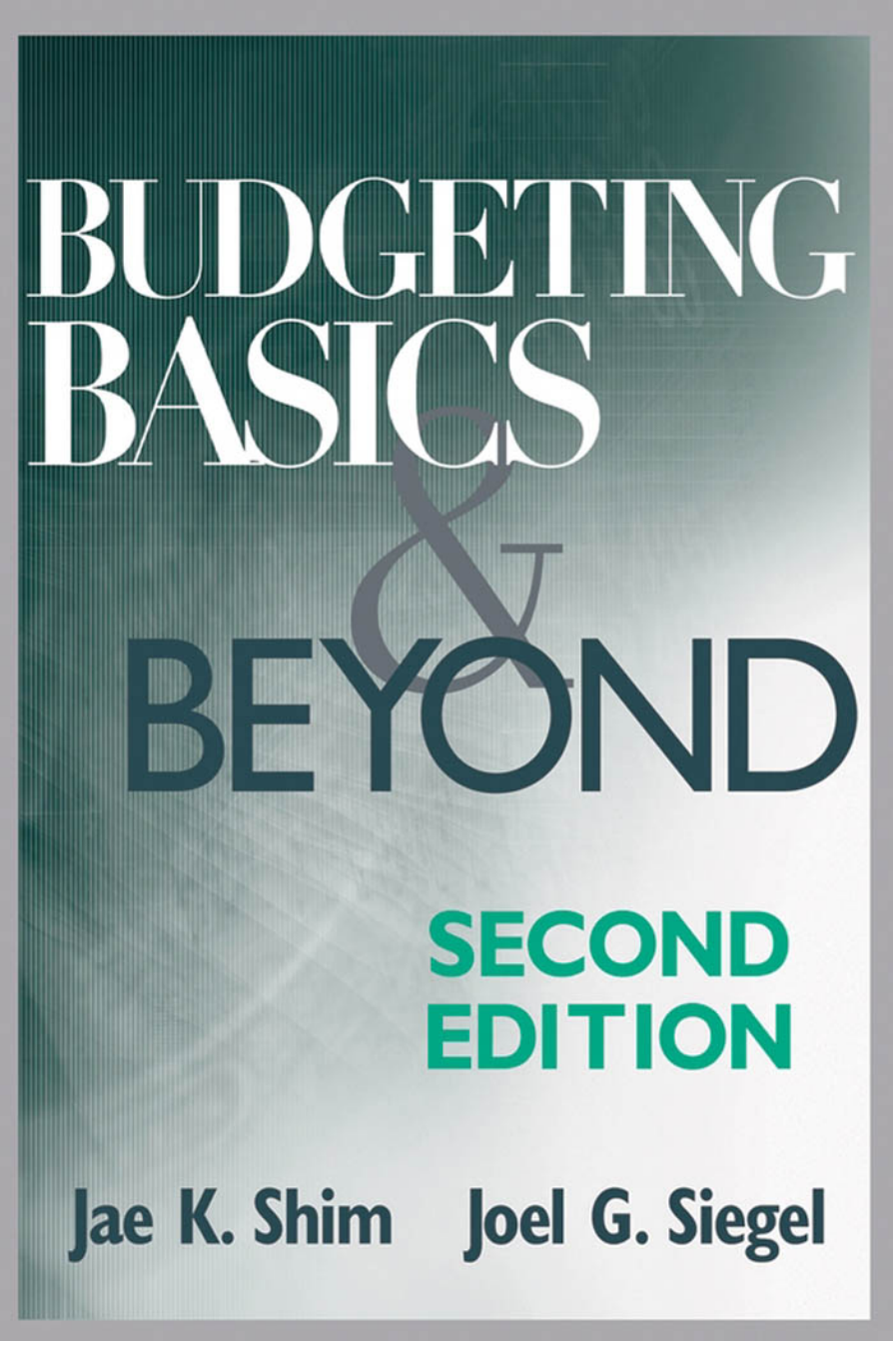

Budgeting Basics and Beyond

SECOND EDITION

Jae K. Shim
Joel G. Siegel

John Wiley & Sons, Inc.

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This book is printed on acid-free paper. ♾

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Preface

Better budgets can boost your department and your career to higher levels of performance and success. Savvy executives use the budgeting process to take stock of their direction, refine their goals, and share their mission with their staff. Their budgeting reveals their position in the market, places untapped resources at their command, and motivates all employees to greater levels of productivity. They use their budgets to propel them towards the top of their industry. This book will show you how to get there.

Budgeting Basics and Beyond shows you how the budget can be your most powerful tool for strategy and communications. It points out that the budget brings into stark relief all of the factors that every manager must consider, such as industry conditions, competition, degree of risk, stability of operations, capacity limitations, pricing policies, turnover rates in assets, production conditions, product line and service considerations, inventory balances and condition, trends in the marketplace, number of employees and their technical abilities, availability and cost of raw materials, available physical resources, technological considerations, economy, and political aspects. Then it uncovers the role each of those factors plays in achieving your corporate goals. And since those goals cannot be achieved single-handedly, this book suggests ways to use the budget to help each employee appreciate how they will contribute to the division's profitability.

Aside from playing a vital role in creating and achieving a sound business strategy, this book shows how budgets can increase your effectiveness every day of the week. In particular, it delivers these on-the-job budgeting tools:

- Techniques for preparing more accurate, realistic, and reliable estimates
- Control and variance analysis devices that signal revenue, cost, and operations thresholds
- Pricing guidelines for products and services
- Planning and scheduling production and related costs
- Profit planning and identifying looming problems
- Financial models that show the relationship among all facets of the business
- Spreadsheet applications for planning, budgeting, and control purposes

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About the Authors

JAE K. SHIM is president of the National Business Review Foundation, a financial consulting firm, and professor of accounting and finance at California State University, Long Beach. He received his Ph.D. degree from the University of California at Berkeley (Hans School of Business).

Dr. Shim has 50 books to his credit and has published over 50 articles in accounting and financial journals including *Financial Management, Decision Sciences, Management Science, Long Range Planning, and Management According*. Many of his articles have dealt with planning, forecasting, and financial modeling.

Dr. Shim received the 1982 Credit Research Foundation Award for his article on financial management.

JOEL G. SIEGEL, Ph.D., CPA, is a self-employed management consultant and professor of accounting and finance at Queens College of the City University of New York.

He was previously associated with Coopers and Lybrand, CPAs, and Arthur Andersen, CPAs. Dr. Siegel currently serves and has acted as a consultant to many companies including Citicorp, International Telephone and Telegraph, and United Technologies.

Dr. Siegel is the author of 50 books and approximately 200 articles on business topics including many articles in the area of budgeting. His books have been published by Prentice-Hall, McGraw-Hill, HarperCollins, John Wiley, Macmillan, Probus, International Publishing, Barron's, and the American Institute of CPAs.

His articles have appeared in many business journals including *Financial Executive, Financial Analysts Journal,* and *The CPA Journal*.

In 1972, he was the recipient of the Outstanding Educator of America Award. Dr. Siegel is listed in *Who's Where Among Writers* and *Who's Who in the World*.

Dr. Siegel is currently the chairperson of the National Oversight Board.

- Implication of active financial planning software
- Sales and financial forecasting methodology

We follow the example of each of these tools with examples of how you can use them to make a difference in your work right away. And we use step-by-step guidelines to pinpoint what to look for, what to watch for, what to do, how to do it, and how to apply it on the job. Through step-by-step illustration, we show how you can put these tools to use.

We hope that you will keep *Budgeting Basics and Beyond* handy for easy, quick reference and daily use.

1

The What and Why of Budgeting:
An Introduction

A budget is defined as the formal expression of plans, goals, and objectives of management that covers all aspects of operations for a designated time period. The budget is a tool providing targets and direction. Budgets provide control over the immediate environment, help to master the financial aspects of the job and department, and solve problems *before* they occur. Budgets focus on the importance of evaluating alternative actions before decisions actually are implemented.

A budget is a financial plan to control *future* operations and results. It is expressed in numbers, such as dollars, units, pounds, hours, manpower, and so on. It is needed to operate effectively and efficiently. Budgeting, when used effectively, is a technique resulting in systematic, productive management. Budgeting facilitates control and communication and also provides motivation to employees.

Budgeting allocates funds to achieve desired outcomes. A budget may span any period of time. It may be short term (one year or less, which is usually the case), intermediate term (two to three years), or long term (three years or more). Short-term budgets provide greater detail and specifics. Intermediate budgets examine the projects the company currently is undertaking and start the programs necessary to achieve long-term objectives. Long-term plans are very broad and may be translated into short-term plans. The budget period varies according to its objectives, use, and the dependability of the data used to prepare it. The budget period is contingent on business risk, sales and operating stability, production methods, and length of the processing cycle.

There is a definite relationship between long-range planning and short-term business plans. The ability to meet near-term budget goals will move the business in the direction of accomplishing long-term objectives. Budgeting is done for the company as a whole, as well as for its component segments including divisions, departments, products, projects, services, manpower, and geographic areas. Budgets

aid decision making, measurement, and coordination of the efforts of the various groups within the entity. Budgets highlight the interaction of each business segment to the whole organization. For example, budgets are prepared for units within a department, such as product lines; for the department itself; for the division, which consists of a number of departments; and for the company.

Master (comprehensive) budgeting is a complete expression of the planning operations of the company for a specific period. It is involved with both manufacturing and nonmanufacturing activities. Budgets should set priorities within the organization. They may be in the form of a plan, project, or strategy. Budgets consider external factors, such as market trends, economic conditions, and the like. The budget should list assumptions, targeted objectives, and agenda before number crunching begins.

The first step in creating a budget is to determine the overall or strategic goals and strategies of the business, which are then translated into specific long-term goals, annual budgets, and operating plans. Corporate goals include earnings growth, cost minimization, sales, production volume, return on investment, and product or service quality. The budget requires the analysis and study of historical information, current trends, and industry norms. Budgets may be prepared of expected revenue, costs, profits, cash flow, production purchases, net worth, and so on. Budgets should be prepared for all major areas of the business.

The techniques and details of preparing, reviewing, and approving budgets varies among companies. The process should be tailored to each entity's individual needs. Five important areas in budgeting are planning, coordinating, directing, analyzing, and controlling. The longer the budgeting period, the less reliable are the estimates.

Budgets link the nonfinancial plans and controls that constitute daily managerial operations with the corresponding plans and controls designed to accomplish satisfactory earnings and financial position.

Effective budgeting requires the existence of:

- Predictive ability
- Clear channels of communication, authority, and responsibility
- Accounting-generated accurate, reliable, and timely information
- Compatibility and understandability of information
- Support at all levels of the organization: upper, middle, and lower

The budget should be reviewed by a group so that there is a broad knowledge base. Budget figures should be honest to ensure trust between the parties. At the corporate level, the budget examines sales and production to estimate corporate earnings and cash flow. At the department level, the budget examines the effect of work output on costs. A departmental budget shows resources available, when and how they will be used, and expected accomplishments.

Budgets are useful tools in allocating resources (e.g., machinery, employees), making staff changes, scheduling production, and operating the business. Budgets

help keep expenditures within defined limits. Consideration should be given to alternative methods of operations.

Budgets are by departments and responsibility centers. They should reflect the goals and objectives of each department through all levels of the organization. Budgeting aids all departmental areas including management, marketing, personnel, engineering, production, distribution, and facilities.

In budgeting, consideration should be given to the company's manpower and production scheduling, labor relations, pricing, resources, new product introduction and development, raw material cycles, technological trends, inventory levels, turnover rate, product or service obsolescence, reliability of input data, stability of market or industry, seasonality, financing needs, and marketing and advertising. Consideration should also be given to the economy, politics, competition, changing consumer base and taste, and market share.

Budgets should be understandable and attainable. Flexibility and innovation is needed to allow for unexpected contingencies. Flexibility is aided by variable budgets, supplemental budgets, authorized variances, and review and revision. Budgets should be computerized to aid "what-if" analysis. Budgeting enhances flexibility through the planning process because alternative courses of action are considered in advance rather than forcing less-informed decisions to be made on the spot. As one factor changes, other factors within the budget will also change. Internal factors are controllable by the company whereas external factors usually cannot be controlled. Internal factors include risk and product innovation.

Forecasting is *predicting* the outcome of events. It is an essential starting point for budgeting. Budgeting is *planning* for a result and controlling to accomplish that result. Budgeting is a tool, and its success depends on the effectiveness to which it is used by staff. In a recessionary environment, proper budgeting can increase the survival rate. A company may fail from sloppy or incomplete budgeting. Exhibit 1.1 shows a graphic depiction of budget segments.

We now consider planning, types of budgets, the budgetary process, budget coordination, departmental budgeting, comparing actual to budgeted figures, budget revision and weaknesses, control and audit, participative budgeting, and the pros and the cons of budgets.

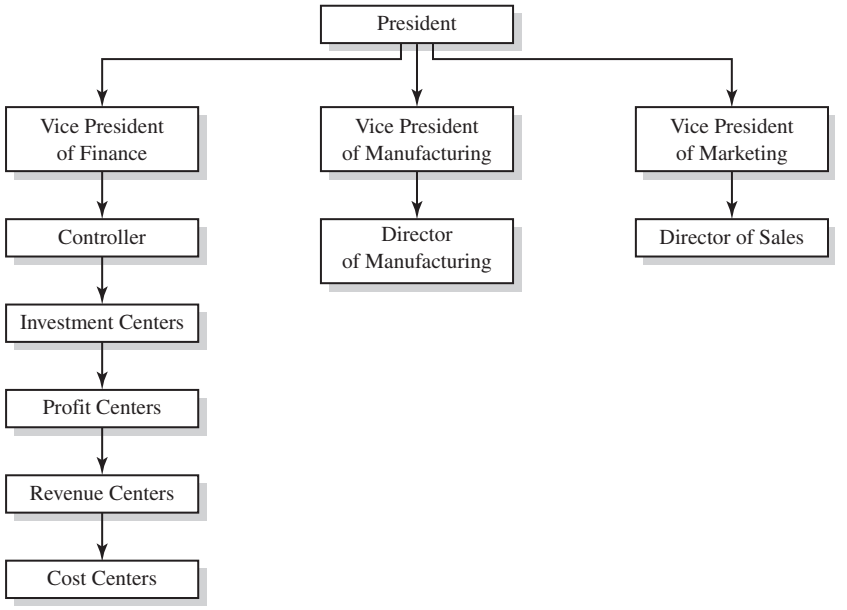
Planning

Budgeting is a planning and control system. It communicates to all members of the organization what is expected of them. Planning is determining the activities to be accomplished to achieve objectives and goals. Planning is needed so that a company can operate its departments and segments successfully. It looks at what should be done, how it should be done, when it should be done, and by whom. Planning involves the determination of objectives, evaluating alternative courses of action, and authorization to select programs. There should be a good interface of segments within the organization.

Budgets are blueprints for projected action and a formalization of the planning process. Plans are expressed in quantitative and monetary terms. Planning is taking

Exhibit 1.1

Budget Segments



an action based on investigation, analysis, and research. Potential problems are searched out. Budgeting induces planning in each phase of the company's operation.

A profit plan is what a company expects to follow to attain a profit goal. Managers should be discouraged from spending their entire budget. Managers should be given credit for cost savings.

Budget planning meetings should be held routinely to discuss such topics as the number of staff needed, objectives, resources, and time schedules. There should be clear communication of how the numbers are established and why, what assumptions were made, and what the objectives are.

Types of Budgets

It is necessary to be familiar with the various types of budgets to understand the whole picture and how these budgets interrelate. The types of budgets include master, operating (for income statement items comprised of revenue and expenses), financial (for balance sheet items), cash, static (fixed), flexible, capital expenditure (facilities), and program (appropriations for specific activities such as research and development, and advertising). These budgets are briefly explained below.

Master Budget

A master budget is an overall financial and operating plan for a forthcoming calendar or fiscal year. It is usually prepared annually or quarterly. The master budget is really a number of subbudgets tied together to summarize the planned activities of the business. The format of the master budget depends on the size and nature of the business.

Operating and Financial Budgets

The operating budget deals with the costs for merchandise or services produced. The financial budget examines the expected assets, liabilities, and stockholders' equity of the business. It is needed to see the company's financial health.

Cash Budget

The cash budget is for cash planning and control. It presents expected cash inflow and outflow for a designated time period. The cash budget helps management keep cash balances in reasonable relationship to its needs and aids in avoiding idle cash and possible cash shortages. The cash budget typically consists of four major sections:

1. Receipts section, which is the beginning cash balance, cash collections from customers, and other receipts
2. Disbursement section, comprised of all cash payments made by purpose
3. Cash surplus or deficit section, showing the difference between cash receipts and cash payments
4. Financing section, providing a detailed account of the borrowings and repayments expected during the period

Static (Fixed) Budget

The static (fixed) budget is budgeted figures at the expected capacity level. Allowances are set forth for specific purposes with monetary limitations. It is used when a company is relatively stable. Stability usually refers to sales. The problem with a static budget is that it lacks the flexibility to adjust to unpredictable changes.

In industry, fixed budgets are appropriate for those departments whose workload does not have a direct current relationship to sales, production, or some other volume determinant related to the department's operations. The work of the departments is determined by management decision rather than by sales volume. Most administrative, general marketing, and even manufacturing management departments are in this category. Fixed appropriations for specific projects or programs not necessarily completed in the fiscal period also become fixed budgets to

the extent that they will be expended during the year. Examples are appropriations for capital expenditures, major repair projects, and specific advertising or promotional programs.

Flexible (Expense) Budget

The flexible (expense) budget is most commonly used by companies. It allows for variability in the business and for unexpected changes. It is dynamic in nature rather than static. Flexible budgets adjust budget allowances to the actual activity. Flexible budgets are effective when volumes vary within a relative narrow range. They are easy to prepare with computerized spreadsheets such as Excel.

The four basic steps in preparing a flexible (expense) budget are:

1. Determine the relevant range over which activity is expected to fluctuate during the coming period.
2. Analyze costs that will be incurred over the relevant range in terms of determining cost behavior patterns (variable, fixed, or mixed).
3. Separate costs by behavior, determining the formula for variable and mixed costs.
4. Using the formula for the variable portion of the costs, prepare a budget showing what costs will be incurred at various points throughout the relevant range.

Due to uncertainties inherent in planning, three forecasts may be projected: one at an optimistic level, one at a pessimistic or extremely conservative level, and one at a balanced, in-between level.

Capital Expenditure Budget

The capital expenditure budget is a listing of important long-term projects to be undertaken and capital (fixed assets such as plant and equipment) to be acquired. The estimated cost of the project and the timing of the capital expenditures are enumerated along with how the capital assets are to be financed. The budgeting period is typically for 3 to 10 years. A capital projects committee, which is typically separate from the budget committee, may be created solely for capital budgeting purpose.

The capital expenditures budget often classifies individual projects by objective, as for

- Expansion and enhancement of existing product lines
- Cost reduction and replacement
- Development of new products
- Health and safety expenditures

The lack of funds may prevent attractive potential projects from being approved.

An approval of a capital project typically means approval of the project in principle. However, final approval is not automatic. To obtain final approval, a special authorization request is prepared for the project, spelling out the proposal in more detail. The authorization requests may be approved at various managerial levels depending on their nature and dollar magnitude.

Program Budget

Programming is deciding on the programs to be funded and by how much. A common application of program budgets is to product lines. Resources are allocated to accomplish a specific objective with a review of existing and new programs. Some suitable program activities include research and development, marketing, training, preventive maintenance, engineering, and public relations. Funds usually are allocated based on cost effectiveness. In budget negotiations, proposed budgetary figures should be explained and justified. The program budget typically cannot be used for control purposes because the costs shown cannot ordinarily be related to the responsibilities of specific individuals.

Depending on needs and convenience, budgets can be classified as incremental, add-on, supplemental, bracket, stretch, strategic, activity-based, target, and/or continuous.

Incremental Budget

Incremental budgeting looks at the increase in the budget in terms of dollars or percentages without considering the whole accumulated body of the budget.

There are also self-contained, self-justified increments of projects. Each one specifies resource utilization and expected benefits. A project may be segregated into one or more increments. Additional increments are required to complete the project. Manpower and resources are assigned to each increment.

Add-on Budget

An add-on budget is one in which previous years' budgets are examined and adjusted for current information, such as inflation and employee raises. Money is added to the budget to satisfy the new requirements. With add-on, there is no incentive for efficiency, but competition forces one to look for new, better ways of doing things. For example, Konica Imaging U.S.A. has combined add-on with zero-based review.

Supplemental Budget

Supplemental budgets provide additional funding for an area not included in the regular budget.

Bracket Budget

A bracket budget is a contingency plan where costs are projected at higher and lower levels than the base amount. Sales are then forecasted for these levels. The purpose of this method is that if the base budget and the resulting sales forecast is not achieved, the bracket budget provides management with a sense of earnings impact and a contingency expense plan. A contingency budget may be appropriate when there are downside risks that should be planned for, such as a sharp drop in revenue.

Stretch Budget

A stretch budget may be considered a contingency budget on the optimistic side. Typically it is only confined to sales and marketing projections that are higher than estimates. It is rarely applied to expenses. Stretch targets may be held informally without making operating units accountable for them. Alternatively, stretch targets may be official estimates for sales/marketing personnel. Expenses may be estimated at the standard budget sales target.

Strategic Budget

Strategic budgeting integrates strategic planning and budgeting control. It is effective under conditions of uncertainty and instability.

Activity-based Budget

Activity-based budgeting budgets costs for individual activities.

Target Budget

A target budget is a plan in which categories of *major expenditures* are matched to *company goals*. The emphasis is on formulating methods of project funding to move the company forward. There must be strict justification for large dollars and special project requests.

Continuous Budget

A continuous (rolling) budget is one that is revised on a regular (continuous) basis. Typically, a company extends such a budget for another month or quarter in accordance with new data as the current month or quarter ends. For example, if the budget is for 12 months, a budget for the next 12 months will be available continuously as each month ends.

Budgetary Process

A sound budget process communicates organizational goals, allocates resources, provides feedback, and motivates employees. The budgetary process should be standardized by using budget manuals, budget forms, and formal procedures. Software, Program Evaluation and Review Technique (PERT), and Gantt facilitate the budgeting process and preparation. The timetable for the budget must be kept. If the budget is a "rush job," unrealistic targets may be set.

The budget process used by a company should suit its needs, be consistent with its organizational structure, and take into account human resources. The budgetary process establishes goals and policies, formulates limits, enumerates resource needs, examines specific requirements, provides flexibility, incorporates assumptions, and considers constraints. The budgeting process should take into account a careful analysis of the current status of the company. The process takes longer as the complexity of the operations increase. A budget is based on past experience plus a change in light of the current environment.

The six steps in the budgeting process are:

1. Setting objectives
2. Analyzing available resources
3. Negotiating to estimate budget components
4. Coordinating and reviewing components
5. Obtaining final approval
6. Distributing the approved budget

A budget committee should review budget estimates from each segment, make recommendations, revise budgeted figures as needed, and approve or disapprove of the budget. The committee should be available for advice if a problem arises in gathering financial data. The committee can also reconcile diverse interests of budget preparers and users.

The success of the budgeting process requires the cooperation of all levels within the organization. For example, without top management or operating management support, the budget will fail. Those involved in budgeting must be properly trained and guided in the objectives, benefits, steps, and procedures. There should be adequate supervision.

The preparation of a comprehensive budget usually begins with the anticipated volume of sales or services, which is a crucial factor that determines the level of activity for a period. In other cases, factory capacity, the supply of labor, or the availability of raw materials could be the limiting factor to sales. After sales are forecast, production costs and operating expenses can be estimated. The budgeting period varies with the type of business, but it should be long enough to include complete cycles of season, production, inventory turnover, and financial activities. Other considerations are product or service to be rendered and regulatory requirements.

The budget guidelines prepared by top management are passed down through successive levels in the company. Managers at each level may make additions and provide greater detail for subordinates. The managers at each level prepare the plans for items under their control. For example, Philip Morris formulates departmental budgets for each functional area.

The budgeting process will forewarn management of possible problems that may arise. By knowing the problems, solutions may be formulated. For example, at the valleys in cash flow, a shortage of cash may occur. By knowing this in advance, management may arrange for a short-term loan for the financing need rather than face a sudden financing crisis. In a similar vein, planning allows for a smooth manufacturing schedule to result in both lower production costs and lower inventory levels. It avoids a crisis situation requiring overtime or high transportation charges to receive supplies ordered on a rush basis. Without proper planning, cyclical product demand needs may arise, straining resources and capacity. Resources include material, labor, and storage.

Bottom-up Versus Top-down

A budget plans for future business actions. Managers prefer a participative bottom-up approach to an authoritative top-down approach. The bottom-up method begins at the bottom or operating (departmental) level based on the objectives of the segment. However, operating levels must satisfy the overall company goals. Each department prepares its own budget (such as estimates of component activities and product lines by department) before it is integrated into the master budget.

Managers are more motivated to achieve budgeted goals when they are involved in budget preparation. A broad level of participation usually leads to greater support for the budget and the entity as a whole, as well as greater understanding of what is to be accomplished. Advantages of a participative budget include greater accuracy of budget estimates. Managers with immediate operational responsibility for activities have a better understanding of what results can be achieved and at what costs. Also, managers cannot blame unrealistic goals as an excuse for not achieving budget expectations when they have helped to establish those goals. Despite the involvement of lower-level managers, top management still must participate in the budget process to ensure that the combined goals of the various departments are consistent with profitability objectives of the company.

The goals may include growth rates, manpower needs, minimum return on investment, and pricing. In effect, departmental budgets are used to determine the organizational budget. The budget is reviewed, adjusted if necessary, and approved at each higher level. The bottom-up approach would forecast sales by product or other category, then by company sales, and then by market share. The bottom-up method may be used to increase the feeling of unit-level ownership in the budget. Disadvantages are the time-consuming process from participative input and the fact that operating units may neglect some company objectives. Bottom-up does not allow for control of the process, and the resulting budget is likely to be unbalanced with regard to the relationship of expenses to revenue.

Typical questions to answer when preparing a bottom-up budget are: What are the expected promotional and travel expenses for the coming period? What staff requirements will be needed? What are the expected raises for the coming year? What quantity of supplies will be needed?

This approach is particularly necessary when responsibility unit managers are expected to be very innovative. Unit managers know what must be achieved, where the opportunities are, what problem areas must be resolved, and where resources must be allocated.

In the top-down approach, a central corporate staff under the chief executive officer or president determines overall company objectives and strategies, enumerates resource constraints, considers competition, prepares the budget, and makes allocations. Management considers the competitive and economic environment. Top management knows the company's objectives, strategies, resources, strengths, and weaknesses. Departmental objectives follow from the action plans.

Top-down is commonly used in long-range planning. A top-down approach is needed for a company having significant interdependence among operating units to enhance coordination. The top-down approach first would forecast sales based on an examination of the economy, then the company's share of the market and the company's sales, and then sales by products or other category. A top-down approach may be needed when business unit managers must be given specific performance objectives due to a crisis situation and when close coordination is required between business units. It is possible that the sum of the unit budgets would not meet corporate expectations. If unit managers develop budgets independently of other units, there are inconsistencies in the assumptions used by different units.

A disadvantage with this approach is that central staff may not have all the knowledge needed to prepare the budget within every segment of the organization. Managers at the operating levels are more knowledgeable and familiar with the segment's operations. Managers will not support or commit to a budget they were not involved in preparing, which will cause a motivational problem. Further, the top-down approach stifles creativity. A budget needs input from affected managers, but top management knows the overall picture.

A combination of the bottom-up and top-down approaches may be appropriate in certain cases. Some large companies may integrate the methods. For example, Konica Imaging uses whichever method fits best. The company uses a blend. Direction is supplied from the top, and senior management develops action plans. Each department must then determine how it will actually implement the plan, specifically looking at the resources and expenditures required. This is the quantification of the action plans into dollars. It is then reviewed to see if it achieves the desired results. If it does not, it will be kicked back until it is brought in line with the desired outcomes. The what, why, and when is specified from the top, and the how and who is specified from the bottom.

As an example of the budgeting process, Power Cord and Cable Corporation (PCCC) uses a comprehensive or master budget to summarize the objective of all its subunits such as Sales, Production, Marketing, Administrative, Purchasing and

Finance. Like all organizations, PCCC uses a master budget as a blueprint for planned operations in a particular time period.

Budget Coordination

There should be one person responsible for centralized control over the budget who must work closely with general management and department heads. A budget is a quantitative plan of action that aids in coordination and implementation. The budget communicates objectives to all the departments within the company. The budget presents upper management with coordinated and summarized data as to the financial ramifications of plans and actions of various departments and units within the company.

Budgets usually are established for all departments and major segments in the company. The budget must be comprehensive, including all interrelated departments. The budget process should receive input from all departments so there is coordination within the firm. For example, operations will improve when marketing, purchasing, personnel, and finance departments cooperate.

Coordination involves obtaining and organizing the needed personnel, equipment, and materials to carry out the business. A budget aids in coordination between separate activity units to ensure that all parts of the company are in balance with each other and know how they fit in. It discloses weaknesses in the organizational structure. The budget communicates to staff what is expected of them. It allows for a consensus of ideas, strategies, and direction.

The interdependencies between departments and activities must be considered in a budget. For example, the sales manager depends on sufficient units produced in the production department. Production depends on how many units can be sold. Most budget components are affected by other components. For example, most components are impacted by expected sales volume and inventory levels, while purchases are based on expected production and raw material inventories.

A budget allows for directing and control. Directing means supervising the activities to ensure they are carried out in an effective and efficient manner within time and cost constraints. Controlling involves measuring the progress of resources and personnel to accomplish a desired objective. A comparison is made between actual results and budgeting estimates to identify problems needing attention.

In summation, the budget must consider the requirements of each department or function and the relationship that departments or functions have with other departments and functions. Activities and resources have to be coordinated.

Departmental Budgeting

All department managers within a company must accurately determine their future costs and must plan activities to accomplish corporate objectives. Departmental

supervisors must have a significant input into budgeting costs and revenues because these people are directly involved with the activity and have the best knowledge of it. Managers must examine whether their budgetary assumptions and estimates are reasonable. Budget targets should match manager responsibilities. At the departmental level, the budget considers the expected work output and translates it into estimated future costs.

Budgets are needed for each department. The sales department must forecast future sales volume of each product or service as well as the selling price. It probably will budget revenue by sales territory and customer. It will also budget costs such as wages, promotion and entertainment, and travel. The production department must estimate future costs to produce the product or service and the cost per unit. The production manager may have to budget work during the manufacturing activity so the work flow continues smoothly. The purchasing department will budget units and dollar purchases. There may be a breakdown by supplier. There will be a cost budget for salaries, supplies, rent, and so on. The stores department will budget its costs for holding inventory. There may be a breakdown of products into categories. The finance department must estimate how much money will be received and where it will be spent to determine cash adequacy. An illustrative budget showing revenue and expense by product line appears in Exhibit 1.2.

Actual Costs Versus Budget Costs

A budget provides an early warning of impending problems. The effectiveness of a budget depends on how sound and accurate the estimates are. The planning must take all factors into account in a realistic way. The budget figures may be inaccurate because of such factors as economic problems, political unrest, competitive shifts in the industry, introduction of new products, and regulatory changes.

At the beginning of the period, the budget is a plan. At the end of the period, the budget is a control instrument to assist management in measuring its performance against the plan so as to improve future performance. Budgeted revenue and costs are compared to actual revenue and costs to determine variances. A determination has to be made whether the variances are controllable or uncontrollable. If controllable, the parties responsible must be identified. Action must be taken to correct any problems.

A comparison should be made between actual costs at actual activity to budgeted costs at actual activity. In this way, there is a common base of comparison. The percentage and dollar difference between the budget and actual figures should be shown. A typical performance report for a division appears in Exhibit 1.3.

Authorized variances in cost budgets allow for an increase in the initial budget for unfavorable variances. This increase may result from unexpected wage increases, prices of raw materials, and so on. Allowance is given for cost excesses that a manager can justify.

Exhibit 1.2

Statement of Revenue and Expense by Product
for the Year Ended 20X2

	All Products		Product Line					
Description	**Amount**	**Percentage of Net Sales**	**X Amount**	**Percentage of Net Sales**	**Y Amount**	**Percentage of Net Sales**	**Z Amount**	**Percentage of Net Sales**
Gross revenue								
Less: Sales returns and allowances								
Net revenue								
Less: Variable cost of sales								
Manufacturing contribution margin								
Direct distribution costs								
Variable								
Fixed								
Semi-direct distribution								
Variable costs								
Contribution margin								
Continuing costs								
Fixed overhead								
Other indirect costs								
Total								
Income before taxes								
Less: Taxes								
Net income								

Exhibit 1.3

XYZ Company
Divisional Performance Evaluation
December 31, 20X2

	Net Income		Over (Under)	Net Sales		Over (Under)
Division	Actual	Expected	Plan	Actual	Expected	Plan
A	$ 2,000	$ 4,000	($2,000)	$1,000	$ 800	$200
B	3,000	5,000	(2,000)	700	600	100
C	5,000	6,000	(1,000)	600	1,000	(400)
Total	$10,000	$15,000	($5,000)	$2,300	$2,400	($100)

Budget Revision

A budget should be monitored regularly. A budget should be revised to make it accurate during the period because of error, feedback, new data, changing conditions (e.g., economic, political, corporate), or modification of the company's plan. Human error is more likely when the budget is large and complex. A change in conditions typically will affect the sales forecast and resulting cost estimates. Revisions are more common in volatile industries. The budget revision applies to the remainder of the accounting period.

A company may "roll a budget," which is continuous budgeting for an additional incremental period at the end of the reporting period. The new period is added to the remaining periods to form the new budget. Continuous budgets reinforce constant planning, consider past information, and take into account emerging conditions.

Budget Weaknesses

The signs of budget weaknesses must be spotted so that corrective action may be taken. Such signs include:

- Managerial goals are off target or unrealistic.
- There is management indecisiveness.
- The budget takes too long to prepare.
- Budget preparers are unfamiliar with the operations being budgeted and do not seek such information. Budget preparers should visit the actual operations firsthand.
- Budget preparers do not keep current.
- The budget is prepared using different methods each year.

- There is a lack of raw information going into the budgeting process.
- There is a lack of communication between those involved in budgeting and operating personnel.
- The budget is formulated without input from those affected by it. This will likely result in budgeting errors. Further, budget preparers do not go into the operations field.
- Managers do not know how their budget allowances have been assigned or what the components of their charges are. If managers do not understand the information, they will not perform their functions properly.
- The budget document is excessively long, confusing, or filled with unnecessary information. There may be inadequate narrative data to explain the numbers.
- Managers are ignoring their budgets because they appear unusable and unrealistic.
- Managers feel they are not getting anything out of the budget process. Changes are made to the budget too frequently.
- Significant unfavorable variances are not investigated and corrected. These variances may also not be considered in deriving budgeted figures for next period. Further, a large variance between actual and budgeted figures, either positive or negative, that repeatedly occurs is an indicator of poor budgeting. Perhaps the budgeted figures were unrealistic. Another problem is that after variances are identified, it is too late to correct their causes. Further, variance reporting may be too infrequent.
- There is a mismatching of products or services.

Budgetary Control and Audit

As discussed previously, the budget is a major control device for revenue, costs, and operations. The purpose is to increase profitability and reduce costs, or to meet other corporate objectives as quickly as possible. Budgetary control may also be related to nonfinancial activities, such as the life cycle of the product or seasonality. An illustrative budget control report is shown in Exhibit 1.4.

A budget audit should be undertaken to determine the correctness of the budgeted figures. Was there a proper evaluation of costs? Were all costs included that should have been? What are the cost trends? Are budgeted figures too tight or too loose? Are budgeted figures properly supported by documentation? A budget audit appraises budgeting techniques, procedures, manager attitudes, and effectiveness. The major aspects of the budgeting process have to be examined.

Exhibit 1.5 depicts the control process in budgeting.

Computer Applications

A computer should be used to make quick and accurate calculations, keep track of projects instantly, and make proper comparisons.

Exhibit 1.4

Budget Control Report

I. Budget Savings

One-year Savings Amount:
Two- to Five-Year Savings Amount:
More Than Five-Year Savings Amount:
Savings Description:

II. Budget impact

Reduction in Current Year Budget
Budget Account
Budget Amount
Budget Adjustment Not Needed

III. Budget Participants

Management:	Names:	Job Description:
Employees:	Names:	Job Description:

IV. Management Incentives:

V. Employee Awards

Prepared By:

Reviewed By:

Approved By:

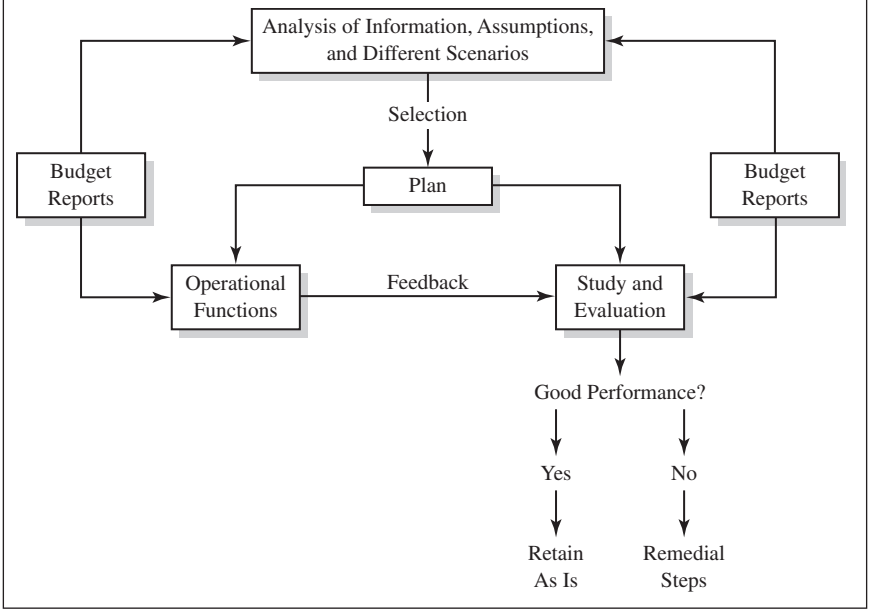
With the use of a spreadsheet program, budgeting can be an effective tool to evaluate "what-if" scenarios. This way the manager should be able to move toward finding the best course of action among various alternatives through simulation. If the manager does not like the result, he or she may alter the contemplated decision and planning set. Specialized software that is solely devoted to budget preparation and analysis also exists.

Motivation

Budgets can be used to affect employee attitudes and performance. Budgets should be participative, including participation by those to be affected by them. Further, lower-level employees are on the operating line every day so they are quite knowledgeable. Their input is needed. Budgets can be used to motivate because participants will internalize the budget goals as their own since they participated in their development. Information should be interchanged among budget participants. An imposed budget will have a *negative* effect on motivation. Further, there is a correlation between task difficulty and loss of control to negative attitudes.

Exhibit 1.5

Budgeting Control Process



A budget is a motivational and challenging tool if it is tight but attainable. It has to be *realistic*. If the budget is too tight, it results in frustration because managers will give up and not try to achieve the unrealistic targets. If it is too loose, complacency will arise and workers may goof off.

The best way to set budget targets is with a probability of achievement by most managers 80 to 90 percent of the time. Performance above the target level should be supplemented with incentives including bonuses, promotion, and additional responsibility.

Advantages and Disadvantages of Budgets

Budgeting involves cost and time to prepare. The benefits of budgeting must outweigh the drawbacks. A budget can be advantageous because it:

- Links objectives and resources
- Communicates to managers what is expected of them. Any problems in communication and working relationships are identified. Resources and requirements are identified
- Establishes guidelines in the form of a road map to proceed in the right direction.
- Improves managerial decision making because emphasis is on future events and associated opportunities

- Encourages delegation of responsibility and enables managers to focus more on the specifics of their plans and how realistic the plans are, and how such plans may be effectively achieved
- Provides an accurate analytical technique
- Provides better management of subordinates. For example, a manager can use the budget to encourage salespeople to consider their clientele in long-term strategic terms
- Fosters careful study before making decisions
- Helps management become aware of the problems faced by lower levels within the organization. It promotes labor relations
- Allows for thinking how to make operations and resources more productive, efficient, competitive, and profitable. It leads to cost reduction
- Allows management to monitor, control, and direct activities within the company. Performance standards act as incentives to perform more effectively
- Points out deviations between budget and actual, resulting in warning signals for changes or alterations
- Helps identify on a timely basis weaknesses in the organizational structure. There is early notice of dangers or departures from forecasts. The formulation and administration of budgets pinpoints communication weaknesses, assigns responsibility, and improves working relationships
- Provides management with foresight into potential crisis situations so alternative plans may be instituted
- Provides early signals of upcoming threats and opportunities
- Aids coordination between departments to attain efficiency and productivity. There is an interlocking within the business organization. For example, the production department will manufacture based on the sales department's anticipated sales volume. The purchasing department will buy raw materials based on the production department's expected production volume. The personnel department will hire or lay off workers based on anticipated production levels. Executives are forced to consider relationships among individual operations and the company as a whole
- Provides a motivational device setting a standard for employees to achieve
- Provides measures of self-evaluation
- Management can make distasteful decisions and blame it on the budget.

