (downtime for breaks and the like).

7.34 In many traditional enterprises, goals are set and budgets prepared annually. If production processes are stable, long-term supply contracts with vendors exist, and direct labor rates are governed by multi-year contracts, management may not expect significant changes in the standards during the year. In these situations, standards may only be revised during the annual budgeting process.

If material prices are unstable, laborers experience significant learning effects, and other costs of production (such as overhead items) are subject to change, management may wish to revise standards frequently. In these situations a continuous budgeting plan may be used (discussed in Chapter 17). Every month, as a new monthly budget is added, the standards can be examined and changes made. The original standards should be maintained in the management accounting database, though, so that the revised standards can be compared to the original ones. This will allow analyses of why the standards changed, and should improve future standard setting.

7.35 The activities that cause short-run variable overhead costs are often different from those causing fixed overhead items. For example, the cost of nails for a general contractor depends on the number and size of houses built. But, the cost of a supervisor for a tract home subdivision, many permits and fees, bonds, and insurance may be a set amount for the project.

Because variable and fixed overhead costs are caused by different activities, they should be accounted for separately. This is necessary for accurate controllability identification and responsibility assignment in performance evaluation. It also facilitates more effective and efficient budgeting.

Thus, for a high quality responsibility accounting system, identifying the different activities that cause both variable and fixed overhead becomes necessary. Chapter 9 discusses the need for multiple variable and fixed overhead accounts for production and nonproduction (support services) departments. Chapters 10 and 11 present multiple overhead accounts and allocations for all the overhead activities involved in production (activity-based costing and activity-based management).

7.36 The standard price for overhead is the POR. These terms are synonymous. In the basic CAS presented in Chapter 4, the total overhead (TOH) POR was illustrated. The basic CAS used absorption costing. In this chapter, the TOH POR is divided into a variable overhead (VOH) POR and a fixed overhead (FOH) POR. The standard cost card included the FOH POR in the standard absorptive manufacturing cost, thus, similar to the basic CAS, it is also based on absorption costing.

7.37 Five common bases for allocating variable overhead, and example VOH cost elements include:

• *Direct labor cost*	Hand tools and supplies when more highly paid workers produce at a faster rate and, thus, use more of these VOH items.
• *Direct labor hours*	The variable costs of meals provided hospital workers. The number (and cost) of the meals depends on the number of total hours worked by all employees eating in the hospital's cafeteria, regardless of any differences in pay rates.
• *Machine hours*	The electricity and machine parts needed to operate equipment.
• *Units of product (weight or volume)*	A fork lift truck used for moving products between operations.
• *Direct materials weight or volume*	A hospital pharmacy delivery clerk's labor cost.

7.38 In choosing the proper overhead allocation base to use, the management accountant's primary goal is to select the base that best represents a cause-effect relationship between the overhead costs and the activities that cause these costs. The re-affirmation of this goal by modern management accountants has lead to the development of activity-based costing (Chapter 10).

7.39 Historically, many manufacturing processes were labor intensive. Most of the overhead items related to the support of laborers. As more labor hours were worked, more overhead items were needed. Consequently, a strong cause-effect relationship existed between overhead costs and direct labor costs.

A second reason was the emphasis on financial reporting. GAAP requires that overhead be allocated in a reasonable and systematic method. Cause-effect, especially when it results in multiple overhead accounts and allocations (such as in activity-based costing), however, is not a requirement of GAAP. Reasonable allocations could be made with simple methods using readily available information (such as direct labor cost). High quality cost management information was not a high enough priority to justify more sophisticated, and costly, allocation techniques.

As manufacturing firms have modernized to compete more effectively in global markets, a significant switch to automated production processes has occurred. The proportion of labor-related costs has decreased, while the proportion of direct materials and overhead costs have increased. Automation has changed the types of overhead costs required. Many WCMs support automated production with ICBISs, further increasing the overhead costs of these enterprises.

The historical cause-effect relationship between labor and overhead no longer is valid for many manufacturing enterprises. Continuing to use a labor-based POR results in inaccurate product costing and low quality cost management information about overhead items. This realization has led to a number of changes in the overhead allocation system:

- Changing the POR base to machine hours or other causal factor related to the technology.
- Developing multiple overhead accounts, PORs, and allocations using different bases for each overhead cost pool having a unique cause-effect relationship. The use of multiple overhead accounts and allocations is discussed in Chapter 9.
- Creating activity-based costing systems (Chapter 10).
- More accurate cost tracing through separately accounting for the costs of automation as a direct cost element (direct technology).

7.40
- *Variable costs* Costs that are constant per unit, but vary in total with changes in production (or other cost object), such as audit staff time for a CPA firm.
- *Fixed costs* Costs that are constant in total regardless of the level of production or number of services provided, such as the cost associated with the building and grounds.
- *Mixed costs* Costs that are part variable and part fixed, such as a telephone bill that includes a flat charge for having telephone service, plus a variable cost based on the amount of long distance telephone calls made (minutes talked).
- *Step costs* Cost that are constant in total over very short ranges of production volume, such as the costs of factory foremen in processes requiring significant direct supervision with narrow spans of control.

7.41 One of the fundamental tenets in standard setting, and budgeting in general, is that costs can be separated into variable and fixed categories. Most costs are not purely variable or fixed over wide ranges of production. For example, normally the same type and quantity of direct materials going into the first product are the same as in the one hundredth product. As production increases beyond some level, though, direct material costs per unit can go down due to quantity purchasing discounts. Conversely, other variable costs, such as electricity and water may go up per kilowatt hour or gallon as demand increases.

Technically, variable and fixed classifications represent a linear relationship between the cost elements and the products. Quantity discounts and surcharges create nonlinear relationships that can lead to inaccurate standards and budgets. Thus, it is important to understand the relevant range of production over which the linear relationships between costs and cost objects is valid. When setting standards, if the relevant range is crossed, the management accountant needs to adjust the variable costs per unit and the fixed costs in total to reflect their new values in different relevant ranges.

7.42 The costs of tuition and fees are an example of a mixed cost:

- Variable costs include tuition fees of $50 per credit and $10 per credit in university fees.
- Fixed costs include $100 per semester for library services and $50 per semester for the Health Center.
- Costs considered as step costs include special assessments such as a $30 per course computer use fee for all accounting courses taken.

If a student enrolls for 15 credit hours for the Spring semester and two of the courses are accounting courses:

Tuition and fees = ($100 + $50 + $30 + $30 in fixed costs)
+ ($60 per credit x 15 credits in variable costs)

= $210 + $900

= $\underline{\underline{\$1,100}}$ for the Spring semester

7.43 Fixed costs are costs that remain constant in total for a period of time regardless of volume or level of activity. Step costs are costs that are constant in total only over small ranges of volume within the relevant range. In the previous review question's tuition and fees example, the computer use fee on accounting course is a step cost. The Health Center and library fees are fixed costs.

7.44 The four quantitative methods in order from worst to best are:

- *Scattergraph Method* — Points are plotted on a graph and a line representing their average values is visually fit.
- *High-low method* — The highest and lowest points are chosen for algebraic determination of the line of best fit.
- *Linear regression method* — A regression model using all the points but only one predictor variable is used to predict the line of best fit.
- *Multiple regression method* — A regression model with multiple predictor variables is used to predict the line of best fit.

The scattergraph method is subjective. Each person can visually fit a different sloping line resulting in a different slope (variable cost component) and intercept (fixed cost component).

Using the high-low method, each person will calculate the same slope and intercept (i.e., the same cost equation). The highest and lowest points, though, may be statistical outliers. Thus, the cost equation may not have a high predictive value (correlation coefficient). Its use in budgeting variable and fixed overhead costs may result in inaccurate estimates.

Linear regression uses all the points in a sample. Its predictive value is less influenced by extreme observations such as used in the high-low method. It should, therefore, result in more accurate cost estimation.

Multiple linear (and nonlinear) regression is appropriate when the costs being predicted have more than one causal variable. Overhead costs, when combined into one account, usually will have multiple cost drivers (causes) for the different cost pools (subsets of overhead). Using multiple predictor variables (cost drivers) should increase the accuracy of the resulting overhead cost equation.

7.45 Maintenance cost is an example of a dependent variable because the amount of maintenance cost incurred during a period can be dependent on production volume for the period. As the level of volume or activity increases, maintenance cost will also increase. The level of volume or activity is called the independent variable because it predicts the amount of maintenance cost that will be incurred during a period.

7.46 The standard quantity for VOH and FOH is the standard quantity for the overhead allocation basis (cost driver). For example, if machine hours is used to allocate overhead, the standard quantity of machine hours needed to produce one product is used as the standard quantity for overhead.

7.47 Fixed overhead standard cost

$$= \frac{\text{Budgeted FOH Cost}}{\text{Production quota}}$$

$$= \frac{\$100{,}000}{20{,}000 \text{ boxes of golf balls}}$$

$$= \underline{\$5.00 \text{ per box}}$$

7.48 The standard variable manufacturing cost only includes standard costs for the variable costs of production. This is called variable costing (sometimes misnamed as direct costing). Fixed overhead is not included in the per unit production cost. Instead, it is written-off in total to COGS.

Absorption costing (also called full costing) treats all costs of production as product costs, regardless of whether they are variable or fixed. Using absorption costing, fixed overhead is allocated into the per unit cost of production. Including a standard cost line for fixed overhead in the standard cost card results in a standard absorptive manufacturing cost for the product.

Variable costing supports cost management in that costs are organized, budgeted, controlled, and evaluated in terms of how they actually behave (within a relevant range). Absorption costing, when used in cost management, can lead to inaccurate budgeting, inappropriate control activities, and improper performance evaluation. Absorption costing, though, can provide meaningful information to profit center managers in setting sales prices.

7.49 Two problems result from the use of a standard absorptive manufacturing cost in standard setting:

- The standard absorptive manufacturing cost cannot be used to budget total production costs for a time period. To accurately budget costs, their behaviors need to be known. Variable costs are constant per unit (over the relevant range). Expressing variable costs on a per unit basis improves predictive accuracy in budgeting. Fixed costs are constant in total. Expressing fixed costs as total amounts improves the predictive accuracy of budgets.
- In setting a standard cost for fixed overhead, a production volume must be chosen. Choosing different production volumes creates implications for accurate product costing and price setting. The alternatives and their implications are discussed in the next review question.

7.50 Four alternatives exist for the denominator of the FOH standard cost:

- *Theoretical capacity* — The maximum production volume under perfect operating conditions working all hours of the period.
- *Practical capacity* — A feasible level of production allowing for normal interruptions, weekends, holidays, and the like.
- *Normal capacity* — The multi-year average production volume.
- *Expected annual capacity* — The budgeted production volume for the time period.

The FOH standard cost serves two purposes: product pricing and financial reporting (which requires absorption costing).