A budget can be disadvantageous because:

- A budget promotes gamesmanship in that those managers who significantly inflate requests, knowing they will be reduced, are in effect rewarded by getting what they probably really wanted.
- A budget may reward managers who set modest goals and penalize those who set ambitious goals that are missed.
- There is judgment and subjectivity in the budgeting process.

- Managers may consider that budgets redirect their flexibility to adjust to changing conditions.
- A budget does not consider quality and customer service.

Conclusion

A budget should be based on norms and standards. The budget should be coordinated, integrated, organized, systematic, clear, and comprehensive to accomplish optimal results. The budget preparation, review, and evaluation process must be facilitated. An orderly budgeting process will result in less cost, less man-hours, and minimization of conflict and turmoil. It will require less revision at a later date. The budget process must consider input-output relationships. The budget aids in anticipating problems before they become critical. Short-term budgets should be used for businesses subject to rapid change. A budget is a tool for planning and for "what-if" analysis. It aids in identifying the best course of action.

As it is in the computer world—garbage in, garbage out—so it is with budgeting. If forecasts are inaccurate so will be the projections, resulting in bad management decisions to the detriment of the firm. A manager must be cautious when analyzing past experience. Unforeseen circumstances such as economic downturns and future innovations have direct inputs on current operations. A manager deviating from a budget target must explain why and, of course, is on the defensive. Without proper justification for missing targets, the manager may be dismissed.

The failure to budget may result in conflicting and contradictory plans as well as in wasting corporate resources. Budget slack should be avoided or minimized. Budget slack is the underestimation of revenues and the overestimation of expenses. Budgets should be revised as circumstances materially change. A manager who has responsibility to meet a budget should also have the authorization to use corporate resources to accomplish that budget. Priorities should be established for the allocation of scarce resources. Budgets may include supplementary information such as break-even analysis by department, by product, and for overall operations.

It is important to avoid the situation in which a manager feels he or she must spend the entire budget or else lose funding in the next period. Managers should not be motivated to spend the entire budget. Rather, cost savings should be realized, and those responsible should be recognized, such as through cash bonuses or nonmonetary awards (e.g., trophy, medals). Budget savers should be protected in the funding for future budgets.

Budgets should not be arbitrarily cut across the board. Doing so may result in disastrous consequences in certain programs. If budget reductions are necessary, determine exactly where and by how much.

2

Strategic Planning and Budgeting:

Process, Preparation, and Control

Although it differs among companies, planning is the direction of the company over a period of time to accomplish a desired result. Planning should link short-term, intermediate-term, and long-term goals. The objective is to make the best use of the company's available resources over the long term. Budgeting is simply one portion of the plan. The annual plan may be based on the long-term plan. The annual budget should be consistent with the long-term goals of the business. There should be a climate conducive to planning and friendly relationships. An objective of planning is to improve profitability. Plans are interrelated.

In planning, management selects long-term and short-term goals and draws up plans to accomplish those goals. Planning is more important in long-run management. The objectives of a plan must be continually appraised in terms of degree of accomplishment and how long it takes to implement. There should be feedback as to the plan's progress. It is best to concentrate on accomplishing fewer targets so proper attention will be given to them. Objectives must be specific and measurable. For example, a target to increase sales by 20 percent is definite and specific. The manager can measure quantitatively the progress toward meeting this target.

The plan is the set of details implementing the strategy. The plan of execution typically is explained in sequential steps including costs and timing for each step. Deadlines are set.

The planning function includes all managerial activities that ultimately enable an organization to achieve its goals. Because every organization needs to set and achieve goals, planning often is called the first function of management. At the highest levels of business, planning involves establishing company strategies, that is, determining how the resources of the business will be used to reach its objective. Planning also involves the establishment of policies—the day-to-day guidelines used by managers to accomplish their objectives. The elements of a plan

include objectives, performance standards, appraisal of performance, action plan, and financial figures.

All management levels should be involved in preparing budgets. There should be a budget for each responsibility center. Responsibility in particular areas should be assigned for planning to specific personnel. At Adolph Coors Company, planning is ongoing, encouraging managers to assume active roles in the organization.

A plan is a predetermined action course. Planning has to consider the organizational structure, taking into account authority and responsibility. Planning is determining what should be done, how it should be done, and when it should be done. The plan should specify the nature of the problems, reasons for them, constraints, contents, characteristics, category, alternative ways of accomplishing objectives, and listing of information required. Planning objectives include quantity and quality of products and services as well as growth opportunities.

A plan is a detailed outline of activities to meet desired strategies to accomplish goals. Such goals must be realistic. Planning requires analysis of the situation. The plan should specify the evaluative criteria and measurement methods. The assumptions of a plan must be specified and appraised as to whether they are reasonable. The financial effects of alternative strategies should be noted. Planning should allow for creativity. Planning involves analyzing the strengths and weaknesses of the company and each segment therein. Planning is needed to allocate various resources to organizational units and programs.

Long-term plans should consider new opportunities, competition, resources (equipment, machinery, manpower), diversification, expansion, financial strength, and flexibility. In planning, consideration has to be given to noncyclical occurrences, such as new product or service introduction, modification in manufacturing processes, and discontinuance of a product or service. Strategic budgeting is a form of long-range planning based on identifying and specifying organizational goals and objectives. The strengths and weaknesses of the organization are evaluated, and risk levels are assessed. The influences of environmental factors are forecast to derive the best strategy for reaching the organization's objectives.

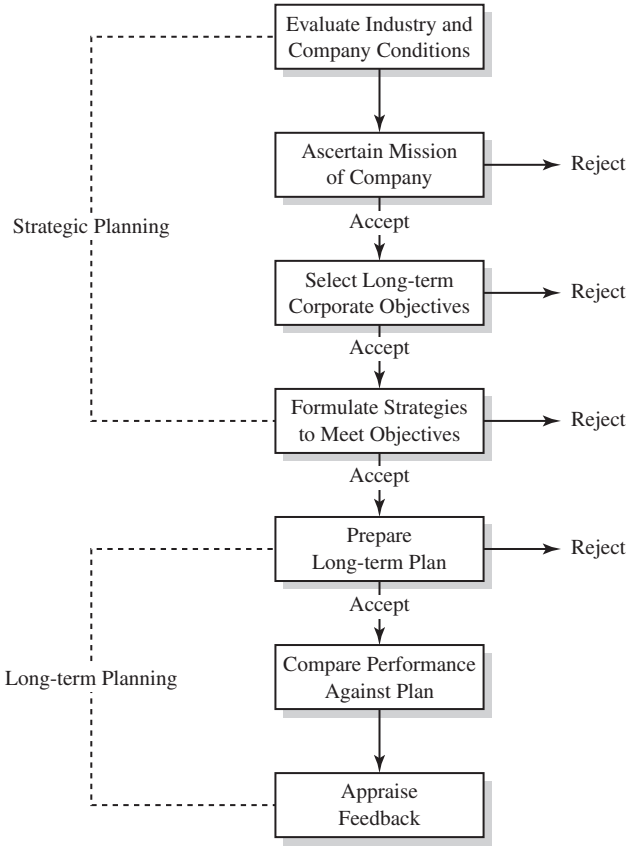
Several planning assumptions should be made at the beginning of the budget process. Some of these assumptions are internal factors; others are external to the company. External factors include general economic conditions and their expected trend, governmental regulatory measures, the labor market in the locale of the company's facilities, and activities of competitors, including the effects of mergers.

Planning is facilitated when the business is stable. For example, a company with a few products or services operating in stable markets can plan better than one with many diverse products operating in volatile markets. Planning should take into account industry and competing company conditions.

A description of products, facilities, resources, and markets should be noted in the plan. The emphasis should be on better use of resources, including physical facilities and personnel. In summation, a plan is a detailed outline of activities and strategies to satisfy a long-term objective. An objective is a quantifiable target. The objective is derived from an evaluation of the situation. A diagram of the strategic planning process appears in Exhibit 2.1.

Exhibit 2.1

Strategic Planning Process



Budgeting

Budgeting is a form of planning and policy development considering resource constraints. It is a profit planning mechanism and may look at "what-if" scenarios. Budgets are detailed and communicate to subunits what is expected of them. Those responsible for expenditures and revenue should provide budget information. Planning should be by the smallest practical segment. Budgeting is worthwhile if its use makes the company more profitable than without it.

Budgets are quantitative expressions of the yearly profit plan and measure progress during the period. The shorter the budgeting period, the more reliable. A cumulative budget may drop the prior month and add the next month.

Probabilities may be used in budgeting. Of course, the total probabilities must add up to 100%.

Example 1

The sales manager assigns these probabilities to expected sales for the year:

Probability	Expected Sales	Probable Sales
50%	$3,000,000	$1,500,000
30%	2,000,000	600,000
20%	4,000,000	800,000
100%		2,900,000

The probabilities are based on the manager's best judgment. The probabilities may be expressed in either quantitative (percentages) or relative terms (high or low probability of something happening).

A typical department budget appears in Exhibit 2.2. A typical checklist for the budgeting system appears in Exhibit 2.3.

Strategic Planning

Strategic plans are long-term, broad plans ranging from 2 to 30 years, with 5 to 10 years being most typical. Strategic planning is continuous and looks where the company is going. It is done by upper management and divisional managers. Most of the information used is external to the company.

The strategic plan is the mission of the company and looks to existing and prospective products and markets. Strategic plans are designed to direct the company's activities, priorities, and goals. They try to position the company so as to accomplish opportunities. Strategic goals are for the long term, considering the internal and external environment, strengths, and weaknesses.

Strategy is the means by which the company uses its capital, financial, and human resources to achieve its objectives. It shows the company's future direction and rationale, and looks at expected costs and return. Strategic planning is detailed plans to implement policies and strategies. Risk-taking decisions are made. Strategies may be implemented at different times. Strategic planning should take into account the financial position, economy, political environment, social trends, technology, risks, markets, competition, product line, customer base, research support, manufacturing capabilities, manpower, product life cycle, and major problems.

Strategic planning is a prerequisite to short-term planning. There should be a linkage of the two. There is considerably more subjectivity in a strategic plan than in a short-term plan.

The strategic plan is formulated by the chief executive officer (CEO) and his or her staff. It considers acquisitions and divestitures. Financial policies, including debt position, are determined. The plan must consider economic, competitive, and industry factors. It establishes direction, priorities, alternatives, and tasks to be performed. The strategic plan is the guideline for each business segment and the needed activities to accomplish the common goals.

Strategic planning is irregular. Further, strategic planning problems are unstructured. If a strategy becomes unworkable, abandon it.

Exhibit 2.2

XYZ Company Department Budget Report

Department _____
Department Administrator _____

Classification	Dollar Amount		Over or Under		Percent Realized Current Month	Moving Average	
	Budget	Actual	Current Month	Cumulative to Date		Current	Prior
Direct Labor							
1							
2							
3							
4							
5							
Total Direct Labor							
Indirect Labor							
Indirect Salaries							
Supervisor Salaries							
Cleaning							
Holidays and Vacations							
Idle Time							
Other Salaries							
Subtotal							
Other Department Costs							
Operating Supplies							
Tools							
Telephone							
Travel							
Consultants							
Memberships							
Misc. Department Expenses							
Subtotal							
Total Department Expenses							

Exhibit 2.3

A Budgetary Checklist

Schedule	Who Is Accountable?	Date Required	Date Received
1. Establish overall goals			
2. Set division and department objectives			
3. Estimate			
a. Capital resource needs			
b. Personnel requirements			
c. Sales to customers			
d. Financial status			
4. Preparation of budgets for:			
a. Profitability			
b. Revenue			
c. Production			
Direct material			
Direct labor			
Factory overhead			
d. Marketing budget			
Advertising and promotion			
Sales personnel and administration			
Distribution			
Service and parts			
e. Cash budget			
f. Budgeted balance sheet			
g. Capital facilities budget			
h. Research and development budget			
5. Prepare individual budgets and the master budget			
6. Review budgets and prepare required changes			
7. Prepare monthly performance reports			
8. Determine difference between budget and actual costs (revenue)			
9. Prepare recommendations to improve future performance			

The elements of a strategic plan are:

- The company's overall *objectives*, such as market position, product leadership, and employee development
- The *strategies* necessary to achieve the objectives, such as engaging in a new promotion plan, enhancing research, product and geographical diversification, and eliminating a division
- The *goals* to be met under the strategy
- The *progress to date* of accomplishing the goals; examples of goals are sales, profitability, return on investment, and market price of stock

In summation, strategic planning is planning for the company as a whole, not just combining the separate plans of the respective parts. There must be a common thread. The strategic plans looks to the long term. It is concerned with the few key decisions that determine the company's success or failure. It provides overall direction and indicates how the long-term goals will be achieved. It is a mission policy statement and must deal with critical issues.

Short-term Plans

Short-range plans are typically for one year (although some plans are for two years). The plans examine expected earnings, cash flow, and capital expenditures. Short-term plans may be for a period within one year, such as a month or week. Short-term planning relies primarily on internal information and details tactical objectives. It is structured, fixed, foreseeable, and continually determinable. The short-term profit plan is based on the strategic plan. It is concerned with existing products and markets.

There should be a short-term profit plan by area of responsibility (product, service, territory, division, department, project, function, and activity). Short-term plans usually are expressed on a departmental basis. They include sales, manufacturing, marketing, management (administration), research, and consolidation (integration) plans. Short-term planning has more lower-level managers involved in providing input. The line manager typically is involved with short-term rather than long-term plans. In making the short-term plan, the line manager should consider the company's objectives and targets outlined in its long-term plan. The manager's short-term plan must satisfy the long-term objectives of the company.

Long-term Plans

Long-term planning is usually of a broad, strategic (tactical) nature to accomplish objectives. A long-term plan is typically 5 to 10 years (or more) and looks at the future direction of the company. It also considers economic, political, and industry conditions. Long-term plans are formulated by upper management. They deal with products, markets, services, and operations. Long-range planning enhances sales, profitability, return on investment, and growth. Long-range plans should be constantly revised as new information becomes available.

Long-range planning covers all major areas of the business including manufacturing, marketing, research, finance, engineering, law, accounting, and personnel. Planning for these areas should be coordinated into a comprehensive plan to attain corporate objectives.

A long-term plan is a combination of the operating and developmental plans. The long-term plan should specify what is needed, by whom, and when. Responsibility should be assigned to segments. Long-term goals include market share, new markets, expansion, new distribution channels, cost reduction, capital maintenance, and reduction of risk. The characteristics of sound long-term objectives

include flexibility, motivation, measurability, consistency and compatibility, adequateness, and flexibility. Long-range plans may be used for growth, market share, product development, plant expansion, and financing.

Long-range plans are details of accomplishing the strategic plans. Compared to strategic planning, long-range planning is closer to planning current operations of all units of the business. Long-range planning includes evaluating alternatives, developing financial information, analyzing activities, allocating resources, product planning, market analysis, planning manpower, analyzing finances, research and development planning, and production planning.

The time period for a long-term plan depends on the time required for product development, product life cycle, market development, and construction of capital facilities. More alternatives are available in long-term plans than in short-term plans. When there is greater uncertainty in the economic and business environment, long-range plans become more important. However, it is more difficult to plan long term than short term because of the greater uncertainties that exist. An illustrative long-term plan appears in Exhibit 2.4.

Time Period

The budget period depends on the objective of the budget and the reliability of the data. Most companies budget yearly, month by month. For example, a seasonal business should use the natural business year beginning when accounts receivable and inventory are at their lowest level.

The time period for a plan should be as far as is useful. The period chosen depends on many factors: the time to develop a market; production period; the time

Exhibit 2.4

Long-term Plan

	Amount
Contract acquisitions —Customer	
—Division	
—Company	
Sales backlog —Customer	
—Division	
—Company	
Total sales	
Profit margin	
Return on investment	
Capital expenditures —Assets	
—Leases	

to develop raw material sources and to construct capital facilities; product development; and product life cycle. The time period also should take into account the type of industry, reliability of financial data and use to which the data will be put, seasonality, and inventory turnover. Shorter budgeting cycles may be called for when unpredictable and unstable events occur during the year. Short-term budgets have considerably more detail than long-term budgets.

Administering the Plan

A committee of senior operating and financial executives, should be involved in administering a budget. The administration plan consists of human resource planning for the various functions to be carried out, technological resource planning, and organizational planning.

Profit Plan

A profit plan is the premise on which management charts an action course for the upcoming year. It is good for planning and control. Alternatives must be evaluated, and the profit plan should be flexible to adjust for contingencies. Profit planning includes a study of appraising profits relative to investment. A profit budget may be used to supplement a cost budget. Profit budgets may be by customer, territory, or product.

The profit plan must set forth selling price, sales volume, sales mix, per-unit cost, competition, advertising, research, market potential, and economic conditions. Profit may be improved through a closer correlation of manufacturing, selling, and administrative expense budgeting to sales and earnings objectives. Cost reduction programs will lower expenses.

Continuous profit planning is used when planning should be for short time periods and where frequent planning is needed. The yearly or quarterly plan may be revised each month.

Operational Plan

The preliminary operational plan is an important part of the strategic plan. It examines the alternative strategies so as to select the best one. The *final* operational plan is much more detailed and is the basis to prepare the annual budgets and to evaluate performance. It also acts as the basis to integrate and communicate business functions. It is concerned with short-term activity or functions of the business. The operational plan typically includes production, marketing (selling), administration, and finance. It examines properly serving product or service markets.

The operational plan summarizes the major action programs and contains this information: objective, program description, responsibility assignments, resource needs (e.g., assets, employees), expected costs, time deadlines for each stage, input needed from other business segments, and anticipated results.

Development Plan

The development plan typically includes research and development, diversification, and divestment. It relates to developing future products, services, or markets. The development plan mostly applies to new markets and products. Bonuses should be given for new ideas.

The corporate development plan is concerned with:

- Discovering or creating new products
- Identifying financially lucrative areas and those having growth potential
- Ascertaining what resources are required in terms of assets, manpower, and so on
- Determining the feasibility of expanding operations into new areas

Contingency Planning

Contingency planning is anticipating in advance unexpected circumstances, occurrences, and situations so that there can be a fast response to a crisis. All possible eventualities should be considered. Contingency planning involves identifying the possible occurrence, ascertaining warning signs and indicators of a problem, and formulating a response.

Contingency planning can be in the form of flexible (bracket) budgets. The plan should be modified if needed to generate the best results. There should be flexibility in the plan to adjust to new information and circumstances and to allow for the resolution of uncertainties.

Activity Budget

An activity budget is a revised analysis of a budget showing expenses at budgeted rates adjusted to actual production volume.

Budget Process

In one company we are familiar with, the Financial Planning Department issues guidelines to department managers. The manager then submits his or her plan to Financial Planning. The plan is returned to the manager if guidelines have not been adhered to. Financial Planning coordinates the plan from the bottom up. The budget goes down to the supervisory level. The company also uses program budgeting, which involves the allocation of resources. The budgeting process requires good, timely communication. Upper management must make its budget goals clear to departmental managers. In turn, the managers must explain departmental operating conditions and limitations.

Departmental Budgets

The decision units in the plan must be identified, and the manpower and dollar support at each decision unit must be noted. Department managers should plan for specific activities. They should put their budgets and trends in perspective relative to other departments in the company, to competing departments in other companies, and to industry norms. The manager should list the problems needing solution or the opportunities to be further capitalized on.

Budget Accuracy

The accuracy of budget preparation may be determined by comparing actual numbers to budget numbers in terms of dollars and units. Budget accuracy is higher when the two figures are closer to each other. Ratios showing budget accuracy include:

Sales Accuracy = Actual Sales/Budgeted Sales
Cost Accuracy = Actual Cost/Budgeted Cost
Profit Accuracy = Actual Profit/Budgeted Profit

Example 2

A manager budgeted sales for 2 million but the actual sales were 2.5 million. This favorable development might be attributed to one or more of these reasons:

- Deficient planning because past and current information were not properly considered when the budget was prepared
- The intentional understatement of expected sales so the manager would look like a hero when actual sales substantially exceeded the anticipated sales
- Higher revenue arising from better economic conditions, new product lines, improved sales promotion, excellent salesperson performance, or other reasons

A significant deviation between budget and actual amounts may indicate poor planning. Is the planning unrealistic, optimistic, or due to incompetent performance? However, the problem may be with wasteful spending or inefficient operations.

Reports

A typical report for manufacturing cost analysis is presented in Exhibit 2.5. Performance reports typically are issued monthly.

Exhibit 2.5

Manufacturing Cost Analysis

Product Line	Units Produced	Material	Labor	Overhead		Total Cost	Average		Gross Margin
				Variable	Fixed		Unit Cost	Selling Price	

Budget Revision

A budget should be revised when it no longer acts as a useful planning and control device. Budgets should be revised when a major change in processes or operations occur, or when there are significant changes in salary rates. For example, additional competitors may enter the market with a product that sells at a lower price and is a good substitute for the company's product. This competition may make meeting the budgeted market share and sales unlikely. If management recognizes that even with increased promotional expenditures, budgeted sales are not realistic, all budgets affected should be revised. These revisions are preferable to using unattainable budgets. Budgets that are repeatedly revised are more informative as a control measure. For a one-year budget, budget estimates may be revised quarterly. Budget revisions should be more frequent in unstable businesses.

Performance Measures

Performance measures also should be directed at the lower levels. Specific task performance for each employee should be measured. Employee performance may be measured by computing revenue per employee, man-hours per employee, and production volume to man-hours.

Control and Analysis

Control is important in budgeting. Budget figures may be checked for reasonableness by looking at relationships. The budgeted costs must be directly tied to planned production output. The manager must be able to strongly defend the initial budget figure and to obtain needed facts. Budget comparisons may be made by current year month to last year month, current year quarter to last year quarter, and cumulative year to date. A comparison is therefore made to similar time periods.

Costs should be examined by responsibility. Cost reduction is different from cost control. Cost reduction attempts to lower costs by improving manufacturing methods and procedures, work assignments, and product or service quality. Cost control includes cost reduction. Cost control attempts to obtain cost objectives within the operational setting. Value analysis is an evaluation of cost components in an operation so as to minimize them to achieve higher profits.

Compare the company's segments to similar segments in competing companies. Variations from the plan should be studied and controlled. The integrated (consolidated) plan usually is prepared yearly. A change in one department's plan will likely affect another department's plan.

3

Administering the Budget:
Reports, Analyses, and Evaluations

A budget should be prepared for each department. Divisional budgets should be consolidated in a binder, and each department should have a separate file folder. The chief executive officer should distribute an executive budget memorandum to each department manager detailing the schedule, policies, and benchmarks for next year's budget. Responsibility should be assigned for collection and consolidation of budget information. Budget instructions, forms, and timetables should be provided. Budget forms should be simple and easy to follow. The budget committee should consider these items before approving a budget: accuracy of budgetary numbers, reliability of information on which estimates are based, budget integration, reliability of source data, budgetary assumptions, and achievability of budgetary goals.

Types of Reports

Long-term reports may be for the company as a whole or for specific areas. The benefit derived from reports should justify their cost. Budget reports are used for planning, control, and information.

Planning reports may be short term, looking at the company as a whole, each division, each department, and each responsibility center within the department. Short-term planning reports may be of income, cash flow, net assets, and capital expenditures. The reports should be prepared regularly. Special studies may be performed of "problem" segments not performing well. The special studies may be of product or service lines, activities or functions, geographic areas, salesperson performance, and warehousing.

Control reports concentrate on performance effectiveness and areas needing improvement. Budget to actual figures are compared by product, service, territory, and manpower.

Information reports assist in planning and policy formulation. The reports show areas of growth or contraction. They may be in dollars, units, percentages, or ratios. Trends are shown over time. An example of an informative ratio is selling expense to revenue. Informational reports study the trend in earnings, profit by product or service, profit by territory, and profit by customer.

Reports for upper management are comprehensive summaries of overall corporate operations. Top management generally prefers narrative reports. Reports are also prepared for special events of concern to top management. Adequate detail should be provided as needed. Middle-management reports include summarized information and detailed information on daily operations. A brief report should be presented at budget meetings.

Lower-level management reports typically deal with daily coordination and control operations. The reports usually emphasize production. Exception reports should be prepared indicating problems. Budget reports inform managers of progress made in meeting budgets and what went wrong, if anything.

A critical area should be reported on more frequently. The frequency of reporting is less as the level of responsibility becomes higher.

Budget reports depend on the requirements of the situation and user. Budget reports should contain these data:

- Trends over the years
- Comparison to industry norms
- Comparison of actual to budget with explanation and responsible party for variances. Follow-up procedures are needed for control

Reports should get to the main points. Each report should begin with a summary followed by detailed information and should be comprehensible to those using it. The emphasis should be on clarity rather than complexity. Reports should be logically organized, relevant, and concise. Reports should be updated on a periodic basis.

Reports may contain schedules, explanations, graphs, and tables. Reports should contain recommendations and highlight problem areas. All reports should be computerized. An illustrative budget worksheet appears in Exhibit 3.1.

Reports may be periodic, advance, or special.

Periodic Reports

These are reports prepared at regular intervals. There is a continual comparison between budget and actual figures. They are the usual source of information to maintain control. They may be issued semiannually, quarterly, monthly, and so on. Monthly reports are most common. Some information may be reported daily (e.g., shipments), while other information may be reported weekly (e.g., sales and production). The timeliness depends on cost/benefit analysis.

Exhibit 3.1

Budget Worksheet

Account:

For the period:

Date:

Month	Components
Explanation:	
Assumptions:	
Analysis:	

Advance Reports

Important partial information may be reported before all information is available for a periodic report. Delay in reporting this information will cause a managerial problem. "Flash reports" should be issued for unusual occurrences that must be reported on immediately.

Special Studies

Special reports are issued for a specific, nonroutine purpose. Special studies may be required for problem situations or if a negative trend exists, such as costs keep rising even though a cost reduction program has been implemented.

Budget reports may contain this supplementary information depending on need:

- Percent of capacity utilization
- Changes in marketing and distribution
- Change in selling price
- Average selling price
- Sales volume and units produced
- Distribution cost relative to sales
- Effect on sales of new product introduction, dropping products, and entering new product lines
- Change in the number of employees and man-hours

A performance report should be prepared for each responsibility center, going from the lowest level to the highest level. The report indicates whether goals have been accomplished. Performance reports evaluate efficiency, and should be repetitive, covering a short time period.

The performance-to-budget report should contain this information by department for year-to-date and for current period:

- Cost accounts
- Budget
- Actual
- Variances and reasons

An illustrative report summarizing departmental performance is shown in Exhibit 3.2.

A performance-to-budget report (cost and variance statement) should be kept for feedback. It is used by management to evaluate the degree to which operating managers meet their budget.

Monthly performance reports should contain variances for the month and cumulative variances to date for the year. Variances can be expressed in dollars and as a percentage of budget.

The statistics and graphics in the report should vary depending on user preference. For example, marketing managers are less inclined to receive statistical data than engineers. However, marketing managers prefer graphs. Graphs may be more informative in presenting relationships and summary comparisons. Graphs include diagrams and charts.

Reports should be timely. If reports are issued periodically, they should be on schedule. If reports must be delayed, a short update should be presented.

Budget Manual

A budget manual describes how a budget is to be prepared. Items usually included in a budget manual are a planning calendar and distribution instructions for all budget schedules. Distribution instructions are important because, once a sched-

Exhibit 3.2

Summary of Department Performance

Item and Explanation	Actual	Budget	Percent of Budget

ule is prepared, other departments within the organization will use the schedule to prepare their own budgets. Without distribution instructions, someone who needs a particular schedule may be overlooked.

The budget manual communicates throughout the company the policies and procedures for budget preparation. It lists the activities and rules to be followed in preparing a budget. It tells how the budget should be used by managers and who is responsible for the different aspects of the budgeting process, including preparation, presentation, reporting, evaluation, and approval. It should list positions rather than names to avoid unnecessary updating. A flow chart for budget preparation chart would be helpful. It provides the budgeting steps and aids in cooperation and coordination. The procedures to be followed to revise the budget based on changing conditions and goals should be specified. For example, revisions may be needed because of changing objectives, new methods, changing economic environment, and errors. The budget manual should receive participation from all affected managerial levels.

The budget manual stipulates authority, responsibility, and duties; fosters standardization; documents procedures; simplifies the process; provides communication; answers users' questions; enhances supervision; and fosters training.

The manual includes:

- Standardized forms, lists, and reports
- Instructions
- Format and coverage of performance reports
- Administrative details
- Follow-up procedures

Each department should be included in a separate section of the manual with an index tab. Operating department managers and employees should provide input in the preparation of the budget manual. Managers and workers may have different information to impart. There may be operating problems, constraints, and limitations that must receive attention. There should be a standard cost table for different types of expenses used by managers of different departments throughout the organization. This allows for consistency and uniformity.

The manual should be in loose-leaf form so pages may be substituted for updates. The budget manual should contain:

- Budget objectives, purposes, procedures, guidelines, and policy
- Desired accomplishments
- Data description
- Personnel duties (who is to prepare, review, approve, and revise the budget)
- Who has authority and responsibility for budget items (with a designation of manager or subordinate who will perform the activity)
- Approval requirements

- Who is to evaluate the difference between budget and actual figures, and who is to take corrective action and when
- Budget timetable
- Illustrative forms, lists, and reports
- Glossary of terminology
- Instructions to complete budget activities
- Uses of budget information
- Policies for budget modification and update calendar
- Communication between upper management and subordinates
- Coordination between departments of the budget
- Explanatory footnotes

The layout of the manual should enhance its clarity and conciseness. It should be easy to understand for nonaccountants, so it should not contain complex or technical language. It should be arranged logically and orderly with a user-friendly index and should be updated as conditions warrant. It should look professional in design, color, print size, and so on, so it is taken seriously by users.

Having a budget manual offers many advantages, including simplification and standardization of budget procedures. It acts as a reference and provides an organized approach to the budget process. It provides consistency between departments, provides job description guidance to new employees, and assists current employees to adjust to new positions when transferred or promoted. The manual helps employee continuity in doing the job.

Budget Sheet

A budget sheet should be designed to record the information used by the operating manager and budget preparer. The budgeting sheet should include this information:

- Historical cost records used
- Cost formulas
- Changes in operating conditions
- Foreseeable conditions

A budget data sheet should be prepared for each cost account in each department or cost center. Attached to the data sheet may be graphs, workpaper analysis, mathematical and statistical calculations, and so on. Budget revisions may also be incorporated.

Fixed, variable, and mixed costs are shown on the data sheet. Material, labor, and overhead should be listed. The sheets should be initialed by those preparing and approving them. The allowances specified in the data sheet should be mutually agreed on by the preparer and operating manager.

A typical budget data sheet is shown in Exhibit 3.3.

Exhibit 3.3

Budget Data Sheet

Date prepared: Time period:

Date accepted:

Date approved:

Date revised:

Cost center identifier

Account identifier

Activity unit

Amount and reason for revision

Items	Total	Fixed	Variable	Mixed (Semivariable)
Total Budget				

A budget summary sheet also should be prepared summarizing the department's budget by listing each budgeted cost and the budget allowance based on average activity. The summary sheet summarizes the departmental budget data sheets. The operating departmental manager always should be provided with a copy of the budget summary sheet and budget data sheets.

A budget data book should be maintained to keep the budgeting information in an orderly manner. The book contains the budget data sheets, supporting worksheets and analysis, and budget summary sheets by department.

Performance Reports

The manager should prepare performance reports. Are objectives and targets being met by subordinates? Are operations being performed efficiently and effectively?

The performance-to-budget report should include this information by department for month and year-to-date: budget, actual, and variance. Variances may be stated in dollars and percentage terms.

An illustrative performance-to-budget report is presented in Exhibit 3.4.

Budget Audit

A budget audit examines whether the budgeting process is operating effectively. It is an evaluation of the budgeting effort. The budget audit examines techniques, procedures, motivation, and budget effectiveness. Effective budgeting should be dynamic.

A budget audit detects problems in the budgeting process. It should be conducted every two to three years by an independent party not a part of the budget

Exhibit 3.4

Performance-to-Budget Report

Department Identifier _____ Activity
Nonfinancial Manager _____ Budget
Actual
Percent of Budget

			This Period				
Year-to-Date Budget	**Actual**	**Variance**	**Budget**	**Actual**	**Variance**	**Cause of Variance**	**Extra Budgetary Allowance for Variance**
Totals							

staff. The budget auditor should report to upper management, who can take appropriate action. An outside consultant should be independent and objective, and should provide fresh ideas.

An audit plan assists in arriving at corrective action. The budget audit considers:

- Cost trends and controls
- Budget revisions
- How adequately costs were analyzed
- How costs were identified and classified
- Looseness or tightness of budget allowances
- Completeness of budget documentation, records, and schedules
- Degree of participation by managers and workers
- Quality of supportive data
- Degree of subjectivity involved

Budget Calendar

The budget planning calendar is the schedule of activities for the development and adoption of the budget. It should include a list of dates indicating when specific information is to be provided by each information source to others. A budget calendar should be prepared for the timing of each aspect or operation of the budget. A timetable must be given to operating managers to submit their proposed budgets so the overall company budget may be prepared on time. The schedule of due

dates for documents and reports must be adhered to. Review and approval dates should also be specified. The schedule dates should be realistic and attainable.

A company can begin the process by issuing a budget preparation calendar, which consists of an overall review of each sequential step in the budgeting process. Accompanying this is a rough time schedule in which the budgeting process will be implemented identifying deadlines, the personnel responsible, and those to receive this information. The plan furnishes the structure of the budgeting process and the overall objectives. These items are crucial for the budgeting process and must be completed before the process can proceed. An illustrative budget calendar for a company is presented in Exhibit 3.5.

Exhibit 3.5

ABC Company Budget Preparation
Calendar Fiscal 20X2

1. *General Guidelines* issued to senior management staff by president gives the broad objectives of the company for the ensuing year. These objectives must be specific enough to provide divisions with adequate direction, yet they should be broad enough so as not to prevent creativity. General indication of gross margins, operating profit, net profit, and productivity are some of the areas to be addressed.
2. *New Products Forecast* will provide an indication of new/improved products to be available next year. This will include estimated availability dates and likely segment as applicable.
3. *Discussion of Action Plans* with particular emphasis on how to achieve objectives (on individual basis) with senior management by president. Each senior vice president will produce in writing and justify in detail how he or she will achieve the objectives for next year. For example, Sales and Marketing should give expected sales by regions supported by level of sales force and related promotional expenses (advertising/conventions and product giveaway).
   (a) *Headcount* by department/division to support objectives must be justified by each senior vice president.
   (b) *C.E. Projections* outline the major projects to be executed in the budget year as determined by the department managers and facilities engineering. Projects should be ranked in order of priority with pros and cons of doing and not doing the projects.
   (c) *Inventory Projections* as furnished by vice president of respective user department (Film, Chemistry, and Equipment) should indicate the levels of the inventory by major product lines. Where applicable, a minimum, desired, and maximum levels to support production and sales should be given.
4. *Fringe Benefits Package* including payroll increase prepared by the Human Resources Department should outline the basis of the company's contribution of the major programs and fringes. Both quantitative and qualitative factors should be presented. Major areas to be covered are incentives, medical, dental, retirement, life insurance and workmen's compensation. Other expenditures such as FICA and unemployment tax will be computed by Corporate Planning.
5. *Budget Package* issued to departmental managers by Corporate Planning contains the necessary forms and instructions to prepare the Budget.
6. *Preliminary Profit & Loss (P&L) Fiscal 20X2* based on sales forecast and assumptions in 2–4 will be prepared by Corporate Planning. This will give an indication of the likely outcome of the actions contemplated. Major directions and proactive measures will then be taken to manage the budget process in line with the president's guidelines.

Exhibit 3.5 (*continued*)

7. *Final Sales Forecast* as issued to senior management staff by Sales/Marketing would give sales volume and dollars by major product lines. For example, film and paper (sq. ft. & $), chemistry (quantity & S) and equipment (unit & $). Film and paper should be analyzed by region, international, dealers, national accounts, and others. New products should be clearly identified. Adequate explanation should be given for any significant changes (over the current year) in volume or price.
8. *Departmental Expense Budgets* are prepared (monthly basis) by department managers and approved by their respective senior management. These include all the operating expenses (excluding payroll, fringes, depreciation and facilities cost) as prepared in the Basic Budget Worksheet.
9. *Preliminary Budget* incorporate data and payroll, fringes, depreciation, and facilities cost as computed by Corporate Planning. The preliminary data is returned to managers for review and any necessary changes.
10. *Revisions* made by managers to preliminary budget are sent to Corporate Planning on a timely basis.

11–13. *Budgets* are sent to senior vice president, and meetings are held to review budgets. Senior vice presidents will present their budgets and negotiate the necessary changes to bring budgets in line with corporate objectives.

14. *Preparation of Budgeted P&L, Cash Flow, Balance Sheet* by Corporate Planning and Finance Division. This will provide management with the financial picture of the budget year.

15–16. *Budget Package* sent to senior management for review and approval prior to presentation to ABC Company.

17. *Presentation of Budget Package* by Corporate Planning and president to ABC Company for approval.
18. *Approved Budgets* issued to respective departments. These will form the guide as to the upper limit of expenditures for the coming year.

4

Break-even and Contribution Margin Analysis:

Profit, Cost, and Volume Changes

Break-even and contribution margin analysis, also known as cost-volume-profit (CVP) analysis, helps managers perform many useful analyses. It deals with how profit and costs change with a change in volume. More specifically, it looks at the effects on profits of changes in such factors as variable costs, fixed costs, selling prices, volume, and mix of products sold. By studying the relationships of costs, sales, and net income, management is better able to cope with many planning decisions.

Break-even analysis determines the break-even sales. Break-even point—the financial crossover point when revenues exactly match costs—does not show up in corporate earnings reports, but managers find it an extremely useful measurement in a variety of ways.

Questions Answered by Break-even and Contribution Margin Analysis

Break-even and contribution margin analysis tries to answer these five questions:

1. What sales volume is required to break even?
2. What sales volume is necessary to earn a desired profit?
3. What profit can be expected on a given sales volume?
4. How would changes in selling price, variable costs, fixed costs, and output affect profits?
5. How would a change in the mix of products sold affect the break-even and target income volume and profit potential?

Contribution Margin Income Statement

The traditional income statement for external reporting shows the functional classification of costs, that is, manufacturing costs versus nonmanufacturing expenses (or operating expenses). An alternative format of income statement, known as the contribution margin income statement, organizes the costs by behavior rather than by function. It shows the relationship of variable costs and fixed costs a given cost item is associated with, regardless of the functions.

The contribution approach to income determination provides data that are useful for managerial planning and decision making. The statement highlights the concept of contribution margin, which is the difference between sales and variable costs. The traditional format emphasizes the concept of gross margin, which is the difference between sales and cost of goods sold.

These two concepts are independent and have nothing to do with each other. Gross margin is available to cover nonmanufacturing expenses, whereas contribution margin is available to cover fixed costs. A comparison is made between the traditional format and the contribution format below.

Traditional Format

Sales		$15,000
Less: Cost of Goods Sold		7,000
Gross Margin		$8,000
Less: Operating Expenses		
Selling	$2,100	
Administrative	1,500	3,600
Net Income		$4,400

Contribution Format

Sales		$15,000
Less: Variable Expenses		
Manufacturing	$4,000	
Selling	1,600	
Administrative	500	6,100
Contribution Margin		$8,900
Less: Fixed Expenses		
Manufacturing	$3,000	
Selling	500	
Administrative	1,000	4,500
Net Income		$4,400

Contribution Margin

For accurate break-even and contribution margin analysis, a distinction must be made between costs as being either variable or fixed. Mixed costs must be separated into their variable and fixed components (to be covered in Chapter 7).

In order to compute the break-even point and perform various break-even and contribution margin analyses, note these important concepts.

Contribution Margin (CM). The contribution margin is the excess of sales (S) over the variable costs (VC) of the product or service. It is the amount of money available to cover fixed costs (FC) and to generate profit. Symbolically, CM = S – VC.

Unit CM. The unit CM is the excess of the unit selling price (p) over the unit variable cost (v). Symbolically, unit CM = p – v.

CM Ratio. The CM ratio is the contribution margin as a percentage of sales, that is,

$$\text{CM ratio} = \frac{\text{CM}}{\text{S}} = \frac{\text{S} - \text{VC}}{\text{S}} = 1 - \frac{\text{VC}}{\text{S}}$$

The CM ratio can also be computed using per-unit data:

$$\text{CM ratio} = \frac{\text{Unit CM}}{\text{p}} = \frac{\text{p} - \text{v}}{\text{p}} = 1 - \frac{\text{v}}{\text{p}}$$

Note that the CM ratio is 1 minus the variable cost ratio. For example, if variable costs account for 70 percent of the price, the CM ratio is 30 percent.

Example 1

To illustrate the various concepts of CM, consider these data for Flip Toy Store:

	Total	Per Unit	Percentage
Sales (1,500 units)	$37,500	$25	100%
Less: Variable costs	15,000	10	40
Contribution margin	$22,500	$15	60%
Less: Fixed costs	15,000		
Net income	$ 7,500		

From the data listed, CM, unit CM, and the CM ratio are computed as:

$$\text{CM} = \text{S} - \text{VC} = \$37,500 - \$15,000 = \$22,500$$

$$\text{Unit CM} = \text{p} - \text{v} = \$25 - \$10 = \$15$$

$$\text{CM ratio} = \frac{\text{CM}}{\text{S}} = \frac{\$22,500}{\$37,500} = 60\% \text{ or } \frac{\text{Unit CM}}{\text{p}} = \frac{\$15}{\$25} = 0.6 = 60\%$$

Break-even Analysis

The break-even point represents the level of sales revenue that equals the total of the variable and fixed costs for a given volume of output at a particular capacity use rate. For example, one might want to ask the break-even occupancy rate (or vacancy rate) for a hotel or the break-even load rate for an airliner.

Generally, the lower the break-even point, the higher the profit and the less the operating risk, other things being equal. The break-even point also provides nonfinancial managers with insights into profit planning. It can be computed using these formulas:

$$\text{Break-even point in units} = \frac{\text{Fixed costs}}{\text{Unit CM}}$$

$$\text{Break-even point in dollars} = \frac{\text{Fixed costs}}{\text{CM ratio}}$$

Example 2

Using the same data given in Example 1, where unit CM = $25 – $10 = $15 and CM ratio = 60%, we get:

Break-even point in units = $15,000/$15 = 1,000 units
Break-even point in dollars = $15,000/0.6 = $25,000

Or, alternatively,

1,000 units × $25 = $25,000

Graphical Approach in a Spreadsheet Format

The graphical approach to obtaining the break-even point is based on the so-called break-even (B–E) chart as shown in Exhibit 4.1. Sales revenue, variable costs, and fixed costs are plotted on the vertical axis while volume, x, is plotted on the horizontal axis. The break-even point is the point where the total sales revenue line intersects the total cost line. The chart can also effectively report profit potentials over a wide range of activity and therefore be used as a tool for discussion and presentation.

The profit-volume (P–V) chart, as shown in Exhibit 4.2, focuses directly on how profits vary with changes in volume. Profits are plotted on the vertical axis while units of output are shown on the horizontal axis. The P–V chart provides a quick condensed comparison of how alternatives on pricing, variable costs, or fixed

Exhibit 4.1

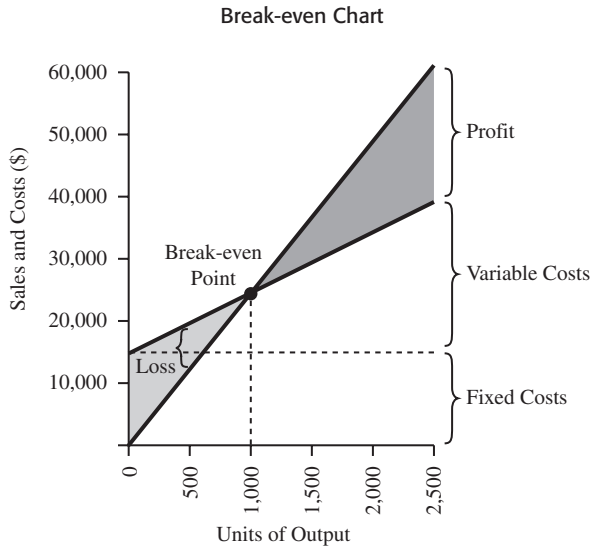
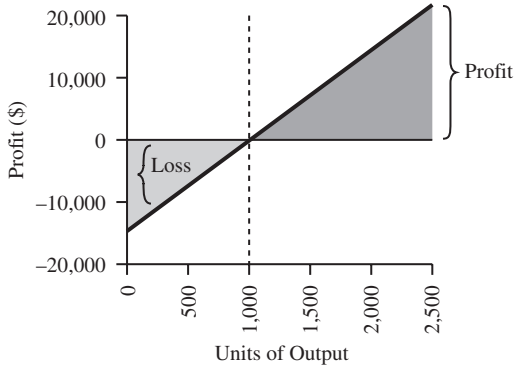


Exhibit 4.2

Profit-Volume (P-V) Chart



costs may affect net income as volume changes. The P–V chart can be easily constructed from the B–E chart. Note that the slope of the chart is the unit CM.

Determination of Target Income Volume

Besides determining the break-even point, break-even and contribution margin analysis determines the sales required to attain a particular income level or target net income. The formula is:

$$\text{Target income volume} = \frac{\text{Fixed costs} + \text{Target income}}{\text{Unit CM}}$$

Example 3

Using the same data given in Example 1, assume that Flip Toy Store wishes to attain a target income of $15,000 before tax.

Then the target income volume would be:

$$\frac{\$15,000 + \$15,000}{\$25 - \$10} = \frac{\$30,000}{\$15} = 2,000 \text{ units}$$

Impact of Income Taxes

If target income is given on an after-tax basis, the target income volume formula becomes:

$$\text{Target income volume} = \frac{\text{Fixed costs} + [\text{Target after-tax income}/(1 - \text{tax rate})]}{\text{Unit CM}}$$

Example 4

Assume in Example 1 that Flip Toy Store wants to achieve an after-tax income of $6,000. The tax rate is 40 percent. Then

$$\text{Target income volume} = \frac{\$15,000 + [\$6,000 / (1 - 0.4)]}{\$15}$$

$$= \frac{\$15,000 + \$10,000}{\$15} = 1,667 \text{ units}$$

Margin of Safety

The margin of safety is a measure of difference between the actual sales and the break-even sales. It is the amount by which sales revenue may drop before losses begin, and is expressed as a percentage of expected sales:

$$\text{Margin of safety} = \frac{\text{Break-even sales}}{\text{Expected sales}}$$

The margin of safety is used as a measure of operating risk. The larger the ratio, the safer the situation since there is less risk of reaching the break-even point.

Example 5

Assume Flip Toy Store projects sales of $35,000 with a break-even sales level of $25,000. The projected margin of safety is

$$\frac{\$35,000 - \$25,000}{\$35,000} = 28.57\%$$

Some Applications of Contribution Margin Analysis and "What-If" Analysis

The concepts of contribution margin and the contribution income statement have many applications in profit planning and short-term decision making. Many "what-if" scenarios can be evaluated using them as planning tools, especially utilizing a spreadsheet program. Some applications are illustrated in Examples 6 to 10 using the same data as in Example 1.

Example 6

Recall from Example 1 that Flip Toy Store has a CM of 60 percent and fixed costs of $15,000 per period. Assume that the company expects sales to go up by $10,000 for the next period. How much will income increase?

Using the CM concepts, we can quickly compute the impact of a change in sales on profits. The formula for computing the impact is:

$$\text{Change in net income} = \text{Dollar change in sales} \times \text{CM ratio}$$

Thus:

$$\text{Increase in net income} = \$10{,}000 \times 60\% = \$6{,}000$$

Therefore, the income will go up by $6,000, assuming there is no change in fixed costs.

If we are given a change in unit sales instead of dollars, then the formula becomes:

$$\text{Change in net income} = \text{Change in unit sales} \times \text{Unit CM}$$

Example 7

Assume that the store expects sales to go up by 400 units. How much will income increase? From Example 1, the company's unit CM is $15. Again, assuming there is no change in fixed costs, the income will increase by $6,000.

$$400 \text{ units} \times \$15 = \$6{,}000$$

Example 8

What net income is expected on sales of $47,500?

The answer is the difference between the CM and the fixed costs:

CM: $47,500 × 60%	$28,500
Less: Fixed costs	15,000
Net income	$13,500

Example 9

Flip Toy Store is considering increasing the advertising budget by $5,000, which would increase sales revenue by $8,000. Should the advertising budget be increased?

The answer is no, since the increase in the CM is less than the increased cost:

Increase in CM: $8,000 × 60%	$4,800
Increase in advertising	5,000
Decrease in net income	$ (200)

Example 10

Consider the original data. Assume again that Flip Toy Store is currently selling 1,500 units per period. In an effort to increase sales, management is considering cutting its unit price by $5 and increasing the advertising budget by $1,000.

If these two steps are taken, management feels that unit sales will go up by 60 percent. Should the two steps be taken?

The answer can be obtained by developing comparative income statements in a contribution format:

	(A) Present (1,500 units)	(B) Proposed (2,400 units)	(B – A) Difference
Sales	$37,500 (@$25)	$48,000 (@$20)	$10,500
Less: Variable cost	15,000	24,000	9,000
CM	$22,500	$24,000	$ 1,500
Less: Fixed costs	15,000	16,000	1,000
Net income	$ 7,500	$ 8,000	$ 500

The answer, therefore, is yes.

Sales Mix Analysis

Break-even and cost-volume-profit analysis requires some additional computations and assumptions when a company produces and sells more than one product. In multiproduct firms, sales mix is an important factor in calculating an overall company break-even point.

Different selling prices and different variable costs result in different unit CM and CM ratios. As a result, the break-even points and CVP relationships vary with the relative proportions of the products sold, called the *sales mix*.

In break-even and CVP analysis, it is necessary to predetermine the sales mix and then compute a weighted average unit CM. It is also necessary to assume that the sales mix does not change for a specified period. The break-even formula for the company as a whole is:

$$\text{Break-even sales in units (or in dollars)} = \frac{\text{Fixed Costs}}{\text{Weighted Average Unit CM (or CM Ratio)}}$$

Example 11

Assume that Knibex, Inc., produces cutlery sets out of high-quality wood and steel. The company makes a deluxe cutlery set and a standard set that have these unit CM data:

	Deluxe	Standard
Selling price	$15	$10
Variable cost per unit	12	5
Unit CM	$ 3	$ 5
Sales mix	60%	40%
	(based on sales volume)	
Fixed costs	$76,000	

The weighted average unit CM = ($3)(0.6) + ($5)(0.4) = $3.80. Therefore, the company's break-even point in units is:

$$\frac{\$76{,}000}{\$3.80} = 20{,}000 \text{ units}$$

Which is divided in this way:

Deluxe: 20,000 units × 60% = 12,000 units
Standard: 20,000 units × 40% = 8,000
20,000 units

Note: An alternative is to build a package containing 3 deluxe models and 2 standard models (3:2 ratio). By defining the product as a package, the multiple-product problem is converted into a single-product one. Then follow the next three steps.

Step 1. Compute the package CM.

	Deluxe	Standard
Selling price	$15	$10
Variable cost per unit	12	5
Unit CM	$ 3	$ 5
Sales mix	3	2
Package CM	$9	$10
	$19 package total	

$76,000/$19 per package = 4,000 packages

Step 2. Multiply this number by their respective mix units.

Deluxe: 4,000 packages × 3 units = 12,000 units
Economy: 4,000 packages × 2 units = 8,000
20,000 units

Example 12

Assume that Dante, Inc., is a producer of recreational equipment. It expects to produce and sell three types of sleeping bags—the Economy, the Regular, and the Backpacker. Information on the bags follows.

	Budgeted			
	Economy	**Regular**	**Backpacker**	**Total**
Sales	$30,000	$60,000	$10,000	$100,000
Sales mix	30%	60%	10%	100%
Less VC	24,000	40,000	5,000	69,000
	(80%)*	(66⅔%)	(50%)	(69%)
CM	$ 6,000	$20,000	$ 5,000	$ 31,000†
CM ratio	20%	33⅓%	50%	31%
Fixed costs				$ 18,600
Net income				$ 12,400

*$24,000/$30,000 = 80%
†$31,000/$100,000 = 31%

The CM ratio for Dante, Inc., is $31,000/$100,000 = 31 percent.

Therefore, the break-even point in dollars is

$$\frac{\$18{,}600}{0.31} = \$60{,}000$$

which will be split in the mix ratio of 3:6:1 to give us these break-even points for the individual products:

Economy:	$60,000 × 30% =	$18,000
Regular:	$60,000 × 60% =	36,000
Backpacker:	$60,000 × 10% =	6,000
		$60,000

One of the most important assumptions underlying CVP analysis in a multiproduct firm is that the sales mix will not change during the planning period. But if the sales mix changes, the break-even point will also change.

Example 13

Assume that total sales from Example 12 was achieved at $100,000 but that an actual mix came out differently from the budgeted mix (i.e., for Economy, 30% to 55%; for Regular, 60% to 40%; and for Backpacker, 10% to 5%).

	Actual			
	Economy	**Regular**	**Backpacker**	**Total**
Sales	$55,000	$40,000	$5,000	$100,000
Sales mix	55%	40%	5%	100%
Less: VC	44,000*	26,667*	2,500*	69,000
	(80%)	(66⅔%)	(50%)	(69%)
CM	$11,000	$13,333	$2,500	$ 26,833
CM ratio	20%	33⅓%	50%	26.83%†
Fixed Costs				$ 18,600
Net income				$ 8,233

*$55,000 × 80% = $44,000; $40,000 × 66.23% = $26,667; $5,000 × 50% = $2,500
†$26,833/$100,000 = 26.83%

Note: The shift in sales mix toward the less profitable line, Economy, has caused the CM ratio for the company as a whole to drop from 31 percent to 26.83 percent.

The new break-even point will be $18,600/0.2683 = $69,325.

The break-even dollar volume has increased from $60,000 to $69,325.

The deterioration (improvement) in the mix caused net income to go down (up). It is important to note that, generally, the shift of emphasis from low-margin products to high-margin ones will increase the overall profits of the company.

Example 14 (Sales Mix Analysis for Service Organizations)

The City Ballet Company features five different ballets per year. For the upcoming season, the five ballets to be performed are *The Dream, Petroushka, The Nutcracker, Sleeping Beauty*, and *Bugaku*. The general manager has tentatively scheduled the following number of performances for each ballet for the coming season:

Dream:	5
Petroushka:	5
Nutcracker:	20
Sleeping Beauty:	10
Bugaku:	5

To produce each ballet, costs must be incurred for costumes, props, rehearsals, royalties, guest artist fees, choreography, salaries of production staff, music, and wardrobe. These costs are fixed for a particular ballet regardless of the number of performances. The direct fixed costs for each ballet are:

Dream:	$275,500
Petroushka:	$145,500
Nutcracker:	$ 70,500
Sleeping Beauty:	$345,000
Bugaku:	$155,500

Other fixed costs are incurred:

Advertising:	$80,000
Insurance:	15,000
Administrative salaries:	222,000
Office rental, phone, and so on:	84,000
Total:	$401,000

For each performance of each ballet, these costs also are incurred:

City Symphony:	$3,800
Auditorium rental:	700
Dancers' payroll:	4,000
Total:	$8,500

The auditorium in which the ballet is presented has 1,854 seats, which are classified as A, B, and C. The best viewing ranges from A seats to C seats. Information concerning the different types of seats follows.

	A Seats	B Seats	C Seats
Quantity	114	756	984
Price	$35	$25	$15
Percentage sold for each performance.*			
Nutcracker	100	100	100
All others	100	80	75

*Based on past experience, the same percentages are expected for the coming season.

The expected revenues from the performances that have been tentatively scheduled can be calculated in this way:

Number of seats sold (expected):
Seats sold = Number of performances × Capacity × Percent sold

	Type of Seat		
	A	**B**	**C**
Dream	570	3,024	3,690
Petroushka	570	3,024	3,690
Nutcracker	2,280	15,120	19,680
Sleeping Beauty	1,140	6,048	7,380
Bugaku	570	3,024	3,690
	5,130	30,240	38,130

$$\begin{aligned}\text{Total revenues} &= (\$35 \times 5,130) + (\$25 \times 30,240) + (\$15 \times 38,130)\\ &= \$179,550 + \$756,000 + \$571,950\\ &= \$1,507,500\end{aligned}$$

Segmented revenues (Seat price × Total seats):

	A	**B**	**C**	**Total**
Dream	$19,950	$ 75,600	$ 55,350	$150,900
Petroushka	19,950	75,600	55,350	150,900
Nutcracker	79,800	378,000	295,200	753,000
Sleeping Beauty	39,900	151,200	110,700	301,800
Bugaku	19,950	75,600	55,350	150,900

Segmented income statement:

	Dream	***Petroushka***	***Nutcracker***
Sales	$150,900	$150,900	$753,000
Variable expenses	42,500	42,500	170,000
Contribution margin	$108,400	$108,400	$583,000
Direct fixed expenses	275,500	145,500	70,500
Segment margin	$(167,100)	$(37,100)	$512,500

	Sleeping Beauty	***Bugaku***	**Total**
Sales	$301,800	$150,900	$1,507,500
Variable expenses	85,000	42,500	382,500
Contribution margin	$216,800	$108,400	$1,125,000
Direct fixed expenses	345,000	155,500	992,000
Segment margin	$(128,200)	$(47,100)	$ 133,000
Common fixed expenses			401,000
Operating income			$(268,000)

The computation of the number of performances of each ballet required for the company as a whole to break-even requires two steps:

Step 1. Computer-weighted contribution margin (package). Note that the current mix is 1:1:4:2:1.

$$\$21{,}680 + \$21{,}680 + 4(\$29{,}150) + 2(\$21{,}680) + \$21{,}680 = \$225{,}000$$
$$\text{Packages} = (\$992{,}000 + \$401{,}000)/\$225{,}000 = 6.19 \text{ or } 7 \text{ packages (rounded up)}$$

Step 2. Multiply this number by their respective mix units. This yields the following number of performances:

7	*Dream*	(1×7)
7	*Petroushka*	(1×7)
28	*Nutcracker*	(4×7)
17	*Sleeping Beauty*	(2×7)
7	*Bugaku*	(1×7)

Contribution Margin Analysis and Nonprofit Organizations

Break-even and contribution margin analysis is not limited to profit firms. It not only calculates the break-even service level for nonprofit organizations, but helps answer a variety of "what-if" decision questions.

Example 15

OCM, Inc., a Los Angeles county agency, has a $1,200,000 lump-sum annual budget appropriation for an agency to help rehabilitate mentally ill patients. On top of this, the agency charges each patient $600 a month for board and care. All of the appropriation and revenue must be spent. The variable costs for rehabilitation activity average $700 per patient per month. The agency's annual fixed costs are $800,000. The agency manager wishes to know how many patients can be served. Let x = number of patients to be served.

$$\text{Revenue} = \text{Total expenses}$$
$$\text{Lump-sum appropriation} + \$600\,(12)\,x = \text{Variable expenses} + \text{Fixed costs}$$
$$\$1{,}200{,}000 + \$7{,}200\,x = \$8{,}400\,x + \$800{,}000$$
$$(\$7{,}200 - \$8{,}400)\,x = \$800{,}000 - \$1{,}200{,}000$$
$$-\$1{,}200\,x = -\$400{,}000$$
$$x = \$400{,}000/\$1{,}200$$
$$x = 333 \text{ patients}$$

We will investigate two "what-if" scenarios:

(1) Suppose the manager of the agency is concerned that the total budget for the coming year will be cut by 10% to a new amount of $1,080,000. All other things remain unchanged. The manager wants to know how this budget cut affects the next year's service level.

$$\$1{,}080{,}000 + \$7{,}200\,x = \$8{,}400\,x + \$800{,}000$$
$$(\$7{,}200 - \$8{,}400)\,x = \$800{,}000 - \$1{,}080{,}000$$
$$-\$1{,}200\,x = -\$280{,}000$$
$$x = \$280{,}000/\$1{,}200$$
$$x = 233 \text{ patients}$$

(2) The manager does not reduce the number of patients served despite a budget cut of 10%. All other things remain unchanged. How much more does the manager have to charge patients for board and care? In this case, x = board and care charge per year.

$$\begin{aligned} \$1,080,000 + 333\,x &= \$8,400\,(333)\,x + \$800,000 \\ 333\,x &= \$2,797,200 + \$800,000 - \$1,080,000 \\ 333\,x &= \$2,517,200 \\ x &= \$2,517,200/333 \text{ patients} \\ x &= \$7,559 \end{aligned}$$

Thus, the monthly board and care charge must be increased to $630 ($7,559/12 months).

CVP Analysis with Step-function Costs

The introduction of step-function costs is somewhat more difficult than it might first appear. Ideally, we would like to be able to assume that, for any given relevant range, we could simply add together the step-function costs and the fixed costs to give us the total applicable fixed costs. We then could utilize the formula as described earlier. Unfortunately, the process is not quite that simple, as the next example illustrates.

Example 16

Amco Magazine Company publishes a monthly magazine. The company has fixed costs of $100,000 a month, variable costs per magazine of $.80, and charges $1.80 per magazine. In addition, the company also has supervisory costs. These costs behave in this way:

Volume	Costs
0–50,000	$10,000
50,001–100,000	20,000
100,001–150,000	30,000

Amco's monthly break-even volume (number of magazines) can be calculated step by step.

If we attempt to solve the break-even formula at the first level of fixed costs, we have this equation:

$$\begin{aligned} x &= FC/(p - v) \\ &= (\$100,000 + 10,000)/(\$1.80 - \$.80) \\ &= \$110,000/.\$1 \\ &= 110.000 \text{ units} \end{aligned}$$

The problem with this solution is that, while the break-even volume is 110,000 magazines, the relevant range for the step-function costs was only 0–50,000

magazines. Thus, a break-even of greater than 50,000 magazines is invalid, and we must move to the next step on the step function, which gives us the next equation:

$$\begin{aligned} x &= FC/(p - v) \\ &= (\$100,000 + 20,000)/(\$1.80 - \$.80) \\ &= \$120,000/.\$1 \\ &= 120,000 \text{ units} \end{aligned}$$

This solution is also invalid. Only when we get to the third level do we encounter a valid solution:

$$\begin{aligned} x &= FC/(p - v) \\ &= (\$100,000 + 30,000)/(\$1.80 - \$.80) \\ &= \$130,000/.\$1 \\ &= 130,000 \text{ units} \end{aligned}$$

The conclusion we must draw is that the incorporation of step-function costs in the CVP formula requires a trial-and-error process to reach the break-even volume.

From a profit-seeking perspective, a 150,000 unit level is most profitable.

	50,000	100,000	150,000
CM(@1)	$ 50,000	$100,000	$150,000
FC	100,000	120,000	130,000
NI	($ 50,000)	($ 20,000)	$ 20,000

Assumptions Underlying Break-even Contribution Margin Analysis

The basic break-even and contribution margin models are subject to six limiting assumptions. They are:

1. The selling price per unit is constant throughout the entire relevant range of activity.
2. All costs are classified as fixed or variable.
3. The variable cost per unit is constant.
4. There is only one product or a constant sales mix.
5. Inventories do not change significantly from period to period.
6. Volume is the only factor affecting variable costs.

Conclusion

Break-even and contribution margin analysis is useful as a frame of reference, as a vehicle for expressing overall managerial performance, and as a planning device via break-even techniques and "what-if" scenarios.

The next points highlight the analytical usefulness of contribution margin analysis as a tool for profit planning:

- A change in either the selling price or the variable cost per unit alters CM or the CM ratio and thus the break-even point.
- As sales exceed the break-even point, a higher unit CM or CM ratio will result in greater profits than a small unit CM or CM ratio.
- The lower the break-even sales, the less risky the business and the safer the investment, other things being equal.
- A large margin of safety means lower operating risk since a large decrease in sales can occur before losses are experienced.
- Using the contribution income statement model and a spreadsheet program, such as Excel, a variety of "what-if" planning and decision scenarios can be evaluated.
- In a multiproduct firm, sales mix is often more important than overall market share. The emphasis on high-margin products tends to maximize overall profits of the firm.

We discussed how the traditional contribution analysis can be applied to the profit and nonprofit setting. Illustrations were provided. Managers can prepare the income statement in a contribution format, which organizes costs by behavior rather than by the functions of manufacturing, sales, and administration. The contribution income statement is widely used as an internal planning and decision-making tool.

5

Profit Planning:
Targeting and Reaching Achievable Goals

In profit planning, we must determine the strategy, which is one of several ways to reach a goal. But we must also determine the objective, which is the target that can be quantified and that is developed from analysis of the situation at present and in the future. And finally, we must see what is needed to implement the plan.

Profit planning involves setting realistic profit objectives and targets and accomplishing them. The plan must consider the organization structure, product line (e.g., up-to-date, obsolete), services rendered, selling prices, sales volume, costs (manufacturing and operating expenses), market share, territories, skill of labor force, sources of supply, economic conditions, political environment, risk, salesforce effectiveness, financial health (e.g., cash flow to fund programs), physical resources and condition, production schedules, human resources (e.g., number and quality of employees, training programs, relationship with union), distribution facilities, growth rate, technological ability, motivational aspects, and publicity.

Each part of the plan must be evaluated for reasonableness as well as for its effect on other parts of the plan. Trouble spots must be identified and corrected. Information should be in the simplest and clearest form. Profits may be increased by increasing revenue (selling price and/or sales volume) and reducing costs, eliminating duplication of work and inconsistencies.

Managers can improve profitability of their responsibility unit by:

- Operating the department with the minimum number of employees. This may include downsizing through layoffs.
- Reducing operating costs, such as using automation and robotics to replace the cost of manual labor
- Buying rather than leasing when cost beneficial

- Emphasizing previous success. For example, if growth has come from product development, then allocate more funds to research and development (R&D)
- Keeping up-to-date
- Using high-technology equipment
- Self-constructing assets when feasible
- Eliminating useless operations and paperwork (e.g., reports)
- Being productive and progressive in obtaining efficiencies realizable with existing resources and capabilities
- Improving the reliability of the product and service
- Expanding into new operations and areas so every opportunity is pursued
- Improving supplier relationships, including negotiating better prices and terms. Alternative sources of supply may be bought when cost effective.
- Screening new hires for honesty and competence
- Having adequate insurance, including business interruption and product liability

The profit plan should be in writing, consistently applied, and contain these key elements:

- Statement of objectives
- Parameters of achieving those objectives (e.g., prohibition of reducing discretionary costs, such as R&D, in the current year just to bolster near-term profits when this will have long-term negative effects)
- Plans (operating and financial)
- Schedules
- Ways to measure and track performance
- Review procedures
- Mechanism for making needed changes

An operating plan tells how the objective is to be achieved. For example, an operating plan for a sales manager may provide for a reduction in selling expenses of 10 percent by improving salesperson productivity through better training, reducing the number of salespeople, and increasing the number of calls per salesperson.

The financial plan is a budget expressed in dollars that quantifies the operating plan. Lower-level managers are more involved with operational specifics (details) and carrying out plans than upper-level managers.

Planning should occur within a reasonable time frame, not rushed, considering alternatives that accomplish the long-term objectives of the manager. For example, a new product should undergo test marketing before it is introduced on a massive scale. Further, profit planning for the next year should begin as early as possible. It must be in place by January 1 of that year.

The profit plan may be for one year and multiyears. For example, in a five-year plan, there should be profit objectives set for each of the years included in that

plan. A five-year plan should be the maximum time period because the longer the time horizon, the more difficult it is to predict. Further, a five-year period would be more practical and attainable than longer periods. The time period chosen should take into account the nature and stability of the business.

Reports should provide managers with the right information needed to make a good decision. Once that decision has been made, control reports should show whether it has worked out or not. Further, managers should not procrastinate once they have made a decision. Managers should not keep changing their mind because of employee reaction.

Managers must address what is crucial. For example, material costs are important to a manufacturing company but not to a financial service business. In airlines, passenger revenue per mile is crucial.

Information has to be given to the right managers and must directly relate to their operations. The type of profit plan and its components will differ among companies, depending on their unique characteristics, features, problems, conditions, and requirements. Unfortunately, profit planning has become more difficult because of competition, the high cost associated with introducing new products (e.g., R&D), more educated consumers, and government regulation.

This chapter discusses establishing and evaluating profit targets, planning objectives, role of nonfinancial managers, plan assumptions and alternatives, manager responsibilities, participation in the planning process, employee relations, coordination and communication, scheduling, handling problems, and analysis and control of the profit plan.

Goal Congruence

We must keep in mind goal congruence, which is top management's viewpoint agreeing with the lower-level managers' viewpoint. Some of this activity could be misdirected if each manager assumes, as is human, that what is best for his or her responsibility center is best for the company. Therefore, the manager must consider general company goals and assumptions as a background for all planning activity.

The standard philosophy is that more is better; that is, more sales, products, fields of activity, profit, and return. Most businesses feel that ceasing to grow is beginning to die.

Profit Targets

Profit planning sets a target profit that takes into account expected sales and costs for next year and for longer periods. The manager should track, on a regular basis, the progress in meeting the profit plan so any needed adjustments may be made in selling effort or cost containment. For example, if the yearly target is an increase in sales of 20 percent and in the first quarter sales have actually decreased by 2 percent, a problem is indicated. Yet if the plan calls for a reduction in yearly costs

of 10 percent and at the end of the second quarter costs have been trimmed by 12 percent, the situation is quite favorable.

A profit target can apply to the individual components of that profit. For example, a company that now derives 80 percent of its earnings from one product may have as its profit goal in three years to derive 40 percent of its profit from this product and 60 percent of its profit from other products. This goal may be achieved through developing new products, enhancing existing products, change in advertising and sales promotion, and R&D efforts.

Objectives in the Profit Plan

An objective states what is going to be done. The objective must be clear, quantifiable, compatible, practical, strong, realistic, and attainable. The objective should be in writing. Objectives changed too often become meaningless. Further, objectives must not conflict with each other.

The objective must be specific. For example, an objective of increasing sales should state by how much, where, and when. It may take this form: "The divisional objective is to increase sales by 50,000 units of product X in territory A for 20XX." The manager should clearly communicate objectives to subordinates.

Objectives should be established in priority order. An example is a marketing department that should give primary emphasis to the existing, successful product line and secondary emphasis to unproven, high-risk new products. Another example is the R&D manager who should give first priority to basic research to improve the existing products and a lower level of priority to research on new products.

Objectives should be ranked in terms of those having the highest return. The progress toward meeting the objective should be measured at regular intervals (e.g., quarterly).

Role of Nonfinancial Managers

The nonfinancial manager must abandon sacred cows to increase profits. For example, a less expensive raw material may be used to result in cost savings without sacrificing product quality. Another example is to lower the quality of a product to save on costs and reduce the selling price to attract more business from price-oriented customers. A company that sells only to a few prestigious accounts that are willing to pay a higher price may produce greater overall profits by lowering the quality and price to get a huge number of price-sensitive accounts. Conversely, the company may keep its high-priced product as is and develop a new second product line of lower prices with a different label to attract the price-conscious consumer.

The marketing manager may increase profits by increasing the selling price, increasing volume, improving quality and service, reducing the time to respond to customer complaints, concentrating on high-demand products, modifying geo-

graphic locations, having clean facilities, altering distribution outlets, introducing new products, redesigning packaging, using more attractive styling, discontinuing unprofitable products, increasing personal selling, changing the sales force, and modifying advertising and sales promotion policy.

The marketing manager should determine how much of each sales dollar goes to meeting marketing expenses. He or she should determine the ratio of the change in marketing expenses over the year to expenses last year to indicate the degree of cost control. The manager must also keep abreast of marketing trends for products and services.

The manager should rate salespeople in terms of the net profitability brought in. A comparison should be made between the salesperson's actual sales relative to the costs to obtain those sales. Other performance measures are dollar sales quotas and the number of orders from existing and new customers.

A sales analysis should examine orders booked, orders backlogged, orders lost by out-of-stock or delayed shipments, ratio of orders billed to orders booked, and aging of orders. A sales effort analysis involves the number of sales calls, number of advertisements and mailings, number of new customers, market share, and sales mix.

The production manager can maximize profits by spreading manufacturing as regularly as possible over the entire year. This may add stability to manufacturing and lower costs (e.g., eliminate overtime, layoffs versus rehiring and training). The manager may also increase profits through private labeling for other companies. This would achieve better plant and machinery utilization and spread fixed costs over more units. The manager should also maintain plant facilities, obtain givebacks from employees or not give raises, derive optimum inventory balances and reduce inventory costs, lower raw material costs, and properly schedule production.

The production manager should use these factory performance measures: capacity in use and units produced, percentage of rejects and rework, yield percentages for direct materials and purchased parts, and trends in costs of service, especially during new product learning curve periods.

The purchasing manager can increase profits by properly timing the purchase of raw materials, obtaining volume and cash discounts, changing suppliers to obtain lower prices (assuming reliability in delivery), and inspecting items to ensure quality.

The transportation manager can boost profits by scheduling delivery routes to economize on time and by lowering mileage costs, including fuel and depreciation.

The personnel manager can improve profits by instituting an incentive plan to improve dollar revenue per employee and sales volume per worker. The ratio of annual terminations to the average number of employees can also be examined.

The research director can contribute by substituting low-cost components for high-cost ones without sacrificing quality or customer acceptance.

The engineering manager can reduce the number of diverse elements in use (e.g., 100) to standardized ones (e.g., 20), and find fewer cost combinations of inputs (e.g., materials and labor mix).

The service manager is concerned with the percentage of billable time, standard and average billing rate, average cost per hour of employee time, and overhead (or

markup) rate to labor time. The manager should maintain a system that can differentiate quickly and accurately between customers based on the degree of service they require and the revenues their patronage is likely to generate.

The credit manager can reduce bad debts and the collection period without losing sales.

Because a nonfinancial manager's responsibility is to plan and control, he or she must be able to communicate effectively in order to accomplish goals. Communication may be written (formal financial reports, ratio, statistics, narrative), graphical (charts, diagrams, pictures), and oral (conferences, group meetings).

Assumptions

Profit plans rely on assumptions and projections. Nonfinancial managers will have to make assumptions in order to predict the future. The assumptions must be continually updated. Any revisions require special approval.

If the assumptions are not realistic—for example, for an increase in selling price if there is a high degree of competition and/or a recession—the basis of the profit plan is in doubt. Further, an increase in selling price may result in a decline in sales volume, hurting overall profits because consumers will switch to cheaper brands (e.g., away from Philip Morris cigarettes).

Alternatives

The financial impact of alternatives in the profit plan has to be considered. Alternative plans can allow for such possibilities as a strike. The alternative selected should be practical and result in the highest profit in conformity with the nonfinancial manager's goals. The bottom line, and not the personal tastes of the manager, is all that counts. For example, the sales manager may prefer to sell through direct mail, but he or she should use the manufacturer's representatives if that is more profitable.

The sales manager should try to obtain the most profitable sales at the minimum cost. Some of the sales manager's options are:

- Modify advertising and sales promotion.
- Change the method of distribution.
- Eliminate unprofitable products.
- Develop new markets and products.
- Combine small orders to reduce transportation charges.
- Redesign truck routes to economize on fuel.
- Change the sales territory.
- Alter the selling price.
- Change credit and collection policies.
- Alter packaging and labeling.

The production manager is responsible for manufacturing sufficient quantities to meet sales needs at the lowest practical cost while maintaining quality within a desired time period.

- Improve the production process and supervision of workers.
- Change the repair and maintenance policy.
- Move production elements (e.g., machinery) or entire facilities.
- Use higher-technology equipment.
- Determine the best production run.
- Properly schedule work flow and employee time.
- Synchronize production and inventory levels.
- Reduce fixed costs.

The purchasing manager is responsible for buying materials and supplies at the least cost while maintaining quality. The purchasing manager should:

- Carefully inspect the quality of purchased items.
- Decrease the days that elapse between purchase and delivery.
- Decide on less expensive product substitutes.
- Obtain volume discounts from larger orders.
- Reduce inventory cost with more frequent deliveries.
- Emphasize standardized (uniform) items.
- Change unreliable suppliers.

The personnel manager can:

- Expand job training.
- Improve recruitment.
- Establish merit increases based on performance.
- Select the right person for the right job.

Responsibility

Profit planning requires that managers be held accountable for their results if they have authority over the items in question. Responsibility without authority causes the profit planning system to fail and results in manager frustration.

Planning should avoid conflicts that have a net negative profit impact on the business. An example is a sales manager who accepts short-term, low-volume sales orders even though they result in unusually high manufacturing costs for the production manager.

A solution is to make nonfinancial managers jointly responsible for an objective that affects both. Interrelated departments must work as a group to maximize

company profit by considering the net advantage or disadvantage to the business. The managers should share credit or blame for these interrelated performances. In this way, managers will work toward meeting overall company objectives.

Each manager must determine whether responsibility unit managers are contributing to the profit plan in the expected proportion.

Participation

Profit planning involves effort and input by managers in sales, production, distribution, research and development, service, engineering, finance, traffic, and general business.

Line managers are concerned with operating and executing plans. Staff managers assist others in an advisory capacity. In either case, the manager must be able to change and try new things.

Financial people should spend time with operating personnel to familiarize themselves with operations, problems, and requirements. Managers should encourage financial personnel to discuss with them the nature and characteristics of their department's or responsibility unit's operations. In this way, the accountant or financial executive can prepare meaningful budget information and performance reports that can be used by nonfinancial managers.

Managers should insist on getting reports, schedules, and forms that are useful. Otherwise, the information may not be suitable or relevant and will be discarded.

Nonfinancial managers should communicate clearly to financial managers the type and nature of information they need. Otherwise, time and money will be wasted on useless information for managers. As a result, the managers may waste time accumulating accounting numbers themselves.

Subordinates

Managers should monitor the performance of subordinates but should give them latitude in making decisions.

Subordinates should be rewarded (e.g., salary increases, merit bonuses) on the basis of results that improve divisional profitability. The optimum pay raise is the minimum pay increase that will yield the maximum productivity increase. Managers whose decisions have hurt profitability should be called to account. They should learn from their errors. If too many errors have been made, a replacement might be appropriate.

Compensation to subordinates should be competitive with other companies in the industry. No limit should be placed on salaries or the successful employee may quit.

Coordination

Profit planning is a team effort involving all managers, line and staff, to accomplish the profit goal. For example, there should be coordination among the sales

manager, production supervisor, purchasing manager, receiving manager, director of engineering, and quality control supervisor, because interrelationships exist between them.

Scheduling

A product introduced should be planned and scheduled in the most economical way. Workers should be available when needed. Each step should proceed logically. Profit planning involves delivering products on time by such means as reducing workers' absentee rates.

Problems

Problems must be identified, addressed with solutions, and profit impacts considered. If the problems cannot be rectified (e.g., they are uncontrollable by the company), the adverse effects must also be taken into account. An example is when a manufacturer loses some retail accounts because of competitors' price cuts and an existing poor relationship between the manufacturer and the retailers because of delivery delays due to a strike.

Control, Evaluation, and Analysis

A management information system (MIS) includes financial information that allows the manager to compare actual results with target figures. It is better to analyze variances "—preferably" monthly. For example, quarterly variance analysis may be too late to give managers the opportunity to correct problems.

A comparison should be made over time between actual profit and budgeted profit. Related useful ratios are actual revenue to budgeted revenue and actual costs to budgeted costs.

The profit expectation of the plan should be compared to prior years' experience as an indicator of reasonableness. For example, it may not be reasonable to project a sales increase for next year of 40 percent when in previous years the sales increase has never exceeded 20 percent. There must be hard evidence (e.g., something in the current year and expected for a future year to justify it) for this dramatic increase.