- In setting sales prices, profit center managers need to know the expected sales and production volume for the time period. This supports the use of expected capacity. If theoretic capacity was used in setting sales prices, for example, too little fixed overhead would be included in the standard absorptive manufacturing cost, and sales prices would be set too low to recover the fixed overhead expected for the period.
- Expected annual capacity will result in all the fixed overhead being absorbed in the units produced (assuming that budgeted FOH equals actual FOH and the sales and production quotas are realized). If another measure of capacity is used, for example theoretical capacity, then the denominator of the FOH standard cost increases, and the standard cost decreases. Assuming budgeted and actual FOH are equal (no FOH budget variance), and the production and sales quotas realized (no FOH volume variance), fixed overhead still will be underapplied. The result is that products have been miscosted throughout the period, and a closing journal entry is required to reallocate FOH (or write it off to COGS).

CHAPTER-SPECIFIC PROBLEMS:

7.51 Susie and Johnny's father, an accounting professor, thinks they should sell lemonade this summer. He sent them to the store to obtain prices for the materials. Pre-sweetened lemonade mix is $1.00 per package that makes 2 gallons. A package of 100 16 ounce cups costs $3.75.

They want to earn $6.00 per hour and it takes 4 minutes to make a 1 gallon pitcher. Their father said to:

- Budget 12 minutes per hour as downtime.
- Treat the cups as variable overhead.
- Budget $10 per day for "rent" (his charge for using the kitchen to make the lemonade, and for the water).
- Expect to make and sell 10 gallons per day.

He then told them to prepare a standard absorptive manufacturing cost, a manufacturing cost equation, and an average cost per cup of lemonade.

Let's Talk

You may wish to copy this page and hand it out to your students so that everyone uses the same example.

If some students are having difficulty with calculating standard quantities given normal input loss (i.e., the downtime in the direct labor standard quantity), you may wish to use a logical approach:

4 minutes = 80% **(4/5ths)** of the standard quantity

4 minutes = 4/5ths of **5 minutes**

Then, for the direct labor standard cost calculation:

5 minutes = 1/12th of an hour

1/12th of $6.00 = **$0.50 per pitcher**

We have found that this logical verification process is a good conceptual and learning device, and it gives these students more confidence in their solutions.

See Review Question 7-19 for the definitions of a standard cost and its components. The standard cost card is presented on the next page.

PROBLEM 7.51

DATA SECTION: STANDARD COSTS

Manufacturing Inputs	Price	Output qty.	Loss%	
Lemonade Mix	$1.00	0.50	0.00%	
Direct Labor	$6.00	0.06667	20.00%	(12 mins./60)
Variable Overhead	$3.75	0.08	0.00%	(8 cups/gallon)
Normal Production Volume		10 pitchers per day		

SOLUTION SECTION: STANDARD COST CARD & MANUFACTURING COST EQUATION

Susie & Johnny's Lemonade
1 gallon pitcher
STANDARD COST CARD

MANUFACTURING INPUTS	STD. PRICES	STANDARD QUANTITIES	STANDARD COSTS
Lemonade Mix	$1.00 /package	0.50 package/pitcher	$0.50 /pitcher
Direct Labor	$6.00 /DLhr	0.0833 DLhr/pitcher	$0.50 /pitcher
Variable Overhead	$3.75 /pack	0.08 pack/pitcher	$0.30 /pitcher
Fixed Overhead	$12.00 /DLhr	0.0833 DLhr/pitcher	$1.00 /pitcher
STANDARD ABSORPTIVE MANUFACTURING COST			$2.30 /pitcher

Daily lemonade production costs = $10 per day + $1.30 /pitcher

STANDARD QUANTITY CALCULATIONS:

$$\frac{\text{Output specification}}{(1 - \text{Loss\%})}$$

Direct labor:

$$\frac{0.06667}{0.80} = 0.0833$$

FOH STANDARD COST = $10 per day/10 pitchers per day = $1.00 per pitcher

7.52 Implicit in the setting of standard quantities is the concept of an acceptable level of performance corresponding to management's goals. That is, does management want to maintain the status quo or build a world-class enterprise? Because standards are goals that are used to judge actual performance, a key question is: "Just how demanding should standards be?" Should they assume theoretical perfection, or should they assume various factors that prevent perfect performance, at least in the short run?

An ideal direct material standard quantity does not include the materials normally lost in production (normal scrap). For direct labor, an ideal standard quantity does not include setup and cleanup time, downtime for machine breakdowns, and may or may not include bathroom time.

Practical standards are tight but achievable. They do not tolerate abnormal scrap and down time, although they allow for normal machine downtime, employee rest periods, and currently necessary but nonvalue-added activities. Unlike ideal standards, practical standards can be achieved and even surpassed on occasion when operations are being performed at high levels of efficiency. They are within the achievable range of most employees, yet difficult enough that when attained employees feel as though something of value has been accomplished.

The degree of difficulty in achieving a standard is known as *tightness*. The more difficult a standard is to attain, the tighter it is said to be. Tight standards can promote positive behavior if they motivate employees to strive for excellence through continuous improvement. Alternatively, they can cause dysfunctional behavior if they are too difficult or impossible to achieve. Standards that are too loose, however, may not motivate employees to perform at their best because such standards can be achieved too easily. Standards that are too loose may not support continuous improvement.

Employees are motivated by practical standards, especially if they've had input into their development, and will normally put forth their best efforts to achieve them. Moreover, practical standards can serve several purposes. In addition to indicating abnormal variances in costs, they can also be used in estimating and planning, whereas ideal standards do not allow for normal efficiencies and, therefore, may result in unrealistic estimating and planning data.

Variances from these standards are very useful to management because they inform management about how well operations are *improving*. Generally, they also have been considered to be the most useful in determining how effectively and efficiently present operations are being carried out.

Some authorities believe practical standards demand too little because such standards may be based more on the past than the future. Certain inefficiencies may be built into the standards. Idle capacity, setup times, material movement, inspection, and other nonvalue-added activities are costs these managers really don't want to include in a standard cost system. A standard cost system with nonvalue-added activities built in may mean that the existence of such waste is never questioned. The goal is zero waste and inventory. Management may never achieve such a lofty goal, but by pursuing it, substantial cost savings will occur. Therefore, some managers believe ideal standards are more useful for continuous improvement.

Whether ideal or practical standards are used, the modern management accountant needs to report improvements in productivity. Most likely, variances from ideal standards will be always unfavorable, but continuous improvement will result in these variances becoming smaller over time. With ideal standards, the change in variances over time measures the movement toward the theoretic optimum. Reporting the change (reduction) in standard quantities and costs as nonvalue-added activities are eliminated from them over time will also provide the same type of information to management when practical standards are used.

7.53

- *Direct labor cost* — The cost of factory supplies used by direct laborers. If all laborers are paid the same wage rate, or the amount of supplies used is proportional to the wage rate, the labor cost will predict the cost of these supplies used.
- *Direct labor hours* — The cost of electricity to power hand tools by assembly department laborers. The more hours worked, the more the tools are used and the greater their electricity cost.
- *Machine hours* — The cost of electricity to power the machines used in a machining shop. The more hours the machinery is used, the greater the electricity cost.
- *Units of product* — As an example of a nonvalue-added variable overhead cost, consider the laborers who move partially assembled products back-and-forth from production departments to a storage area (WIP). The greater the size or weight, the greater the number of moves required and the greater the cost of this indirect labor.
- *Direct materials weight or volume* — RMI clerks working on the receiving dock, or moving materials into a production department. The size or weight of the materials will determine the number of moves and the cost of this labor.

7.54

Let's Talk

Some texts that cover standard setting include an allocation of RMI costs in the standard direct materials price. We have chosen not to do this because of its effect on cost variance analysis.

- In calculating the direct materials price variance, the actual net delivered purchase price is compared to the standard price. If the standard price includes an allocation of RMI costs, an allocation of actual RMI costs must be made for a valid comparison. This degrades the quality of the cost variance reporting system, however, because price variances may be caused by price differences and/or by RMI variances.

- An approach supporting a high quality cost variance reporting system treats RMI as a service department, separately allocating the variable and fixed costs of RMI and calculating cost variances for this service department. Such a report is illustrated in Chapter 9, Exhibits 9-13 and 9-14. In this manner, the direct materials price variance is separated from the RMI cost variances.

Students should be cautioned about rounding values. This was first discussed in the "Let's Talk" box for Problem 6.54(a). We carried-out the standard quantities to four decimal places to avoid rounding errors when compared to the spreadsheet solution. As was demonstrated in Problem 6.54 for process costing, rounding when large production volumes are used will result in potentially significant rounding errors in total costs.

The solution to Problem 7.54 is presented on the next two pages.

PROBLEM 7.54

STANDARD PRICE CALCULATIONS:

	DM-A	DM-B		DL-1	DL-2
Gross purchase price	$3.50	$5.00	Wage rate	$10.500	$13.12
Less purchase discounts	(0.35)	(0.25)	+Employer		
Add freight-in	0.85	1.25	burden	2.625	3.28
Standard price	$4.00	$6.00		$13.125	$16.40

STANDARD QUANTITY CALCULATIONS:

$$\frac{\text{Output specification}}{(1 - \text{Loss\%})} = \frac{6.00}{0.95} = 6.3158 \qquad \frac{1.00}{0.875} = 1.1429$$

$$= \frac{2.00}{0.90} = 2.2222 \qquad \frac{2.00}{0.875} = 2.2857$$

PROBLEM 7.54

DATA SECTION: STANDARD COSTS

Manufacturing Inputs	Price	Output qty.	Loss%	
Direct Material A	$4.00	6.00	5.00%	
Direct Material B	$6.00	2.00	10.00%	
Direct Labor Dept. 1	$13.125	1.00	12.50%	(15+15+30)/480
Direct Labor Dept. 2	$16.40	2.00	12.50%	(5+25+30)/480
Variable Overhead				
Fixed Overhead				
Normal Production Volume				

SOLUTION SECTION: STANDARD COST CARD

Pest Control, Inc.
Quikill Insecticide (5 gallon container)
STANDARD COST CARD

MANUFACTURING INPUTS	STD. PRICES	STANDARD QUANTITIES	STANDARD COSTS
Direct Material A	$4.00 /pound	6.3158 pounds/unit	$25.26 /unit
Direct Material B	$6.00 /pound	2.2222 pounds/unit	$13.33 /unit
Direct Labor Dept. 1	$13.125 /DLhr	1.1429 DLhr/unit	$15.00 /unit
Direct Labor Dept. 2	$16.40 /DLhr	2.2857 DLhr/unit	$37.49 /unit
Variable Overhead			
Fixed Overhead			
STANDARD ABSORPTIVE MANUFACTURING COST			$91.08 /unit

7.55 ***Note:*** See the "Let's Talk" box for Problem 7.54.

STANDARD PRICE CALCULATIONS:

	DM-X	DM-Y		DL-1	DL-2
Gross purchase price	$6.50	$8.25	Wage rate	$8.75	$12.250
Less purchase discounts	(0.13)	(0.33)	+Employer		
Add freight-in	0.63	0.08	burden	1.75	3.675
Standard price	$7.00	$8.00		$10.50	$15.925

STANDARD QUANTITY CALCULATIONS:

$$\frac{\text{Output specification}}{(1 - \text{Loss\%})} = \frac{4.00}{0.90} = 4.4444 \qquad \frac{1.50}{0.84375} = 1.7778$$

$$= \frac{3.00}{0.95} = 3.1579 \qquad \frac{3.00}{0.8125} = 3.6923$$

DATA SECTION: STANDARD COSTS

Manufacturing Inputs	Price	Output qty.	Loss%	
Direct Material X	$7.00	4.00	10.00%	
Direct Material Y	$8.00	3.00	5.00%	
Direct Labor Dept. 1	$10.50	1.50	15.625%	(20+25+30)/480
Direct Labor Dept. 2	$15.925	3.00	18.750%	(30+30+30)/480
Variable Overhead				
Fixed Overhead				
Normal Production Volume				

SOLUTION SECTION: STANDARD COST CARD

Pest Control, Inc.
Quikill Insecticide (7 gallon container)
STANDARD COST CARD

MANUFACTURING INPUTS	STD. PRICES	STANDARD QUANTITIES	STANDARD COSTS
Direct Material X	$7.00 /pound	4.4444 pounds/unit	$31.11 /unit
Direct Material Y	$8.00 /pound	3.1579 pounds/unit	$25.26 /unit
Direct Labor Dept. 1	$10.50 /DLhr	1.7778 DLhr/unit	$18.67 /unit
Direct Labor Dept. 2	$15.925 /DLhr	3.6923 DLhr/unit	$58.80 /unit
Variable Overhead			
Fixed Overhead			
STANDARD ABSORPTIVE MANUFACTURING COST			$133.84 /unit

7.56

DATA SECTION: STANDARD COSTS

Manufacturing Inputs	Price	Output qty.	Loss%
Chocolate	$1.50	1.00	25.00%
Wrapping paper	$0.10	6.00	0.00
Direct Labor	$4.00	0.20	20.00% (96/480)
Variable Overhead	$0.30		
Fixed Overhead	$11.68		
Normal Production Volume	20,000		

SOLUTION SECTION: STANDARD COST CARD & MANUFACTURING COST EQUATION

Donchalikeit Candy Company
1 pound box of Chocolates
STANDARD COST CARD

MANUFACTURING INPUTS	STD. PRICES	STANDARD QUANTITIES	STANDARD COSTS
Chocolate	$1.50 /pound	1.33 pounds/unit	$2.00 /unit
Wrapping paper	$0.10 /sheet	6.00 sheets/unit	$0.60 /unit
Direct Labor	$4.00 /DLhr	0.25 DLhr/unit	$1.00 /unit
Variable Overhead	$0.30 /DLhr	0.25 DLhr/unit	$0.08 /unit
Fixed Overhead	$11.68 /DLhr	0.25 DLhr/unit	$2.92 /unit
STANDARD ABSORPTIVE MANUFACTURING COST			$6.60 /unit

Annual 1 pound box of Chocolates manufacturing costs = $58,400 per year + $3.68 /unit

STANDARD QUANTITY CALCULATIONS:

		Candy mix		Direct labor
Output specification / (1 - Loss%)	1.00 / 0.75	1.3333	0.20 / 0.80	0.25

HIGH-LOW METHOD FOR OVERHEAD:

$$\text{VOH POR} = \frac{\$62,000 - \$60,500}{12,000 - 7,000} = \$0.30 \text{ /DLhr}$$

BUDGETED FOH = $60,500 - (7,000 DLhr x $0.30/DLhr) = $58,400

FOH POR = $58,400 / 20,000 units / .25 DLhr/unit = $11.68 /DLhr

7.57

DATA SECTION: STANDARD COSTS

Manufacturing Inputs	Price	Output qty.	Loss%	
Candy mix	$1.60	0.25	20.00%	
Direct Labor	$6.00	0.60	10.00%	(15+15+5+5+8)/480
Variable Overhead	$1.00	0.50		
Fixed Overhead	$10.00	0.50		
Normal Production Volume	10,000			

SOLUTION SECTION: STANDARD COST CARD & MANUFACTURING COST EQUATION

Donchalikeit Candy Company
Basic Lollipop
STANDARD COST CARD

MANUFACTURING INPUTS	STD. PRICES	STANDARD QUANTITIES	STANDARD COSTS
Candy mix	$1.60 /pound	0.3125 pounds/unit	$0.50 /unit
Direct Labor	$6.00 /DLhr	0.6667 DLhr/unit	$4.00 /unit
Variable Overhead	$1.00 /Mhr	0.50 Mhr/unit	$0.50 /unit
Fixed Overhead	$10.00 /Mhr	0.50 Mhr/unit	$5.00 /unit
STANDARD ABSORPTIVE MANUFACTURING COST			$10.00 /unit

Annual basic lollipop mfg. costs = $50,000 per year + $5.00 /unit

STANDARD QUANTITY CALCULATIONS:

		Candy mix		Direct labor
Output specification	0.25		0.60	
(1 - Loss%)	0.80	0.3125	0.90	0.6667

HIGH-LOW METHOD FOR OVERHEAD:

$$\text{VOH POR} = \frac{\$62{,}500 - \$56{,}500}{12{,}500 - 6{,}500} = \$1.00 \text{ /Mhr}$$

BUDGETED FOH = $62,500 - (12,500 Mhr x $1.00/Mhr) = $50,000

FOH POR = $50,000 / 10,000 units / .5 Mhr/unit = $10.00 /Mhr

7.58 *Four capacity measure alternatives:*

- *Theoretical capacity* — The maximum production volume under perfect operating conditions working all hours of the period.
- *Practical capacity* — A feasible level of production allowing for normal interruptions, weekends, holidays, and the like.
- *Normal capacity* — The multi-year average production volume.
- *Expected annual capacity* — The budgeted production volume for the time period.

The capacity measure is the denominator of the FOH standard cost. The greater the denominator, the smaller the FOH standard cost. Theoretical capacity provides the lowest FOH standard cost, followed by practical capacity. If normal capacity is greater than the current year's expected capacity, normal capacity will produce a lower FOH standard cost than expected capacity.

Answers to questions:

1. (a): The formula for the TOH POR is:

$$\text{TOH POR} = \frac{\text{Budgeted total overhead cost}}{\text{Budgeted quantity for applying overhead}}$$

The basis used to apply overhead to products (i.e., its cost driver) should represent a cause-effect relationship. Common causes of variable overhead are:

- Direct labor cost or hours
- Machine hours
- Physical measure of the products (weight or volume)
- Physical measure of direct materials
- Quantity of services provided to production departments by a service department or overhead activity cost pool

Common cause of fixed overhead include:

- The size of the plant (for plant-wide common costs such as rent, heating and air conditioning, property taxes, and property insurance)
- The maximum potential quantities of a service that could be required by production departments from service departments or overhead activity cost pools

Service department allocations are covered in Chapter 9. Activity-based costing is presented in Chapter 10.

2. (d) The common bases used to allocate overhead are listed in the previous answer.

3. (a) This is discussed in the answer to the first part of the problem.

4. (b) In this situation, two workers paid different wage rates will use different amounts of variable overhead such as factory supplies and electricity to operate hand tools or specialized equipment. If a direct labor hours base is used to allocate VOH, then the two workers, each working one hour, will result in the same allocated VOH cost. The correct allocation should result in more overhead being used and applied by the higher paid worker. Using direct labor cost will represent this cause-effect relationship.

7.59 a. $$\text{VOH POR} = \text{slope} = \frac{\$34,500,000 - \$29,880,000}{2,760,000 \text{ DLhr} - 2,160,000 \text{ DLhr}}$$

$$= \underline{\$7.70 \text{ per DLhr}}$$

Using the high value:

Budgeted FOH = intercept = \$34,500,000 - (2,760,000 DLhr x \$7.70 per DLhr)

= <u>\$13,248,000 per year</u>

Using the low value:

Budgeted FOH = intercept = \$29,880,000 - (2,160,000 DLhr x \$7.70 per DLhr)

= <u>\$13,248,000 per year</u>

TOH cost equation:

Budgeted TOH per year = \$13,248,000 per year + \$7.70 per DLhr

b. Budgeted TOH for 19X5 = \$13,248,000 per year + (\$7.70 x 2,300,000 DLhr)

= <u>\$30,958,000</u>

c. For 19X5:

VOH POR = <u>\$7.70 per DLhr</u> (from part a)

$$\text{FOH POR} = \frac{\$13,248,000}{2,300,000 \text{ DLhr}} = \underline{\$5.76 \text{ per DLhr}}$$

TOH POR = \$7.70 + \$5.76 = <u>\$13.46 per DLhr</u>

d. *Cost equation for **labor-related** overhead costs* (indirect labor, employee benefits, and supervision):

$$\text{VOH POR} = \text{slope} = \frac{\$18,045,000 - \$14,505,000}{2,760,000 \text{ DLhr} - 2,160,000 \text{ DLhr}}$$

$$= \underline{\$5.90 \text{ per DLhr}}$$

Budgeted labor-related FOH = \$18,045,000 - (2,760,000 DLhr x \$5.90 per DLhr)

= <u>\$1,761,000 per year</u>

Cost equation for ***machinery-related*** *overhead costs* (supplies and power, see the "Let's Talk" box on the next page):

$$\text{VOH POR = slope} = \frac{\$4{,}968{,}000 - \$3{,}888{,}000}{2{,}000{,}000 \text{ Mhr} - 1{,}500{,}000 \text{ Mhr}}$$

$$= \underline{\$2.16 \text{ per Mhr}}$$

Budgeted machinery-related FOH = $4,968,000 - (2,000,000 Mhr x $2.16 per Mhr)

= $648,000 per year

Total budgeted FOH = heat & light, depreciation, property taxes and insurance, labor-related FOH, and machinery-related FOH

= $552,000 + $7,930,000 + $3,005,000 + $1,761,000 + $648,000

= $13,896,000 per year

TOH cost equation = $13,896,000 per year + $5.90 per DLhr + $2.16 per Mhr

Budgeted overhead for 19X5 (assume 1,700,000 Mhr are budgeted):

Budgeted TOH = $13,896,000 + [(2,300,000 DLhr x $5.90 per DLhr) + (1,700,000 Mhr x $2.16 per Mhr)]

= $31,138,000

TOH PORs for 19X5:

For direct labor-related overhead:

VOH POR = $5.90 per DLhr

$$\text{FOH POR} = \frac{\$1{,}761{,}000}{2{,}300{,}000 \text{ DLhr}} = \$0.7657 \text{ per DLhr (rounded)}$$

TOH POR = $5.90 + $0.7657 = $6.6657 per DLhr (rounded)

For machinery-related overhead:

VOH POR = $2.16 per Mhr

$$\text{FOH POR} = \frac{\$648{,}000}{1{,}700{,}000 \text{ Mhr}} = \$0.3812 \text{ per Mhr (rounded)}$$

TOH POR = $2.16 + $0.3812 = $2.5412 per Mhr (rounded)

Let's Talk

Machine hours may be the most appropriate cost driver for these overhead costs. Some students might comment that direct labor hours cause machine usage and these machinery-related costs. This is true only under the following conditions, though:

- The supplies and electricity are for the machines, not for any direct labor activities such as assembling or testing.
- The machines need to be operated by direct laborers.
- The machines are turned off when not being operated (so no supplies or electricity are consumed when laborers are not operating the machinery).
- The laborers are machine operators and do nothing else that can be classified as direct labor, i.e., they spend all their time solely operating the machinery.