The projections in the profit plan should be compared to competing companies' experiences. For example, company X will start a new program or project if it earns a rate of return of 30 percent. However, six competing companies have already tried this program or project and either have lost money or earned a return rate below 5 percent. This makes the company's projected 30 percent rate of return questionable unless special or unique reasons to justify it can be shown.

Ratios may be prepared comparing projected performance to historical performance. Some useful ratios include return on investment (ROI) (net income/total assets), profit margin (net income/sales), cost of sales to sales, direct material to

sales, direct labor to sales, factory overhead to sales, selling expenses to sales, and general and administrative expenses to sales. However, in making ratio calculations, the data must be comparable over the years.

The manager should not overstate current year profit at the expense of sacrificing future profitability.

The manager must track the status of a project or program and make immediate decisions if an operation is not productive or profitable. Further, part of a department that no longer serves a useful purpose may be disbanded.

A comparison may be made between the unit costs of the old and the new manufacturing operation to see if the latter is successful.

After a product has been marketed, the company must continually evaluate and improve it, based on customer reaction. Feedback should occur on a timely basis so that necessary corrective steps may be taken.

In order to make valid comparisons between the company and a competitor, there must be a comparable base. For example, if one company has old and inefficient plant facilities, it is not comparable to one with modern, efficient facilities.

An illustrative profit plan is presented in Exhibit 5.1.

Internal Controls

Internal controls are fundamental in profit planning. Assets should be safeguarded and controlled. An individual's work should be checked by another. One person should not have control over a transaction from beginning to end. Requests and requisitions should be reviewed and approved. Before an item is paid, make certain it is appropriate.

Real-life Illustrations in Profit Planning

Staples, the office supply company, achieves the lowest net-landed cost in the entire office stationery business. But it also targets small business companies employing fewer than 50 people. To further the relationship with this market segment, Staples has created a club. Customers join at no extra cost and get at least a 5 percent discount on fast-moving items. In order to get the discount, the customers must show their cards, allowing Staples to track sales by customer and gain useful data for satisfying its market. Some store managers now have incentives based on customer satisfaction.

Some companies look at a customer's lifetime value to the company, not the value of a single transaction. Home Depot is an example of such a company.

Clerks do not spend time with customers to be nice. They do so because the company's business strategy is built around not only selling home repair and improvement items inexpensively, but around customers' needs for information and service.

Although new products win new markets, it may be better in some cases to stick with existing customer segments. It is easier to build sales volume with customers who already know the company. When Entenmann's of New York, a

Exhibit 5.1

Profit Plan

	Jan.	Feb.	Mar.	First Quarter	Remainder of Year	Total for Year
Sales						
Units						
Dollars						
Less: Returns						
Discounts						
Net Sales						
Expenses						
Cost of Goods Sold						
General & Administrative Expenses						
Selling Expenses						
Total Expenses						
Operating Profit						

loyalty leader in specialty bakery products, saw its sales leveling off, it monitored customer purchase patterns in each local market.

Through telephone surveys and focus groups, the company found that customers were looking for fat-free and cholesterol-free items. Entenmann's determined that it was much more economical to develop new health products than to go with another group of customers. Its new product line has been highly successful by addressing the changing needs of the core clientele and also attracting new customers.

The Olive Garden restaurant chain is another company that believes that customer loyalty plays a major role in profit planning. The chain goes against the norm of promoting successful managers to other restaurants every few years and letting assistants take over. It hires local managers whose major asset is that they are known and trusted in the community. Managers stay where they are. They get to know the customers, and their longtime hires add value to the company. It is with employees that the customer builds a bond of trust and expectations. When those people leave, the bond is broken.

Another company that uses this same philosophy is State Farm, the insurance company. Its focus on customer service has resulted in faster growth then most other multiple-line insurers. But rather than being consumed by growth, its capital has mushroomed (all through internally generated surplus) to more than $18 billion, representing the largest capital base of any financial services company in North America.

State Farm began by choosing the right customers. Because of this, it was still able to build the capital necessary to protect its policyholders in years such as 2004, when the company incurred some $6 billion in catastrophe losses.

State Farm agents work from neighborhood offices, which allows them to build long-lasting relationships with their customers and provide personal service. For example, agents scan the local newspaper for the high school honor roll and are sure that their young customers' good grades are recognized with discounts. Commissions are structured to encourage long-term thinking. Rather than bringing in lots of new customers, the company's marketing efforts encourage existing customers to buy additional products, such as home and life insurance.

State Farm's success in building customer loyalty is reflected in retention rates that exceed 90 percent, consistently the best performance of all the national insurers that sell through agents.

Dell Computer has focused on operational excellence to boost profits. Operational excellence is a specific strategy involving the production and delivery of products and services. The objective of this strategy is to lead its industry in price and convenience. Dell's goal is to show PC buyers that they do not have to sacrifice quality or state-of-the-art technology in order to buy personal computers easily and inexpensively.

In the mid-1980s, while Compaq concentrated on making its PCs less expensive and faster than IBM's, Dell saw the opportunity to outdo both IBM and Compaq by focusing not on the product, but on the delivery system. Dell came onto the scene with a radically different and far more efficient operating mode.

Dell realized that Compaq's marketing strategy of selling PCs through dealers to novices could be outperformed by a model that cut dealers out of the distribution process altogether. By selling to customers directly, building to order rather than to inventory, and creating a disciplined and extremely low-cost culture, Dell has been able to undercut Compaq and other PC manufacturers in price and service.

While Dell has risen to $1.7 billion in revenue in less than 10 years, Compaq has been forced to cut prices and overhead. In 2004, Dell had sales of $46 billion.

Global competition, changing markets, and new technologies are opening new roads to reinvent value. IKEA is one company that accomplished this. It changed from a small Swedish mail-order furniture operation into the world's largest retailer of home furnishings, with a global network of 186 enormous stores. In 2004, these stores were visited by more than 150 million people, generated revenues of 15.5 billion, and had an average annual growth rate of 15 percent with profit margins estimated between 8 and 10 percent.

IKEA's huge suburban stores sell simple high-quality knock-down furniture kits that customers transport and assemble themselves. IKEA passes down a portion of what it saves on low-cost components, efficient warehousing, and customer self-service to its customers in the form of lower prices—anywhere from 25 to 50 percent below those of competitors.

IKEA's strategy is to allow customers to take on key tasks that were traditionally done by manufacturers and retailers, such as the assembly of products and delivery to customers' homes. And for doing this it promises substantially lower prices. Part of IKEA's goal is to make itself not just a furniture store but a family outing destination. It provides free strollers, child care, and playgrounds as well as wheelchairs for the disabled and elderly. IKEA stores also have dining facilities.

IKEA's strategic intent is to have its customers understand that their role is not to consume value but to create it. It provides customers with catalogs, tape measures, pens, and notepaper to help them make choices without the need of salespeople. IKEA's goal is not to relieve customers of doing certain tasks but to mobilize them to do easily certain things they have never done before. IKEA has set out to reinvent value and the business system that delivers value for customers and suppliers alike.

The question is "Does IKEA offer a product or a service?" The answer is neither—and both.

This change of values can be compared to cash withdrawals from automatic teller machines (ATMs). Not long ago, it was inconceivable that a customer would replace a personal relationship with a bank teller for a computer system. But today most cash withdrawals come from ATMs.

There are many implications for profit planning.

- Value for customers can be restated to mobilize customers to take advantage and create value for themselves.
- Companies do not compete with each other anymore. Rather, it is the offerings that compete for the customers' money.

- A result of a company's strategic task is the reconfiguration of its relationships and business systems.
- To win at this strategy, the key is to keep offerings competitive. This is why IKEA has become the world's largest furniture retailer, using a strategy that could be applied to many industries.

Conclusion

A profit plan may be stated as target return on investment (e.g., 20 percent ROI), growth in earnings (e.g., 5 percent) or in earnings per share and percentage of sales.

Performance reporting compares actual results with expectations.

All efforts must be expended to accomplish profit goals. Problems have to be identified and addressed immediately.

The manager should rank items in terms of profit potential and growth.

6

Master Budget:

Genesis of Forecasting and Profit Planning

A comprehensive—master—budget is a formal statement of management's expectation regarding sales, expenses, volume, and other financial transactions for the coming period. It consists basically of a pro forma income statement, pro forma balance sheet, and cash budget.

At the beginning of the period, the budget is a plan or standard. At the end, it serves as a control device to help management measure its performance against the plan so that future performance may be improved.

With the aid of computer technology, budgeting can be used as an effective device for evaluation of "what-if" scenarios. Management can find the best course of action among various alternatives through simulation. If management does not like what it sees on the budgeted financial statements in terms of financial ratios such as liquidity, activity (turnover), leverage, profit margin, and market value ratios, it can always alter its contemplated decision and planning set.

The budget is classified broadly into two categories:

1. Operating budget
2. Financial budget

The operating budget consists of:

- Sales budget
- Production budget
- Direct materials budget
- Direct labor budget
- Factory overhead budget
- Selling and administrative expense budget
- Pro forma income statement

The financial budget consists of:

- Cash budget
- Pro forma balance sheet

The five major steps in preparing the budget are:

1. Prepare a sales forecast.
2. Determine expected production volume.
3. Estimate manufacturing costs and operating expenses.
4. Determine cash flow and other financial effects.
5. Formulate projected financial statements.

Exhibit 6.1 presents a master budget.

Comprehensive Sales Planning

Chapter 5 gave an overview of a comprehensive profit plan. The initiating management decisions in developing the plan were the statements of broad objectives, specific goals, basic strategies, and planning premises. The sales planning process is a necessary part of profit planning and control because (1) it provides for the basic management decisions about marketing, and (2) based on those decisions, it is an organized approach for developing a comprehensive sales plan. If the sales plan is not realistic, most if not all of the other parts of the overall profit plan also are not realistic. Therefore, if the management believes that a realistic sales plan cannot be developed, there is little justification for profit planning and control. Despite the views of a particular management, such a conclusion may be an implicit admission of incompetence. Simply, if it is really impossible to assess the future revenue potential of a business, there would be little incentive for investment in the business initially or for continuation of it except for purely speculative ventures that most managers and investors prefer to avoid.

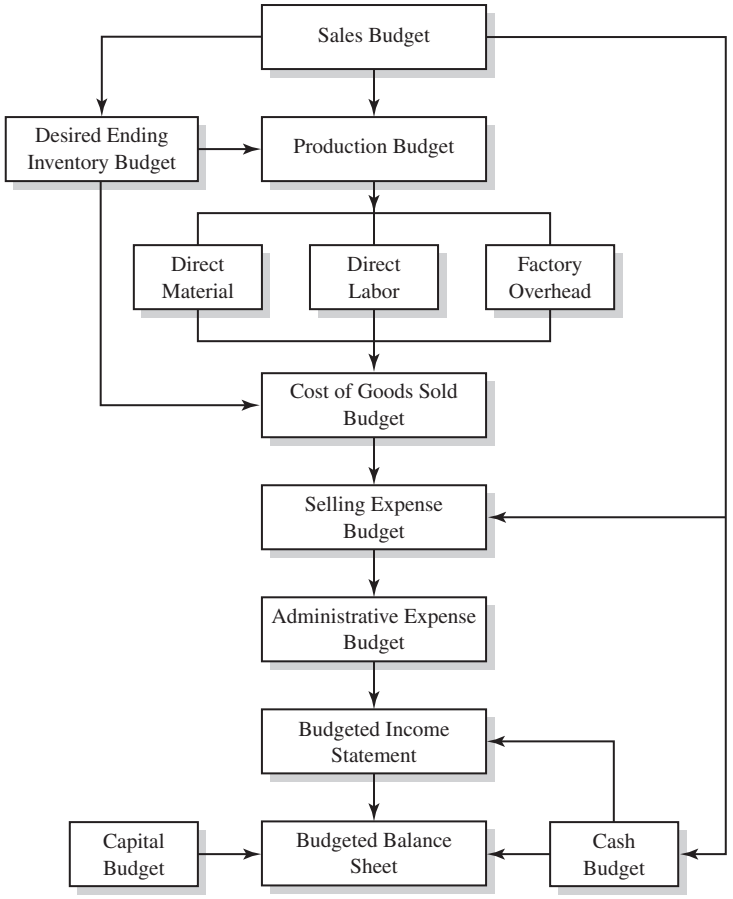
The primary purposes of a sales plan are (1) to reduce uncertainty about the future revenues, (2) to incorporate management judgments and decisions into the planning process (e.g., in the marketing plans), (3) to provide necessary information for developing other elements of a comprehensive profit plan, and (4) to facilitate management's control of sales activities.

Sales Planning Compared with Forecasting

Sales planning and forecasting often are confused. Although related, they have distinctly different purposes. A *forecast* is not a plan; rather it is a statement and/or a quantified assessment of future conditions about a particular subject (e.g., sales revenue) based on one or more explicit assumptions. A forecast should always state the assumptions on which it is based. A forecast should be viewed as only one

Exhibit 6.1

Master Budget



input into the development of a sales plan. The management of a company may accept, modify, or reject the forecast. In contrast, a *sales plan* incorporates management decisions that are based on the forecast, other inputs, and management judgments about such related items as sales volume, prices, sales effects, production, and financing.

Testing the Top Line

Most companies do not really manage top-line growth. They allocate resources to businesses they think will be most productive and hope the economy cooperates. But a growing number of companies are taking a less passive approach and

studying revenue growth more carefully. They argue that quantifying the sources of revenue can yield a wealth of information, which results in more targeted and more effective decision-making. With the right discipline and analysis, they say, growing revenues can be as straightforward as cutting costs. Some companies go so far as to link the two efforts. The idea is to bring the same systematic analysis to growing revenue that we have brought to cost cutting.

A sources-of-revenue statement (SRS) is useful in this effort. The information on revenue captured by traditional financial statements is woefully inadequate. Sorting revenues by geographic market, business unit, or product line tells the source of sales. But it does not explain the underlying reason for those sales.

The SRS model breaks revenue into five categories:

1. Continuing sales to established customers (known as base retention)
2. Sales won from the competition (share gain)
3. New sales from expanding markets
4. Moves into adjacent markets where core capabilities can be leveraged
5. Entirely new lines of business unrelated to the core

To produce an SRS statement, five steps are required in addition to establishing total revenues for comparable periods, as is commonly done for purposes of completing an income statement:

1. Determine revenue from the core business by establishing the revenue gain or loss from entry to or exit from adjacent markets and the revenue gain from new lines of business, and subtracting this from total revenue.
2. Determine growth attributable to market positioning by estimating the market growth rate for the current period and multiplying this by the prior period's core revenue.
3. Determine the revenue not attributable to market growth by subtracting the amount determined in Step 2 from that determined in Step 1.
4. To calculate base retention revenue, estimate the customer churn rate, multiply it by the prior period's core revenue, and deduct this from the prior period's core revenue.
5. To determine revenue from market-share gain, subtract retention revenue, growth attributable to market positioning, and growth from new lines of business and from adjacent markets from core revenue.

Example

To illustrate how all these budgets are put together, we will focus on a *manufacturing* company called the Putnam Company, which produces and markets a single product. We will make these assumptions:

- The company uses a single material and one type of labor in the manufacture of the product.
- It prepares a master budget on a *quarterly* basis.
- Work-in-process inventories at the beginning and end of the year are negligible and are ignored.
- The company uses a single cost driver—direct labor hours (DLH)—as the allocation base for assigning all factory overhead costs to the product.

Sales Budget

The sales budget is the starting point in preparing the master budget, since estimated sales volume influences nearly all other items appearing throughout the master budget. The sales budget should show total sales in quantity and value. The expected total sales can be break-even or target income sales or projected sales. It may be analyzed further by product, by territory, by customer, and, of course, by seasonal pattern of expected sales.

Generally, the sales budget includes a computation of expected cash collections from credit sales, which will be used later for cash budgeting.

Schedule 1

THE PUTNAM COMPANY
Sales Budget
For the Year Ended December 31, 20B

	Quarter				Year as a Whole
	1	**2**	**3**	**4**	
Expected sales in units*	1,000	1,800	2,000	1,200	6,000
Unit sales price*	× $150	× $150	× $150	× $150	× $150
Total sales	$150,000	$270,000	$300,000	$180,000	$900,000

*Given.

Schedule of Expected Cash Collections

Accounts receivable, 12/31/20A	$100,000*				$100,000
1st-quarter sales ($150,000)	60,000†	$ 90,000‡			150,000
2nd-quarter sales ($270,000)		108,000	$162,000		270,000
3rd-quarter sales ($300,000)			120,000	$180,000	300,000
4th-quarter sales ($180,000)				72,000	72,000
Total cash collections	$160,000	$198,000	$282,000	$252,000	$892,000

*All of the $100,000 accounts receivable balance is assumed to be collectible in the first quarter.
†40 percent of a quarter's sales are collected in the quarter of sale.
‡60 percent of a quarter's sales are collected in the quarter following.

Monthly Cash Collections from Customers

Frequently there are time lags between monthly sales made on account and their related monthly cash collections. For example, in any month, credit sales are collected in this manner: 15 percent in month of sale, 60 percent in the following month, 24 percent in the month after, and the remaining 1 percent are uncollectible.

	April—Actual	May—Actual	June—Budgeted	July—Budgeted
Credit sales	$320	200	300	280

The budgeted cash receipts for June and July are computed:

For June:

From April sales	$320 × .24	$ 76.80
From May sales	200 × .6	120.00
From June sales	300 × .15	45.00
Total budgeted collections in June		$241.80

For July:

From May sales	$200 × .24	$ 48
From June sales	300 × .6	180
From July sales	280 × .15	42
Total budgeted collections in July		$270

Production Budget

After sales are budgeted, the production budget can be determined. The production budget is a statement of the output by product and is generally expressed in units. It should take into account the sales budget, plant capacity, whether stocks are to be increased or decreased, and outside purchases. The number of units expected to be manufactured to meet budgeted sales and inventory requirements is set forth in the production budget.

Expected production volume = Planning sales + Desired ending inventory − Beginning inventory

The production budget is illustrated in Schedule 2.

Schedule 2

THE PUTNAM COMPANY
Sales Budget
For the Year Ended December 31, 20B

	Quarter				Year as
	1	**2**	**3**	**4**	**a Whole**
Planned sales (Schedule 1)	1,000	1,800	2,000	1,200	6,000
Desired ending inventory*	180	200	120	(300)†	(300)
Total needs	1,180	2,000	2,120	1,500	6,300
Less: Beginning inventory	[200]†	180‡	200	120	[200]
Units to be produced	980	1,820	1,920	1,380	6,100

*10 percent of the next quarter's sales (for example, 180 = 10% × 1,800).
†Given.
‡The same as the previous quarter's ending inventory.

Inventory Purchases, Merchandising Firm

Putnam Company is a manufacturing firm, so it prepares a production budget, as shown in Schedule 2. If the company were a *merchandising* (retailing or wholesaling) firm, then instead of a production budget, it would develop a *merchandise purchase budget* showing the amount of goods to be purchased from its suppliers during the period. The merchandise purchases budget is in the same basic format as the production budget, except that it shows *goods to be purchased* rather than goods to be produced:

Budgeted cost of goods sold (in units or dollars)	$500,000
Add: Desired ending merchandise inventory	120,000
Total needs	$620,000
Less: Beginning merchandise inventory	(90,000)
Required purchases (in units or in dollars)	$530,000

Direct Material Budget

When the level of production has been computed, a direct material budget should be constructed to show how much material will be required for production and how much material must be purchased to meet this production requirement.

The purchase will depend on both expected usage of materials and inventory levels. The formula for computation of the purchase is:

$$\text{Purchase in units} = \text{Usage} + \text{Desired ending material inventory units} - \text{Beginning inventory units}$$

The direct material budget is usually accompanied by a computation of expected cash payments for materials.

Schedule 3

THE PUTNAM COMPANY
Sales Budget
For the Year Ended December 31, 20B

	Quarter				Year as a Whole
	1	**2**	**3**	**4**	
Units to be produced (Sch.2)	980	1,820	1,920	1,380	6,100
Material needs per unit (lbs)*	× 2	× 2	× 2	× 2	× 2
Production needs (usage)	1,960	3,640	3,840	2,760	12,200
Desired ending inventory of materials†	910	960	690	520‡	520
Total needs	2,870	4,600	4,530	3,280	12,720
Less: Beginning inventory of materials	490†	910§	960	690	490
Materials to be purchased	2,380	3,690	3,570	2,590	12,230
Unit price*	× $5	× $5	× $5	× $5	× $5
Purchase cost	$11,900	$18,450	$17,850	$12,950	$61,150

*Given.
†25 percent of the next quarter's units needed for production. For example, the 2nd-quarter production needs are 3,640 lbs. Therefore, the desired ending inventory for the 1st quarter would be 25% × 3,640 lbs. = 910 lbs. Also note: 490 lbs = 25% × 1,960 = 490 lbs.
‡Assume that the budgeted production needs in lbs. for the 1st quarter of 20C = 2,080 lbs. So, 25% × 2,080 lbs. = 520 lbs.
§The same as the prior quarter's ending inventory.

Schedule of Expected Cash Collections

Accounts payable, 12/31/20A	$ 6,275*				$ 6,275
1st-quarter purchases ($11,900)	5,950	5,950†			11,900
2nd-quarter purchases ($18,450)	5,950*†	9,225	9,225		18,450
3rd-quarter purchases ($17,850)			8,925	8,925	17,850
4th-quarter sales ($180,000)				6,475	6,475
Total disbursements	$12,225	$15,175	$18,150	$15,400	$60,950

*All of the $6,275 accounts payable balance (from the balance sheet, 20A) is assumed to be paid in the first quarter.
†50 percent of a quarter's purchases are paid for in the quarter of purchase; the remaining 50 percent are paid for in the following quarter.

Direct Labor Budget

The production requirements as set forth in the production budget also provide the starting point for the preparation of the direct labor budget. To compute direct labor requirements, expected production volume for each period is multiplied by the number of direct labor hours required to produce a single unit. The direct labor hours to meet production requirements is then multiplied by the (standard) direct labor cost per hour to obtain budgeted total direct labor costs.

Schedule 4

THE PUTNAM COMPANY
Direct Labor Budget
For the Year Ended December 31, 20B

	Quarter				Year as
	1	2	3	4	a Whole
Units to be produced (Sch. 2)	980	1,820	1,920	1,380	6,100
Direct labor hours per unit*	× 5	× 5	× 5	× 5	× 5
Total hours	4,900	9,100	9,600	6,900	30,500
Direct labor cost per hour*	× $10	× $10	× $10	× $10	× $10
Total direct labor cost	$49,000	$91,000	$96,000	$69,000	$305,000

*Both are given.

Factory Overhead Budget

The factory overhead budget should provide a schedule of all manufacturing costs other than direct materials and direct labor. Using the contribution approach to budgeting requires the cash budget, we must remember that depreciation does not entail a cash outlay and therefore must be deducted from the total factory overhead in computing cash disbursement for factory overhead.

Schedule 5

To illustrate the factory overhead budget, we will assume that

- Total factory overhead budgeted = $18,300 fixed (per quarter), plus $2 per hour of direct labor. This is one example of a cost-volume (or flexible budget) formula ($y = a + bx$), developed via the *least-squares method* with a high R^2.
- Depreciation expenses are $4,000 each quarter.
- Overhead costs involving cash outlays are paid for in the quarter incurred.

THE PUTNAM COMPANY
Factory Overhead Budget
For the Year Ended December 31, 20B

	Quarter				Year as
	1	2	3	4	a Whole
Budgeted direct labor	4,900	9,100	9,600	6,900	30,500
Variable overhead rate	× 2	× 2	× 2	× 2	× 2
Variable overhead budgeted	9,800	18,200	19,200	13,800	61,000
Fixed overhead budgeted	18,300	18,300	18,300	18,300	73,200
Total budgeted overhead	28,100	36,500	37,500	32,100	134,200
Less: Depreciation*	4,000	4,000	4,000	4,000	16,000
Cash disbursements for Factory overhead	$24,100	$32,500	$33,500	$28,100	$118,200

*Depreciation does not require a cash outlay.

Ending Finished Goods Inventory Budget

The ending finished goods inventory budget provides us with the information required for the construction of budgeted financial statements. After completing Schedules 1 to 5, sufficient data will have been generated to compute the per-unit manufacturing cost of finished product. This computation is required for two reasons: (1) to help compute the cost of goods sold on the budgeted income statement, and (2) to give the dollar value of the ending finished goods inventory to appear on the budgeted balance sheet.

Schedule 6

THE PUTNAM COMPANY
Ending Inventory Budget
For the Year Ended December 31, 20B

Ending Inventory

Units	Unit Product Cost	Total
300 units (Sch.2)	$82*	$24,600

*The unit product cost of $82 is computed as follows:

	Unit Cost	Units	Total
Direct materials	$5 per lbs.	2 pounds	$10
Direct labor	10 per hr.	5 hours	50
Factory overhead‡	4.40 per hr.	5 hours	22
Unit product cost			$82

‡Predetermined factory overhead applied rate = budgeted annual factory overhead/budgeted annual activity units = $134,200/30,500 DLH = $4.40.

Selling and Administrative Expense Budget

The selling and administrative expense budget lists the operating expenses involved in selling the products and in managing the business. Just as in the case of the factory overhead budget, this budget can be developed using the cost-volume (flexible budget) formula in the form of $y = a + bx$.

If the number of expense items is very large, separate budgets may be needed for the selling and administrative functions.

Schedule 7

THE PUTNAM COMPANY
Selling and Administrative Expense Budget
For the Year Ended December 31,20B

	Quarter				Year as
	1	2	3	4	a Whole
Expected sales in units	1,000	1,800	2,000	12,000	6,000
Variable selling and administrative expense per unit*	× 3	× 3	× 3	× 3	× 3
Budgeted variable expense	$3,000	$5,400	$6,000	$3,200	$18,000
Fixed selling and administrative expense†:					
Advertising	20,000	20,000	20,000	20,000	80,000
Insurance		12,600			12,600
Office salaries	40,000	40,000	40,000	40,000	160,000
Taxes				7,400	7,400
Total budgeted selling and administrative expenses‡	$63,000	$78,000	$66,000	$71,000	$278,000

*Assumed. It includes sales agents' commissions, shipping, and supplies.
†Scheduled to be paid.
‡Paid for in the quarter incurred.

Cash Budget

The cash budget is prepared for the purpose of cash planning and control. It presents the expected cash inflow and outflow for a designated time period. The cash budget helps management keep cash balances in reasonable relationship to its needs. It aids in avoiding unnecessary idle cash and possible cash shortages. The cash budget consists typically of five major sections:

1. The *cash receipts* section, which is cash collections from customers and other cash receipts, such as royalty income and investment income.
2. The *cash disbursements* section, which comprises all cash payments made by purpose.
3. The *cash surplus* or *deficit* section, which simply shows the difference between the total cash available and the total cash needed including a *minimum cash balance* if required. If there is surplus cash, loans may be repaid or temporary investments made.
4. The *financing* section, which provides a detailed account of the borrowings, repayments, and interest payments expected during the budgeting period.
5. The *investments* section, which encompasses investment of excess cash and liquidation of investment of surplus cash.

Schedule 8

To illustrate, we will make these assumptions:

- Putnam Company has an open line of credit with its bank, which can be used as needed to bolster the cash position.
- The company desires to maintain a $10,000 minimum cash balance at the end of each quarter. Therefore, borrowing must be sufficient to cover the cash shortfall and to provide for the minimum cash balance of $10,000.
- All borrowings and repayments must be in multiples of $1,000 amounts, and interest is 10 percent per annum.
- Interest is computed and paid on the principal as the principal is repaid.
- All borrowings take place at the beginning of a quarter, and all repayments are made at the end of a quarter.
- No investment option is allowed in this example. The loan is *self-liquidating* in the sense that the borrowed money is used to obtain resources that are combined for sale, and the proceeds from sales are used to pay back the loan.

Note: To be useful for cash planning and control, the cash budget must be prepared on a *monthly* basis.

Note also:

Cash balance, beginning
Add receipts:
  Total cash available before financing (a)
Deduct disbursements:
  Total cash disbursements (b)
+ Minimum cash balance desired
  Total cash needed (c)
Cash surplus or deficit (a) – (c)

Financing:
  Borrowing (at beginning)
  Repayment (at end)
  Interest
  Total effects of financing (d)
Cash balance, ending [(a) – (b) + (d)]

THE PUTNAM COMPANY
Cash Budget
For the Year Ended December 31, 20B

From Schedule		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year as a Whole
Expected sales in units		$19,000*	10,675	10,000	10,350	19,000
Add: Receipts:						
Collections from customers	1	160,000	198,000	282,000	252,000	892,000
Total cash available (a)		179,000	208,675	292,000	262,350	911,000
Less:						
Disbursements:						
Direct materials	3	12,225	15,175	18,150	15,400	60,950
Direct labor	4	49,000	91,000	96,000	69,000	305,000
Factory overhead	5	24,100	32,500	33,500	28,100	118,200
Selling and admin.	7	63,000	78,000	66,000	71,000	278,000
Equipment purchase	Given	30,000	12,000	0	0	42,000
Dividends	Given	5,000	5,000	5,000	5,000	20,000
Income tax	10	15,000	15,000	15,000	15,000	60,000
Total disbursements (b)		198,325	248,675	233,650	203,500	884,150
Minimum cash balance		10,000	10,000	10,000	10,000	10,000
Total cash needed (c)		208,325	258,675	243,650	213,500	894,150
Cash surplus (deficit) (a) – (c)		(29,325)	(50,000)	48,350	48,850	16,850
Finance:						
Borrowing		30,000†	50,000	0	0	80,000
Repayment		0	0	(45,000)	(35,000)	(80,000)
Interest		0	0	(3,000)‡	(2,625)§	(5,625)
Total effect of financing (d)		30,000	50,000	(48,000)	(37,625)	(5,625)
Cash balance, ending [(a) – (b) + (d)]		$10,675	$10,000	$10,350	$21,225	$21,225

*$19,000(from balance sheet 20A).

†The company desires to maintain a $10,000 minimum cash balance at the end of each quarter. Therefore, borrowing must be sufficient to cover the cash shortfall of $19,325 and to provide for the minimum cash balance of $10,000, for a total of $29,325.

‡The interest payments relate only to the principal being repaid at the time it is repaid. For example, the interest in quarter 3 relates only to the interest due on the $30,000 principal being repaid from quarter 1 borrowing and on the $15,000 principal being repaid from quarter 2 borrowing. Total interest being paid is $3,000, shown as:

$$\$30{,}000 \times 10\% \times 3/4 = \$2{,}250$$
$$\$15{,}000 \times 10\% \times 2/4 = \quad 750$$

§$\$35{,}000 \times 10\% \times 3/4 = \$2{,}625$

Budgeted Income Statement

The budgeted income statement summarizes the various component projections of revenue and expenses for the budgeting period. However, for control purposes, the budget can be divided into quarters or even months, depending on the need.

Schedule 9

THE PUTNAM COMPANY
Budgeted Income Statement
For the Year Ended December 31,20B

	From Schedule		
Sales (6,000 units @$150)			$900,000
Less: Cost of goods sold:			
Beginning finished goods inventory	10	$ 16,400	
Add: Cost of goods manufactured (6,100 units @$82)	6	500,200	
Cost of goods available for sale		516,600	
Less: Ending finished goods inventory	6	(24,600)	$492,000
Gross margin			$408,000
Less: Selling and administrative expense	7		278,000
Operating income			130,000
Less: Interest expense	8		5,625
Net income before taxes			124,375
Less: income taxes			60,000*
Net income after taxes			$ 64,375

*Estimated.

Budgeted Balance Sheet

The budgeted balance sheet is developed by beginning with the balance sheet for the year just ended and adjusting it, using all the activities that are expected to take place during the budgeting period. Some of the reasons why the budgeted balance sheet must be prepared are:

- It could disclose some unfavorable financial conditions that management might want to avoid.
- It serves as a final check on the mathematical accuracy of all the other schedules.
- It helps management perform a variety of ratio calculations.
- It highlights future resources and obligations.

We can construct the budgeted balance sheet by using:

- The December 20A balance sheet (Schedule 10)
- The cash budget (Schedule 8)
- The budgeted income statement (Schedule 9)

Putnam's budgeted balance sheet for December 31, 20B, is presented next. Supporting calculations of the individual statement accounts are also provided.

Schedule 10

To illustrate, we will use this balance sheet for the year 20A.

THE PUTNAM COMPANY
Balance Sheet
December 31, 20A

Assets

Current assets:		
Cash	$19,000	
Accounts receivable	100,000	
Materials inventory (490 lbs.)	2,450	
Finished goods inventory (200 units)	16,400	
Total current assets		$137,850
Plant and equipment:		
Land	30,000	
Building and equipment	250,000	
Accumulated depreciation	(74,000)	
Plant and equipment, net		206,000
Total assets		$343,850

Liabillities and Stockholders' Equity

Current liabilities		
Accounts payable (raw materials)	$ 6,275	
Income tax payable	60,000	
Total current liabilities		$ 66,275
Stockholders' equity:		
Common stock, no par	$200,000	
Retained earnings	77,575	
Total stockholders' equity		277,575
Total liabilities and stockholders' equity		$343,850

THE PUTNAM COMPANY
Balance Sheet
December 31, 20B

Assets

Cash	$21,225	(a)	
Accounts receivable	108,000	(b)	
Materials inventory (520 lbs.)	2,600	(c)	
Finished goods inventory (300 units)	24,600	(d)	
Total current assets			$156,425
Plant and equipment:			
Land	30,000	(e)	
Buildings and equipment	292,000	(f)	
Accumulated depreciation	(90,000)	(g)	
Plant and equipment, net			232,000
Total assets			$388,425

Liabilities and Stockholders' Equity			
Current liabilities			
Accounts payable (raw materials)	$6,475	(h)	
Income tax payable	60,000	(i)	
Total current liabilities			$66,475
Stockholders' equity:			
Common stock, no par	$200,000	(j)	
Retained earnings	121,950	(k)	
Total stockholders' equity			321,950
Total liabilities and stockholders' equity			$388,425

Supporting computations:

a. From Schedule 8 (cash budget).
b. $100,000 (Accounts receivable, 12/31/20A) + $900,000 (Credit sales from Schedule 1) – $892,000 (Collections from Schedule 1) = $108,000, *or* 60% of 4th-quarter credit sales, from Schedule 1 ($180,000 × 60% = $108,000).
c. Direct materials, ending inventory = 520 pounds × $5 = $2,600 (From Schedule 3).
d. From Schedule 6 (ending finished goods inventory budget).
e. From the 20A balance sheet and Schedule 8 (no change).
f. $250,000 (Building and Equipment, 12/31/20A) + $42,000 (purchases from Schedule 8) = $292,000.
g. $74,000 (Accumulated Depreciation, 12/31/20A) + $16,000 (depreciation expense from Schedule 5) = $90,000.
h. Note that all accounts payable relate to material purchases. $6,275 (Accounts payable, 12/31/20A) + $61,150 (credit purchases from Schedule 3) – $60,950 (payments for purchases from Schedule 3) = $6,475, *or* 50% of 4th-quarter purchase = 50% ($12,950) = $6,475.
i. From Schedule 9.
j. From the 20A balance sheet and Schedule 8 (no change).
k. $77,575 (Retained earnings, 12/31/20A) + $64,375 (net income for the period, Schedule 9) – $20,000 (cash dividends from Schedule 8) = $121,950.

Some Financial Calculations

To see what kind of financial condition the Putnam Company is expected to be in for the budgeting year, a sample of financial ratio calculations are in order. (Assume 20A after-tax net income was $45,000.)

Current ratio	20A	20B
(Current assets/current liabilities)	$137,850/$66,275 = 2.08	$156,425/$66,475 = 2.35
Return on total assets: (Net income after taxes/ total assets)	$45,000/$343,850 = 13.08%	$64,375/$388,425 = 16.57%

Sample calculations indicate that the Putnam Company is expected to have better liquidity as measured by the current ratio. Overall performance will be improved as measured by return on total assets. This could be an indication that the contemplated plan may work out well.

Using an Electronic Spreadsheet to Develop a Budget Plan

Schedules 1 to 10 showed a detailed procedure for formulating a master budget. In practice, a common shortcut uses computer technology. With a spreadsheet program, managers will be able to develop a master budget and evaluate various "what-if" scenarios.

Conclusion

Forecasting is an essential element of planning and budgeting. Forecasts of future sales and their related expenses provide managers with information needed to plan other activities of the business.

This chapter has emphasized budgets. The process involves developing a sales forecast and, based on its magnitude, generating those budgets needed by a specific firm. Once developed, the budgeting system provides nonfinancial management with a means of controlling their activities and of monitoring actual performance and comparing it to budget goals.

Budgeting can be done easily with the aid of electronic spreadsheet software. Many specialized application programs are available.

7

Cost Behavior:
Emphasis on Flexible Budgets

Not all costs behave in the same way. Certain costs vary in proportion to changes in volume or activity, such as labor hours and machine hours. Other costs do not change, even though volume changes. An understanding of cost behavior is helpful to managers for four reasons:

1. Flexible budgeting
2. Break-even and contribution margin analysis
3. Appraisal of divisional performance
4. Short-term choice decisions

A Look at Costs by Behavior

Depending on how a cost will react or respond to changes in the level of activity, costs may be viewed as variable, fixed, or mixed (semivarible). This classification is made within a specified range of activity, called the relevant range. The relevant range is the volume zone within which the behavior of variable costs, fixed costs, and selling prices can be predicted with reasonable accuracy.

Variable Costs

Variable costs vary in total with changes in volume or level of activity. Examples of variable costs include the costs of direct materials, direct labor, and sales commissions. These factory overhead items fall into the variable cost category:

Variable Factory Overhead	
Supplies	Receiving costs
Fuel and power	Overtime premium
Spoilage and defective work	

Fixed Costs

Fixed costs do not change in total regardless of the volume or level of activity. Examples include advertising expense, salaries, and depreciation. These factory overhead items fall in the fixed cost category:

Fixed Factory Overhead	
Property taxes	Rent on factory building
Depreciation	Indirect labor
Insurance	Patent amortization

Mixed (Semivariable) Costs

Mixed costs contain both a fixed element and a variable one. Salespersons' compensation, including salary and commission, is an example. These factory overhead items may be considered mixed costs:

Mixed Factory Overhead	
Supervision	Maintenance and repairs
Inspection	Compensation insurance
Service department costs	Employer's payroll taxes
Utilities	Rental of delivery truck
Fringe benefits	

Note that factory overhead, taken as a whole, would be a perfect example of mixed costs. Exhibit 7.1 displays how each of these three types of costs varies with changes in volume.

Analysis of Mixed (Semivariable) Costs

For forecasting, planning, and budgeting, mixed costs need to be separated into their variable and fixed components. Because the mixed costs contain both fixed and variable elements, the analysis takes this mathematical form, which is called a cost-volume formula (or flexible budget formula):

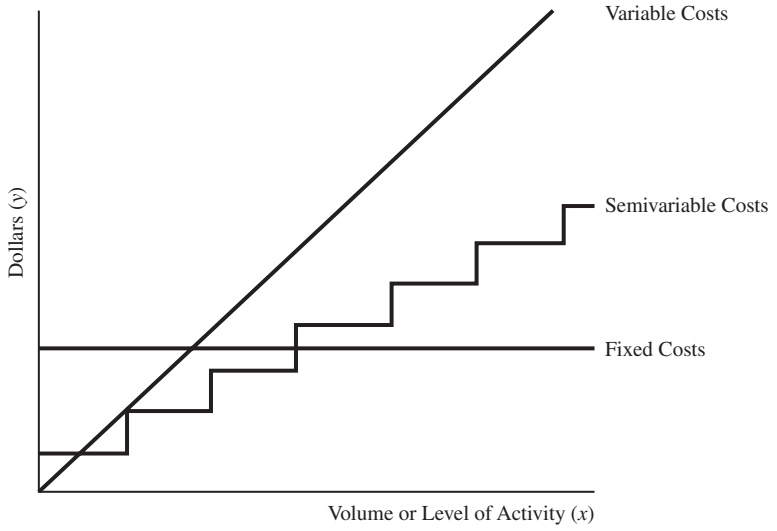
$$Y = a + bX$$

Where Y = the mixed cost to be broken up
X = any given measure of activity such as direct labor hours, machine hours, or production volume
a = the fixed cost component
b = the variable rate per unit of X

Separating the mixed cost into its fixed and variable components is the same thing as estimating the parameter values a and b in the Y = a + bX formula. Several methods can be used for this purpose, including the high-low method and regression analysis. They are discussed next.