Students may inquire about the interpretation of a machinery-related FOH cost component. This may be the costs of machines when they are not being used. For example, the machines are turned on at the beginning of each day, thus machine idle time exists. While idling, the machinery still incurs supplies and electric costs, although at a lower level from when they are in use.

We added the machine hours for 19X4 and 19X5 to illustrate this observation. The supplies and electricity are also assumed to be for the machinery, and not for non-machinery related tasks.

Part d can also serve as an example of the need for multiple overhead rates and activity-based costing (i.e., as a lead-in to Chapters 9 and 10).

7.60 a. Equation 2 provides a more accurate prediction of shipping costs. Prediction accuracy is measured by the coefficient of determination, r^2. Equation 2 has a much greater r^2 as compared to equation 1. The representativeness of the regression equation with respect to the dispersion of the sample's observations from the regression line is measured by the standard error of the estimate (S_e). Equation 2's S_e is less than equation 1's, indicating that the average distance from the estimated and actual values is less with equation 2.

b. SC = \$642.90 per week + (\$3.92 per carton shipped x 600 cartons)

= <u>\$2,994.90</u>

c. Using the scattergraph method, the predictive equation is determined by visually fitting a line through the points. Each person can draw a slightly different sloping line. Thus, the slope and intercept will be different. The result is that everyone may not agree on the budgeted cost.

Using a statistical method, everyone should develop the same equation and agree on the budgeted cost. This assumes, of course, that everyone agrees on the legitimacy of the equation, specifically the relationship between the dependent and independent variables. In this situation, it appears reasonable to expect that the number of cartons shipped causes the costs of the shipping department. Common sense is critical in identifying cause-effect relationships leading to the choice of a cost driver.

Everyone may not agree on the regression equation's parameters, though. For example, the shipping department automated some of its processes ten month's ago. The costs from previous time periods do not represent the current operations, and may not provide an accurate prediction. Considerations such as these have led to the development of activity-based costing (Chapter 10). Maynard Shephard should consider an analysis of the resources and activities now used by the (automated) shipping department and develop an activity-based allocation equation to use in predicting future shipping department costs.

Regression analysis provides a more accurate mathematical prediction as compared to the scattergraph and high-low methods. Visual observation and activity-based costing, however, may provide a better cost estimation procedure. The modern management accountant is a member of the management team, getting out of his or her office (and away from the historical cost database) to *better* understand the current (and projected future) operations of the enterprise. With this understanding, and the consensus resulting from team involvement, even better cost prediction models should result.

7.61 Answers to matching questions:

1. c (Using a units-of-output based depreciation method results in depreciation becoming a variable cost.)
2. f
3. k
4. b (Once the $9.25 cost per pound is reached, this becomes a linear variable cost.)
5. a
6. d
7. j
8. h (A constant number of employees is not the same as employing the same employees throughout the year. Allowing for employee turnover, FUTA taxes will be paid throughout the year, but the amount will be less per hour in the latter part of the year.)
9. c
10. g

7.62

$$\text{VOH POR} = \text{slope} = \frac{\$20{,}000 - \$14{,}000}{3{,}800 \text{ DLhr} - 2{,}200 \text{ DLhr}}$$

$$= \underline{\$3.75} \text{ per DLhr}$$

Budgeted FOH = intercept = $20,000 - (3,800 DLhr x $3.75 per DLhr)

= $\underline{\$5{,}750}$ per month

Monthly electricity cost = $5,750 per month + $3.75 per DLhr

7.63 a.

$$\text{VOH POR} = \text{slope} = \frac{\$14{,}200 - \$8{,}000}{12{,}400 \text{ Guest-days} - 4{,}400 \text{ Guest-days}}$$

$$= \underline{\$0.775} \text{ per Guest-day}$$

Budgeted FOH = intercept = $14,200 - (12,400 Guest-days x $0.775 per Guest-day)

= $\underline{\$4{,}590}$ per month

Monthly custodial supplies cost = $4,590 per month + $0.775 per Guest-day

b. Budget for 11,500 guest-days:

Monthly custodial supplies cost = $4,590 per month + ($0.775 per Guest-day x 11,500 Guest-days)

= $\underline{\$13{,}502.50}$

7.64 a.

VOH POR = slope = $\frac{\$3,750 - \$1,800}{900 \text{ units} - 300 \text{ units}}$

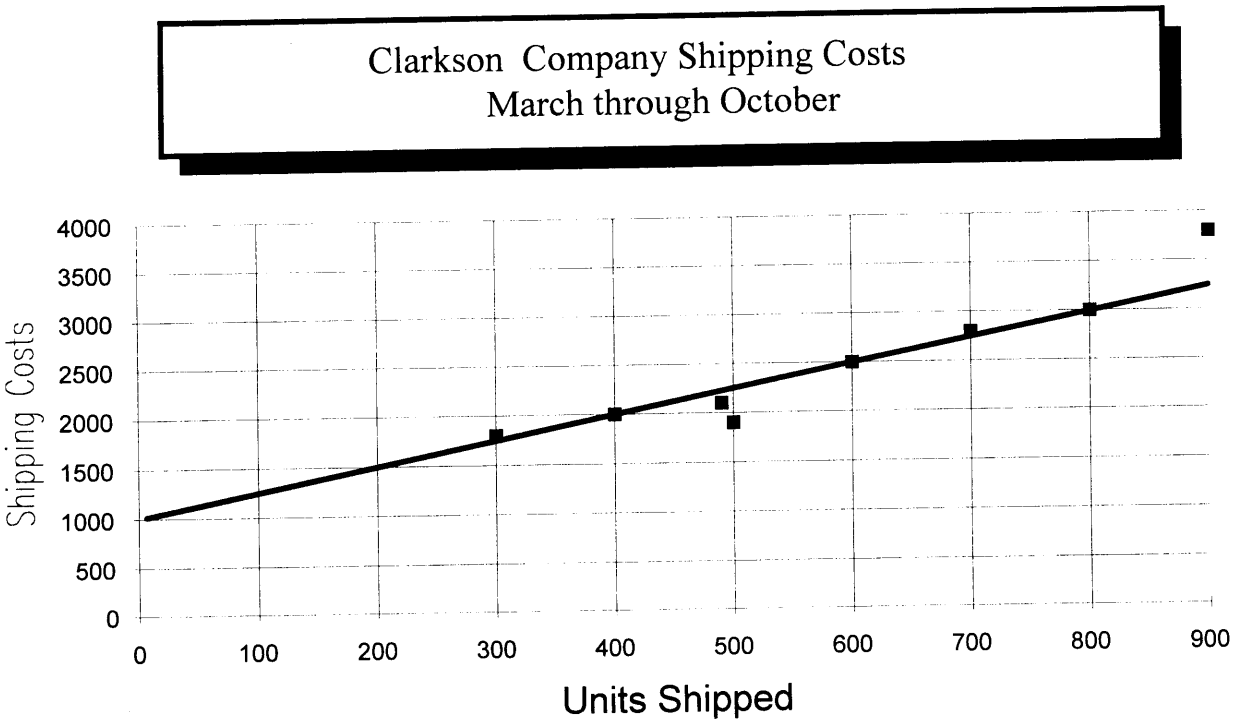
= $3.25 per unit

Budgeted FOH = intercept = $3,750 - (900 units x $3.25 per unit)

= $825 per month

Monthly shipping costs = $825 per month + $3.25 per unit

b.



Intercept = $1,000 per month

Slope = $\frac{\$2,000 - \$1,000}{400 \text{ units}}$ (Any point falling on the line can be chosen)

= $2.50 per unit

Monthly shipping costs = $1,000 per month + $2.50 per unit

7.65 Monthly TOH = $10,000 + ($600,000 x .2)

= $130,000

7.66 a. 5,000 cases x 4 Mhr per case = 20,000 Mhr for the month

Total monthly overhead = $90,000 + ($10 per Mhr x 20,000 Mhr)

= $290,000

b. FOH POR = $\frac{\$90{,}000 \text{ per month x 12 months per year}}{60{,}000 \text{ cases x 4 Mhr per case}}$

= $4.50 per Mhr

c. VOH standard cost = VOH POR x Mhr standard quantity

= $10 per Mhr x 4 Mhr per case

= $40 per case

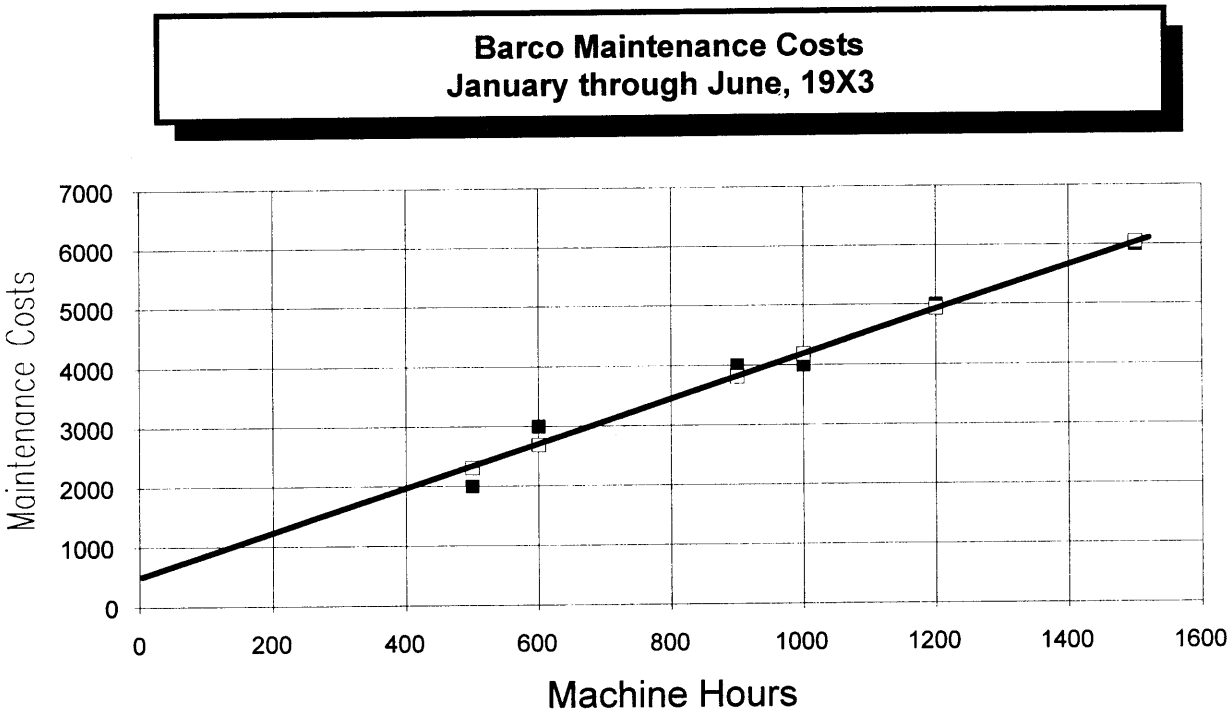
7.67

Let's Talk

This problem allows a comparison of the three quantitative methods to predict a cost equation from historical data. An interesting aspect is that the high-low method results in no fixed maintenance cost (i.e., maintenance is budgeted as a purely variable cost)! This highlights the high-low method problem from using the two extreme values. Both the scattergraph method and the regression method indicate a fixed cost component for maintenance.

In the scattergraph, the black boxes denote the monthly observations. The white boxes are the regression estimates.

a. Scattergraph (with regression line included):



Assuming an intercept of $500 by visual inspection, the slope using the point at 400 Mhr is:

$$\text{VOH POR} = \frac{\$2{,}000 \text{ total cost} - \$500 \text{ fixed cost}}{400 \text{ Mhr}} = \underline{\$3.75} \text{ per Mhr}$$

Monthly maintenance cost = $500 per month + $3.75 per Mhr

b. High-low method:

$$\text{VOH POR = slope} = \frac{\$6{,}000 - \$2{,}000}{1{,}500 \text{ Mhr} - 500 \text{ Mhr}} = \underline{\$4.00} \text{ per Mhr}$$

Budgeted FOH = intercept = $6,000 - (1,500 Mhr x $4.00 per Mhr)

= $0 per month

Monthly maintenance cost = $4.00 per Mhr

c. Spreadsheet output from regression analysis:

VOH POR = $3.74 per Mhr

Budgeted FOH = $446.04 per month

Monthly maintenance cost = $446.04 per month + $3.74 per Mhr

7.68 Answers to multiple choice questions:

a. 4

b. 1

c. 4 The regression equation is:

Monthly maintenance costs = \$684.65 per month + \$7.2884 per Mhr

For 420 Mhr in a month: = \$684.65 + (\$7.2884 per Mhr x 420 Mhr)

= \$3,746 (rounded)

d. 1 (Use the coefficient of determination, r^2)

THINK-TANK PROBLEMS:

7.69 A cost variance is an example of a problem: the difference between desired and actual outcomes. Outcomes may result from a number of different, but possibly related, underlying causes. Thus, technically speaking, a cost variance is the financial result of one or more production problems. In industrial engineering, a production problem is called a "variance."

A simple example:
Almost Fresh Sandwich Company makes ham and cheese sandwiches for distribution through vending machines. Cheese is purchased in 25 pound blocks. The Cheese Preparation Department cuts the cheese into 4 inch square slices. These slices should be separated by wax paper and stored in containers for use by the Sandwich Assembly Department. After sandwiches are assembled, they are moved to cold storage, and then to the Packaging Department where they are cut diagonally, inserted into cardboard packages (half boxes), and wrapped in cellophane. The containers are placed in cold storage until needed in assembly. Each department is evaluated on their ability to achieve their production quotas with no cost variances.

Running behind their production schedule during the week, the Cheese Preparation workers do not insert wax paper between the cheese slices before placing them in the containers. Through this action (an example of suboptimal (dysfunctional) behavior), Cheese Preparation looks good because they have:

- Minimized their direct materials usage variance for wax paper (or created a favorable variance)
- Minimized their direct labor usage variance (or created a favorable variance)
- Achieved (or beat) their production quota

When Assembly Department workers have to use these slices in production, the following cost variances can result:

- An unfavorable direct materials (cheese) usage variance results when cheese slices stick together and have to be discarded.
- An unfavorable direct labor usage variance results from the attempts to separate the slices rather than automatically discarding them.
- An unfavorable direct labor usage variance results when workers have to go to cold storage and get more cheese slices.
- Falling behind their production quota, Sandwich Assembly Department workers begin to insert stuck-together slices into the sandwiches. One worker jokingly stated that the customer is getting "more for his money" because of the extra cheese included in these sandwiches.

When these sandwiches are transferred to the Packaging Department:

- At times, the stuck-together cheese slices are not perfectly in alignment. Packaging workers have to trim the cheese to match to bread slices before inserting the sandwiches into their cardboard packages. This creates an unfavorable direct labor usage variance.

- Because of the extra cheese in these sandwiches, they do not fit easily into the cardboard packages. Packaging workers can squeeze the sandwiches into the packages, but this requires extra time (i.e, another unfavorable direct labor usage variance).
- As Packaging Department workers fall behind their production schedule, these sandwiches are discarded. This creates an unfavorable direct materials usage variance and an unfavorable direct labor usage variance when these workers have to go back to cold storage to get additional sandwiches.

Cost variances:
During the week the following cost variances resulted due to not inserting wax paper between the cheese slices:

• In the Cheese Preparation Department:	
• Favorable direct materials (wax paper) usage variance	$2.00
• Favorable direct labor usage variance	$50.00
• In the Sandwich Assembly Department:	
• Unfavorable direct materials (cheese) usage variance	$10.00
• Unfavorable direct labor usage variance	$150.00
• In the Packaging Department:	
• Unfavorable direct materials (sandwiches) usage variance	$100.00
• Unfavorable direct labor usage variance	$200.00
Total unfavorable cost variance due to not inserting wax paper	$408.00

Cause identification, ICBIS, and reporting:
- The technology platform and ICBIS should be designed so that workers can input the sources and causes of cost variances. A simple coding system can be created for recurring production problems that can be used by shop floor workers in inputting this information.
- Computer terminals can be installed in each department for input coding activities. As workers input a cost variance cause, if the source of this problem is in another department, that department is immediately notified (on its terminal) through a visual factory control system. That department must respond to the alert message.
- The database aggregates cost variances across departments by source and cause. A report such as the summary above can be used to identify the total cost overrun resulting from this problem. The report should be available to management as well as the departments.
- Assume that the real cause of this problem was a shortage of wax paper due to insufficient ordering of wax paper by the purchasing department. The database stores this information so that it is available for use in future situations concerning wax paper shortages. This type of information may lead to adaptive control measures to minimize the problem in the future. For example, Cheese Preparation workers may be instructed to lay the cheese slices at a 45 degree angle to the slice below (to minimize slices sticking together). Through the visual factory control system, Cheese Preparation notifies assembly that this container of slices exists (the feedforward role of the SCAS). Assembly knows to use this container next (minimizing the time the slices are stored, and the potential for sticking).

The unfavorable cost variance in assembly can be estimated based on the historical information from the ICBIS's database. If the least-cost corrective action is in assembly, then this cost variance is preplanned. The ICBIS should report this so that, in performance evaluation, the assembly workers are not penalized.

Let's Talk

This example can be used to illustrate the problems with traditional SCAS designs in interactive, multidepartment processes. Problems can be created in one department and then transported to subsequent departments, reeking havoc "down-the-line." Participation, communication, and coordination are not just restricted to budgeting standards. These team concepts are critical in monitoring and controlling daily operations. The modern management accountant, as a member of the management team, plays a critical role in this communication and coordination.

This example can also be used as a "springboard" into Chapter 8. In calculating, journalizing, and reporting cost variances, a high quality SCAS needs to capture cost variance sources and causes. Even in JITs this is true, as illustrated in the last section of Chapter 8.

This problem can spark class discussion and serve as an excellent integrating vehicle if it is assigned during your coverage of Chapter 7 and then (again) when covering Chapter 8. Our students have found that Chapter 8 provides some new "ammunition" in rethinking their original solutions. Some interesting class discussions have resulted when we asked students to especially consider the role of the management accountant as a member of the team in this process.

Acetate transparencies are available for this problem, if you wish to copy the example and hand it out to your students so that everyone can think about (and generate ideas for) the same situation.

Only the direct materials and labor usage variances were considered in the solution (to keep it simple). You may wish to ask students what other types of cost variances may result, such as variable overhead variances and production quota variances (FOH volume variances).

7.70

Let's Talk

This problem can lead to two types of ERDs. Most students will prepare a functional ERD similar to Exhibit 8-1. From this perspective, you may find this problem to be a good introduction to Chapter 8 through linking the behavioral components of an SCAS, discussed in the first section of this chapter, with the behavioral discussion in the first section of Chapter 8 (ending with Exhibit 8-1).