Exhibit 7.1

Cost Behavior Patterns



High-low Method

The high-low method, as the name indicates, uses two extreme data points to determine the values of a (the fixed cost portion) and b (the variable rate) in the equation Y = a + bX. The extreme data points are the highest representative X – Y pair and the lowest representative X – Y pair. The activity level X, rather than the mixed cost item y, governs their selection.

The high-low method is explained, step by step:

Step 1: Select the highest pair and the lowest pair.

Step 2: Compute the variable rate, b, using the formula:

$$\text{Variable rate} = \frac{\text{Difference in cost y}}{\text{Difference in activity x}}$$

Step 3: Compute the fixed cost portion as:

$$\text{Fixed cost portion} = \text{Total mixed cost} - \text{Variable cost}$$

Example 1

Flexible Manufacturing Company decided to relate total factory overhead costs to direct labor hours (DLH) to develop a cost function in the form of Y = a + bX. Twelve monthly observations are collected. They are given in Exhibit 7.2.

Exhibit 7.2

Direct Labor/Factory Overhead Table

Month	Direct Labor Hours (X)	Factory Overhead (Y)
January	105	$2,510
February	100	2,479
March	88	2,080
April	116	2,750
May	95	2,330
June	107	2,690
July	97	2,480
August	110	2,610
September	135	2,920
October	115	2,730
November	117	2,760
December	96	2,109

The high-low method is simple and easy to use. It has the disadvantage, however, of using two extreme data points, which may not be representative of normal conditions. The method may yield unreliable estimates of a and b in the formula. In this example, the negative value for a is questionable. In such a case, it would be wise to drop these data points and choose two other points that are more representative of normal situations. Be sure to check the scatter diagram for this possibility.

The high-low points selected from the monthly observations are

	X	Y
High	135 hours	$2,920 (September pair)
Low	88	2,080 (March pair)
Difference	47 hours	$ 840

$$\text{Variable rate b} = \frac{\text{Difference in Y}}{\text{Difference in X}} = \frac{\$840}{47 \text{ hours}} = \$17.8723 \text{ per DLH}$$

The fixed cost portion is computed as:

	High	Low
Factory overhead (Y)	$2,920	$2,080
Variable expense ($17.8723 per DLH)	(2,412.76)*	(1,572.76)*
	507.234	507.234

*$17.8723 × 135 hours = $2412.76; $17.8723 × 88 hours = $1572.76

Therefore, the flexible budget formula for factory overhead is

$507.234 fixed plus $17.8723 per DLH.

Regression Analysis

One popular method for estimating the cost function is regression analysis. Unlike the high-low method, in an effort to estimate the variable rate and the fixed cost portion, the regression method includes all the observed data and attempts to find a line of best fit.

From the regression output of Excel (see Exhibit 7.3), the flexible budget formula is

$$Y = 566.02 + 18.47\ X \text{ with } R^2 = 82.58\%$$

or $566.02 fixed, plus $18.47 per DLH

Note: R^2 tells us how good the estimated regression equation is. In other words, it is a measure of "goodness of fit" in the regression. Therefore, the higher the R^2, the more confidence we have in our flexible budget formula.

Exhibit 7.3

Summary Output

Regression Statistics	
Multiple R	0.9087524
R-Squared	0.825831
Adjusted R-Squared	0.808414
Standard Error	114.29182
Observations	12

ANOVA

	df	**SS**
Regression	1	619370.4611
Residual	10	130626.2056
Total	11	749996.6667

	Coefficients	**Standard Error**
Intercept	566.02156	288.1776914
Direct labor hours (x)	18.466621	2.681805902

Example 2

Assume 95 direct labor hours are to be expended next year. The projected factory overhead for next year would be computed as:

$$Y = 566.02 + 18.47\ X = 566.02 + 18.47\ (95)$$

$$= \$566.02 + \$1754.65 = \$2320.67$$

Fixed Budgets versus Flexible Budgets and Performance Reports

A fixed (static) budget presents budgeted amounts at the expected capacity level. It is best used when the department's activities (e.g., sales) are stable. A deficiency with the static budget is the lack of flexibility to adjust to unexpected changes.

The fixed budget is suitable for a department whose workload does not have a direct relationship to sales, production, or other volume related to a department's operations. The workload is determined primarily by management decision instead of sales volume. Some examples of departments in this category are administrative and marketing. Fixed budgets may be used for projects involving fixed appropriations for specific programs, such as capital expenditures, advertising and promotion, and major repairs.

A flexible budget is a tool that is extremely useful in cost control. In contrast to a static budget, the flexible budget

- Is geared toward a range of activity rather than a single level of activity
- Is dynamic in nature rather than static. By using the flexible budget formula, a series of budgets can be easily developed for various levels of activity.

Four steps are involved in creating a flexible budget:

1. Estimate the range of expected activity for the period.
2. Analyze cost behavior trends, whether fixed, variable, or mixed.
3. Separate costs by behavior, that is, break up mixed costs into variable and fixed.
4. Determine what costs will be incurred at different levels of activity.

The static (fixed) budget is geared for only one level of activity and has problems in cost control. Flexible budgeting distinguishes between fixed and variable costs, thus allowing for a budget that can be adjusted automatically (via changes in variable cost totals) to the particular level of activity actually attained. Thus, variances between actual costs and budgeted costs are adjusted for volume ups and downs before differences due to price and quantity factors are computed. The primary use of the flexible budget is to accurately measure performance by comparing actual costs for a given output with the budgeted costs for the same level of output. *Note:* A flexible budget is appropriate for marketing budgets as well as for manufacturing cost budgets.

Example 3

To illustrate the difference between the static budget and the flexible budget, assume that the Assembly Department of Omnis Industries, Inc., was budgeted to produce 6,000 units during June. Assume further that the company was able to produce only 5,800 units. The budget for direct labor and variable overhead costs is:

OMNIS INDUSTRIES, INC.
The Direct Labor and Variable Overhead Budget
Assembly Department
For the Month of June

Budgeted production	6,000 units	
Actual production	5,800 units	
Direct labor		$39,000
Variable overhead costs:		
Indirect labor		6,000
Supplies		900
Repairs		300
		$46,200

If a static budget approach is used, the performance report will appear in this way:

OMNIS INDUSTRIES, INC.
Direct Labor and Variable Overhead
Static Budget Versus Actual
Assembly Department
For the Month of June

	Budget	Actual*	Variance (U or F)†
Production in units	6,000	5,800	200U
Direct labor	$39,000	$38,500	$500F
Variable overhead costs:			
Indirect labor	6,000	5,950	50F
Supplies	900	870	30F
Repairs	300	295	5F
	$46,200	$45,615	$585F

*Given.
†A variance represents the deviation of actual cost from the standard or budgeted cost. U and F stand for "unfavorable" and "favorable," respectively.

These cost variances are useless, in that they are comparing oranges with apples. The problem is that the budget costs are based on an activity level of 6,000 units, whereas the actual costs were incurred at an activity level below this (5,800 units).

From a control standpoint, it makes no sense to try to compare costs at one activity level with costs at a different activity level. Such comparisons would make

a production manager look good as long as the actual production is less than the budgeted production. Using the flexible budget formula and generating the budget based on the 5,800 actual units gives the next performance report.

OMNIS INDUSTRIES, INC.
Performance Report
Assembly Department
Flexible Budget Versus Actual
For the Month of June

Budgeted production	6,000 units			
Actual production	5,800 units			
	Flexible Budget formula	**Flexible Budget 5,800 units**	**Actual 5,800 units**	**Variance (U or F)**
Direct labor	$6.50 per unit	$37,700	$38,500	$800U
Variable overhead:				
Indirect labor	1.00	5,800	5,950	150U
Supplies	0.15	870	870	0
Repairs	0.05	290	295	5U
	$7.70	$44,660	$45,615	$955U

Notice that all cost variances are unfavorable (U), as compared to the favorable cost variances on the performance report based on the static budget approach.

Example 4

Exhibit 7.4 illustrates a static budget, Exhibit 7.5 presents a flexible budget, and Exhibit 7.6 illustrates a performance report showing variances.

Exhibit 7.4

X-Ray Unit
Medical Service Corporation
Performance Report—Static Budget
May 20X2

	Master Budget	Actual	Variance
Units	2,000	1,200	800
Sales revenue	$60,000	$36,000	$24,000*
Variable costs:			
Film	16,000	11,500	4,500+
Other material	4,000	3,000	1,000+
Technician	3,000	2,500	500+
Other labor	900	600	300+
Other variable	2,400	2,000	400+
Total variable	26,300	19,600	6,700+
Contribution margin	33,700	16,400	17,300*
Fixed costs:			
Rent	800	800	0
Depreciation	400	400	0
Supervision	2,000	2,000	0
Other fixed	3,500	3,300	200+
Total fixed	6,700	6,500	200+
Operating income	27,000	9,900	17,100*

*Unfavorable.
+Favorable.

Exhibit 7.5

X-Ray Unit
Medical Service Corporation
Flexible Budget
May 20X2

	Budgeted per unit	Number of X-rays per Month				
		1,000	1,200	1,400	1,800	2,000
Sales revenue	$30.00	$30,000	$36,000	$42,000	$54,000	$60,000
Variable costs:						
Film	8.00	8,000	9,600	11,200	14,400	16,000
Other material	2.00	2,000	2,400	2,800	3,600	4,000
Technician	1.50	1,500	1,800	2,100	2,700	3,000
Other labor	0.45	450	540	630	810	900
Other variable	1.20	1,200	1,440	1,680	2,160	2,400
Total variable costs	13.15	13,150	15,780	18,410	23,670	26,300
Contribution margin	16.85	16,850	20,220	23,590	30,330	33,700
Fixed costs:						
Rent		800	800	800	800	800
Depreciation		400	400	400	400	400
Supervision		2,000	2,000	2,000	2,000	2,000
Other fixed		3,500	3,500	3,500	3,500	3,500
Total fixed costs		6,700	6,700	6,700	6,700	6,700
Operation income		10,150	13,520	16,890	23,630	27,000

Exhibit 7.6

X-Ray Unit
Medical Service Corporation
Performance Report—Flexible Budget
May 20X2

Units	Costs Incurred	Flexible budget	Variance Explanation
Units	1,200	1,200	0
Sales revenue	$36,000	$36,000	0
Variable costs:			
Film	11,500	9,600	1,900*
Other material	3,000	2,400	600*
Technician	2,500	1,800	700*
Other labor	600	540	60*
Other variable	2,000	1,440	560*
Total variable costs	9,600	15,780	3,820*
Contribution margin	16,400	20,220	3,820*
Fixed costs:			
Rent	800	800	0
Depreciation	400	400	0
Supervision	2,000	2,000	0
Other fixed	3,300	3,500	200+
Total fixed costs	6,500	6,700	200+
Operation income	9,900	13,520	3,620*

*Unfavorable.
+Favorable.

Conclusion

Nonfinancial managers must investigate cost behavior for break-even and cost–volume-profit analysis, for appraisal of managerial performance, and for flexible budgeting. We have looked at three types of cost behavior—variable, fixed, and mixed. We illustrated two popular methods of separating mixed costs in their variable and fixed components: the high-low method and regression analysis. Emphasis was placed on the use of simple regression. The idea of flexible budgeting was emphasized in an attempt to correctly measure the efficiency of the cost center (e.g., assembly department).

8

Evaluating Performance:
The Use of Variance Analysis

A standard cost is a predetermined cost of manufacturing, servicing, or marketing an item during a given future period. It is based on current and projected future conditions. The norm is also dependent on quantitative and qualitative measurements. Standards may be based on engineering studies looking at time and motion. The formulated standard must be accurate and useful for control purposes.

Standards are set at the beginning of the period. They may be in physical and dollar terms. Standards assist in the measurement of both effectiveness and efficiency. Examples are sales quotas, standard costs (e.g., material price, wage rate), and standard volume. Variances are not independent, so a favorable variance in one responsibility area may result in an unfavorable one in other segments of the business.

Variance analysis compares standard to actual performance. It could be done by division, department, program, product, territory, or any other responsibility unit. When more than one department is used in a production process, individual standards should be developed for each department in order to assign accountability to department managers. Variances may be as detailed as necessary, considering the cost/benefit relationship. Evaluation of variances may be done yearly, quarterly, monthly, daily, or hourly, depending on the importance of identifying a problem quickly. Because actual figures (e.g., hours spent) are not known until the end of the period, variances can be determined only at this time. A material variance requires notifying the person responsible and taking corrective action. Insignificant variances need not be looked into further unless they recur repeatedly and/or reflect potential difficulty. Generally, a variance should be investigated when the inquiry is anticipated to result in corrective action that will reduce costs by an amount exceeding the cost of the inquiry.

When the production cycle is long, variances that are computed at the time of product completion may be too late for prompt corrective action to be taken. In such a case, inspection may be undertaken at key points during the processing stage. This allows for spoilage, labor inefficiency, and other costs associated with problems to be recognized before product completion.

One measure of materiality is to divide the variance by the standard cost. A variance of less than 5 percent may be deemed immaterial. A 10 percent variation may be more acceptable to a company using tight standards compared to a 5 percent variation to a company employing loose standards. In some cases, materiality is looked at in terms of dollar amount or volume level. For example, a company may set a policy looking into any variance that exceeds $10,000 or 20,000 units, whichever is less. Guidelines for materiality also depend on the nature of the particular element as it affects performance and decision-making. For example, where the item is critical to the future functioning of the business (e.g., critical part, promotion, repairs), limits for materiality should be such that reporting is encouraged. Further, statistical techniques can be used to ascertain the significance of cost and revenue variances.

An acceptable range of tolerance should be established for managers (e.g., percent). Even if a variance never exceeds a minimum allowable percentage or minimum dollar amount, the manager may want to bring it to upper management's attention if the variance is consistently close to the prescribed limit each year. This may indicate the standard is out of date and proper adjustment to current levels is mandated to improve overall profit planning.

Because of the critical nature of costs, such as advertising and maintenance, materiality guidelines are more stringent.

Often the reasons for the variance are out-of-date standards or a poor budgetary process and not actual performance.

By questioning the variances and trying to find answers, the manager can make the operation more efficient and less costly. It must be understood, however, that quality should be maintained.

If a variance is out of the manager's control, follow-up action by the manager is not possible. For example, utility rates are not controllable internally.

Standards may change at different operational volume levels. Further, standards should be appraised periodically, and when they no longer realistically reflect conditions, they should be modified. Standards may not be realistic any longer because of internal events, such as product design, or external conditions, such as management and competitive changes. For instance, standards should be revised when prices, material specifications, product designs, labor rates, labor efficiency, and production methods change to such a degree that current standards no longer provide a useful measure of performance. Changes in the methods or channels of distribution, or basic organizational or functional changes, would require changes in selling and administrative activities.

Significant favorable variances should also be investigated and should be taken advantage of further. Those responsible for good performance should be rewarded.

Regression analysis may provide reliable association between costs and revenue.

Variances are interrelated, and hence the net effect has to be examined. For example, a favorable price variance may arise when lower-quality materials are bought at a cheaper price, but the quantity variance will be unfavorable because of more production time to manufacture the goods due to poor material quality.

In the case of automated manufacturing facilities, standard cost information can be integrated with the computer that directs operations. Variances can then be identified and reported by the computer system and necessary adjustments made as the operation proceeds.

In appraising variances, consideration should be given to information that may have been, for whatever reason, omitted from the reports. Have there been changes in the production processes that have not been reflected in the reports? Have new product lines increased setup times that necessitate changes in the standards?

Usefulness of Variance Analysis

Standards and variance analyses resulting from them are essential in financial analysis and decision making.

Advantages of Standards and Variances

- Aid in inventory costing
- Assist in decision making
- Sell price formulation based on what costs should be
- Aid in coordinating by having all departments focus on common goals
- Set and evaluate divisional objectives
- Allow cost control and performance evaluation by comparing actual to budgeted figures. The objective of cost control is to produce an item at the lowest possible cost according to predetermined quality standards.
- Highlight problem areas through the "management by exception" principle
- Pinpoint responsibility for undesirable performance so that corrective action may be taken. Variances in product activity (cost, quality, quantity) are typically the production manager's responsibility. Variances in sales orders and market share are often the responsibility of the marketing manager. Variances in prices and methods of deliveries are the responsibility of purchasing personnel. Variances in profit usually relate to overall operations. Variances in return on investment relate to asset utilization.
- Motivate employees to accomplish predetermined goals
- Facilitate communication within the organization, such as between top management and supervisors
- Assist in planning by forecasting needs (e.g., cash requirements)
- Establish bid prices on contracts

Standard costing is not without some drawbacks, such as the possible biases in deriving standards and the dysfunctional effects of establishing improper norms and standards.

When a variance has multiple causes, each cause should be cited.

Standard Setting

Standards may be set by engineers, production managers, purchasing managers, and personnel administrators. Depending on the nature of the cost item, computerized models can be used to corroborate what the standard costs should be. Standards may be established through test runs or mathematical and technological analysis.

Standards are based on the particular situation being appraised. Some examples:

Situation	Standard
Cost reduction	Tight
Pricing policy	Realistic
High-quality goods	Perfection

Capacity may be expressed in units, weight, size, dollars, selling price, and direct labor hours. It may be expressed in different time periods (e.g., weekly, monthly, yearly).

Types of Standards

- *Basic.* These are not changed from period to period and are used in the same way as an index number. They form the basis to which later period performance is compared. What is unrealistic about basic standards is that no consideration is given to a change in the environment.
- *Maximum efficiency.* These are perfect standards assuming ideal, optimal conditions, allowing for no losses of any kind, even those considered unavoidable. They will always result in unfavorable variances. Realistically, certain inefficiencies will occur, such as materials will not always arrive at workstations on time and tools will break. Ideal standards cannot be used in forecasting and planning because they do not provide for normal inefficiencies.
- *Currently attainable (practical).*These refer to the volume of output possible if a facility operated continuously, but after allowing for normal and unavoidable losses such as vacations, holidays, and repairs. Currently attainable standards are based on efficient activity. They are possible but difficult to achieve. Considered are normal occurrences such as anticipated machinery failure and normal materials shortage. Practical standards should be set high enough to motivate employees and low enough to permit normal interruptions. Besides pointing to abnormal deviations in costs, practical standards may be used in forecasting cash flows and in planning inventory. Attainable standards typically are used in practice.
- *Expected.* These are expected figures based on foreseeable operating conditions and costs. They come very close to actual figures.

Standards should be set at a realistic level. Those affected by the standards should participate in formalizing them so there will be internalization of goals.

When reasonable standards exist, employees typically become cost conscious and try to accomplish the best results at the least cost. Standards that are too tight will discourage employee performance. Standards that are too loose will result in inefficient operations. If employees receive bonuses for exceeding normal standards, the standards may be even more effective as motivation tools.

A standard is not an absolute and precise figure. Realistically, a standard constitutes a range of possible acceptable results. Thus, variances can and do occur within a normal upper-lower limit. In determining tolerance limits, relative magnitudes are more important than absolute values. For instance, if the standard cost for an activity is $100,000, a plus or minus range of $4,000 may be tolerable.

Variance analysis usually is complicated by the problem of computing the number of equivalent units of production.

Variances may be controllable, partly controllable, or uncontrollable. It is not always easy to assign responsibility, even in the case of controllable variances. The extent to which a variance is controllable depends on the nature of the standard, the cost involved, and the particular factors causing the variance.

Planning Variance

The planning variance arises when expected industry or other environmental factors do not materialize. For example, at the beginning of the period, the sales projection may be based on reviewing supply and demand. However, because of actual conditions in the industry, the actual sales may be much less. This sales unit variance may then be deemed a planning error and not a performance problem. Industry sales typically are considered beyond manager control.

Sales Variances

Sales standards may be established to control and measure the effectiveness of the marketing operations as well as for other relevant purposes such as stimulating sales, reallocating sales, resources, and providing incentive awards. The usual standard set for a salesperson, branch, or territory is a sales quota. Although the sales quota typically is expressed in dollars, it may also be expressed in volume. Other types of standards that may be set to evaluate sales efforts are number of calls, order size, gross profit obtained, new customers obtained, and number of regular customers retained.

Sales variances are computed to gauge the performance of the marketing function.

Example 1

Western Corporation's budgeted sales for 20X1 were

Product A 10,000 units at $6.00 per unit	$ 60,000
Product B 30,000 units at $8.00 per unit	240,000
Expected sales revenue	$300,000

Actual sales for the year were

Product A 8,000 units at $6.20 per unit	$ 49,600
Product B 33,000 units at $7.70 per unit	254,100
Actual sales revenue	$303,700

There is a favorable sales variance of $3,700, consisting of the sales price variance and the sales volume variance.

The sales price variance equals
(Actual Selling Price versus Budgeted Selling Price) × Actual Units Sold

Product A ($6.20 versus $6.00 × 8,000)	$1,600 Favorable
Product B ($7.70 versus $8.00 × 33,000)	9,900 Unfavorable
Sales price variance	$8,300 Unfavorable

The sales volume variance equals
(Actual Quantity versus Budgeted Quantity) × Budgeted Selling Price

Product A (8,000 versus 10,000 × $6.00)	$12,000 Unfavorable
Product B (33,000 versus 30,000 × $8.00)	24,000 Favorable
Sales volume variance	$12,000 Favorable

The sales price variance indicates if the product is being sold at a discount or premium. Sales price variances may be due to uncontrollable market conditions or managerial decisions.

The analysis of sales volume includes consideration of budgets, standards, sales plans, industry comparisons, and manufacturing costs. Note that high sales volume does not automatically mean high profits. There may be high costs associated with the products.

An unfavorable sales volume variance may arise from poor marketing or price cuts by competing companies. If the unfavorable volume variance is coupled with a favorable price variance, the marketing manager may have lost sales by raising prices.

The sales volume variance reflects the effect on the total budgeted contribution margin that is caused by changes in the total number of units sold. The variance can be caused by unpredictable product demand, lack of product demand, or poor sales forecasting.

An unfavorable total sales variance may signal a problem with the marketing manager because he or she has control over sales, advertising, and often pricing. Another possible cause of the unfavorable sales situation may be a lack of quality control, substitution of poorer-quality components due to deficient purchasing, or deficient product design emanating from poor engineering.

The sales variances (price and volume) are prepared only for the product sales report and the sales district report.

The marketing manager is responsible for sales variances and must explain any deviations to upper management.

An electronic spreadsheet can be used to compute sales variances.

Cost Variances

When a product is made or a service is performed, three measures have to be determined:

1. Actual Cost = Actual Price × Actual Quantity, where Actual Quantity = actual quantity per unit of work × actual units of work produced
2. Standard Cost = Standard Price × Standard Quantity, where Standard Quantity = standard quantity per unit of work × actual units of work produced
3. Total (control) Variance = Actual Cost – Standard Cost

Total (control) variance has these elements:

- Price (rate, cost) variance:
  (Standard Price versus Actual Price) × Actual Quantity

- Quantity (usage, efficiency) variance:
  (Standard Quantity versus Actual Quantity) × Standard Price

Price as quantity variances are computed for both material and labor.
A variance is unfavorable when actual cost is higher than standard cost.

Material Variances

Quantity and delivery standards have to be established before a standard price per unit can be determined. Material price standards are set by the purchasing manager because he or she has knowledge of price date and market conditions. The manager should increase the initial standard price per unit to a standard weighted-average price per unit to incorporate expected price increases for the period. The standard price should reflect the total cost of buying the material, which includes the basic price less discounts plus freight, receiving, and handling. The standard price must coincide with the specific quality material. In setting the material price standard, the price should be in accord with the firm's inventory policies regarding the most economical order size and/or frequency of ordering. It is further assumed that buying, shipping, and warehousing will occur on favorable terms. Special bargain prices are ignored unless they are readily available. The material price standard should include normal or unavoidable spoilage allocations.

The material price variance can be used to evaluate the activity of the Purchasing Department and to see the impact of raw material cost changes on profitability. A material price variance may be isolated at the time of purchase or usage.

The material quantity variance is the responsibility of the production supervisor. Material quantity standards should include not only the raw materials but also purchased parts, cartons, and packing materials that are visible in, or can be directly related to, the product. Material quantity standards usually are determined from material specifications prepared by engineers, based on product design and

production flow. The standard quantity should be based on the most economical size and quality of product. It should be increased to take into account normal waste, rejections, and spoilage. The standard should consider prior experience for the same or similar operation. Test runs may be made under controlled conditions. Material standards may be aided by analyzing previous experiences using descriptive statistics and/or test runs under controlled conditions. Physical standards for materials are based on determination of kind and quality specifications, quantity specifications, and assembly specifications.

When many different types of raw materials are needed for a product, the types and standard quantities of each raw material is itemized on the *standard bill of materials.*

Example 2

The standard cost of one unit of output (product or service) was $15: three pieces at $5 per piece. During the period, 8,000 units were made. Actual cost was $14 per unit; two pieces at $7 per piece.

Total Material Variance	
Standard quantity times standard price (24,000 × $5)	$120,000
Actual quantity times actual price (16,000 × $7)	112,000
	$ 8,000 F
Material Price Variance	
(Standard price versus actual price) times actual quantity ($5 versus $7 × 16,000)	$ 32,000 U
Material Quantity Variance	
(Standard quantity versus actual quantity) times standard price (24,000 versus 16,000 × $5)	$ 40,000 F

When the amount of material purchased is different from the amount issued to production, a price variance is determined at the time of purchase. When material is issued, a quantity (usage) variance is determined. In this case, the variances are determined in this way:

Material Price Variance

(Actual price versus standard price) times actual quantity bought

Material Quantity Variance

(Actual quantity issued versus standard quantity issued) times standard price

Example 3

Material purchased was 20,000 pounds. Material issued to production was 15,000 pounds. Material budgeted per unit is 1 pound. Budgeted price is $2.50 per pound while actual price is $3.00 per pound. Production was 10,000 units.

Material Price Variance	
(Actual price versus standard price) times quantity purchased ($3.00 versus $2.50) × 20,000	$10,000 U
Material Quantity Variance	
(Actual quantity issued versus standard quantity) × standard price (15,000 versus 10,000) × $2.50	$12,500 U

Material price variances cannot be controlled when higher prices are due to inflation or shortage situations, or when rush orders are required by the customer, who will bear the ultimate cost increase.

If the material price variance is favorable, one would expect higher quality material being acquired. Thus, a favorable usage variance should be forthcoming. If it is not, there is an inconsistency. A favorable material price variance may occur from other causes, such as when actual price is less than expected because of excess supply of the raw material.

The controllable portion of a price variance should be segregated from the uncontrollable in management reports. Exhibit 8.1 presents a Daily Material Price Variance Report.

Generally, the material quantity variance is the responsibility of the production manager. However, the purchasing manager will be responsible for inferior goods to economize on cost.

The reason and responsible party for an unfavorable material variance follows.

Reason	**Responsible party**
Overstated price paid, failure to take discounts, improper specifications, insufficient quantities, use of a lower-grade material purchased to economize on price, uneconomical size of purchase orders, failure to obtain an adequate supply of a needed variety, purchase at an irregular time, or sudden and unexpected purchase required	Purchasing Manager
Poor mix of materials, poorly trained workers, improperly adjusted machines, substitution of nonstandard materials, poor production scheduling, poor product design or production technique, lack of proper tools or machines, carelessness in not returning excess materials to storeroom, or unexpected volume changes	Production Manager
Failure to detect defective goods	Receiving Manager
Inefficient labor, poor supervision, or waste on the production line	Foreman
Inaccurate standard price	Budgeting
Excessive transportation charges or too small a quantity purchased	Traffic management
Insufficient quantity bought because of a lack of funds	Financial

Exhibit 8.1

Details of Material Price Variance

Date _____ **Prepared by** _____ **Approved by** _____

Voucher No.	Item No.	Item Name	Vendor No.	Quantity Purchased	Standard Cost		Actual Cost		Variance		Percent from Standard	Explanation
					Per Unit	Total	Per Unit	Total	Per Unit	Total		

To correct an unfavorable material price variance, one can increase selling price, substitute cheaper materials, change a production method or specification, or engage in a cost-reduction program.

An unfavorable price variance does not automatically mean the purchasing manager is not performing well. It may point to a need for new pricing, product, or buying decisions. For these purposes, price variances may be broken down by product, vendor class, or other appropriate distinction. When several types of raw materials are used, it might be better to break down the price variance by major category of material used (e.g., steel, paint).

Tip: One should examine the variability in raw material costs. Look at price instability in trade publications. Emphasize vertical integration to reduce the price and supply risk of raw materials.

To aid in identifying material usage variances, if additional material is required to complete the job, additional materials requisitions could be issued in a different color with a distinctive code number to show that the quantity of material is above standard. This approach brings attention to the excessive usage of materials while production is in process and allows for the early control of a developing problem. When material usage is recorded by flow meters, such as in chemical operations, usage variances can be identified on materials usage forms in a similar manner as excess labor hours identified on labor time tickets.

Purchasing managers should have the option to acquire cheaper raw materials or to combine available resources so that overall corporate costs are minimized. For instance, slightly inferior raw materials (i.e., lower grade of metals) may intentionally be purchased at a bargain price. The material price variance may thus be quite favorable. However, such raw material component may cause above-average defective finished items and/or excessive productive labor hours, resulting in an unfavorable efficiency variance. The production manager may have permission to engage in this trade-off if it results in a significant net reduction in total manufacturing costs.

A standard cost system should not be rigid in the sense that an unfavorable variance is regarded as always being bad. The production manager should look to see if overall objectives have been accomplished. Because many interdependencies exist, one should look at the entire picture rather than at just the fact that a given variance is unfavorable.

When computing material price variances, it may be good to eliminate increasing costs due to inflation, which are not controllable by nonfinancial managers.

Illustration of How Inflationary Cost Increases May Be Isolated from the Material Price Variance

Assume these data for Charles Company for 20X1:	
Standard price of material per foot	$3.00
Actual price of material per foot	3.80
Actual material used	10,000 ft.
The inflation rate for the year is 16%	

The direct material price variance can be broken down into the inflation aspect and the controllable element.

Price variance due to inflation

(Standard price versus inflation adjusted price) × actual quantity
$3.00 versus $3.48 × 10,000 ft $4,800

Controllable price variance

(Inflation adjusted price versus actual price) × actual quantity
$3.48 versus $3.80 × 10,000 ft $3,200

Proof—Material Price Variance

(Standard price versus actual price) × actual quantity
$3.00 versus $3.80 × 10,000 ft $8,000

It is important to have prompt reporting. Production managers should immediately be informed of variances so problems are identified and corrections made at the production level.

Exhibit 8.2 presents a daily material usage report. Exhibit 8.3 presents a monthly material variance report.

Exhibit 8.2

Daily Material Usage Report

Cost Center **Unit**
Material Type **Date**

	Daily			Month		Year	
Date	**Variance**	**Variance Percent**	**Explanation**	**Variance**	**Variance Percent**	**Variance**	**Variance Percent**

Exhibit 8.3

Monthly Material Variance Report

	Month			Year to Date
Department	**Variance**	**Percent**	**Variance**	**Percent**

Labor Variances

Standard labor rates may be computed, based on the current rates adjusted for future changes in such variables as:

- Union contracts
- Changes in operating conditions
- Changes in the mix of skilled versus unskilled labor
- The average experience of workers

The wage system affects the standard cost rates. The basic rates are (1) day or hourly, (2) straight piece rate, and (3) multiple piece rates or bonus systems. Wage incentive systems can be tied to a standard cost system once standards have been formulated.

Direct labor quantities may be obtained from engineering estimates. Line supervisors can corroborate the estimates by observing and timing employees.

When salary rates are set by union contract, the labor rate variance usually will be minimal. For planning purposes, the rate standard should be the average rate expected to prevail during the planning period. *Note:* Labor rates for the same operation may vary due to seniority or union agreement.

Labor time standards should include only the elements controllable by the worker or work center. If the major purpose of a cost system is control, there should be a tight labor time standard. If costing or pricing is the major purpose of the cost system, looser labor standards are needed. Labor efficiency standards typically are estimated by engineers on the basis of an analysis of the production operation. The standard time may include allowances for normal breaks, personal needs, and machine downtime.

Labor variances are determined in a manner similar to that in which material variances are determined. Labor variances are isolated when labor is used for production.

Example 4

The standard cost of labor is four hours times $9 per hour, or $36 per unit. During the period, 7,000 units were produced. The actual cost is six hours times $8 per hour, or $48 per unit.

Total Labor Variance	
Standard quantity times standard price (28,000 × $9)	$252,000
Actual quantity times actual price (42,000 × $8)	336,000
	$ 84,000 U
Labor Price Variance	
(Standard price versus actual price) times actual quantity ($9 versus $8 × 42,000)	$ 42,000 F

Labor Quantity Variance	
(Standard quantity versus actual quantity) × standard price (28,000 versus 42,000 × $9)	$126,000 U

Possible causes of *unfavorable* labor variances are:

For a labor price (rate) variance:

- Increase in wages
- Poor scheduling of production, resulting in overtime work
- Use of workers commanding higher hourly rates than expected

For a labor efficiency variance:

- Poor supervision
- Use of unskilled workers paid lower rates or the wrong mixture of labor for a given job
- Use of poor-quality machinery
- Improperly trained workers
- Poor quality of materials, requiring more labor time in processing
- Machine breakdowns
- Employee unrest
- Production delays due to power failure

Possible reasons for a labor price variance and the person responsible follow.

Reason	**Responsible Party**
Use of overpaid or excessive number of workers	Production manager or union contract
Poor job descriptions or excessive wages	Personnel
Overtime and poor scheduling of production	Production Planning

In the case of a shortage of skilled workers, it may be impossible to avoid an unfavorable labor price variance.

Price variances due to external factors are beyond the nonfinancial manager's control (e.g., a new minimum wage established by the government).

The cause and responsible party for an unfavorable labor efficiency variance follow.

Cause	**Responsible Entity**
Poor-quality workers or poor training	Personnel or Training
Inadequate supervision, inefficient flow of materials, wrong mixture of labor for a given job, inferior tools, or idle time from production delays	Foreman
Employee unrest	Personnel or Foreman
Improper functioning of equipment	Maintenance
Insufficient material supply or poor quality	Purchasing

To control against an unfavorable labor efficiency variance due to inadequate materials or sales orders, a daily direct labor report should be prepared.

An unfavorable labor efficiency variance may indicate that better machinery is needed, plant layout should be revised, improved operating methods are needed, and better employee training and development are required.

If a permanent change occurs in the amount of labor required or the labor wage rate for the various types of employee help, the production manager may wish to switch to more capital assets than labor.

Variances interrelate. A favorable labor efficiency variance coupled with an unfavorable labor rate variance may mean that higher skilled labor was employed than was necessary. However, the production manager would be justified in doing this if a rush order arose in which the selling price was going to be upwardly adjusted.

Exhibit 8.4 presents a daily labor mix report. Exhibit 8.5 presents a labor performance report. Looking at this report aids in evaluating labor effectiveness and coming up with a revision in labor policies. A graph of weekly labor efficiency is presented in Exhibit 8.6.

Exhibit 8.4

Daily Labor Mix Report

Department Skill level	Actual Hours	Actual Hours in Standard Proportions	Output Variance
I			
II			
III			

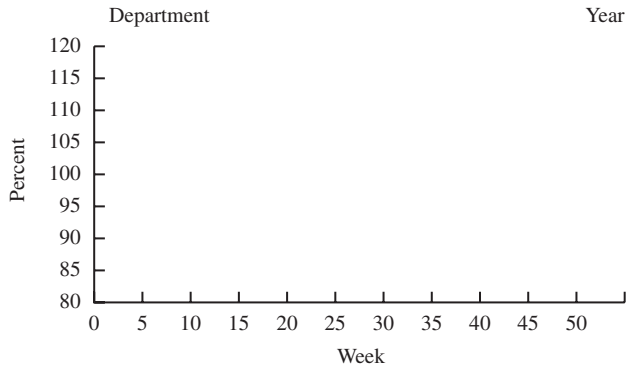
Exhibit 8.5

Labor Performance Report

Department

	Day		Date	
Machine Operator	Achieved in Percent	Explanation	Month to Date in Percent	Year to Date in Percent

Exhibit 8.6



Overhead Variances

Management is concerned with the trade-off between fixed and variable costs. As the output level increases, the capital-intensive business will be more efficient. The cost associated with a wrong decision is the variance between the total costs of operating the given plant and the total costs of operating the most efficient one based on the actual output level.

Overhead variances may be determined by department and by cost center. Fixed and variable overhead variances should be analyzed independently. In many firms, variances are expressed in both dollars and physical measures.

Variable Overhead Variances

The two variances associated with variable overhead are price (spending) and efficiency.

Variable Overhead Price (Spending) Variance

Actual variable overhead versus budget adjusted to actual hours (actual hours × standard variable overhead rate)

Variable Overhead Efficiency Variance

Budget adjusted to actual hours versus budget adjusted to standard hours (standard hours × standard variable overhead rate)

Variable overhead variance information is helpful in arriving at the output level and output mix decisions. The production manager is usually responsible for any variable overhead variance that might occur. This variance also assists in appraising decisions regarding variable inputs.

Example 5

The standard hours are three hours per unit. The standard variable overhead rate is $12 per hour. Actual variable overhead is $13,000. There are 2,500 actual hours. Production is 1,000 units. The variable overhead variances are:

Variable Overhead Price Variance

Actual variable overhead	$13,000
Budget adjusted to actual hours (2,500 × $4)	10,000
Price Variance	$ 3,000 U

Variable Overhead Efficiency Variance

Budget adjusted to actual hours	$10,000
Budget adjusted to standard hours (3,000 × $4)	12,000
Efficiency Variance	$ 2,000 F

Fixed Overhead Variances

Fixed overhead may be analyzed in terms of the budget (flexible budget, spending) variance and volume (production volume) variances. The volume variance may be further broken down into the efficiency and pure volume variances.

Fixed Overhead Budget Variance

Actual fixed overhead versus budgeted fixed overhead (denominator or budget hours × standard fixed overhead rate)

Note: Budgeted fixed overhead also may be referred to as lump-sum amount.

Fixed Overhead Volume Variance

Budgeted fixed overhead versus standard overhead (standard hours × standard fixed overhead rate)

The breakdown of the volume variance follows.

Fixed Overhead Efficiency Variance

(Actual hours versus standard hours) × standard fixed overhead rate

Fixed Overhead Pure Volume Variance

(Actual hours versus budgeted hours) × standard fixed overhead rate

Fixed overhead variance data provide information about decision-making astuteness when buying some combination of fixed plant size variable production inputs. However, variances for fixed overhead are of questionable usefulness for control purposes, since these variances are usually beyond the control of the production manager.

The volume variance is a measure of the cost of deviating from denominator (budgeted) volume used to set the fixed overhead rate. When actual volume is less than budgeted volume, the volume variance will be unfavorable. In the opposite

case, the volume variance is favorable because it is considered as a benefit of better-than-anticipated utilization of facilities.

Example 6

Standard hours are two hours per unit. Standard fixed overhead rate is $20 per hour. Actual hours per unit are two. Total production is 9,500 units. Actual hours are 20,200. Actual fixed overhead is $420,000. The denominator activity is 10,000 units. The fixed overhead variances are:

Fixed Overhead Budget Variance

Actual fixed overhead	$420,000
Budgeted fixed overhead (10,000 × 2 = 20,000 × $20)	400,000
Budget Variance	$ 20,000 U

Volume Variance

Budgeted fixed overhead	$400,000
Standard fixed overhead (9,500 × 2 = 19,000 × $20)	380,000
Volume Variance	$ 20,000 U

The production volume variance of $20,000 is now broken down into the efficiency and pure volume variances.

Fixed Overhead Efficiency Variance

(Actual hours versus standard hours) × standard fixed overhead rate	
(20,200 versus 19,000) × $20	$ 24,000 U

Fixed Overhead Pure Volume Variance

(Actual hours versus budget hours) × standard fixed overhead rate	
(20,200 versus 20,000) × $20	$ 4,000 F

Variances for Total Overhead

One way, two-way, and three-way analysis may be used for total overhead.

One-Way Method

The total (control, net) variance is:

Total Overhead Variance

Actual overhead
Standard overhead (standard hours × standard overhead rate)

Two-Way Method

Under the two-variance method, the overhead variance comprises the controllable (budget, flexible budget, spending) and volume (capacity, idle capacity, activity, denominator) variances.

Controllable Variance

Actual overhead
Budget adjusted to standard hours
  Fixed overhead (denominator hours × standard fixed overhead rate)
  Variable overhead (standard hours × standard variable overhead rate)

Volume (Production) Variance

Standard overhead
Budget adjusted to standard hours

The controllable (budget) variance may indicate changes in the amount charged for overhead services or in the correlation between overhead items and the variable used to measure output. If such changes are permanent, output levels may have to be revised.

Managers use the overhead budget variance as a basis for determining the extent to which the cost centers were within their budgeted cost levels. Such variances are useful in formulating decisions regarding cost center operations.

The controllable variance is the responsibility of the foreman, because he or she influences actual overhead incurred. An unfavorable variance may be due to price increases, a lack of control over costs, and waste.

The volume variance is the responsibility of production managers, since they are involved with plant utilization.

Note: A consistently unfavorable volume variance may be due to having purchased the incorrect size plant. An unfavorable volume variance may arise from controllable factors such as poor scheduling, lack of orders, shortages or defectiveness in raw materials, inadequate tooling, lack of employees, machine breakdowns, long operating times, and incompetent workers. Uncontrollable factors for the overhead volume variance are decrease in customer demand, excess plant capacity, and calendar fluctuations (e.g., differences in number of working days in a month).

Overhead capacity variances can bring to a production manager's attention the existence of slack resources. Idle capacity may imply long run operating planning deficiencies.

The volume of activity often is determined outside the factory, based on customer orders. If this is the case, volume variances may not be controllable by the department head or even by the plant manager. They still should be reported to plant managers to help in explaining the total overhead variance to higher management.

Responsibility for the factory overhead volume variance rests with those responsible for generating volume. In some cases, marketing managers, rather than manufacturing managers, bear this responsibility.

Possible Reasons for a Recurring Unfavorable Overhead Volume Variance

- Buying the wrong size plant
- Improper scheduling
- Insufficient orders
- Shortages in material
- Machinery failure
- Long operating time
- Inadequately trained workers

The existence of idle capacity may indicate long-term operating planning problems.

A deficiency of controllable overhead variance analysis is the failure to segregate the responsibility for increased costs due to inflation from those due to inefficient spending. This deficiency can be corrected through a revised method of overhead analysis, taking into account inflation.

Note: A favorable variance may be causing an unfavorable one. For example, lower maintenance expenditures for equipment may lower the overhead budget variance, but lead to machinery breakdowns and cause an unfavorable volume variance.

Three-Way Method

The three-variance method involves further analysis of the two-variance method. The three-way approach consists of the spending, efficiency, and volume variances. *Note:* The volume variance is identical under the three-way and two-way approaches. The controllable variance under the two-way method is broken down into the spending and efficiency variances under the three-way method.

Spending Variance
Actual overhead
Budget adjusted to actual hours
Fixed overhead (denominator hours × standard fixed overhead rate)
Variable overhead (Actual hours × standard variable overhead rate)

Efficiency Variance
Budget adjusted to actual hours
Budget adjusted to standard hours

Volume (Production) Variance
Budget adjusted to standard hours
Standard overhead

The efficiency variance is the production manager's responsibility and arises from inefficiencies or efficiencies in the production process. The variance is unfavorable when actual hours exceed standard hours charged to production. Inefficiencies may arise from such factors as unskilled labor, modification of operations, deficient machinery, and inferior quality materials.

Spending and efficiency variances are the responsibility of the department supervisor. The volume variance is attributable to executive management because the decision as to the degree of plant utilization rests with them. Idle capacity may be due to the lack of a proper balance between production facilities and sales. It may also arise from a favorable selling price that recovers fixed overhead at an exceptionally low production level.

Example 7

The standards for total overhead are:

Variable overhead	2 hrs. @ $ 6 = $12 per unit
Fixed overhead	2 hrs. @ $20 = $40 per unit

The actual figures are:

Production 9,500 units
Denominator activity 10,000 units
Variable overhead $115,000
Fixed overhead $420,000
Actual hours 20,200

Part 1: *One-Way Analysis*

Control Variance

Actual overhead ($115,000 = $420,000)		$535,000
Standard overhead (9,500 × 2 = 19,000 × $26)		494,000
Control variance		$ 41,000 U

Part 2: *Two-Way Analysis*

Controllable Variance

Actual overhead		$535,000
Budget adjusted to standard hours		
Fixed overhead (10,000 × 2 = 20,000 × $20)	$400,000	
Variable overhead (19,000 × $6)	114,000	
		514,000
Controllable Variance		$ 21,000 U

Volume (Production) Variance

Budget adjusted to standard hours		$514,000
Standard overhead		494,000
Volume Variance		$ 20,000 U

OR

Budgeted hours	20,000
Standard hours	19,000
Difference in hours	1,000
× Fixed overhead rate	× $20
Volume Variance	$20,000 U

Part 3: *Three-Way Analysis*

Spending Variance

Actual overhead		$535,000
Budget adjusted to actual hours		
Fixed overhead (10,000 × 2 = 20,000 × $20)	$400,000	
Variable overhead (20,200 × $6)	121,200	
		$521,200
Spending Variance		$ 13,800 U

Efficiency Variance

Budget adjusted to actual hours	$521,200
Budget adjusted to standard hours	514,000
Efficiency Variance	$ 7,200 U

OR

Actual hours	20,200
Standard hours	19,000
Difference in hours	1,200
× Standard variable overhead rate	× $6
Efficiency Variance	$ 7,200 U

Volume Variance

Budget adjusted to standard hours	$514,000
Standard overhead	494,000
Volume Variance	$ 20,000 U

Example 8 presents comprehensive illustration showing *all* the variances for material, labor, and overhead.

Example 8

These standards are given:

		Per Unit
Direct Material	5 lbs. @ $ 4 per lb.	$ 20
Direct Labor	3 hrs. @ $12 per hr.	36
Variable overhead	3 hrs. @ $ 7 per hr.	21
Fixed overhead	3 hrs. @ $20 per hr.	60
		$137

Actual data follow:

Production 9,800 units
Denominator (budget) activity 11,000 units
Purchases 50,000 lbs. @ $150,000
Direct material used 44,000 lbs.
Direct labor 22,000 hrs. @ $220,000
Variable overhead $125,000
Fixed overhead $450,000

Part 1: *Material*

Material Price Variance

(Actual price versus standard price) × actual quantity bought
($3 versus $4) × 50,000 $ 50,000 F

Material Quantity Variance

(Actual quantity issued versus standard quantity) × standard price
(44,000 versus 49,000) × $4 $ 20,000 F

Part 2: *Labor*

Control Variance

Standard quantity × standard price (29,400 × $12	$352,800
Actual quantity × actual price (22,000 × $10)	220,000
Control Variance	$132,800 F

Labor Price Variance

(Actual price versus standard price) × actual quantity
($10 versus $12) × 22,000 — $ 44,000 F

Labor Quantity Variance

(Actual quantity versus standard quantity) × standard price
(22,000 versus 29,400*) × $12 — $ 88,800 F
*9,800 × 3 = 29,400

Part 3: *Variable Overhead*

Variable Overhead Price Variance

Actual variable overhead	$125,000
Budget adjusted to actual hours (22,000 × $7)	154,000
Price Variance	$ 29,000 F

Variable Overhead Efficiency Variance

Budget adjusted to actual hours	$154,000
Budget adjusted to standard hours (9,800 × 3 = 29,400 × $7)	205,800
Efficiency Variance	$ 51,800 F

Part 4: *Fixed Overhead*

Fixed Overhead Budget Variance

Actual fixed overhead	$450,000
Budgeted fixed overhead (11,000 × 3 = 33,000 × $20)	660,000
Budget Variance	$210,000 F

Fixed Overhead Volume Variance

Budgeted fixed overhead	$660,000
Standard overhead (9,800 × 3 = 29,400 × $20)	588,000
Volume Variance	$ 72,000 U

The fixed overhead volume variance is broken down into the fixed overhead efficiency variance and fixed overhead pure volume variance.

Fixed Overhead Efficiency Variance

(Actual hours versus standard hours) × standard fixed overhead rate
(22,000 versus 29,400) × $20 — $148,000 F

Fixed Overhead Pure Volume Variance

(Actual hours versus budgeted hours) × standard fixed overhead rate
(22,000 versus 33,000) × $20 — $220,000 U

Part 5: *One-Way Analysis*

Total Overhead Variance

Actual overhead	$575,000
Standard overhead (29,400 × $27)	793,800
Total Overhead Variance	$218,800 F

Part 6: *Two-Way Analysis*

Controllable Variance

Actual overhead		$575,000
Budget adjusted to standard hours		
Fixed overhead (11,000 × 3 = 33,000 × $20)	$660,000	
Variable overhead (9,800 × 3 = 29,400 × $7)	205,800	865,800
Controllable Variance		$290,800 F

Volume Variance

Budget adjusted to standard hours	$865,800
Standard overhead	793,800
Volume Variance	$ 72,000 U

Part 7: *Three-Way Analysis*

Spending Variance

Actual overhead		$575,000
Budget adjusted to actual hours		
Fixed overhead (11,000 × 3 = 33,000 × $20)	$660,000	
Variable overhead (22,000 × $7)	154,000	814,000
Spending Variance		$239,000 F

Efficiency Variance

Budget adjusted to actual hours	$814,000
Budget adjusted to standard hours	865,800
Efficiency Variance	$ 51,800 F

Volume Variance

Budget adjusted to standard hours	$865,800
Standard overhead	793,800
Volume Variance	$ 72,000 U

Interrelationship of Variances

With regard to variance analysis for all production costs (direct material, direct labor, and overhead), it is important to note that each variance does *not* represent a separate and distinct problem to be handled in isolation. All variances in one way or another are interdependent. For example, the labor rate variance may be favorable because lower-paid workers are being used. This could lead to an (1) unfavorable material usage variance because of a higher incidence of waste, (2) unfavorable labor efficiency variance because it takes longer hours to make the equivalent number of products, (3) unfavorable overhead efficiency variance because the substandard work causes more hours to be spent for a specified output, and (4) unfavorable overhead volume variance arising from abnormally high machine breakdowns because of less skilled operators.

A trade-off between variances may be a manager's objective. For example, a material price variance may be favorable because of a bargain purchase opportunity or because of a combination of available resources designed to save overall costs. However, the raw material acquired may be somewhat inferior in quality to that which is usually purchased. In processing, use of this material may lead to

greater waste or more labor hours in producing a finished item that will satisfy product quality guidelines. The goal here may be to minimize total production costs through the trade-off of a favorable price variance and an unfavorable quantity variance. The net effect of the variances, in this case, is what counts.

Mix and Yield Variances for Material and Labor

Mix refers to the relative proportion of various ingredients of input factors such as materials and labor. *Yield* is a measure of productivity.

Material and Labor Mix Variances

The material mix variance indicates the impact on material costs of the deviation from the standard mix. The labor mix variance measures the impact of changes in the labor mix on labor costs.

Formulas

$$\text{Material Mix Variance} = \left(\begin{array}{l}\text{Actual Units}\\ \text{Used at}\\ \text{Standard Mix}\end{array} - \begin{array}{l}\text{Actual Units}\\ \text{Used at}\\ \text{Actual Mix}\end{array}\right) \times \begin{array}{l}\text{Standard}\\ \text{Unit}\\ \text{Price}\end{array}$$

$$\text{Labor Mix Variance} = \left(\begin{array}{l}\text{Actual Hrs.}\\ \text{Used at}\\ \text{Standard Mix}\end{array} - \begin{array}{l}\text{Actual Hrs.}\\ \text{Used at}\\ \text{Actual Mix}\end{array}\right) \times \begin{array}{l}\text{Standard}\\ \text{Hourly}\\ \text{Price}\end{array}$$

Mix and Yield Variances

The material quantity variance is divided into a material mix variance and a material yield variance. The material mix variance measures the impact of the deviation from the standard mix on material costs, while the material yield variance reflects the impact on material costs of the deviation from the standard input material allowed for actual production. We compute the material mix variance by holding the total input units constant at their actual amount.

We compute the material yield variance by holding the mix constant at the standard amount. The computations for labor mix and yield variances are the same as those for materials. If there is no mix, the yield variance is the same as the quantity (or usage) variance.

Formulas

$$\text{Material Yield Variance} = \left(\begin{array}{l}\text{Actual Units}\\ \text{Used at}\\ \text{Standard Mix}\end{array} - \begin{array}{l}\text{Actual Units}\\ \text{Output at}\\ \text{Standard Mix}\end{array}\right) \times \begin{array}{l}\text{Standard}\\ \text{Unit}\\ \text{Price}\end{array}$$

$$\text{Labor Yield Variance} = \left(\begin{array}{l}\text{Actual Hrs.}\\ \text{Used at}\\ \text{Standard Mix}\end{array} - \begin{array}{l}\text{Actual Output}\\ \text{Hrs. at}\\ \text{Standard Mix}\end{array}\right) \times \begin{array}{l}\text{Standard}\\ \text{Hourly}\\ \text{Price}\end{array}$$

Probable Causes of Unfavorable Mix Variances

- Capacity restraints force substitution.
- Poor production scheduling
- Lack of certain types of labor
- Certain materials are in short supply.

Probable Causes of Unfavorable Yield Variances

- The use of low-quality materials and/or labor
- The existence of faulty equipment
- The use of improper production methods
- An improper or costly mix of materials and/or labor

Example 9 (Mix Variances)

J Company produces a compound composed of Materials Alpha and Beta, which is marketed in 20-pound bags. Material Alpha can be substituted for Material Beta. Standard cost and mix data have been determined as follows:

	Unit Price	Standard Unit	Standard Mix Proportions
Material Alpha	$3	5 lbs.	25%
Material Beta	4	15	75
		20 lbs.	100%

Processing each 20 pounds of material requires 10 hours of labor. The company employs two types of labor, skilled and unskilled, working on two processes, assembly and finishing. The following standard labor cost has been set for a 20-pound-bag.

	Standard Hrs.	Standard Wage Rate	Total	Standard Mix Proportions
Unskilled	4 hrs.	$2	$ 8	40%
Skilled	6	3	18	60
	10	$2.60	$26	100%

At standard cost, labor averages $2.60 per unit. During the month of December, 100 20-pound bags were produced with these labor costs:

	Actual Hrs.	Actual Rate	Actual Wages
Unskilled	380 hrs.	$2.50	$ 950
Skilled	600	3.25	1,950
	980		$2,900

Material records show:

	Beginning Inventory	Purchase	Ending Inventory
Material Alpha	100 lbs.	800 @ $3.10	200 lbs.
Material Beta	225	1,350 @ $3.90	175

We now want to determine these following variances from standard costs:

- Material purchase price
- Material mix
- Material quantity
- Labor rate
- Labor mix
- Labor efficiency

We will show how to compute these variances in a tabular form.

(a) *Material Purchase Price Variance*

	Material Price per Unit			Actual Quantity Purchased	Variance ($)
	Standard	Actual	Difference		
Material Alpha	$3	$3.10	$.10 U	800 lbs.	$ 80 U
Material Beta	4	3.90	.10 F	1,350	135 F
					$ 55 F

(b) *Material Mix Variance*

	Units that Should Have Been Used at Standard Mix*	Actual Units at Actual Mix†	Difference	Standard Unit Price	Variance ($)
Material Alpha	525 lbs.	700 lbs.	175 U	$3	$525 U
Material Beta	1,575	1,400	175 F	4	700 F
	2,100	2,100			$175 F

The material mix variance measures the impact on material costs of the deviation from the standard mix. Therefore, it is computed holding the total quantity used constant at its actual amount and allowing the material mix to vary between actual and standard. As shown, due to a favorable change in mix, we ended up with a favorable material mix variance of $175.

*This is the standard mix proportions of 25% and 75% applied to the actual material units used of 2,100 lbs.

†Actual units used = Beginning inventory + purchases – Ending inventory.

Therefore,

Material Alpha: 700 lbs. = 100 + 800 – 200
Material Beta: 1,400 lbs. = 225 + 1,350 – 175

(c) *Material Quantity Variance*

	Units that Should Have Been Used at Standard Mix	Standard Units at Standard Mix	Diff.	Standard Unit Price	Variance ($)
Material Alpha	525 lbs.	500 lbs.	25 U	$3	$75 U
Meterial Beta	1,575	1,500	75 U	4	300 U
	2,100	2,000			$375 U

The total material variance is the sum of the three variances:

Purchase price variance	$ 55 F
Mix variance	175 F
Quantity variance	375 U
	$145 U

The increase of $145 in material costs was due solely to an unfavorable quantity variance of 100 pounds of material Alpha and Beta. The unfavorable quantity variance, however, was compensated largely by favorable mix and price variances.

J Company must look for ways to cut down waste and spoilage.

The labor cost increase of $300 ($2,900 – $2,600) is attributable to three causes:

1. An increase of $.50 per hour in the rate paid to skilled labor and $.25 per hour in the rate paid to unskilled labor
2. An unfavorable mix of skilled and unskilled labor
3. A favorable labor efficiency variance of 20 hours

Three labor variances are computed next.

(d) *Labor Rate Variance*

	Labor Rate per Hr.			Actual Hrs.	Variance
	Standard	Actual	Diff.	Used	($)
Unskilled	$2	$2.50	$.50 U	380 hrs.	$190 U
Skilled	3	3.25	.25 U	600	150 U
					$340 U

(e) *Labor Mix Variance*

	Actual Hrs. at Standard Mix*	Actual Hrs. at Actual Mix	Diff.	Standard Rate	Variance ($)
Unskilled	392 hrs.	380 hrs.	12 F	$2	$24 F
Skilled	588	600	12 U	3	36 U
	980	980			$12 U

*This is the standard proportions of 40% and 60% applied to the action total labor hrs. used of 980.

(f) *Labor Efficiency Variance*

	Actual Hrs. at Standard Mix	Standard Hrs. at Standard Mix	Diff.	Standard Rate	Variance ($)
Unskilled	392 hrs.	400 hrs.	8 F	$2	$16 F
Skilled	588	600	12 F	3	36 F
	980	1,000			$52 F

The total labor variance is the sum of these three variances:

Rate variance	$340 U
Mix variance	12 U
Efficiency variance	52 F
	$300 U

which is proved to be:

Total Labor Variance

	Actual Hrs. Used	Actual Rate	Total Actual Cost	Standard Hrs. Allowed	Standard Rate	Total Standard Cost	Variance ($)
Unskilled	380 hrs.	$2.50	$ 950	400	$2	$ 800	$150 U
Skilled	600	3.25	1,950	600	3	1,800	150 U
			$2,900			$2,600	$300 U

The unfavorable labor variance, as evidenced by the cost increase of $300, may be due to:

- Overtime necessary because of poor production scheduling resulting in a higher average labor cost per hour, and or
- Unnecessary use of more expensive skilled labor

J Company should put more effort into better production scheduling.

Example 10 (Yield Variances)

The Giffen Manufacturing Company uses a standard cost system for its production of a chemical product. This chemical is produced by mixing three major raw materials, A, B, and C. The company has these standards:

36 lbs. of Material A	@	$1.00	=	$ 36.00
48 lbs. of Material B	@	2.00	=	96.00
36 lbs. of Material C	@	1.75	=	63.00
120 lbs. of standard mix	@	$1.625	=	$195.00

The company should produce 100 pounds of finished product at a standard cost of $1.625 per pound ($195.00/120 lbs.)

Converting 120 pounds of materials into 100 pounds of finished chemical requires 400 DLH at $3.50 per DLH, or $14.00 per pound. During the month of December, the company produced 4,250 pounds of output with direct labor of 15,250 hrs. @ $3.50.

	Materials Purchased During the Month	Materials Used During the Month
Material A	1,200 @ $1.10	1,160 lbs.
Material B	1,800 @ 1.95	1,820
Material C	1,500 @ 1.80	1,480

The material *price variance is isolated at the time of purchase.* We want to compute the material purchase price, quantity, mix, and yield variances.

We will show the computations of variances in a tabular form.

(a) *Material Variance*

Material Purchase Price Variance

	Material Price per Unit			Actual Quantity Purchased	Variance ($)
	Standard	Actual	Diff.		
Material A	$1.00	$1.10	$.10 U	1,200 lbs.	$120 U
Material B	2.00	1.95	.05 F	1,800	90 F
Material C	1.75	1.80	.05 U	1,500	75 U
					$105 U

The material quantity variance computed next results from changes in the mix of materials as well as from changes in the total quantity of materials. The standard input allowed for actual production consists of 1,275 pounds of Material A, 1,700 pounds of Material B and 1,275 pounds of Material C, a total of 4,250 pounds. The actual input consisted of 1,160 pounds of Material A, 1,820 pounds of Material B and 1,480 pounds of Material C, a total of 4,460 pounds. To separate these two changes, the material quantity variance is subdivided into a material mix variance and a material yield variance.

Material Quantity Variance

	Actual Units Used at Actual Mix	"Should Have Been" Inputs Based on Actual Output	Diff.	Standard Unit Price	Variance ($)
Material A	1,160 lbs.	1,275 lbs.	115 F	$1.00	$115 F
Material B	1,820	1,700	120 U	2.00	240 U
Material C	1,480	1,275	205 U	1.75	358.75 U
	4,460	4,250			$483.75 U

The computation of the material mix variance and the material yield variance for the Giffen Manufacturing Company is given next.

Material Mix Variance

	"Should Have Been" Individual Inputs Based on Total Actual Throughput*	Actual Units Used at Actual Mix	Diff.	Standard Unit Price	Variance ($)
Material A	1,338 lbs.	1,160 lbs.	178 F	$1.00	$178 F
Material B	1,784	1,820	36 U	2.00	72 U
Material C	1,338	1,480	142 U	1.75	248.5 U
	4,460	4,460			$412.5 U

Material Mix Variance

	Expected Input Units at Standard Mix	"Should Have Been" Inputs Based on Actual Output*	Diff.	Standard Unit Price	Variance ($)
Material A	1,338 lbs.	1,275 lbs.	63 U	$1.00	$ 63 U
Material B	1,784	1,700	84 U	2.00	168 U
Material C	1,338	1,275	63 U	1.75	110.25 U
	4,460	4,250			$341.25 U†

*This is the standard mix proportion of 30%, 40%, and 30% applied to the actual throughput of 4,460 pounds or *output* of 4,250 pounds.

†The material yield variance of $341.25 U can be computed alternatively in this way:

Actual input quantity at standard prices

Material A 1,338 lbs. @ $1.00 = $1,338
Material B 1,784 lbs. @ 2.00 = 3,568
Material C 1,338 lbs. @ 1.75 = 2,341.5 $7,274.50

Actual output quantity at standard price

4,250 lbs. @ 1.625 $6,906.25

Hence, $7,247.5 – $6.906.25 = $341.25 U

The material mix and material yield variances are unfavorable, indicating that a shift was made to a more expensive (at standard) input mix and that an excessive quantity of material was used. Poor production scheduling requiring an unnecessarily excessive use of input materials and an undesirable mix of Materials A, B, and C was responsible for this result.

To remedy the situation, the company must ensure that four steps are taken:

1. The material mix is adhered to in terms of the least cost combination without affecting product quality.
2. The proper production methods are being implemented.

3. Inefficiencies, waste, and spoilage are within the standard allowance.
4. Quality materials, consistent with established standards, are being used.

Employees seldom complete their operations according to standard times. Two factors should be brought out in computing their variances if the analysis and computation will be used to fix responsibility:

1. The change in labor cost resulting from the efficiency of the workers, measured by a labor efficiency variance. (In finding the change, allowed hours are determined through the material input.)
2. The change in labor cost due to a difference in the yield, measured by a labor yield variance. (In computing the change, actual output is converted to allowed input hours.)

For the Giffen Manufacturing Company, more efficient workers resulted in a savings of 383.33 hours (15,250 hrs. – 14,866.67 hrs.). Priced at the standard rate per hour, this produced an unfavorable labor efficiency variance of $1,341.66 as shown next:

Labor Efficiency Variance

Actual hrs. at standard rate	$53,375
Actual hrs. at expected output (4,460 hrs. × 400/120 = 14,866.67 hrs @ $3.5)	52,033.34
	$ 1,341.66 U

With a standard yield of $83\frac{1}{3}\%$ (= 100/120), 4,250 pounds of finished material should have required 17,000 hours of direct labor (4,250 lbs. × 400 DLH/100). Comparing the hours allowed for the actual input, 14,866.67 hours with the hours allowed for actual output, 17,000 hours, we find a favorable labor yield variance of $7,466.66, as shown next.

Labor Yield Variance

Actual hrs. at expected output	$52,033.34
Actual output (4,250 lbs. × 400/100 = 17,000 hrs. @ $3.5 or 4,250 lbs. @ $14.00)	59,500
	$ 7,466.66 F

The labor efficiency variance can be combined with the yield variance to give us the *traditional* labor efficiency variance, which turns out to be favorable.

Labor efficiency variance	$1,341.66 U
Labor yield variance	7,466.66 F
	$6,125 F

This division is necessary when there is a difference between the actual yield and standard yield, if responsibility is to be fixed. The production manager cannot be

credited with a favorable efficiency variance of $6,125. Note, however, that a favorable yield variance, which is a factor most likely outside the control of the producing department, more than offsets the *unfavorable* labor efficiency variance of $1,341.66 for which the producing department should have been responsible.

Profit Variance Analysis

Gross profit analysis is determining the causes for the change in gross profit. Any variances that have an impact on gross profit are reported so corrective steps may be taken.

Causes of Profit Variance

- Changes in unit sales price and cost
- Changes in the volume of products sold
- Changes in sales mix

Analysis of the changes furnishes data needed to bring actual operations in line with budgeted expectations. Comparisons should be made between budgeted and actual operations for the current year or between actual operations for the previous year and those for the current year. Changes in gross profit may be looked at in terms of the entire company or by product line.

In an effort to improve profitability, the change in character of sales or mix of sales is just as important as the increase in total volume. For example, if the total volume in the budget is constant, but a larger proportion of high-margin products is sold than was budgeted, then higher profits will result. For instance, in the furniture business, there is an increasing trend toward more expensive and durable pieces carrying a higher margin per unit, although volume may not be all that great. Computations and analysis of sales mix variances are a very important part of profit analysis. It provides an additional insight into (a) what caused the increase or decrease in profit over the previous year and (b) why the actual profit differed from the original expectation.

Gross profit (or contribution margin) is usually the joint responsibility of sales managers and production managers. The sales manager is responsible for the sales revenue component, and the production manager is accountable for the cost-of-goods-sold component. However, it is the task of top management to ensure that the target profit is met. The sales manager must hold fast to prices, volume, and mix. The production manager must control the costs of materials, labor and factory overhead, and quantities. The purchasing manager must purchase materials at budgeted prices. The personnel manager must employ the right people at the right wage rates. The internal audit manager must ensure that the budgetary figures for sales and costs are being adhered to by all departments that are, directly or indirectly, involved in contributing to making profit.

The computation of the production mix variance is very similar to that of the sales mix variance. While the sales mix variance is part of profit analysis, the

production mix variance for materials and labor is an important part of cost variance analysis. We must realize, however, that the analysis of standard cost variances should be understood as part of what is broadly known as profit analysis. In industries where each cost element is substituted for each other and production is at or near full capacity, how we combine different types of materials and different classes of labor will affect the extent to which the costs are controlled and gross profit maximized. The production volume variance must be further analyzed to separate the effect on costs of a change in mix of the production inputs such as materials and labor.

The yield variances for materials, labor, and overhead are useful in controlling material consumption. In some cases, the newly found mix is accompanied by either a favorable or an unfavorable yield of the finished product. Usually the favorable mix variance may be offset by an unfavorable yield variance, or vice versa. It is the responsibility of the laboratory or the engineering manager to make sure that no apparent advantage created by one type of variance is canceled out by another.

Taken as a whole, the analysis of profit involves careful evaluation of sales variances and cost variances. In particular, the effect of changes in mix, volume, and yield on profits must be separated and analyzed. The analysis of these variances provides managers with added dimensions of responsibility since it provides additional insight into what caused the increase or decrease in profits or why the actual profit deviated from the target profit. Analyzing the change in gross profit via an effective responsibility system based on the control of costs and sales variances is a step toward maximization of profits.

We now discuss the computation of the profit variances.

Profit Variance Analysis for a Single Product:

(a) Sales price variance
= (Actual price – Budget or standard price) × Actual sales
(b) Costs price variance
= (Actual cost – Budget or standard cost) × Actual sales
(c) Sales volume variance
= (Actual sales – Budget or standard sales) × Budget or standard price
(d) Cost volume variance
= (Actual sales – Budget or standard sales) × Budget or standard cost per unit

Profit Variance Analysis for Multiple Products:

The total volume variance in a single product situation is comprised of (a) sales mix variance and (b) sales quantity variance.

(a) Sales mix variance

$$= \begin{pmatrix} \text{Actual sales at budget} \\ \text{or standard mix} \end{pmatrix} - \begin{pmatrix} \text{Budget or standard sales} \\ \text{at budget or standard mix} \end{pmatrix} \times \begin{matrix} \text{Budget or} \\ \text{standard CM} \\ \text{(or GM) per unit} \end{matrix}$$

CM = contribution margin and GM = gross margin.

(b) Sales quantity variance

$$= \left(\begin{array}{l}\text{Actual sales at budgeted}\\ \text{or standard mix}\end{array} - \begin{array}{l}\text{Actual sales at budgeted}\\ \text{or standard mix}\end{array}\right) \times \begin{array}{l}\text{Budgeted or}\\ \text{standard CM}\\ \text{(or GM) per unit}\end{array}$$

(c) Total volume variance
= Sales mix variance + sales quantity variance

$$\text{or} = \left(\begin{array}{l}\text{Actual sale at budgeted}\\ \text{or actual mix}\end{array} - \begin{array}{l}\text{Budgeted or standard sales}\\ \text{at budgeted or standard mix}\end{array}\right) \times \begin{array}{l}\text{Budgeted or}\\ \text{standard CM}\\ \text{(or GM) per unit}\end{array}$$

The sales price variance and the cost price variance are calculated the same way as for a single product.

Frequently, a contribution margin approach is superior to the gross profit approach. That is because gross profit as a deduction for fixed costs may be beyond the control of the nonfinancial manager. A simple example follows.

	Budget		Actual		Variance	
	Unit A	**Unit B**	**Unit A**	**Unit B**	**Unit A**	**Unit B**
Sales Price	$10	$5	$11	$6	$ 1 F	$ 1 U
Units	10	8	10	8	-0-	-0-
Variable Manufacturing Costs	$ 4	$3	$ 6	$4	$ 2 U	$ 1 U
Fixed Manufacturing Costs	$ 3	$1	$ 4	$2	$ 1 U	$ 1 U
Manufacturing Contribution Margin per Unit	$ 6	$2	$ 5	$2	$1 U	$-0-
Gross Profit per Unit	$ 3	$1	$ 1	$0	$2 U	$1 U

Using these data, an unfavorable manufacturing contribution margin variance of $10 ($1 × 10 units) for Unit A and $0 ($0 × 8 units) for Unit B is more meaningful than the $20 ($2 × 10 units) and $8 ($1 × 8 units) unfavorable gross profit variance, if local managers had no control over fixed costs.

Example 11 (Profit Variance Analysis)

The Lake Tahoe Ski Store sells two ski models, Model X and Model Y. For the years 20X1 and 20X2, the store realized a gross profit of $246,640 and only $211,650, respectively. The owner of the store was astounded, since the total sales volume in dollars and in units was higher for 20X1 than for 20X2, yet the gross profit actually declined. Given below are the store's unaudited operating results for 20X1 and 20X2. No fixed costs were included in the cost of goods sold per unit.

	Model X				Model Y			
Year	Selling Price	Cost of Goods Sold per Unit	Sales (in Units)	Sales Revenue	Selling Price	Cost of Goods Sold per Unit	Sales (in Units)	Sales Revenue
1	$150	$110	2,800	$420,000	$172	$121	2,640	$454,080
2	160	125	2,650	424,000	176	135	2,900	510,400

We explain why the gross profit declined by $34,990. We include a detailed variance analysis of price changes and changes in volume for sales and cost. Also, we subdivide the total volume variance into changes in price and changes in quantity.

Sales price and sales volume variances measure the impact on the firm's CM (or GM) of changes in the unit selling price and sales volume. In computing these variances, all costs are held constant in order to stress changes in price and volume. Cost price and cost volume variances are computed in the same manner, holding price and volume constant. All these variances for the Lake Tahoe Ski Store are computed next.

Sales Price Variance

Actual Sales for 20X2:

Model X 2,650 × $160 = $424,000
Model Y 2,900 × 176 = 510,400 $934,400

Actual 20 × 2 sales at 20X1 prices:

Model X 2,650 × $150 = $397,500
Model Y 2,900 × 172 = 498,800 $896,300
$ 38,100 F

Sales Volume Variance

Actual 20 × 2 sales at 20X1 prices: $896,300

Actual 20 × 1 sales (at 20X1 prices):

Model X 2,800 × $150 = $420,000
Model Y 2,640 × 172 = 454,080 874,080
$ 22,220 F

Cost Price Variance

Actual cost of goods sold for 20X2:

Model X 2,650 × $125 = $331,250
Model Y 2,900 × 135 = 391,500 $722,750

Actual 20X2 sales at 20X1 costs:

Model X 2,650 × $110 = $291,500
Model Y 2,900 × 121 = 350,900 642,400
$ 80,350 U

Cost Volume Variance

Actual 20X2 sales at 20X1 costs: $642,400

Actual 20X1 sales (at 20X1 costs):

Model X 2,800 × $110 = $308,000	
Model Y 2,640 × 121 = 319,440	627,440
	$ 14,960 U

Total volume variance = sales volume variance – cost volume variance
= $22,250 F – $14,960 U = $7,260 F

The total volume variance is computed as the sum of a sales mix variance and a sales quantity variance:

Sales Mix Variance

	20X2 Actual Sales at 20X1 Mix*	20X2 Actual Sales at 20X2 Mix	Diff.	20X1 Gross Profit per Unit	Variance ($)
Model X	2,857	2,650	207 U	$40	$ 8,280 U
Model Y	2,693	2,900	207 F	51	10,557 F
	5,550	5,550			$ 2,277 F

*This is the 20X1 mix (used as standard or budget) proportions of 51.47% (or 1,800/5,440 = 51.47%) and 48.53% (or 2,640/5,440 = 48.53%) applied to the actual 20X2 sales figure of 5,550 units.

Sales Quantity Variance

	20X2 Actual Sales at 20X1 Mix*	20X1 Actual Sales at 20X1 Mix	Diff.	20X1 Gross Profit per Unit	Variance ($)
Model X	2,857	2,800	57 U	$40	$2,280 F
Model Y	2,693	2,640	53 F	51	2,703 F
	5,550	5,440			$4,983 F

A favorable total volume variance is due to a favorable shift in the sales mix (i.e., from Model X to Model Y) and also to a favorable increase in sales volume (by 110 units), which is shown next.

Sales mix variance	$2,277 F
Sales quantity variance	4,983 F
	$7,260 F

However, there remains the decrease in gross profit. The decrease in gross profit of $34,990 can be explained in this way.

	Gains	Losses
Gain due to increased sales price	$38,100 F	
Loss due to increased cost		80,350 U
Gain due to increase in units sold	4,983 F	
Gain due to shift in sales mix	2,277 F	
	$45,360 F	$80,350 U
Hence, net decrease in gross profit = $80,350 – $45,360 =		$34,990 U

Despite the increase in sales price and volume and the favorable shift in sales mix, the Lake Tahoe Ski Store ended up losing $34,990, compared to 20X1. The major reason for this comparative loss was the tremendous increase in cost of goods sold, as indicated by an unfavorable cost price variance of $80,350. The costs for both Model X and Model Y went up quite significantly over 20X1. The store has to take a close look at the cost picture. Even though only variable costs were included in cost of goods sold per unit, both variable and fixed costs should be analyzed in an effort to cut down on controllable costs. In doing that, it is essential that responsibility be clearly fixed to given individuals. In a retail business like the Lake Tahoe Ski Store, operating expenses such as advertising and payroll of store employees must also be closely scrutinized.

Example 12 (Sales Mix and Quantity Variances)

Shim and Siegel, Inc., sells two products, C and D. Product C has a budgeted unit CM (contribution margin) of $3 and Product D has a budgeted unit CM of $6. The budget for a recent month called for sales of 3,000 units of C and 9,000 units of D, for a total of 12,000 units. Actual sales totaled 12,200 units, 4,700 of C, and 7,500 of D. We compute the sales volume variance and break this variance down into the sales quantity variance and sales mix variance.

Shim and Siegel's sales volume variance is computed next. As we can see, while total unit sales increased by 200 units, the shift in sales mix resulted in a $3,900 unfavorable sales volume variance.

Sales Volume Variance

	Actual Sales at Actual Mix	Standard Sales at Budget Mix	Difference	Budgeted CM per Unit	Variance ($)
Product C	4,700	3,000	1,700 F	$3	$5,100 F
Product D	7,500	9,000	1,500 U	6	9,000 U
	12,200	12,200			$3,900 U

In multiproduct firms, the sales volume variance is further divided into a sales quantity variance and a sales mix variance. The computations of these variances are shown next.

Sales Quantity Variance

	Actual Sales at Budgeted Mix	Standard Sales at Budgeted Mix	Difference	Standard CM per Unit	Variance ($)
Product C	3,050	3,000	50 F	$3	$ 150 F
Product D	9,150	9,000	150 F	6	900 F
	12,200	12,000			$1,050 F

Sales Mix Variance

	Actual Sales at Budgeted Mix	Actual Sales at Actual Mix	Difference	Standard CM per Unit	Variance ($)
Product C	3,050	4,700	1,650 F	$3	$4,950 F
Product D	9,150	7,150	1,650 U	6	9,900 U
	12,200	12,200			$4,950 F

The sales quantity variance reflects the impact on the CM or GM (gross margin) of deviations from the standard sales volume, whereas the sales mix variance measures the impact on the CM of deviations from the budgeted mix. In the case of Shim and Siegel, Inc., the sales quantity variance came out to be favorable—$1,050 F—and the sales mix variance came out to be unfavorable—$4,950 U. These variances indicate that while there was favorable increase in sales volume by 200 units, it was obtained by an unfavorable shift in the sales mix, that is, a shift from Product D, with a high margin, to product C, with a low margin.

Note that the sales volume variance of $3,900 U is the algebraic sum of two variances:

Sales quantity variance	$1,050 F
Sales mix variance	4,950 U
	$3,900 U

In conclusion, the product emphasis on high margin sales is often a key to success for multiproduct firms. Increasing sales volume is one side of the story, selling the more profitable products is another.

In view of the fact that Shim and Siegel, Inc., experienced an unfavorable sales volume variance of $3,900 due to an unfavorable (or less profitable) mix in the sales volume, the company is advised to put more emphasis on increasing the sale of Product D.

In doing that the company might wish to take four steps:

1. Increase the advertising budget for succeeding periods to boost Product D sales.
2. Set up a bonus plan in such a way that the commission is based on quantities sold rather than higher rates for higher-margin item such as Product D or revise the bonus plan to consider the sale of Product D.
3. Offer a more lenient credit term for Product D to encourage its sale.
4. Reduce the price of Product D enough to maintain the present profitable mix while increasing the sale of product. This strategy must take into account the price elasticity of demand for Product D.

Nonmanufacturing Activities

When nonmanufacturing activities repeat and result in a homogeneous product, standards may be used. The manner of estimating and employing standards can be similar to that applicable with a manufactured product. For instance, standards may be used for office personnel involved in processing sales orders and a standard unit expense for processing a sales order may be derived. The variance between the actual cost of processing a sales order with the standard cost can be appraised by sales managers and corrective steps taken. The number of payroll checks prepared should be a reliable measure of the activity of the payroll department. The number of invoices or vouchers prepared apply to billing and accounts payable. In these two cases, a standard cost per unit could be based on the variable expenses involved.

Variance analysis is used in non-production-oriented companies such as service businesses. Because we are not dealing with a product, a measure of volume other than units is necessary, for example, time spent. The measure of revenue is fee income.

The cost variances are still the same as in a manufacturing concern, namely budgeted costs versus actual costs. We also can derive the gross margin or contribution margin variance as the difference between that budgeted and that actually obtained. The profitability measures are expressed as a percent of sales rather than as dollars per unit. The relationship between costs and sales often is highlighted.