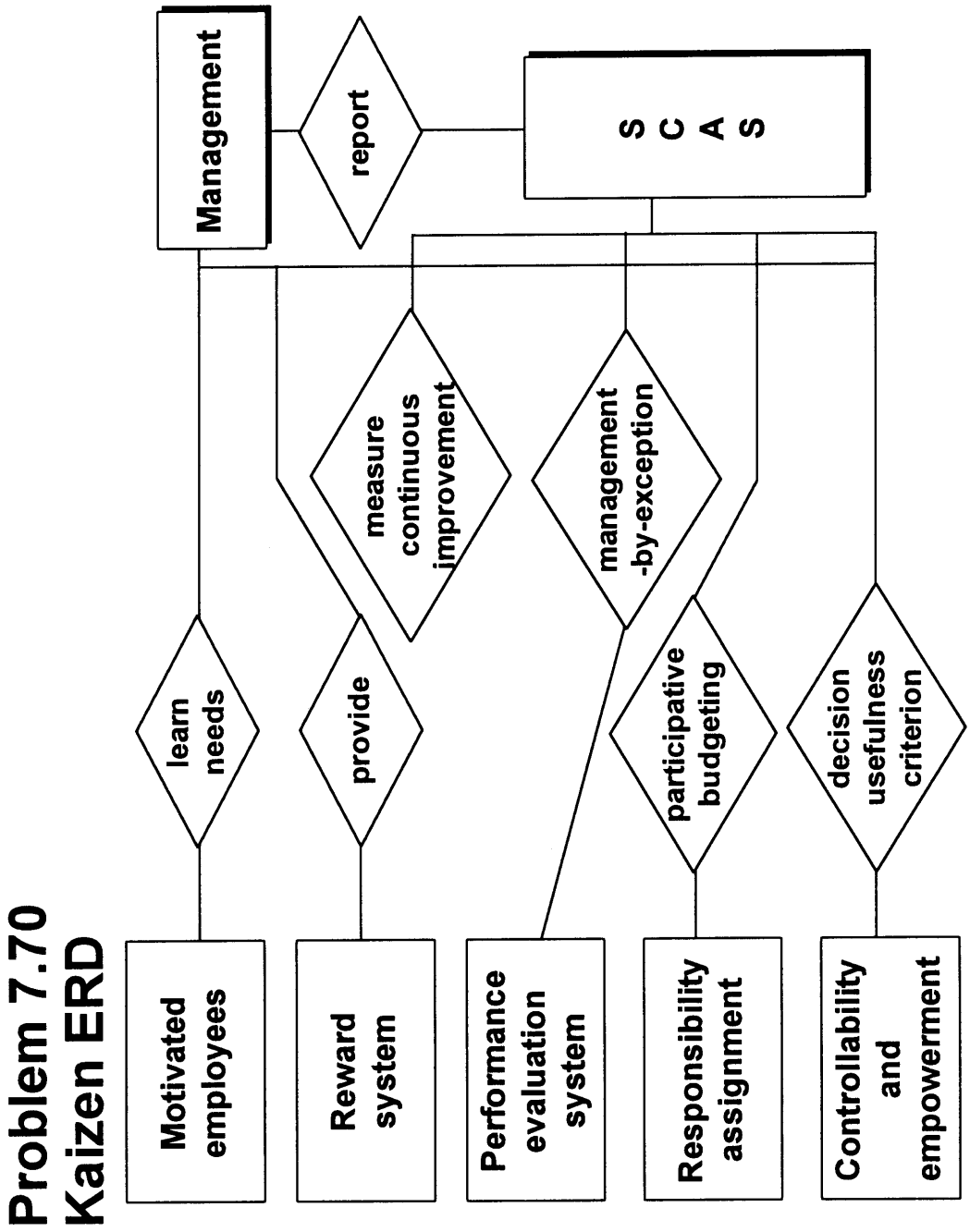
The second and last questions are behaviorally-oriented and may prompt some students to create a motivationally-based ERD. The ERD presented on the next page integrates the SCAS and the organizational control system linkages with the five criteria for a responsibility accounting system. These are discussed in the section "Behavioral Dimensions to Responsibility Accounting" in the text.

Comments on the kaizen ERD (presented on the next page):

- Remembering perhaps the most important responsibility accounting design criterion, "You get what you measure," the SCAS should provide relevant information for performance evaluation.
  - Short-run information using cost variances should report their sources and causes, whether they were preplanned, and if they have been corrected. The total cost of production problems is provided by summing cost variances by cause.
  - Long-run information includes the change in standards over time (when using practical standards) and the change in cost variances over time (when using ideal standards). If operations are continuously improving, both should go down. Graphical displays, such as those presented in Chapter 11 (Activity-based Management) provide easily understood trend analyses. Quality cost reports (Chapter 12, Total Quality Management) also provide meaningful information for measuring product quality improvement.

- Continuous improvement requires motivated employees. This commitment requires participation in setting the standards to measure short-run performance as well as long-run improvement.

Problem 7.70 is continued on page 45.


Problem 7.70
Kaizen ERD
Management
report
S C A S
learn needs
provide
measure continuous improvement
management -by-exception
participative budgeting
decision usefulness criterion
Motivated employees
Reward system
Performance evaluation system
Responsibility assignment
Controllability and empowerment

- The new "buzz word" for controllability is **employee empowerment**. This involves:
  - Providing employees with the requisite skills to take control actions at the source of production problems (where and when the problems occur).
  - Budgeting appropriate materials and labor time within their standard quantities so that employees know that these are important activities.
  - Providing real-time feedback to the employees on current performance.
  - Providing access to instructions, help, and demonstrations at their workstations through visual control system video displays.

7.71 A high-quality standard cost card possesses five attributes:

- *Accuracy:*
  - The more people that participate in setting standards, the more accurate they will be in measuring accomplishment of the enterprise's goals. Purchasing, production, and marketing personnel need to be involved in setting standard material prices. Workers and production management jointly set standard quantities for labor. Line managers must work with the personnel department in determining the labor rate standards based on the different classes of workers needed. By including separate price and quantity information for each cost element, the standard cost card helps focus attention on each component by the right groups.
  - Accurate performance measurement in operational control and performance evaluation requires accurate standards. Standards that are outdated, for example, will not provide accurate results when used to calculate cost variances.
- *Relevancy:*
  - When budgeting (group decision making), information about the change in standards and cost variances over time is useful in setting new standards for continuous improvement. Relevant information includes the reduction in scrap included in the direct materials standard quantities. Similarly, the reduction in the direct labor output specification from learning, and in nonvalue-added activities in downtime, are relevant to setting new labor standard quantities. In budgeting total production costs, the standard cost card should also include the manufacturing cost equation.
  - In monitoring and controlling operations, cost variances from ideal standards may not be relevant. Practical standards provide information about deviations from currently expected performance.
  - For performance evaluation, the standard cost card should provide separate standard prices and quantities for each cost element. This allows separate reporting of spending and usage variances to the people responsible. For example, the direct materials spending variances are reported to the purchasing agent while the usage variance are reported to the shop floor. Labor rate variances may be the responsibility of a human resources management department while labor usage variances are reported to the production departments.

- *Timeliness:*
  - In setting standards, groups and individuals cannot wait months to obtain current standard cost information. Users in different LANs need to access the cost accounting LAN through an ICBIS.
  - In operational control activities, real time information should be available at production workstations. The standard cost card files need to contain detailed information about individual standard quantities, budgeted scrap and downtime, expected learning, and the like.
  - Management needs timely feedback for performance evaluation. Receiving cost variance reports weeks late inhibits learning about production problems and the corrective actions taken (or not taken). The standard cost card information needs to be available for timely comparisons with actual performance.
- *Fairness:*
  - Participative budgeting promotes the perception of fair standards by those evaluated against the standards. Imposed standards "from the top" may not be accepted as fair if proper allowances are not made for individual control tasks.
  - By participating in the standards used to report current information for shop floor control activities, workers are more likely to consider the differences between their performance and the standards as fair measures of their performance.
  - Each responsibility center should have its own standards (prices and/or quantities) separately included in the standard cost card. This allows specific cost variance reporting to those responsible.
- *Usability:*
  - In group planning, as well as in individual standard setting, graphical information about the changes in specific standards over time is useful in measuring continuous improvement. The standard cost card file should be accessible to various LANs and contain this historical information.
  - Information such as standard prices and quantities should be available to use in real time for operational control. Information about specific standard material and labor quantities is needed for measuring current performance.
  - Detailed standards are needed for specific variance calculations and responsibility assignment in performance evaluation.

7.72 Past overhead costs can be quantitatively analyzed using three methods:

- *Scattergraph method:*
  Budgeting and standard setting is a group decision-making activity. Consensus is needed in the overhead cost equation before overhead standards can be set. The scattergraph method often results in different cost predictions because of its subjectivity. Each person involved in the overhead budgeting process can visually fit a slightly different sloping line to the observations. This results in a different overhead cost equation and predicted cost.

- *High-low method:*
  Using the same two points to calculate the overhead cost equation, consensus will result in the overhead cost equation and budgeted overhead cost. The overhead budget and the overhead standards may not be accurate, though. The highest and lowest observations are the first candidates for removal from the data set as statistical outliers.

  Before any statistical analysis is performed, the data always should be plotted, outliers identified and removed, and an appropriate modeling technique selected. Patterns with low correlations signal the possibility of an inappropriate independent variable (cost driver). Nonlinear correlations signal the need for data transformations and nonlinear regression models.
- *Regression analysis:*
  Regression analysis is the statistically most accurate method of the three. Univariate regression analysis of total overhead may not provide useful information for operational control and performance evaluation even though the regression equation demonstrates a high correlation coefficient. Total overhead is comprised of many cost pools, each having a different cause (**cost driver**). To control and properly evaluate overhead costs, the different cost drivers and responsibility centers must be identified and separate reportings made. Participative budgeting is necessary for effective control and evaluation. This means that instead of using a regression equation, each responsibility center should budget its own overhead cost pool costs.
- *Problems with all three methods:*
  How representative is the sample of the true overhead activity or process being budgeted?
  - During the data collection period, the process or activity from which the data are collected should not undergo significant changes. For example, a change in a maintenance activity from a primarily manual process to a machine-intensive process would lead to two sets of fundamentally different observations.

    As manufacturers modernize production processes, significant changes in labor and automation result. The radical changes in processes destroy the validity of past data to predict future costs. This is perhaps the most serious problem with statistical analysis techniques applied to historical costs from heterogeneous activities such as those comprising overhead.
  - If data are drawn from more than one activity, the underlying characteristics of the different activities must be the same. For example, if some maintenance costs are incurred in a U-shaped manufacturing cell with cross-trained workers, and some from a sequential, department-based manufacturing process with no cross training of workers, sample data from the two activities will probably give substantially different results.
  - A sufficient number of observations are necessary. The observations used to develop the cost equation should be within the relevant range for the period being budgeted. Using observations outside the relevant range may result in inaccurate parameters.

Let's Talk

The text purposefully underplays statistical problems such as heteroscedasticity, serial correlation, and multicollinearity (see footnote 15 in the chapter). A number of students have not yet completed a regression course before enrolling in a cost accounting course. Detailed discussions often "go over their heads" and cause unnecessary confusion. Student attention should be focused on the most important ideas at this stage of learning.

When they refer back to the text in real-world budgeting situations, they will be reminded to investigate the potential for these problems. Statistical software (or their statistics texts) will provide the detailed information they need.

- *Why are these methods used?*
  Historically, in some traditional enterprises, the management accountant was expected to identify a basis for budgeting and allocating overhead, and to prepare the overhead standards independent from production personnel. Historically, financial accounting systems dominated the attention of accountants. In these systems, direct materials, direct labor, and total overhead were separately accounted for, but variable and fixed overhead did not need to be differentiated. To satisfy external reporting requirements, the primary goal became to select a base that resulted in a reasonable allocation of overhead. Many times a simple base to measure, such as direct labor hours, was chosen. As long as all the overhead was allocated in some systematic fashion to all the products, then GAAP was satisfied. The concern was for overhead cost prediction, not cost control.