Service firms typically have numerous variances expressed in physical, rather than dollar, measures. Examples of physical measures are number of customers serviced and turnover rate in customers.

Illustrative Variance Analysis Report for a Service Business

For a service business, cost variances may be reported in special reports. For example, the variance in time and cost spent for processing payments to creditors may be analyzed. An illustrative format follows.

	Variance in Time	Variance in Cost
Function		
Processing purchase orders		
Processing receiving reports		
Processing vendors' invoices		
Preparing checks		
Filing paid vouchers and supporting documents		

Variances for these functions are useful only for large companies where the volume of activity allows for the arrangement and analysis of such repetitive tasks.

Variances to Evaluate Marketing Effort

Prior to setting a marketing standard in a given trade territory, examine prior, current, and forecasted conditions for the company itself and that given geographical area. Standards will vary, depending on geographical location. In formulating standard costs for the transportation function, minimum cost traffic routes should be selected on the basis of the given distribution pattern.

Standards for advertising cost in particular territories will vary depending on the types of advertising media needed, which are in turn based on the type of customers the advertising is intended to reach, as well as the nature of the competition.

Some direct selling costs can be standardized, such as product presentations for which a standard time per sales call can be established. Direct selling expenses should be related to distance traveled and frequency of calls made. If sales commissions are based on sales generated, standards can be based on a percentage of net sales.

Time and motion studies are usually a better way of establishing standards than prior performance, because the past may include inefficiencies.

Cost variances for the selling function may pertain to the territory, product, or personnel.

Variances in Selling Expenses

The control of selling expenses is not as significant for a company manufacturing a standard line of products with a limited number of established customers as for a manufacturer of custom products in a very competitive market. For the latter, significant advertising and salespeople costs are mandated. The variance in selling costs is equal to the actual cost versus the flexible budgeted cost.

Assume actual cost is $88,000 and the flexible budget is:

$$\$40{,}000 + (5\% \times \text{sales revenue}) = (\$.03 \text{ per unit shipped})$$

If sales revenue is $500,000 and 100,000 units are shipped, the flexible budgeted cost is:

$$\$40{,}000 + (5\% \times \$500{,}000) + (\$.03 \times 100{,}000 \text{ units}) = \$68{,}000$$

The variance is unfavorable by $20,000. Perhaps advertising and travel should be investigated further. These costs are highly discretionary in that they may easily be altered by marketing managers.

Further refinement of the selling expense variance is possible. Each element of selling expense (i.e., advertising, travel, commissions, shipping costs) could be looked at in terms of the difference between budgeted cost and actual cost.

Sales Personnel Performance

Actual sales may not be the best measure of sales personnel performance. It does not take into account differing territory potentials. Also, a high-volume salesperson may have to absorb high selling cost, making the profit generated low. Profit is what counts, not sales.

The evaluation of sales personnel based on the trend in their sales generated over the years shows signs of improvement. However, not considered here are customer's market demand, potential markets, product mix, and cost incurrence.

Travel expense standards often are formulated on the basis of distance traveled and the frequency of customer calls. Standards for salesperson automobile expense may be in terms of cost per mile traveled and cost per day. Entertainment and gift expenditures can be based on the amount, size, and potential for customers. The standard might relate to cost per customer or cost per dollar of net sales. Selling expense standards are frowned on by sales managers because they may create ill will among sales personnel. The standards also do not take into account sales volume or product mix.

Profitability per salesperson may be a good measurement yardstick. Sales, less variable product costs, less selling expenses, per salesperson will give the relevant profitability. Not considered here, however, are territory expectations or territory demand.

Standard costing procedures and performance measures should be used to control sales personnel costs and compute earnings generated by salesperson category. Further, revenue, cost, and profit by type of sales solicitation (i.e., personal visit, telephone call, mail) should be determined.

A break-even analysis for individual salespeople also may be performed.

Sales commissions should be higher for higher-profit merchandise. Any quotas established should be based on a desired sales mix.

Consideration of fixed versus variable costs for a function is critical in marketing cost control and in deciding whether to add or drop sales regions and product lines.

Fixed marketing costs include administrative salaries, wages of warehousing and shipping personnel, rent, and insurance. Variable marketing costs are comprised of processing, storing, and shipping goods, which tend to fluctuate with sales volume. Also of a variable nature are sales personnel salaries and commissions as well as travel and entertainment.

It is difficult to project marketing costs because they may change materially as market conditions are altered. An example is a modification in the channels of distribution. Also, customer brand loyalty is difficult to predict. The point here is that it is more difficult to forecast and analyze marketing costs than manufacturing costs. Thus, standards established in this area are quite tentative and very difficult to manage.

Illustrative Marketing Performance Report

An illustrative format for a marketing performance report designed for the marketing manager follows.

	Budget	Percent	Actual	Percent	Variance
Sales					
Less: Standard variable cost of sales					
Manufacturing margin					
Less: Variable distribution costs					
Contribution margin					
Less: Regional fixed charges					
Controllable regional contribution margin					
Less: Marketing fixed charges (i.e., central marketing administration costs, national advertising)					
Marketing contribution margin					

An illustrative format for a marketing performance report designed for the regional sales manager follows.

	Budget	Percent	Actual	Percent	Variance
Sales					
Less: Standard variable cost of sales					
Manufacturing margin					
Less: Variable distribution costs (i.e., sales personnel commissions, freight out)					
Contribution margin					
Less: Regional fixed charges (i.e., salesmen salaries, travel and entertainment, local advertising)					
Controllable regional contribution margin					

The marketing manager should be responsible for standard variable cost of sales, distribution costs (i.e., packing, freight out, marketing administration) and sales. Standard variable cost of sales is used to avoid having the marketing area absorb manufacturing efficiencies and inefficiencies. An illustrative format follows.

Sales

Less: Standard variable cost of sales
Less: Distribution costs
Profitability

The profit figure constitutes the marketing efforts contribution to fixed manufacturing costs and administration costs.

How to Analyze Salesperson Variances

Appraise sales force effectiveness within a territory, including time spent and expenses incurred.

Example 13

Sales data for the company follow.

Standard cost	$240,000
Standard salesperson days	2,000
Standard rate per salesperson day	$ 120
Actual cost	$238,000
Actual salesperson days	1,700
Actual rate per salesperson day	$ 140

Total Cost Variance

Actual cost	$238,000
Standard cost	240,000
	$ 2,000 F

The control variance is broken down into salesperson days and salesperson costs.

Variance in Salesperson Days

Actual days versus standard days times standard rate per day (1,700 versus 2,000 × $120)	$ 36,000 F

The variance is favorable because the territory was handled in fewer days than expected.

Variance in Salesperson Costs

Actual rate versus standard rate times actual days ($140 versus $120 × 1,700)	$ 34,000 F

An unfavorable variance results because the actual rate per day is greater than the expected rate per day.

Example 14

A salesperson called on 55 customers and sold each an average of $2,800 worth of merchandise. The standard number of calls is 50, and the standard sales is $2,400. Variance analysis looking at calls and sales follows.

Total Variance

Actual calls × actual sale 55 × $2,800	$154,000
Standard calls × standard sale 50 × $2,400	120,000
	$ 34,000

The elements of the $34,000 variance are

Variance in Calls

Actual calls versus standard calls × standard sale (55 versus 50 × $2,400)	$ 12,000

Variance in Sales	
Actual calls versus standard sale × standard calls ($2,800 versus $2,400 × 50)	$ 20,000
Joint Variance	
(Actual calls versus standard calls) × (Actual sale versus standard sale) (55 versus 50) × ($2,800 versus $2,400)	$ 2,000

Additional performance measures of sales force effectiveness include meeting sales quotas, number of orders from existing and new customers, profitability per order, and the relationship between salesperson costs and revenue obtained.

The trend in the ratios of selling expense to sales, selling expense to sales volume, and selling expense to net income should be computed. Are selling expenses realistic in light of revenue generated? Are selling expenses beyond limitations, pointing to possible mismanagement and violation of controls?

Variances in Warehousing Costs

In warehousing, standards for direct labor may be in terms of cost per item handled, cost per pound handled, cost per order filled, and cost per shipment.

Variances in warehousing costs can be calculated by looking at the cost per unit to store the merchandise and the number of orders anticipated.

Example 15

This information applies to a product:

Standard cost	$12,100
Standard orders	5,500
Standard unit cost	$ 2.20
Actual cost	$14,030
Actual orders	6,100
Actual unit cost	$ 2.30
Total Warehousing Cost Variance	
Actual cost	$14,030
Standard cost	12,100
	$ 1,930 U

The total variance is segregated into the variance in orders and variance in cost.

Variance in Orders	
Actual orders versus standard orders × standard unit cost 6,100 versus 5,500 × $2.20	$ 1,320 U
Variance in Cost	
Actual cost per unit versus standard cost per unit × actual orders $2.30 versus $2.20 × 6,100)	$ 610 U

Variances in Administrative Expenses

As business expands, there is a tendency for administrative expenses to increase proportionately and get out of line. However, central general and administrative expenses typically are of a fixed cost nature and hence there is less need to monitor these types of costs. Here comparison of budgeted to actual costs can be made quarterly or even yearly. These comparisons should be done by department or unit of responsibility. Suggested standards for administrative expenses follow.

Administrative Function	Unit of Standard Measurement
Handling orders	Number of orders handled
Billing	Number of invoices
Check writing	Number of checks written
Clerical	Number of items handled
Customer statements	Number of statements
Order writing	Number of orders
Personnel	Number of employees hired
Payroll	Number of employees

Selling and administrative variances for nonoperating items are the responsibility of top management and staff. Such items include taxes and insurance. Performance reports may be prepared for the administrative function, such as the salaries of top executives and general department service costs such as data processing. Performance measures also may be of a nonmonetary nature, such as the number of files processed, the number of phone calls taken, and the number of invoices written. Variances between the dollar and nondollar factors can be determined and analyzed.

Capital Expenditures

Variance reports are useful in controlling capital expenditures by looking at the actual versus budgeted costs as well as actual versus budgeted times for proposals at each stage of activity. Such reports enable managers to take corrective cost-saving action, such as changing the construction schedule. The director of the project is held accountable for the construction cost and time budget. Component elements within the project also should be analyzed. We also can compare the expected payback period and actual payback period. This assists in measuring operational results and budgeting efficiency. Also, estimated cash flows of the project can be compared with actual cash flows.

Variance Analysis Reports

Performance reports may be prepared that examine the difference between budgeted and actual figures for:

- Production in terms of cost, quantity, and quality
- Sales
- Profit
- Return on investment
- Turnover of assets
- Income per sales dollar
- Market share
- Growth rate

Variance reports raise questions rather than answering them. For example, is sales volume down because of deficiencies in sales effort or the manufacturer's inability to produce?

Variance analysis reports may be expressed not only in dollars, but also in percentages, ratios, graphs, and narrative.

Performance reports are designed to motivate nonfinancial managers and employees to change their activities and plans when variances exist. They should be terse and concentrate on potential difficulties and opportunities. A section for comments should be provided so that explanations may be given for variances.

The timeliness of performance reports and detail supplied depends on the manager the report is addressed to and the nature of the costs being measured. A production manager may need daily information on the manufacturing operations, the plant manager may need only weekly data, and the vice president of manufacturing may be satisfied with monthly performance figures for each plant. As we become more distant from the actual operation, the time interval for performance evaluation lengthens. Also, as we go up the ladder, performance reports contain data in increasingly summarized form.

Because performance reports depend on the organizational structure, they should be designed based on the company's organization chart. Reports designed for a senior vice president might deal with the entire business operation of the firm and the earnings derived from it. The manufacturing manager would look at the efficiency of the production activity. The marketing manager would evaluate the selling and distribution function. A plant head would be concerned with the output and earnings generated from the plant. A department head within the plant would be concerned with the output and earnings generated from the area as well as with cost control.

Performance reports should contain analytical information. To obtain it, source data such as work orders, material requisitions, and labor cards should be evaluated. Reasons for inefficiency and excessive costs should be noted, such as those due to equipment malfunction and low-quality raw materials.

For labor, the productivity measurement ratio of volume output per direct labor hour should be computed. Further, the output of the individual or machine should be compared to the normal output established at the beginning of the reporting period. Operating efficiency can thus be measured. A labor efficiency ratio also can

be computed, which is the variation between actual hours incurred and standard hours.

With regard to the evaluation of the divisional manager, fixed costs are generally not controllable by the manager, but variable costs are. There are instances, however, where variable costs are controllable by those above the division manager's level. An example is fringe benefits. These items should be evaluated independently because the division manager has no responsibility for them. The opposite may also be true; that is, the department manager may have control over certain fixed expenses, such as lease costs. In such cases the manager should similarly be assigned responsibility, although a successor not involved in the lease negotiation may not be assigned responsibility.

Appraisal of Marketing Department

Revenue, cost, and profitability information should be provided by product line, customer, industry segment, geographic area, channel of distribution, type of marketing effort, and average order size. New product evaluations also should be undertaken, balancing risk with profitability. Analysis of competition in terms of strengths and weaknesses should be made. Sales force effectiveness measures also should be employed for income generated by salespeople, call frequency, sales incentives, sales personnel costs, and dollar value of orders generated per hours spent. Promotional effectiveness measures should be employed for revenue, marketing costs, and profits before, during, and after promotional efforts, including a discussion of competitive reactions. Advertising effectiveness measures, such as sales generated based on dollar expenditure per media and media measures (i.e., audience share), are also useful. Reports discussing product warranty complaints and disposition also should be provided.

Marketing costs may be broken down into selling, promotion, credit evaluation, accounting, and administration (i.e., product development, market research). Another element is physical distribution—inventory management, order processing, packaging, warehousing, shipping outbound transportation, field warehousing, and customer services.

Control of marketing cost is initiated when such costs are assigned to functional groups such as geographic area, product line, and industry segment. Budgeted costs and rates should be provided and comparisons made between standard costs and actual costs at the end of the reporting period.

Conclusion

Variance analysis is essential for the appraisal of all aspects of the business, including manufacturing, marketing, and service. Variances should be investigated if the benefits outweigh the costs of analyzing and correcting the source of the variance. Variance analysis reports should be in dollars and percentages.

Variance analysis identifies trouble spots, highlights opportunities, encourages decision making, and fosters coordination between responsibility units.

Significant unfavorable variances must be examined to ascertain whether they are controllable or uncontrollable by nonfinancial managers because they relate solely to external factors. When controllable, immediate corrective action must be undertaken to handle the problem. The manager should provide recommendations. If a variance is favorable, an examination should be made of the reasons so that corporate policy may include the positive aspects found. Further, the responsible entity for a favorable variance should be recognized and rewarded.

Different degrees of significance of variances may be present, including:

- The variance is within tolerable and normal range and thus no remedial steps are necessary.
- The variance is intolerable and thus either performance must be improved or new standards formulated in light of the current environment.
- The decision model was inappropriate, considering the goal to be achieved, and thus a more relevant model should be developed.

Reports on operating performance should show where performance varies from standard, the trend of performance, and the reasons for the variances, including the manager's explanation.

Reporting systems differ among companies regarding the frequency and timeliness of reports, details presented, arrangement of data, employee distribution, and size of variances necessitating follow-up. Variances can be evaluated by divisions, subdivisions, departments, and cost centers.

If responsibility for a variance is joint, corrective action also should be joint. If correction of an unfavorable variance involves a conflict with a corporate policy, the policy should be reevaluated and perhaps changed. If the policy is not changed, the variance should be considered uncontrollable.

Even if a variance is below a cut-off percent or dollar figure, the manager may still want to investigate it if the variance is consistently unfavorable, because it may reveal a problem (e.g., poor supervision, wasteful practice). The cumulative impact of a repeated small unfavorable variance may be just as damaging as an occasional one.

9

Manufacturing Costs:

Sales Forecasts and Realistic Budgets

In a manufacturing firm, costs are divided into two major categories, by the functional activities with which they are associated. These are manufacturing costs and nonmanufacturing costs, also called operating expenses.

Manufacturing costs are subdivided into direct materials, direct labor, and factory overhead. Direct materials are all materials that become an integral part of the finished product. Examples are the steel used to make an automobile and the wood to make furniture. Glues, nails, and other minor items are called indirect materials (or supplies) and are classified as part of factory overhead, which is explained below.

Direct labor is the labor directly involved in making the product. Examples of direct labor costs are the wages of workers on an assembly line and the wages of machine tool operators in a machine shop. Indirect labor, such as wages of supervisory personnel and janitors, is classified as part of factory overhead.

Factory overhead includes all costs of manufacturing except direct materials and direct labor. Examples include depreciation, rent, taxes, insurance, fringe benefits, payroll taxes, and cost of idle time. Factory overhead also is called manufacturing overhead, indirect manufacturing expenses, and factory burden.

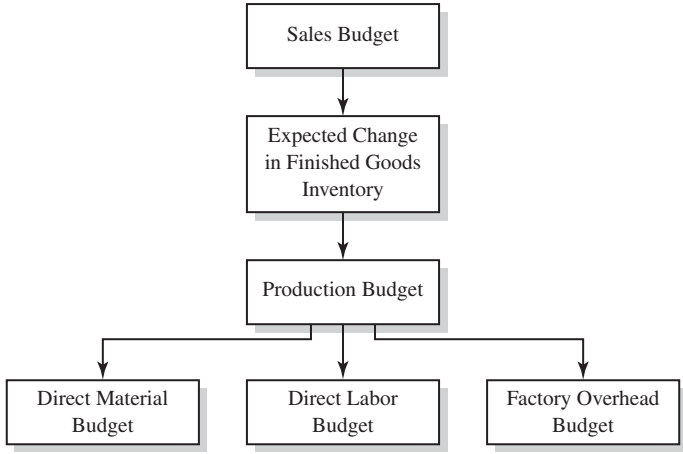
In order to budget for manufacturing costs, a production budget needs to be established, which in turn requires a sales budget. Exhibit 9.1 illustrates this relationship.

Illustration

To illustrate how all manufacturing cost budgets are put together, consider a manufacturing company called the Worth Company, which produces and markets a single product.

Exhibit 9.1

Sales Budget/Production Budget Diagram



Sales Budget

The sales budget is the starting point in preparing the manufacturing budget, because estimated sales volume influences nearly all other items appearing throughout the master budget. The sales budget should show total sales in quantity and value. The expected total sales can be break-even, target income, or sales. The budget may be analyzed further by product, territory, customer, and seasonal pattern of expected sales.

Example 1

THE WORTH COMPANY
Sales Budget
For the Year Ending December 31, 20B

	Quarter				
	1	**2**	**3**	**4**	**Total**
Expected sales in units	800	700	900	800	3,200
Unit sales price	× $80	× $80	× $80	× $80	× $80
Total sales	$64,000	$56,000	$72,000	$64,000	$256,000

Production Budget

The production budget is a statement of the output by product and is generally expressed in units. It should take into account the sales budget, plant capacity, whether stocks are to be increased or decreased, and outside purchases. The number of units expected to be manufactured to meet budgeted sales and inventory requirements is set forth in the production budget.

The expected volume of production is determined by subtracting the estimated inventory at the beginning of the period from the sum of the units expected to be sold and the desired inventory at the end of the period. The production budget is illustrated next.

Example 2

THE WORTH COMPANY
Production Budget
For the Year Ending December 31, 20B

	Quarter				
	1	**2**	**3**	**4**	**Total**
Planned sales (Example 1)	800	700	900	800	3,200
Desired ending inventory*	70	90	80	100†	100
Total needs	870	790	980	900	3,300
Less: Beginning inventory‡	80	70	90	80	80
Units to be produced	790	720	890	820	3,220

*10 percent of the next quarter's sales.
†Estimated.
‡The same as the previous quarter's ending inventory.

Direct Material Budget

When the level of production has been computed, a direct material budget should be constructed to show how much material will be required for production and how much material must be purchased to meet this production requirement. The purchase will depend on both expected usage of materials and inventory levels. The formula for computation of the purchase is:

Purchase in units = Usage + Desired ending material inventory units
– Beginning inventory units

Example 3

THE WORTH COMPANY
Direct Material Budget
For the Year Ending December 31, 20B

	Quarter				
	1	**2**	**3**	**4**	**Total**
Units to be produced (Example 2)	790	720	890	820	3,220
Material needs per unit (lbs.)	× 3	× 3	× 3	× 3	× 3
Material needs for production	2,370	2,160	2,670	2,460	9,660
Desired ending inventory of materials	216	267	246	250	250
Total needs	2,586	2,427	2,916	2,710	9,910
Less:Beginning inventory of materials	237	216	267	246	237
Materials to be purchased	2,349	2,211	2,649	2,464	9,673
Unit price	× $2	× $2	× $2	× $2	× $2
Purchase cost	$4,698	$4,422	$5,298	$4,928	$19,346

Direct Labor Budget

The production requirements as set forth in the production budget also provide the starting point for the preparation of the direct labor budget. To compute direct labor requirements, expected production volume for each period is multiplied by the number of direct labor hours required to produce a single unit. The direct labor hours to meet production requirements is then multiplied by the (standard) direct labor cost per hour to obtain budgeted total direct labor costs.

Example 4

THE WORTH COMPANY
Direct Labor Budget
For the Year Ending December 31, 20B

	Quarter				
	1	**2**	**3**	**4**	**Total**
Units to be produced (Example 2)	790	720	890	820	3,220
Direct labor hours per unit	× 5	× 5	× 5	× 5	× 5
Total hours	3,950	3,600	4,450	4,100	16,100
Direct labor cost per hour	× $5	× $5	× $5	× $5	× $5
Total direct labor cost	$19,750	$18,000	$22,250	$20,500	$80,500

Factory Overhead Budget

The factory overhead budget should provide a schedule of all manufacturing costs other than direct materials and direct labor. Using the contribution approach to

budgeting requires the development of a predetermined overhead rate for the variable portion of the factory overhead.

Example 5

To illustrate the factory overhead budget, assume that the cost-volume (or flexible budget) formula is:

Total factory overhead budgeted = $6,000 fixed (per quarter), plus $2 per hour of direct labor.

Example 5

THE WORTH COMPANY
Factory Overhead Budget
For the Year Ending December 31, 20B

	Quarter				
	1	**2**	**3**	**4**	**Total**
Budgeted direct labor hours (Example 4)	$ 3,950	$ 3,600	$ 4,450	$ 4,100	$16,100
Variable overhead rate	× $2	× $2	× $2	× $2	× $2
Variable overhead budgeted	7,900	7,200	8,900	8,200	32,200
Fixed overhead budgeted	6,000	6,000	6,000	6,000	24,000
Total budgeted overhead	$13,900	$13,200	$14,900	$14,200	$56,200

Planning and Control of Material Purchases and Usage

After determining the number of units to be produced, the company prepares the materials requirement budget and the materials purchase budget. Purchase of materials depends on production requirements and inventories. The direct materials budget involves a balancing of raw material needed for production, the raw material inventory balances, and the purchase of raw materials. The budget may provide for allowances for waste and spoilage.

This section discusses the procedures for developing material budgets in more detail.

Materials Budgets

The materials and inventory budgets in a typical manufacturing firm involve a determination of:

- The quantities and cost of raw materials to be used.
- The quantities and value of materials to be carried in the inventory. The inventory balance depends on how long it takes to receive raw materials from suppliers after the order is placed.

- The quantities and cost of materials to be purchased. The amount to purchase considers expected production and raw material levels. The units of raw material needed equals the raw material usage multiplied by the units of production. In budgeting purchases, consideration should be given to expected price changes, interest cost to finance inventory, volume and cash discounts, desired delivery date, warehousing availability and cost, and obsolescence risk.
- The quantity and value of finished goods to be carried in the inventory

There are basically two methods of developing the inventory budget of raw materials:

1. Budget each important item separately, based on the production budget.
2. Budget materials as a whole or classes of materials based on selected production factors.

Practically all companies must use both methods to some extent.

Budgeting Individual Items of Material

Six steps should be taken in budgeting the major individual items of materials:

1. Determine the physical units of material required for each items of goods that is to be produced during the budget period.
2. Accumulate these into total physical units of each material item required for the production plan.
3. Determine for each item of material the quantity that should be on hand periodically to provide for the production budget, with a reasonable degree of safety.
4. Deduct material inventories, which it is expected will be on hand at the beginning of the budget period, to ascertain the total quantities to be purchased. The formula for computation of the purchase is:

$$\text{Purchase in units} = \text{Usage} + \text{Desired ending material inventory units} - \text{Beginning inventory units}$$

5. Develop a purchase policy that will ensure that quantities will be on hand at the time they are needed. The purchase policy must consider such factors as economic order quantities (EOQ), economy of transportation, quantity discounts, and possible depletion of inventory.
6. Translate the inventory and purchase requirements into dollars by applying the expected prices of materials to budgeted quantities.

Note: The dollar amount of purchases is one of the major cash disbursement items in the cash budget.

Budget Based on Production Factors

For those items of materials that cannot be budgeted individually, the budget must be based on production factors such as total budgeted labor hours, productive hours, standard allowed hours, cost of materials consumed, or cost of goods manufactured.

Example 6

Assume that cost of materials consumed (other than basic materials, which are budgeted individually) is budgeted at $2,000,000 and that past experience demonstrates that these materials and supplies should be held to a rate of 4 times per year. Then an average inventory of $500,000 should be budgeted. This would mean that individual items of material could be held in stock about 90 days (360 days/4).

Materials Purchase Budget Illustrated

The next example illustrates a typical method of budgeting the quantities and cost of raw materials to be purchased. Assume that there are three classes of materials: X, Y, and Z.

Class X—Materials for which a definite quantity and monthly distribution is established in advance. Exhibit 9.2 presents standard unit information by month.

Class Y—Material items for which definite quantities are established for the entire budget period but for which no definite monthly distribution program is

Exhibit 9.2

Materials Purchase Budget—Standard Unit Information by Month

	Item A			Item B			
	Units	Standard Unit Cost	Amount	Units	Cost	Standard Unit Amount	Total
July	300	$1.10	$ 330	650	$2.00	$1,300	$1,630
August	200	1.00	200	700	2.00	1,400	1,600
September	500	1.00	500	400	2.10	840	1,340
October	250	1.00	250	250	2.25	563	813
November	300	1.00	300	350	2.25	788	1,088
December	400	1.00	400	250	2.25	563	963
Total	1,950		$1,980	2,600		$5,453	$7,433

Exhibit 9.3

Materials Purchase Budget—Unit Information for Items

	Total Units Required to Be Purchased	Estimated Price per Unit	Total cost
Item H	2,500	0.25	625
I	3,400	0.34	1,156
J	4,500	0.23	1,035
K	2,700	0.45	1,215
Total	13,100		$4,031

Exibit 9.4

Materials Purchase Budget—Percentage Distribution Information

	Percentage Distribution Based on Past Experience	Material Items H	I	J	K	Total
July	30%	$188	$ 347	$ 311	$ 365	$1,209
August	20%	$125	$ 231	$ 207	$ 243	$ 806
September	10%	$ 63	$ 116	$ 104	$ 122	$ 403
October	20%	$125	$ 231	$ 207	$ 243	$ 806
November	10%	$ 63	$ 116	$ 104	$ 122	$ 403
December	10%	$ 63	$ 116	$ 104	$ 122	$ 403
Total	100%	$625	$1,156	$1,035	$1,215	$4,031

established. Exhibit 9.3 presents unit information for items. Here the distribution to months of the total cost of $4,031 must be made on the basis of past experience of budgeted production factors such as machine hours. Exhibit 9.4 presents percentage distribution information.

Class Z—Miscellaneous material items that are grouped together and budgeted only in terms of total dollar purchases for the total budget period. The distribution to months is again made on the basis of past experience or production factors. The following figures may be assumed, based on budgeted machine hours (cost of Class Z materials is assumed to be $5 per hour).

Exhibit 9.5 presents budgeted productive hours. Note that total purchases required for Class Z materials amount to $4,200.

The total purchase budget may then be summarized as in Exhibit 9.6, which presents information by material class.

Exhibit 9.5

Materials Purchase Budget—Budgeted Production Hours

	Budgeted Productive Hours	Distribution to Months
July	150	$ 750
August	240	$1,200
September	175	$ 875
October	80	$ 400
November	95	$ 475
December	100	$ 500
Total	840	$4,200

Exhibit 9.6

Materials Production Budget—Information by Material Class

	Class X Materials	Class Y Materials	Class Z Materials	Total
July	$1,630	$1,209	$ 750	$ 3,589
August	1,600	806	1,200	3,606
September	1,340	403	875	2,618
October	813	806	400	2,019
November	1,088	403	475	1,966
December	963	403	500	1,866
Total	$7,433	$4,031	$4,200	$15,664

The estimated days material is to be held may be computed. Assume direct material used is budgeted at $500,000 with an expected turnover rate of 4 times. Thus, the average inventory is budgeted at $125,000. Material will be stored about 90 days (360/4). Material price and usage variances are discussed in Chapter 8. An illustrative budget is presented in Example 7.

Example 7

XYZ COMPANY
Purchases Budget
For the Year Ended December 31, 20X1

Type of Raw Material	Production	+	Ending Inventory	–	Beginning Inventory	Budgeted Price	Budgeted Purchase
A	200,000 etc.		40,000		20,000	$1.50	$330,000

Planning and Control of Direct Labor

Direct labor is paid either by piecework, in which the factory labor is paid so much per piece, or by day work, in which the labor is paid a stipulated hourly rate regardless of the job he is assigned.

Planning and control of direct labor has two primary objectives:

1. To obtain the maximum output from each of the employees
2. To ensure that product costs reflect proper labor charges

Planning and budgeting direct labor costs is considered straightforward for two reasons. First, direct labor operations are normally of a type for which an engineered standard can be properly set.

Standard implies the amount of time it should take an average operator to perform a function under a normal operating condition. Standards are set by such means as average actual time over the years, laboratory experiment, random sampling, or a motion and time study.

Second, because almost all direct labor can be identified with a specific product or job, there is relatively little difficulty in determining where and how much direct labor costs should be charged.

The control function is equally clear. When actual results are reported, they are compared with the plan or target and quickly reveal when plans went astray.

Planning and Control of Factory Overhead

Planning and control of overhead items have two major goals:

1. To minimize overhead costs wherever they occur
2. To make certain that overhead is allocated, in the most accurate manner, to the various jobs and products being manufactured

For flexible budgeting purposes, it is important to distinguish between variable and fixed overhead expenses. Some are mixed costs that need to be divided, using such methods as the high-low method and regression analysis.

For example, these cost-volume (flexible budget) formulas can be developed for various overhead items:

Factory Overhead Costs	Formula
Electricity	$50 + $10 DLH
Maintenance	$100 + $15 DLH
Supervisors' salaries	$5,000 per month
Indirect materials	$8 per DLH
Factory depreciation	$7,000 per month

Conclusion

This chapter has emphasized manufacturing budgets. The process involves developing a sales forecast and, based on its magnitude, generating production and manufacturing expense budgets needed by a specific firm. Once developed, the budgeting system provides management with a means of controlling its activities and of monitoring actual performance and comparing it to budget goals.

A comprehensive profit planning and control program involves budgeting the materials and parts used in the production process. The budget process involving manufacturing expenses includes the material usage and purchase budgets, direct labor budgets, and factory overhead budgets.

10

Marketing:

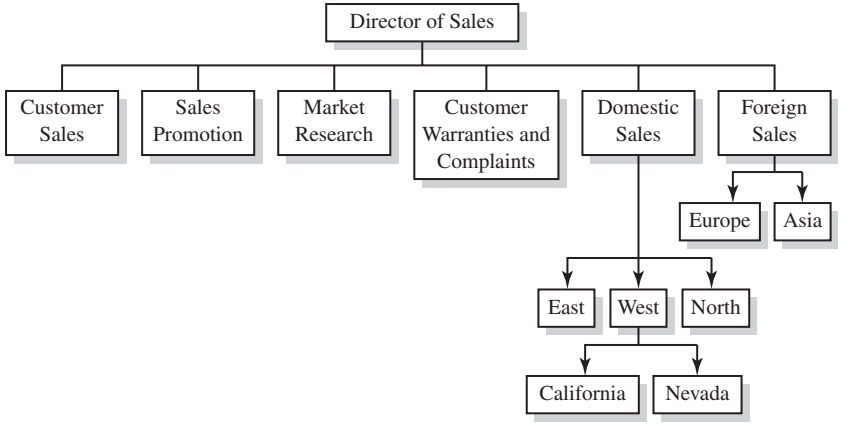
Budgeting for Sales, Advertising, and Distribution

Before presenting the budgeting aspects for a marketing department, it would be informative to review Exhibit 10.1, which shows the usual organization of a sales division.

A marketing manager needs a promotion and advertising plan, selling expense plan, and marketing plan. Coordination should exist between the sales plan and the marketing plan. Sales promotion expenses should be budgeted by product, activity, media, territory, and salesperson. Authorization may be needed for unusual marketing expenditures.

Exhibit 10.1

Structure of a Sales Division



Direct costs are directly traceable to a nonfinancial manager's segment, while indirect costs are general charges that are allocable in some way to each segment. The unit cost of an operation equals total expenditures divided by units of measure.

The manager should consider cost per order received, cost per order filled, cost per item handled, cost per customer account, transportation cost (e.g., auto, plane, train) per month, and cost per mile by category.

The number of salesperson calls and sales per call should be budgeted and then compared to actual calls and sales per call. Variances should be analyzed.

The manager should determine if a large percentage of products, orders, or customers generate a small portion of sales. Marketing expenses typically increase in proportion to the amount of customer orders and products, not sales dollars. A change in sales mix can have a significant effect upon profitability.

The sales manager may attempt to protect profits by increasing selling prices when costs are increasing or sales volume is decreasing. However, there are circumstances in which selling prices may not be increased because it is either impractical or prohibited. Examples are government price controls, high degree of competition (e.g., airlines), and poor economic conditions.

This chapter discusses budget preparation and analysis and control over marketing costs, including selling expenses, advertising and sales promotion, distribution costs, packaging, and travel and entertainment.

Marketing Budgets

The marketing budget depends on the type of product or service, competition, market share, type of customer, costs to obtain and maintain an account, territory, anticipated sales calls, distribution channel, order size and frequency, and promotion efforts. Industry standards may be referred to when preparing marketing budgets.

Budgets aid in planning sales efforts. Sales may be budgeted by product, service, customer, territory, and salesperson. Budgets should consist of sales volume and sales dollars by salesperson broken down by territory.

A lump-sum appropriation may be made, consisting of a maximum amount of expenditure. Controllable and noncontrollable expenses should be identified.

A budget may be based on:

Type of Expenditure	Budgeting Basis
Automobile	Mileage
Lodging, food and telephone	Daily allowance
Other	Special authorization

A typical budget for a marketing division is shown in Exhibit 10.2.

Exhibit 10.2

Marketing Division Budget

Department	Type of Budget	Current Year Quarter 1	2	3	4	Total	Prior Year	Increase (Decrease)
Advertising and Promotion Project								
Illinois								
New Jersey								
Florida								
Direct Selling Administrative								
West								
East								
North								
South								
Total								
Storage and Warehouse Standard								
New York								
California								
Pennsylvania								
Michigan								
Administrative								
General and Administrative								
Market Research Project								
Customer Relations Administrative								
Branch Office Administrative								
Total								

Selling Expenses

Selling expenses are those that are required to make a sale (sales commissions, salesperson salaries, advertising, and sales promotion) and to distribute the merchandise to the customer (order processing, handling, storage, and delivery charges). The manager should appraise the efficiency and effectiveness of getting and filling orders.

Sales may be appraised by customer, product, service, salesperson, sales method, territory, and distribution outlet. Selling effort is subject to diminishing returns because, after a certain point, additional sales volume from selling efforts do not justify the additional cost and time. Further, the sales manager should set sales personnel requirements by number and grade.

The manager is responsible for the selling expense budget. The variable-fixed breakdown is highly recommended. Many selling expenses may be budgeted based on a percentage of sales, including salesperson commissions and salaries,

sales promotion, distribution (including freight out), travel, entertainment, warranties, and training. However, some selling expenses, such as rent and advertising, may be constant or initially set by the sales manager. A fixed appropriation of selling expenses may be irreducible because a minimum amount is needed to function.

Selling expenses may be budgeted, reported, and analyzed by department, division, product, service, class of customer, territory, time period (e.g., monthly), transaction, distribution outlet, sales method, and source of sale. There should be a monthly breakdown of the target selling expenses in the budget for control and monitoring purposes.

There should be a budget provision for increased training costs, if additional salespeople are to be hired.

Standardized activities are repetitive and subject to quantitative measurement. Examples are field selling expenses and storage handling charges. Costs should be segregated by function. The field selling expense may be based on a per-diem standard allowance. For example, auto expense may be at a standard mileage rate, telephone may be at a monthly allowance, and entertainment may be at a per-diem rate.

Exhibit 10.3 graphs the ratio of selling expenses to net sales over a representative time period.

Exhibit 10.4 presents an illustrative field selling expense budget.

Exhibit 10.5 shows a typical monthly performance report for selling expenses broken down by responsibility.

Exhibit 10.3

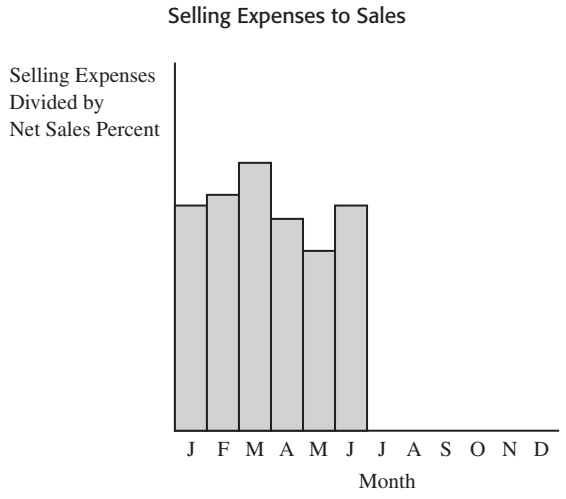


Exhibit 10.4

Budgeted Field Selling Expenses
June 20X5

Salesperson Name and Number _____ Sales Territory _____

	June 20X5				Cumulative			
							Over (Under) Budget	
Description	**Allowance**	**Actual**	**Budget**	**Over (Under) Budget**	**Actual**	**Budget**	**Amount**	**Percent**
Days traveled								
Field Selling Expenses								
Food $20 per diem								
Lodging $100 per diem								
Telephone $15 per diem								
Valet $6 per diem								
Travel								
Airplane								
Railroad								
Auto $.30 per mile								
Conventions								
Promotions and Entertainment								
$50 per diem								
Other $10 per diem								
Total Expenses								
Selling Ratios:								
Cost per travel day								
Cost per telephone call								
Sales generated per call								
Comments:								

Exhibit 10.5

Monthly Performance Report Sales Manager X

For Month			Year-to-Date		
Actual	**Budget**	**Variance**	**Actual**	**Budget**	**Variance**

If, in the monthly analysis, a selling expense item is heading over budget for the year, the nonfinancial manager notes this in the performance report, after discussing it with the responsible party. There are three options:

1. Request a revision of the target budget.
2. Request an allocation from a contingency fund, if any.
3. Take action to keep the expense on target.

An illustrative budget report for a sales manager is shown in Exhibit 10.6. A typical sales engineering project budget report appears in Exhibit 10.7.

Exhibit 10.6

General Sales Manager Budget Report

	Current Month		Cumulative	
	Actual	**Over (Under) Budget**	**Actual**	**Over (Under) Budget**
Number of salespeople				
Costs				
Rent				
Insurance				
Travel				
Promotion and entertainment				
Depreciation				
Salaries				
Fringe benefits				
Dues				
Supplies				
Total Expenses				
Percentage of net sales				

Exhibit 10.7

Sales Engineering Project Budget Report

Project Number	Project Name	Hours	Actual Costs by Type	Budgeted Costs by Type	Variance	Estimated Costs to Complete	Commitments

Advertising and Sales Promotion

Advertising may be local, regional, national, or international.

The manager must determine how much, when, where and how advertising should be used to obtain the optimum benefit. Advertising depends on product leadership, degree of competition, market economy, and financial condition. It has to be coordinated with sales and production. Responsibility for advertising may be assigned to specific individuals, where appropriate.

The major considerations in budgeting, analyzing, and controlling advertising are cost, type and number of audience, advertising frequency, consistency in meeting product, price, and distribution, and demographics.