- *Overcoming these problems:*
  The modern management accountant is a member of a team, getting out of the office and onto the shop floor to obtain the information necessary from the people who know. Understanding the real overhead activities is a prerequisite for accurate budgeting, efficient control, and effective performance evaluation. Shop floor personnel can be expected to know the activities that cause variable and fixed overhead. With the help of the management accountant, engineers, and others, standard prices (PORs) and standard quantities can be estimated. This can be done through direct observation and/or special engineering studies by the team. A high quality SCAS will have multiple variable and fixed overhead accounts, one for each cost pool with a unique cost driver. Designing such an overhead accounting system is the topic of Chapters 9 and 10.

7.73 • *Process systems:*
SCASs are applicable to mass production environments because the process is usually fairly stable with many routinized operations. The processes are well understood and consensus in establishing standards is relatively easy.

- *Job order processes:*
SCASs are becoming more frequent in these processes as manufacturing firms seek to standardize subassembly operations for better quality control and efficiency. With increased competition both locally and globally, the importance of budgeting specific job costs is also increasing. The budgeting process provides standards necessary for price setting and job profitability analysis. For example, in construction, standards can be as specific as separate prices and quantities for each type of direct equipment cost element. Standards are also set for subcontracted activities such as site grading, paving, landscaping, and the like. This was illustrated in Chapter 5 (see, for example, Exhibits 5-21 and 5-22).
- *Non-manufacturing enterprises:*
  - Increased competition in profit-oriented service firms is leading to the use of standards in bidding, controlling, and evaluating specific jobs. Legal, engineering, and CPA firms often develop standard labor rates (and charges) and quantities for various types of labor (research time, travel time, consulting time, audit hours, and the like).
  - Better control over the activities involved in non-profit service firms is increasing in importance as sources of funds are reduced due to governmental budget constraints. For example, activity-based costing is becoming more frequent in hospitals and governmental services. In direct response to the budgeting crises, activity-based standard costs are being developed by some governmental agencies to determine billing rates to charge the funding organizations.

7.74 a. Factors affecting the level of participation:

- *Employee motivation:*
The more employees are involved in the operations of the enterprise, the greater their motivation to participate. This has been evidenced in a number of JIT conversions in which methods, such as the "single minute exchange of die" and the delphi technique, have been used to increase participation in identifying and eliminating nonvalue-added activities. These methods develop a sense of team membership, responsibility, and control (empowerment).
- *Management style:*
The motivation to participate depends on the type of participation management allows. At the western plant, it appears that worker input was solicited, but the final standards delivered by management were different than expected by the workers. The workers believed that the management style was more autocratic than participative. The western plant workers should have been provided with an explanation of why the standards were different (management feedback).

- *Organizational culture:*
  Employee perceptions build up over time. If they continue to feel that standards are imposed, these negative reactions will quickly lead to a culture of nonparticipation which will be transferred to new workers. Culture is often, in part, a result of the management style. In other words, it is the workers' response to their perceptions of management's commitment to them. Management style and the culture developed by employees creates a synergistic effect on the motivation to participate.
- *Employee empowerment:*
  The employees' level of perceived control over the process, whether it is setting standards or *jidoka*, will influence their desire to participate. At the western plant, employees did not feel they had any control over the final standards. Conversely, the southern plant workers were highly motivated due to the reality of their production process control.
- *Reward system:*
  Employees must feel that they will be rewarded adequately for performing activities that the firm desires (goal congruence). A good example is the reward systems being established in many world-class manufacturers for quality improvement suggestions.
- *The SCAS:*
  Through its provision of standards, input coding activities required for operational control, and its use in performance evaluation, the SCAS significantly influences participation motivation. Employees must internalize the SCAS, feeling that it is part of *their* control system. Having workers set their standards, empowering them to control their activities, requiring them to input control information (such as the sources and causes of cost variances) and communicate that information across functional boundaries, and providing them with real time feedback, all add to the perception that they "own the SCAS."

b. Western plant SCAS:
   - If the plant is so large that employees cannot participate in each step of the standard setting process, employee teams should be created to participate with management throughout the planning process. Ground rules for all employees to use can be established and communicated by the team members to others throughout the plant. The team can act as a liaison approving each step of the process before management can move to the next step.
   - Building on the previous point, individual workers and the team members must be allowed enough time away from their workstations to communicate and coordinate their ideas.
   - Management can seek feedback such as having employees identify the incompatible demands implicit in the standards. If the western plant management believes some of the new organizational behavior research stating that employees will often set higher standards for themselves than their bosses do, and achieve these goals more often, the planning process should begin with the workers submitting standards.
   - Revise standards frequently to levels employees believe to be tight but attainable.

- The employees should have a final approval right over the standards. If they receive imposed standards from management without the proper explanations (management feedback), they have the right to employ *jidoka* to the standard setting process.

c. Southern plant and *jidoka*:
Not much information is available from the problem's narrative for this answer and it requires a number of assumptions.
- One obvious benefit, though, is that increased controllability (empowerment) led to an increased motivation to be involved in all aspects of the operations (including, we assume, standard setting).
- *Jidoka* motivates all workers and management to engineer a high quality product and process, as well as to control operations and avoid shutting down the line.
- Usually as part of the reengineering process, a number of safety features are incorporated into the process. This alone can lead to a perception by the employees that management thinks they are important.
- Because of the many changes that probably were made, workers became accustomed to change. As standards change, less resistance results.

d. Quality circles at the northern plant:
- Routine and uninteresting jobs have led to a lack of commitment, a high turnover rate, and excessive absenteeism. The creation of quality circles is one type of job enlargement. By assuming more tasks and rotating between them making one product from start to finish, worker tasks throughout the day will vary enough to overcome the boredom they are currently experiencing.
- Quality circles should increase the employees' perception of ownership over the process. They control it from start to finish. This should also increase their motivations to continuously improve the process.
- Simply by jointly working with management in the analysis and redesign of the production process, workers should feel that management believes they are important.

7.75 a(1). There are five criteria for the design of an SCAS:
- *The planning criterion: participative budgeting* — First, it must communicate the organization's objectives and goals to its employees, allowing them to participate in setting their own goals consistent with the company's.
- *The operational control criterion: decision usefulness* — Second, it should provide timely, relevant information so that managers can make the best individual and group decisions possible on a day-to-day basis. In other words, it is a high quality information system.

- *The short-run performance evaluation criterion: management-by-exception* — Third, it should evaluate performance by comparing planned outcomes against actual results.
- *The long-run performance evaluation criterion: continuous improvement* — Fourth, it should evaluate long-run improvement in standards over time.
- *The performance evaluation criterion: controllability* — However, fifth, the responsibility accounting system also should distinguish (for proper performance evaluation) those activities over which a worker, manager, or JIT cell team, has been given control.

a(2). Implementing the SCAS for employee motivation:

- *Organizational control* requires that people in the organization be properly motivated to take actions that will lead to the firm's goals.
- *Motivation* requires knowing what organizational members want, and providing a reward system to give it to them. The motivation to control operations comes from employees knowing that they will receive acceptable rewards for making goal congruent decisions. This is the role of the reward system.
- The *reward system* requires an evaluation system.
- The *evaluation system* requires organizational goals to use as benchmarks in measuring performance. To successfully motivate employees to accept the organization's goals as their own, the budgeting process must communicate the firm's goals and allow the employees to participate in setting the standards used in their performance evaluations.
- *Performance measurement* requires the assignment of responsibilities. Responsibility for activities must start during the standard setting stage. It is unlikely that positive motivations will result if employees are held responsible for certain activities but not responsible for budgeting (planning) how the activities should be performed.
- *Responsibility* requires controllability over the factors measured and evaluated.
- *Controllability* requires the ability to influence both the standards which represent the goals to be accomplished, as well as actual events (decisions) related to those goals. The accounting system must also evaluate performance in a way that is acceptable to the people being evaluated. The motivation to control operations comes from employees accepting the legitimacy of the planning and evaluation components of the responsibility accounting system, which they see as linked to an adequate reward system.

b(1). Management-by-exception involves the reporting of problems to those in the enterprise who are responsible for identifying, correcting, and preventing them. The financial effects of production problems are called cost variances. Thus, management-by-exception is implemented through an SCAS.

b(2). Behavioral implications:

- When cost variance information is reported in real time to the shop floor, workers can see the results of their production and control activities. This concurrent feedback allows workers to identify and correct certain types of production problems with minimum disruption to the process.
- By focusing management attention on current problems, their efficiency and effectiveness is increased.
- If, contrarily, cost variance information is not provided in a timely fashion, the underlying causes (production problems) are less likely to be identified. Buck passing, information falsification, and infighting can result in attempting to assign responsibility after-the-fact. This is discussed further in part c.
- Concurrent feedback is not sufficient to assure goal congruent behaviors, though. Workers need to input the sources and causes of production problems and whether they have been corrected. Cost variances often result from corrective actions. These need to be identified through SCAS input coding activities for total quality management (TQM) and continuous improvement.
- If the source of a cost variance is in another department or production cell, those workers need to be concurrently notified. To properly assign responsibility, correct the problem, and prevent it from re-occurring, workers in these other departments need to be aware of the problem as soon as possible. By using a visual factory control system, this type of information can be displayed in real time on various production LAN workstation terminals.

c. Negative behaviors:

- Employees must participate in setting the standards used to evaluate their performance. If standards are imposed, and not accepted as legitimate, intended control actions may not result.
- A "pounds in the bucket" mentality has often resulted from the inappropriate use of cost variances in performance evaluation. For example, a welding department is given three goals: hit the production quota, and don't incur an unfavorable direct materials or direct labor usage variance. By producing as fast as possible, not using an adequate amount of materials, and not inspecting their work, the welders can achieve these goals.
- If welded components go into a large WIP inventory, any problems may not be discovered until a much later time, and in a subsequent department like assembly. Assembly workers, to avoid unfavorable labor variances and missed production quotas, will scrap the parts. Problem identification, correction, and prevention through TQM activities will not result.
- Friction between assembly workers and welders will increase over time as welders cause problems for assembly but get rewarded while assembly does not.
- Over time, management can begin to accept scrap rates and build them into the standards.
- Through participative budgeting, standards may become too loose as workers and managers seek to avoid unfavorable variances and performance evaluations.

- Assembly workers will appeal cost variances to management claiming that they should not be responsible for shoddy welding. Management will have to investigate, often disrupting operations in the attempt to determine the causes of problems that occurred up to a month (or more) ago. Welders will claim that they cannot remember what might have caused these problems in previous periods. The determination of the real causes, and the proper assignment of responsibility may not result.
- Production foremen, knowing that they will have to explain cost variances at a later date (untimely cost variance reports from traditionally designed SCASs that do not capture source-cause information), start to keep notes about problems. In one research study, managers falsified their own notes so that they could "pass the buck" and avoid unfavorable performance evaluations.

7.76 a(1). Advantages of an SCAS:

- *Budgeting:*
  - Setting standards requires group decision making, communication, and coordination, between management and workers, and between workers in different departments. This can build a feeling of team membership and assure that organizational goals are captured within the standards.
  - Focusing on individual prices and quantities helps to organize and control the budgeting process.
  - Accurate standards reflecting current operating conditions can facilitate estimating new product costs and methods changes. This will be especially important to Mark-Wright management if expansion is to continue.
- *Operational control:*
  - Standards allow employees to understand more clearly what is expected of them. In this way, standards serve an educational role nurturing cost consciousness.
  - The reasons for deviations from standard can be input into the SCAS if workers are required to input the sources and causes of cost variances as they happen. A history of problems, corrective actions, and their costs can provide information needed for TQM and reengineering activities as part of an activity-based management (ABM) system (Chapter 11 covers ABM and Chapter 12 presents TQM).
  - By requiring input coding activities concerning the sources and causes of cost variances, communication and coordination is promoted as management attention is focused on interdepartmental cause-effect chains.
- *Performance evaluation:*
  - Standards provide benchmarks for evaluating whether the organization's goals are being accomplished.
  - In short-run performance evaluation, deviations from practical standards signal abnormal operating conditions that should be investigated if they have not been already corrected.
  - In long-run evaluation, the difference between ideal and current (practical) standards measures the "room for improvement." Continuous improvement is evidenced by this difference decreasing over time.
  - Standards and variances also lead to a better understanding of cost relationships and product profitability for future planning decisions.

a(2). Disadvantages of an SCAS:

- *Budgeting:*
  - Budgeting is a time-consuming process, especially when group planning activities are involved. Setting detailed standards for each cost element requires accurate measurements of raw materials, labor, machinery, and incidental costs, which can become a costly and tedious process.
  - Mark-Wright management should expect substantial implementation costs in converting to an SCAS.
  - An emphasis on short-run operating standards may not allow proper attention to the long-run continuous improvement goals captured in ideal standards. In standard setting, attention to long-run goals, as well as short-run goals, requires a management "balancing act."
- *Operational control:*
  - Standards that are too tight may not motivate proper daily operational control actions.
  - Standards that are too loose may not motivate employees to improve.
  - Inputting deviations from standards, and their sources and causes, requires an additional investment in computerized control systems so that this detailed information can be concurrently communicated to other departments (feedforward and feedback). The use of workstation terminals requires additional time and expenditures for proper worker training.
- *Performance evaluation:*
  - Traditional SCAS designs have not required information about the sources and causes of cost variances, much less capturing this information in real time. This lack of attention to the SCAS's role in operational control often has led to a short-run focus on within department cost variance minimization. Interdepartmental cause-effect chains have not been considered, and a way to identify them designed into the SCAS.
  - Too heavy of an emphasis on cost variance minimization and within department reporting often has resulted in pressures to take cost-cutting steps contrary to the long-run objectives of the enterprise. The consulting firm has indicated a need for cost cutting at Mark-Wright. This may be implemented through the use of ideal standards.
  - Performance evaluation has not been based on standards. Some worker discomfort should be expected if an SCAS is implemented. Using ideal standards to achieve cost reductions during the initial implementation of an SCAS may result in worker rejection of the control and evaluation system. Thus, the motivation for quality control, which is critically important at Mark-Wright, may decrease.

b(1). Who should participate in setting standards?

- Management needs to be involved to assure that the standards embody organizational goals, both short run and long run. Managers can provide the communication and coordination across functional boundaries necessary for global quality control.
- The workers who will be evaluated by the standards also need to be involved. Participative budgeting is necessary to assure that all the production and control tasks are included in the standard quantities, and that employees understand what is expected. Participation can identify any gaps in worker training and knowledge required for proper operational control. Through participation, workers are more likely to internalize the standards.
- Support personnel possessing needed information also should be involved in standard setting. For example, human resource management personnel possess information about labor rates, payroll taxes, and fringe benefits. Property management personnel possess information about the costs of many fixed overhead costs. Management accountants can access the cost accounting system's database for relevant information, and can format and present this information in usable ways.

b(2). Characteristics of an effective SCAS:

- Participative budgeting involves all the people who possess the knowledge and skills to set appropriate and accurate standards, and assure that their accomplishment will lead to the goals of the organization. Participation by workers will help to establish the legitimacy of the standards when used in performance evaluation.
- Detailed information about the standards, presented in usable forms, should be available to the shop floor in real time. This information includes standard prices and quantities for the individual cost elements and tasks workers must control on a daily basis. Normal scrap rates, control activities and allowed time for them, and freight costs for direct materials, are examples of the detailed information needed to control these costs.
- As deviations from standards occur, workers should input the sources and causes into the SCAS via workstation terminals. This information promotes concurrent control and problem identification. It also provides a history of cause-effect linkages for continuous improvement and TQM programs.
- In reporting cost variances for performance evaluation, the SCAS should report the total costs of the underlying causes across departments. Reporting a summary direct materials usage variance for the month for each department does not facilitate identification of production problems and whether they have been corrected.
- The SCAS should report both short-run and long-run productivity measurements. For example, the difference between the ideal standard and the current year's standard is the continuous improvement goal. The change in standards from last year to this year is this year's improvement goal. Aggregated standards and variances across departments, including engineering, production, sales, and service, can provide information for total costs of quality reporting (Chapter 12).

c. Imposing standards can inhibit the accomplishment of Mark-Wright's objectives.
   - The consulting firm has reported that costs need to be reduced. Often this takes the form of across-the-board cost cutting without proper regard to the changes necessary for expansion. Further, Jane Morgan, Stan Walters, and Tom Lopez have stressed the increased importance of quality control if expansion is to continue. The communication and coordination necessary may not result if an outside consulting firm sets the standards.
   - If the consulting firm sets the standards, cost elements may be included that are not controllable by those being evaluated. This can degrade their perceived legitimacy, thwarting Mark-Wright's goals.
   - The consulting firm may not gain the necessary understanding of production and control processes. This may result in inappropriate standards and bad management information adversely affecting future decisions.
   - The problem does not provide any indication that these people cannot effectively work together in setting standards. If frictions exist, though, the use of an outside consulting firm may be necessary to provide communication and coordination. Imposed standards may not be accepted as valid by the Mark-Wright employees unless the consulting firm involves everyone intimately throughout the process. The consulting firm will have to play a facilitating role, allowing the employees to actually set and modify standards until consensus across departments and with upper management results.

7.77 a. The standard cost card is presented on the next page.

b. The following ethical standards were violated by Joe Adams:
   - *Competence* — Relevant and reliable information should be reported. Joe did not report the $0.50 per quart current price for strawberries.
   - *Objectivity* — Joe biased the information reported to Doug Gilbert by overstating the current cost of strawberries.
   - *Integrity* — Joe is attempting to help his friend at the expense of Quincy Farms. This adversely affects the attainment of Quincy Farms' objectives. His personal integrity has been degraded, and he has discredited the management accounting profession.

PROBLEM 7.77

DATA SECTION: STANDARD COSTS

Manufacturing Inputs	Price	Output qty.	Loss%	
Strawberries	$0.80	6.00	20.00%	(1 of 5 quarts)
Other ingredients	$0.45	10.00	0.00%	
Sorting Labor	$9.00	0.30	0.00%	(3 minutes
Blending labor	$9.00	0.20	0.00%	x 6 quarts)
Packaging	$0.38	40.00	0.00%	(40 qts/batch)

SOLUTION SECTION: STANDARD COST CARD

Quincy Farms
10 gallon batch of Strawberry Jam
STANDARD COST CARD

MANUFACTURING INPUTS	STD. PRICES	STANDARD QUANTITIES	STANDARD COSTS
Strawberries	$0.80 /quart	7.50 quarts/batch	$6.00 /batch
Other ingredients	$0.45 /gallon	10.00 gallons/batch	$4.50 /batch
Sorting Labor	$9.00 /DLhr	0.30 DLhr/batch	$2.70 /batch
Blending labor	$9.00 /DLhr	0.20 DLhr/batch	$1.80 /batch
Packaging	$0.38 /quart	40.00 quarts/batch	$15.20 /batch
PARTIAL STANDARD MANUFACTURING COST			$30.20 /batch

STANDARD QUANTITY CALCULATIONS:

		Strawberries
Output specification / (1 - Loss%)	= 6.00 / 0.80 =	7.50

7.78 a. Budgeted number of workers:

Total workers needed per day = 5.062 + (0.023 per shipment x 1,200 shipments)

= 33 workers per day (always round up)

If 10 permanent workers are available, 23 temporary workers should be hired.

b. Regression 2 appears more appropriate for the following reasons:
- Regression 1 includes all weeks for the past year. The weeks when only 10 permanent workers were used is outside the relevant range. Regression 2 excluded these nonrepresentative weeks.
- The coefficient of determination for Regression 2 is slightly higher than Regression 1. This indicates that Regression 2 more accurately predicts the total number of workers needed when daily orders exceed 300.
- The standard error of the estimate for Regression 2 is less than Regression 1 indicating that Regression 2 represents the observations better (i.e., there is less dispersion between the predicted and actual values).

c. Conditions for use of regression analysis:
- 300 or more shipments are forecast for a day.
- The shipping activities are stable with respect to the amount of work required. For example, the number, size, and weight of books shipped is stable across orders.
- Worker productivity is fairly constant. Supervisors, permanent workers, and temporary workers all perform the same quantity and quality of work across orders.
- The work environment is stable over time. For example, extreme weather condition changes do not occur or affect performance.

d. The regression equation might be improved by:
- Removing the supervisor hours from the data. The need for temporary workers only occurs when shipments are greater than 300 per day. At this volume, supervisors do not load shipments.
- Changing the predictor (independent) variable from number of workers to total worker hours required.
- Identifying special situations, such as rush orders, and building a separate equation for them.
- Adding current data as it become available and recalculating the regression equation.
- Regression 2 already yields an extremely high coefficient of determination and an extremely low standard error of the estimate. Improving on its predictive ability may not result from any of the above suggestions.

7.79 A spreadsheet program was used to create the solutions to Problems 7.56 and 7.57 presented in this manual. This same program was expanded to provide the cost variance report demonstrated in Exhibits 8-11 and 8-12.

Let's Talk

West Publishing has a spreadsheet workbook and templates available for your, and your students, use. If you have specific questions, comments, or suggestions, or we can help in any way, please contact Mike Thomas at (702) 784-6699 (FAX: (702) 784-1769).