The highest percentage of a marketing budget usually is reserved for advertising. The advertising budget helps the marketing manager plan how much and where to spend. The advertising budget depends on territories, customers, products, services, activities, programs, and media. Advertising should be sufficient to accomplish objectives, such as growth rate. After the advertising budget has been determined, funds have to be assigned to specific items. The advertising budget may be broken down into departmental budgets, total budget, calendar periods, media, and sales areas.

The marketing manager should set up a contingency fund so there is flexibility in the advertising budget. The fund can cover special circumstances, such as the introduction of a new product, specials available in local media, or sudden actions by competitors.

The objectives of advertising are to make potential customers aware of the products or services and how to use them, improve market share, develop new markets, stimulate new products, project a favorable image and brand loyalty, counteract bad publicity, foster a negative image for competitors or counteract competition, promote sales, increase selling price, reduce selling costs, and counteract contemplated government regulation.

There are various kinds of advertising, including:

- Promotions of a particular brand
- Mass advertising to a large population cross section
- Class of customer
- Message about the company in general, rather than about a specific product or service

The types of advertising media include directories (phone, etc.), print (newspapers, magazines, trade publications), direct mail, outdoor, broadcasts (television, radio), door-to-door solicitation, specialty items, and movies.

Sales promotion, which is directly related to advertising, is needed for future sales. It may include special programs, store fixtures, and trade shows.

Sales managers will have to justify their advertising budgets to upper management. They will have to state objectives, how to accomplish them, and the cost of

each component of the program. The factors to be considered in the advertising budget include profit per product, estimated advertising expense per unit, and projected additional sales volume resulting from incremental advertising expenditures.

There are various ways to determine how much should be spent on advertising and sales promotion. These include arbitrary appropriation, such as that based on prior years' advertising, all available funds, competitive parity, percentage of sales or profit, unit sales (fixed sum per unit suitable for uniform or a few products such as specialty goods), return on investment, objective-task method, and a lump sum (suitable for established products with a predictable track record and stable environment).

Advertising for necessities should be expanded in recessionary years; advertising for luxuries should be emphasized in strong economic periods. Advertising may reduce direct selling costs.

Let us now discuss three popular methods:

1. Percentage of sales or profit
2. Unit sales method
3. Objective-task method

Percentage of Sales or Profit

With this widely used approach, advertising will be consistent with the budgeted or prior years' revenue (e.g., five years' average sales). Advertising also may be based on a percent of prior years' net profit or gross margin.

$$(\text{Unit} \times \text{Price}) \times \text{Percentage Allocated}$$
$$\text{or}$$
$$\text{Profit} \times \text{Percentage}$$

Unit Sales Method

Under this approach, a fixed sum is established for each unit of product to be sold, based on experience and trade knowledge of how much advertising is required to sell each unit. The budget basically is based on units sold instead of dollar sales. For example, if $2 is allocated for each unit of product and there are 20,000 expected units, $40,000 would be allocated to advertising.

Objective-task Method

This method relates the advertising appropriation, under typical conditions and in the long run, to sales volume, so that earnings and revenue are not drained.

Exhibits 10.8 and 10.9 show typical advertising budgets.

There should be a comparison between successive budgeted advertising cost and anticipated incremental profit by program.

Exhibit 10.8

Advertising and Promotion Expense Budget

	Amount
Radio advertisements	
Television advertisements	
Newspaper advertisements	
Magazine advertisements	
Shopper advertisements	
Telephone advertisements and directories	
Catalogs	
Personal demonstrations	
Direct mail	
Door-to-door solicitation	
Samples	
Exhibits	
Total advertising and promotion expenses	

Exhibit 10.9

Advertising Budget

Classification	Project Budget	Actual Expenditures	Commitment	Total	Estimated Cost to Complete	Balance Available

Exhibit 10.10 shows the impact of successive advertising outlays on earnings. Measures of advertising include:

- Trend in advertising cost to sales
- Advertising cost per unit sold
- Advertising cost per sales dollars
- Advertising cost per customer
- Advertising cost per transaction
- Advertising cost by product, media, and territory

Exhibit 10.10

Impact of Increased Advertising on Profits

(1) Additional Advertising Expenditures	(2) Additional Sales Volume	(3) Additional Profit per Unit	(4) = (1) ÷ (2) Incremental Advertising Cost per Unit	(5) = (3) – (4) Unit Incremental Profit	(6) = (2) × (5) Profit
$10,000	10,000	$1.50	$1	$.50	$ 5,000
10,000	15,000	1.40	.67	.73	10.950

The advertising plan should be reviewed periodically to ensure that the right products are being emphasized. For example, the sales manager would not want to promote obsolete, unsuccessful, or hazardous products.

The marketing manager can evaluate the effectiveness of advertising by reviewing sales and profits before, during, and after promotion. The nonfinancial manager can monitor which customers are buying through coupons and reply cards. An analysis of competitors' activities should be made as they affect the company. Further, cost information for advertising programs can furnish data to make decisions on future media channels.

The marketing manager should appraise the effectiveness of a particular medium, such as by examining the cost per thousand (CPT). CPT is defined as the cost of advertising per thousand individuals reached by the media.

$$\text{Cost per Thousand} = \frac{\text{Cost of Dollars}}{\text{Circulation in Thousands}} \times 1,000$$

After the marketing manager has selected an appropriate media to use, these questions should be answered:

- How essential is creativity?
- Is there a way to buy space and time that will stretch the advertising budget?
- How should the product or service be positioned?

Creativity involves getting attention with color, print size, layout, and contrast. Space and time are essential if the marketing manager wants to reach the target audience. For example, what days and hours do customers watch television? If you sell sports equipment, then Saturday and Sunday are the best times.

The marketing manager should properly position advertising toward those consumers most likely to buy the product and segment the market by demographics such as social class, age, gender, education, and income.

Advertising standards should be established to control costs. They may be based on cost per sales dollar, cost per sales transaction, cost per account, cost per unit of space, and cost per request for information.

Variances between budget and actual costs should be examined as a control measure. Exhibit 10.11 presents a variance analysis report for advertising and sales promotion.

Exhibit 10.12 presents a typical budget comparing sales by brand for the current month and cumulatively. Variances between budget and actual figures are expressed in dollars and percentage.

Exhibit 10.13 shows an analysis of product revenue.

In comparing advertising costs to those of competing companies, reference may be made to *Advertising Age*.

Exhibit 10.11

Budget and Actual Advertising and Sales Promotion

Media Classification	Budget	Actual	Commited Funds	Total	Estimated Cost to Complete	Total Cost	Balance Available
Radio	$ 700	$ 500	$100	$ 600	$ 50	$ 650	$ 50
Television	630	400	150	550	60	610	20
Magazines	860	600	150	750	70	820	40
Newspapers	1,000	800	100	900	30	930	70
Displays	500	400	50	450	40	490	10
Catalogs	600	500	50	550	50	600	0
Direct Mail	400	300	60	360	20	380	20
Total	$4,690	$3,500	$660	$4,160	$320	$4,480	$210

Exhibit 10.12

Sales by Brand

	Month		Variance		Cumulative			
Brand	Budget	Actual	Dollar	Percent	Budget	Actual	Dollar	Percent
Brand X—Green								
Brand X—Yellow								
Brand X—Blue								
Total Brand X								
Brand Y—Red								
Brand Y—Orange								
Total Brand Y								
Brand Z—Small								
Brand Z—Regular								
Brand Z—Large								
Brand Z—Extra Large								
Other Brands								
All Brands								

Exhibit 10.13

Analysis of Product Revenue
Southern Territory
June 1–30, 20X1

	Product W		Product X		Product Y		Product Z		Total
Week	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Dollars
June 1–7									
June 8–14									
June 15–21									
June 22–30									
Total Actual									
Total Budget									
Variance									
Units									
Dollars									

Distribution Costs

Distribution costs are costs to sell or market products in different territories. They are the costs for activities after goods are produced and until they are received by customers.

Marketing managers are responsible for budgeting and controlling distribution costs, which include packaging, advertising, transportation, credit and collection, warehousing and storage, salesperson salaries and commissions, promotion, and market research. A comparison should be made of the trend in distribution costs to total costs. There should be coordination of distribution policies in the overall marketing plan, including sales promotion, advertising, direct selling, warehousing, storage, and transportation.

Distribution factors and selling effort should be combined in such a way as to maximize sales and profits.

There is an interrelationship between the distribution cost budget and the manufacturing and financial budgets, as well as to the sales budget. Costs should be budgeted in total and for each activity. Distribution costs and efforts should be increased in those areas providing the most profitability.

For each territory, budgeted distribution costs depend on sales effort needed per dollar of cost, potential customers, buying power, population density, size of geographic area, and competition.

The manager must decide how much to pay for each type of distribution and the timing and classification of distribution expenditures.

The distribution budget aids in coordinating distribution policies and in deriving the best combination of distribution resources, including sales volume, selling

prices, and selling effort. Distribution costs should be budgeted by function or activity, territory, salesperson, program or project, product, call, and type of selling effort. They should be budgeted in absolute dollars and as a percentage of net sales. The budget promotes cost control.

A typical distribution cost budget appears in Exhibit 10.14.

Exhibit 10.15 presents an illustrative project budget.

Distribution efforts should be based on market potential. Distribution costs may be reduced by modifying geographic areas to reduce selling cost and obtain more coverage, changing customer mix, altering distribution channels, modifying product mix, reassigning salespeople, and changing the method of sale. Costs for planning and control should be identified by responsibility, type of expenditure, order size, activity, program, territory, segment, distribution channel, and method of sale.

There should be a comparison of budget to actual distribution costs. Variances should be determined and analyzed. Further, distribution costs should be compared to those in competing companies.

Analysis and Evaluation of Distribution Costs

Distribution cost analysis has as its objective obtaining the optimum distribution policy. Costs should be appraised by activity or function to promote planning and control. Cost analysis may be made by product or service, segment (department, store, branch), territory (state, city, district, county), customer type, order size, distribution channel (manufacturer, wholesaler, retailer, direct to customer), sales terms (cash, installment), salesperson, method of delivery (store delivery, over-the-counter), and method of sale (mail order, company store, salesperson, house solicitation).

There should be a comparison of each individual distribution cost to sales, such as transportation to sales. A higher ratio is unfavorable because a larger distribution expense is required for each sales dollar. Higher ratios mean less

Exhibit 10.14

Distribution Cost Budget

Direct Selling		$300,000
Transportation costs		
Truck	$50,000	
Rail	60,000	
Air	130,000	240,000
Storage		40,000
Market research		20,000
Other		10,000
Total distribution costs		$610,000

Exhibit 10.15

Project Budget Report

Number	Name	Hours	Salaries	Other Expenses	Total	Commitments	Estimated Cost to Complete	Total Cost	Project Budget	Under or Over Budget

productivity. When distribution efforts are recurring and routine, it is useful to compare actual to budgeted costs for variance determination.

The variances are then investigated as to cause and appropriate action taken, if needed. In addition, a comparison should be made between the distribution costs in the company to those of competing companies. The differences should be analyzed.

Control over Distribution Costs

Distribution cost control involves functional responsibility and cost objectives. Costs should be assigned by responsibility center. Distribution costs by territory may be controlled by reorganizing the territory so that effort is more in line with benefits (e.g., selling expenses may be reduced with better coverage), eliminating unprofitable territories, changing the method of sale, reassigning salespeople, altering distribution channels, modifying advertising policy by territory, changing warehouse facilities, and identifying neglected customers who may buy.

Packaging

Product development may take into account packaging changes and new kinds of packaging. Repackaging may be designed to save costs. The sales manager must decide on product size and form.

Travel and Entertainment

The budget for travel and entertainment is prepared by the sales manager after obtaining input from salespeople. The manager should evaluate entertainment expenses. Are they proportionate to the revenue obtained by salesperson, customer, and territory?

Budget Meetings

At budget meetings, the manager should present a reasonable basis for budget expectations. The manager should give an impression of being prepared, knowledgeable, and in control. A possible inconsistency in the presentation may raise doubts. For example, a manager may propose a slight budget increase in revenue because of a recession but at the same time request substantially higher expenditures because of inflation.

The manager does not want to give upper management the impression he or she is rushing through the budget or has not given it sufficient preparation.

Conclusion

The marketing manager must prepare budgets for marketing costs so proper planning may occur. These costs include selling, advertising, and distribution. It is

better to budget expenses based on a percentage of budgeted sales rather than on prior years' sales. What held in the past may not hold in the current year.

A thorough analysis and evaluation of marketing costs should be made to determine if they are excessive, such as by comparing each major expense category to sales. Problem areas must be identified and rectified. In this connection, the marketing manager should assign specific responsibilities to subordinates, such as salespeople, by territory or customer.

If sales are increasing due to higher sales prices but sales volume is about the same, only a few marketing expenses will increase. The work volume to process orders and the delivery costs will be about the same. However, advertising and promotion costs will increase to overcome sales resistance to the higher prices.

When sales volume increases, most marketing expenses increase, but they may not increase in proportion to sales volume. If the increased sales volume is from larger orders only and from existing customers, the collection, credit, and delivery costs will not increase in proportion to sales.

11

Research and Development:
Budgets for a Long-term Plan

Research and development (R&D) is needed to develop new products and services or to significantly improve existing ones in order to remain competitive and grow. R&D includes:

- Conceptual formulation and design, as well as testing, in search for or evaluation of possible product or process alternatives
- Modification of the formulation or design of a product or process
- Design, construction, and testing of preproduction prototypes and models
- Design of tools and dies involving new technology

There should be planning and control over such R&D areas as how much to spend, what to spend it on, and how to ensure that the funds are being spent properly. R&D should be accumulated by type of expenditure, by division, by department, and by responsibility center within a department. The budget for technical departments is the sum of the total budget for all R&D activities and supporting engineering services. The nonfinancial manager must constantly appraise R&D progress, success rate, problems, risks, staff, and facilities. R&D should primarily be based on long-run goals, competition, judgment, and financial capabilities.

R&D should be consistent with the goals of the division or department. Therefore, R&D should be higher for high-technology divisions. A division with older technology typically spends less on R&D and more on engineering to sustain current products and processes.

Preferably, R&D should be directed toward the future rather than to maintain current products. Its objectives should be based on a division's program. Resources may be spent for research and exploration, development, and sustainment.

R&D activities should be undertaken when the return obtained from such research justifies the costs incurred and risks assumed. In addition, R&D is worthwhile if the new product can be introduced before it is already obsolete or out of favor.

This chapter discusses the types of R&D costs, planning, establishing the proper funding level, preparation of R&D budgets, modifications to the budget, analysis and evaluation of R&D status, cost controls, risks associated with R&D efforts, and coordination of R&D policies within the company.

R&D Costs

Direct and indirect costs are associated with R&D projects:

- Personnel costs, including those of independent consultants. In general, personnel costs range between 50 to 75 percent of R&D costs.
- Depreciation on R&D laboratory and equipment
- Supplies and materials
- Subscriptions to journals and magazines
- Rentals
- Travel
- Professional membership fees and attendance at technical conferences
- Property taxes
- Outside contractor fees
- Cost of intangibles purchased from others

R&D Planning

In R&D, individual projects have to be planned, appraised, and controlled. Any project limitations have to be noted. These items should be considered:

- Progress of research efforts
- New and better products developed over the last 10 years
- The percentage of new products to total sales
- Average time required to proceed from the initial research stage (e.g., laboratory) to commercial production
- Cost/benefit of research
- Relationship between research and sales; comparison should be made to success of competition in research (e.g., industry norms)

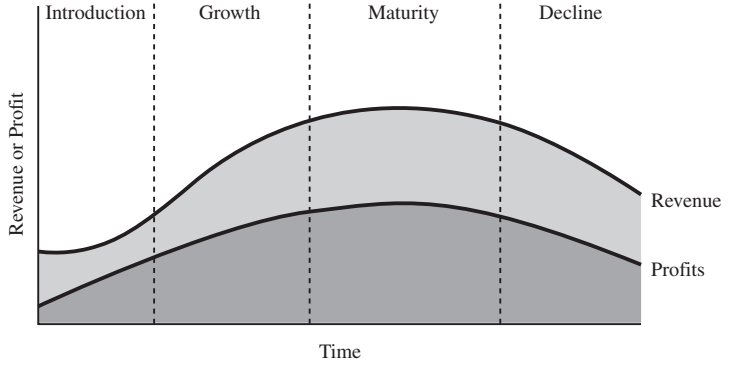
Exhibit 11.1 depicts the product life cycle.

Funding Level

The manager must decide how much to fund research and which specific activities should be funded. The amount funded depends on how much support is needed to succeed, project priorities, number of programs desired, growth rate, size and capability of research staff, competition, trade and industry statistics, state of the economy, and political concerns.

Exhibit 11.1

Product Life Cycle



The manager should set a minimum-maximum range for R&D funding and decide what circumstances would change this range.

Revised R&D calculation should be made when researchers request additional funding or time. The manager should determine if the request has merit or is a waste of additional resources. Then the manager must decide whether to support the project modification or drop the product. The manager should set a high priority to fund developmental projects, and these projects should be ranked after taking into account capital investment, expected costs, and anticipated earnings, including forecasted royalty receipts.

R&D Budget

The R&D budget is based on an annual amount that the manager has decided to commit to develop new and improved products. The amount depends on the anticipated benefits based on previous efforts and success, desired growth rate, size of the division, risk and uncertainties, diversification, competition, market share, consumer tastes, financial resources, physical facilities, availability of raw materials, productivity, safety, reliability, price profitability, efficiency, productivity, employee number and capability, time constraints, product life cycle, stability of research program, obsolescence, and technological aspects.

A budget provision is needed so engineering keeps current products from becoming out-of-date.

The R&D budget may be based on:

- Estimated cost of specific projects
- A percentage of expected sales
- A percentage of current year and/or prior year sales
- A percentage of profit
- A percentage of operating income

- A percentage of investment in capital assets
- A percentage of cash flow
- R&D per unit
- R&D cost per hour equal to total R&D project costs divided by chargeable hours
- Product life cycle

The R&D budget should take into account the expected return on sales, return on investment (ROI), payback period, discounted payback period, net present value, and internal rate of return. A comparison should be made between the estimated ROI of a research project and its actual ROI. Variances should be computed and analyzed, with corrective action taken when warranted.

R&D costs should be allocated by responsibility center and then to each project or program within that segment, including support services.

In preparing the budget, there should be a reconciliation of budget costs of research efforts with the total estimated cost of maintaining R&D facilities and operations.

Program budgeting is research-related or applies to technical jobs applicable to programs. It typically follows a study of work performed.

If a proposal involving R&D cannot be scheduled, no budget should be prepared for the entire project. Instead, there should be a step-by-step budget allocating a specific amount for research work. Once the first step is completed, a budget allotment may be made for the second step.

A typical format for an R&D division budget is shown in Example 1.

Example 1

R&D DIVISION BUDGET
For the Year Ended December 31, 20XX

	Quarter				
	1	**2**	**3**	**4**	**Total**
Costs					
Controllable					
Salaries					
Professional dues					
Heat, light, and power					
Supplies					
Cleaning					
Total					
Noncontrollable					
Insurance					
Depreciation					
Taxes					
Total					
Total R&D Costs					

Examples 2 and 3 present typical R&D budgets.

Example 2

R&D BUDGET

Materials and Supplies
Laboratory
Equipment
Repairs
Total Materials and Supplies
Salaries
Administrative
Nonadministrative
Technical staff
Total salaries
Other Direct Costs
Membership Dues
Depreciation
Insurance
Utilities
Taxes
Travel and Entertainment
Total Other Direct Costs
Total Research and Development

Example 3

R&D BUDGET

Project	New Staff Required	Total Man-hours	Cost
Research			
Electronic 5			
Laser 3			
Hydro 1			
Completed Projects			
Total Research			
Development			
Tubes			
Gauges			
Testers			
Modes			
Total Development			
Total Project Budgets			
Administrative			
Patent			
Research			
Library			
General			
Total Administrative			
Grand Total			

Example 4 presents a budget report.

Example 4

BUDGET REPORT

Name of Department:
Period:
Date:

	Current Month			Cumulative for Year		
Project	**Actual**	**Budget**	**Variance**	**Actual**	**Budget**	**Variance**

Example 5 shows an illustrative R&D cost budget.

Example 5

R&D EXPENSE BUDGET

Cost	Category	Actual	Latest	Estimate	Budget	Variance

Examples 6 and 7 present illustrative project budgets.

Example 6

R&D BUDGET

Project	Budget Man-hours	Actual Man-hours	Variance	Budgeted Cost	Actual Cost	Variance

Example 7

R&D BUDGET

Project	Project Number	Man-hours	Costs	Commitments	Estimated Cost and Hours to Complete	Budget Variance

Example 8 shows a proposed R&D budget.

Example 8

PROPOSED R&D BUDGET

Budget	Employees	Man-hours	Period Cost	Cumulative Cost

R&D risk must be appraised by product and market. There is a greater risk when a manager goes from established products and markets to new products and markets. The longer the period between R&D activity and cash flows from the project, the greater the risk.

Coordination

A research project may involve coordination between several departments and their managers, who must provide input and assistance to each other. They must know how to interact, what rules to follow, and how the research will benefit their particular responsibility areas and products.

Analysis and Evaluation

R&D analysis involves looking at past, current, and future projects. Each R&D project should be thoroughly analyzed in terms of marketing, production, and distribution. There should be a priority ranking so that the best R&D projects are undertaken, given the limitations of manpower, facilities, and financial resources.

R&D may be related to sales, profits, production, number of employees, labor hours, number of segments, entering new markets, expansion of product lines or services, and diversification attempts. The manager must determine whether the research staff has the technical ability and resources to undertake the project successfully.

The manager should evaluate where R&D funds are being used, how successful the R&D undertakings are by category and type, where additional funding should be placed because of potential opportunities, and where less funding should be made because of unsuccessful and problem programs.

He or she should evaluate R&D on a recurring, periodic basis, such as quarterly or semiannually. Projects having greater uncertainty or risk may be evaluated more frequently, such as monthly. The manager should prepare a project screening report evaluating proposed R&D in terms of marketing, production, technical, safety, and legal and financial aspects. There should be progress points to appraise and track R&D efforts.

Performance standards for research should be used and compared to actual performance. These standards include number of patents received, cost per patent, cost per operation, cost per hour, number of tests and formulas, number of requisitions, and research hours by activity. There should be a comparison between the actual costs incurred by program or activity to the funds budgeted for each R&D program or activity.

The manager should keep track of:

- R&D to net sales
- R&D by product
- Expected rates of return
- Estimated project costs
- Salaries to man-hours
- Average R&D projects per period
- Research commitments

R&D employees (engineers, scientists) should be required to keep time sheets of hours spent by project, because a high percentage of R&D cost is labor.

Research programming examines research fields to be investigated and the depth of such coverage.

There should be periodic R&D status reports presenting objectives, potential, priority classification, technical achievements, amount of expenditures, and schedule of conformance.

Exhibits 11.2, 11.3, and 11.4 present R&D status reports.

Control over R&D

R&D is project-oriented, and costs are accumulated by project. Due to the long duration of a project, adequate project control must exist to accumulate all costs from start-up to the finished product. Further, R&D projects cannot be measured by quantity, volume-driven factors, or money that has been or has not been spent. For example, 75 percent of the money may have already been spent on the project, but that does not mean the project is 75 percent complete.

R&D expenditures should be in conformity with budget limitations. There should be project controls. Control reports are required by commitment and expenditure. In the control phase, there should be a comparison between the technical and financial aspects of projects. Projects should be continually appraised to determine which ones should be expanded, dropped, modified, or deferred.

A significant degree of cost control should be placed over high-risk R&D projects.

Exhibit 11.2

Project Status Report

Project	Project Identifier	Month				Cumulative to Date			Estimated Cost to Complete		Total Cost	Project Budget	Cost (Over) or Under
		Man-hours	Salaries	Other Expense	Total	Man-hours	Amount	Purchase Commitments	Man-hours	Amount			
Product Improvements													
Project A													
Project B													
Project C													
Project D													
Total													
New Product Research													
Project X													
Project Y													
Project Z													
Total													
Sales Revenue													
Project P													
Project Q													
Total													
Fundamental Research													
Project L													
Project M													
Total													
Total R&D													

Exhibit 11.3

R&D Project Status Report

Project Number	Month		Cumulative to Date			Budget	Cost Overun
	Man-hours	Expenditures	Man-hours	Expenditures	Commitments		

Exhibit 11.4

Project Status Report

Project Name:
Account Number:
Date Started:
Estimated Completion Date:
Priority Code:
Total Estimated Cost:
Review Date:
Budget:
Actual:
Status:
Progress and Accomplishments:
Recommendations and Comments:

R&D Risk

The risk must be analyzed. If there has been a high failure rate in R&D, proposed projects will have to be examined very closely. Have R&D projects in past years been completed at budget dollar amounts and within expected time periods? What has caused cost overruns and time delays? Do problems still exist or have they been rectified?

Conclusion

Research is defined as the testing in search for a product, while development means translating that research into a design for the new product.

R&D may be classified as new products, enhancements to current products, projects requested by salespeople and marketing, projects requested by the factory, and fundamental projects having no immediate commercial use.

The manager should continually appraise R&D programs. If a specific R&D project has excessive costs and delays, the feasibility of that project may be questionable.

The manager must decide on where to direct R&D efforts and how much to spend. The best alternative project must be selected and the progress on the project closely monitored.

12

General and Administrative Costs:

Budgets for Maximum Productivity

The nonfinancial manager may identify general and administrative expenses by a particular function, activity, product line, service, segment, unit or other responsibility center. Managers may be assigned responsibility for administrative costs.

Administrative departments include general administration, personnel, legal, insurance, and computer services. Examples of administrative expenses are executive and office salaries, office rent, office expenses, legal expenses, and dues.

This chapter discusses the budget process, analysis and evaluation of costs, cost control, and employee considerations.

Budget Process

The manager may budget general and administrative expenses based on specific plans and programs. Because most administrative expenses are fixed, an analysis of the historical record typically will provide a sound basis to budget them. The variable-fixed breakdown is highly recommended.

The budgeting of administrative expenses is difficult to plan and control. One approach is to establish acceptable ranges of costs as percentages of revenue to achieve target earnings. Another is to review administrative costs and determine how much should be allocated to each area by using historical data.

It is worthwhile to break general and administrative expenses into discretionary and nondiscretionary costs. Discretionary costs, such as bonuses, are those that are not essential to satisfy short-term business goals. These costs are usually targets for cutting when costs need to be reduced.

The manager may budget rent simply by using the monthly rent figure. This figure should include an adjustment for cost of living increases, property taxes, and rent escalation clauses.

In budgeting salaries, multiply the number of employees by their monthly salaries. There should be included a provision for salary increase, sick leave time, vacation, holidays, and fringe benefits.

In budgeting taxes and licenses, use a historical percentage rate. Research city, state, and federal sources for potential increases. Divide by 12 months and apply it to each month of the budget. Payroll taxes can be approximated by taking a percentage between 10 and 15 percent of the gross payroll cost as the monthly budget.

In budgeting travel costs, determine what trips will be taken, where they will be taken, and who will be going. If only modest trips can be taken, divide the total annual dollars by 12 to determine the monthly budget. If extensive traveling is involved, calculate each month separately by the actual expected trips for that month.

A departmental budget for general and administrative expenses appears in Exhibit 12.1

Analysis and Evaluation

Budgeted expenses should be documented as to how the amounts are derived and the source of information. Costs should be evaluated by type. They should be compared to sales over the years and to competing companies. If cost increases are substantially disproportionate to sales or production, the reasons must be found and, if necessary, corrective action taken. Costs may also be related to direct labor hours, operating income, and number of transactions.

Many administrative costs are not subject to specific measurement, standardization, or predication. The manager should consider how many employees answer to him or her, what their job responsibilities are, and what objectives are to be met.

Exhibit 12.1

Department Budget

Department name and number:

Department manager:

Period:

Item	Budgeted Cost	Actual Cost	Variance	Percent of Variance to Budget

A manager in the engineering area should segregate the budget into suitable categories, such as product enhancement, operating difficulties, and cost reduction. The deadline dates for each major work stage should be stated.

Cost Control

Cost controls must exist, and there should be a balance between costs and sales. Maximum percentages by which certain costs cannot exceed sales may be set (e.g., 15 percent of sales). Costs may be reduced by eliminating duplicate or unnecessary activities.

Employees

Specific individuals should be assigned responsibility and control of general and administrative expenses. Further, there should be a balance in workload among employees. Employee bonuses and incentives should be based on earnings.

Conclusion

Productivity always must be maintained in the administrative area, so the manager should exercise tight supervision. The general and administrative expense budget should be carefully prepared and analyzed, taking into account past history and the current environment.

13

Capital Expenditures:

Assets to Be Bought, Sold, and Discarded

Capital expenditures should be consistent with the long-term plan of the company. They may be for generating earnings by providing additional revenue or reducing costs, such as when the purchase of more efficient equipment and machinery results in lower maintenance expenditures. They should generate an adequate return, and therefore a desired return on investment should be set. Capital expenditures include replacing machinery to economize on costs, expanding production to increase volume, marketing of a new product, improving the quality of products or services, and manufacturing under proposed contracts. Capital expenditures should take into account current and needed facilities. Commitments also must be considered.

The capital expenditure budget reveals how much is required to invest in capital assets to meet the nonfinancial manager's objectives, so that the division or department can function properly. The budget breaks down the capital assets by major category, how much funding is needed, when that funding is required, the location of the assets, and pertinent reasons and comments.

The timing, nature, and adequacy of capital expenditures have a long-term impact on the manager's responsibility center.

Capital expenditures may be incurred because of growth, increased sales, increased production, changes in production methods, change in style, cost reduction, efficiency and effectiveness, productivity, improvement in product quality, new business, normal replacement, preventive maintenance, and counteracting competition.

The capital expenditure budget depends on such factors as future potential, return on investment, sales, profitability, productivity and efficiency, capacity utilization, payback period (how many years it takes to get the initial investment back), timing of needed capital expenditures, risk, technological obsolescence, diversification, safety concerns, financial position including cash flow, tax benefit and other government incentives, market share, new product development, maintenance and repair requirements, problem areas, replacement options, nature of industry, economic conditions, political factors, and laws and regulations (e.g., pollution requirements, restrictive uses on assets).

There are uncertain benefits for capital expenditures because of the significant cash outlay and long time period involved. In fact, if for some reason a capital expenditure fails, a significant loss is likely.

The manager should prepare the capital expenditure budget needed for his or her responsibility unit after consulting with engineering and technical staff. A capital asset cannot be bought unless it has been included in the capital budget.

Capital assets include equipment, furniture, machinery, storage facilities, distribution facilities, and computers.

The manager should approve capital expenditures only after detailed study and justification and, after that, continual monitoring and control are recommended. The manager should set up a priority listing of capital projects based on earnings or strategic importance. The planning should take into account the peculiar characteristics and nature of the industry and company.

Duplication in capital expenditures results in inefficiency and excessive costs. Control is in the form of comparing budgeted expenditures to actual expenditures. The trend in the ratio of insurance expense to the carrying value of the capital assets, and the insured value relative to replacement cost, will indicate the adequacy of insurance protection.

The timing of capital expenditures depends on available alternatives, start-up time, and funds. The manager must identify capital expenditures that are not essential, can be delayed for a reasonable time, or are urgently needed.

Some capital expenditures result in profit reductions, such as outlays that are required by law, that improve research and development, and that enhance employee morale. Some capital expenditures are required by government, such as for employee safety and to conform to building codes.

This chapter discusses the budget process, authorization of capital budgets, capital budget forms and reports (including special reports), budget revisions, analysis and evaluation of capital expenditures, and controls.

Budget Process

For budgeting, capital expenditures may be classified as normal or special. Normal expenditures are routine, less costly, and made to maintain current operations.

Each project typically does not involve a large cash outlay. The normal capital expenditure should meet the needs of the manager's division or department. An example is a minor replacement of machinery.

Special capital expenditures are unusual, costly, and made for a specific purpose, such as the purchase of a new machine to manufacture a product for a special job of a one-time nature.

Major capital projects typically are planned and proposed by operating managers and must be approved by upper management. The manager must properly budget and package the capital expenditure. These expenditures must be classified by category, class, need, consequence, and feasibility. Capital expenditures may be required or optional. In the case of minor capital expenditures, the division and department managers may have the authority to approve them on their own.

The four steps in the capital expenditure budgetary process are:

1. Approving the project
2. Approving the estimate
3. Authorizing the project
4. Follow-up

The capital expenditure proposal should contain a description, starting date, completion date, source information, and advantages and disadvantages of the proposal.

Some capital expenditures are minor and not subject to detailed planning. Examples are low-cost machinery and minor renovations. These minor expenditures may be lumped together with a blanket appropriation.

Capital expenditure policy should take into account:

- Desired rate of return
- Cost impact
- Age of existing assets
- Expected capacity of the item
- Asset life
- Growth potential
- Employee availability
- Competition
- Stage of the business cycle
- Legal liability exposure
- Regulatory requirements

The manager should set a priority ranking for capital expenditures in terms of operating necessities and nonnecessities. These dates should be noted:

- Dates manpower will be available
- Marketing schedules for products to be produced
- Delivery dates when items are needed

A current capital budget usually covers three to five years in annual segments of planned capital expenditures.

Authorization of Capital Budget

If capital expenditures exceed authorized limits, special approval by top management is required. A project not meeting expectations or that is no longer appropriate, given current circumstances, may be canceled. It is better to cancel a project if the cost/benefit relationship indicates that the project is no longer viable. If a project is a succession of individual projects, a partial authorization may be made.

Exhibit 13.1 is an illustrative capital budget request schedule form.

An authorization form should be filled out for approved capital expenditures. The reason and purpose of the expenditure should be given. Exhibits 13.2 and 13.3 are illustrative authorization forms.

The amount authorized should be compared periodically to actual costs incurred. In addition, commitments must be recorded and monitored because ultimately the total appropriated amount may be exceeded. The estimated cost to complete also should be noted along with any expected overruns or underruns.

Exhibit 13.1

ABC Company
Annual Capital Budget Request 20X5

Description	Appropriations		ROI	Total Commited Amount	Expected Capital Expenditures				
	20X4 Previous Year	20X5 This Year			20X4	20X5	20X6	20X7 and Later	Total
Absolutely Required									
Air Pollution									
Conveyer									
Grinder									
Crusher									
Need to Maintain									
Competitive Position									
Quality Control Facility									
Color Retention									
Replacements									
Growth and Expansion									
DEF Recovery System									
LMN Plant									
Minimal but Recommended									
Lift Trucks									
Landscaping									
Roofing									
Contingency Funding									
Total									

Exhibit 13.2

Capital Expenditure Authorization

Division Name:
Division Number:
Location:
Date:
Reason for Authorization:
Estimated Total Cost:
Item Requested:
Description:
Estimated Cost Breakdown:
Comments and Recommendations:

	Approved	Rejected	Date	Reason
Requested by:				
Approved by:				

Exhibit 13.3

Capital Expenditure Authorization

Division: Date:
Plant:

The capital expenditure is needed because of: (Check appropriate item)

____ New product
____ Normal replacement
____ Modification in production process
____ Cost reduction
____ Increased sales volume
____ New quality control standards
____ Style change

Description and justification

Estimated Cost
Material
Labor
Overhead
Contingency
Total Cost

Expected Return on Investment
Payback Period
Life
Construction Period
Disposal Value

Manager's Comments and Recommendations:

Requested by:
Approved by:

Capital Budget Forms

Request forms should be completed and approved for capital expenditures. A commitment record contains the purchase orders issued. An appropriation form for capital expenditures provides information on the benefits to be obtained from the proposed project and the expected cost savings. The authorization sets forth the type and scope of the project. Exhibit 13.4 is a typical annual capital budget request form.

Exhibit 13.5 is an illustrative preliminary budget request form.

An appropriation request form is filled out by the manager of the responsibility unit in detail, providing justification to support the capital proposal. The manager must thoroughly appraise the proposed capital project.

A proposal form for capital expenditures may include title of project, project objectives, description of project, proposed budget, analysis and evaluation, supporting documentation and calculations, justification, and time estimates.

Exhibits 13.6, 13.7, and 13.8 present typical appropriation request forms.

A capital budget form summarizes proposed capital projects for the period by responsibility center. Exhibit 13.9 presents an illustrative capital budget form.

Exhibit 13.4

Annual Capital Budget Request Form

Description	Appropriations	Capital	Expenditures	Future Commitments

Exhibit 13.5

Preliminary Budget Request Information

Division Name: Department Name: Date:
Division Number: Department Number:
Responsible Individuals:
Project Classification:
Original Request or Supplementary Request:
Funds Requested:
Proposal Description:
Time Schedule:
  Beginning Date:
  Expected Ending Date:

Expected Benefits:
Priority Level:
Expected Return:
Approvals

Exhibit 13.6

Appropriation Request Form

Division:
Department:
Responsibility Unit:

Project Description:
Project Location:

Expected Expenditures
- Initial Request Amount
- Amount Approved to Date
- Future Request
- Total Project Cost

Return on Investment
Payback Period:
Net Present Value:
Internal Rate of Return:
Background Information:
Recommendations:
Classifications:
Nature of Capital Project Proposal:

Exhibit 13.7

Preliminary Budget Request Information

Date
Division Name:
Division Number:

Department Name:
Department Number:

Type of Capital Expenditure
- New
- Expansion
- Replacement
- Cost Reduction
- Other (Description)

Request
- Initial
- Supplementary

Priority Classification
Proposal Description
Identification of Capital Expenditure
Expected Rate of Return
Expected Cash Flows (net)
Time Schedule

Approvals
- Department Manager: Date:
- Division Manager: Date:
- Vice President: Date:

Comments

Exhibit 13.8

Capital Expenditures Request Form

Responsibility Unit Name:
Responsibility Unit Number:
Time Period:

Description	Quantity	Justification	Budgeted	Cost	Date of Purchase

Prepared by: Date:

Approved by: Date:

Exhibit 13.9

Capital Budget Form

Department	Item	Description	Item Number	Status	Total Expenditure	Expected Rate of Return	Priority	Classification

Capital Budget

The capital asset budget includes beginning balance, additions, deletions, depreciation, construction in progress, and ending balance. The budget format should include category, class, project title, project number, project life, capital costs, and return on investment. The budget should contain a provision for explanatory comments.

Extraordinary repairs are usually included in the capital expenditure budget but ordinary repairs are included in the expense budget.

The production budget may require capital additions.

Exhibits 13.10 to 13.16 present illustrative capital budgets.

Exhibit 13.10

Capital Expenditures Budget
For the Year Ended December 31, 20XX

Machinery	$1,500,000
Equipment	800,000
Furniture and Fixtures	200,000
Total	$2,500,000

Exhibit 13.11

Capital Expenditures Budget

Item	To Maintain Current Operations	To Expand	Total
A	$300,000	$200,000	$500,000
C	100,000	50,000	150,000
Equipment	150,000	100,000	250,000
Total	$550,000	$350,000	$900,000

Exhibit 13.12

Preliminary Capital Budget

				Unit Projected Total Cost Classified by Date of Expenditure					Estimated Expenditures 2005–2007 Classified by Accounting Disposition			Expense	
Item Number	Work Order Number	Appropriation Number	Description of Job by Department	Before 2005	2005	2006	2007	After 2007	Additional Facilities	Replacements	Rehabilitation	Repairs	Other

Exhibit 13.13

Capital Expenditure Budget

Project	Budgeted Amount	Amount Authorized	Unexpended Balance	Actual Expenditures	Amount Subject to Authorization	Amount Spent

Exhibit 13.14

Capital Expenditure Budget

	Amount to Be Expended by Quarter					
	1	2	3	4	Total	In Later Periods
Approved Projects:						
Proposed New Projects:						
Proposed Replacements:						

Exhibit 13.15

Capital Asset Budget
Division X

Type of Project	Carryforward Amount	Commitments		Expenditures			Carryforward to Future years
		New Commitments	Total Amount Available	On Previous Years' Commitments	Current Year Authorization	Total for Year	
Capital Expenditures							
Capital Leases							

Exhibit 13.16

Budget for Capital Assets

Classification	Amount at Beginning of Year	Additions	Subtractions	Depreciation	Amount at End of Year

Capital Expenditure Reports

The capital expenditure report should contain information of the authorized amount, actual costs, committed funds, unencumbered balance, estimated cost to complete, and cost overrun (underrun).

Exhibit 13.17 presents a capital expenditures process report.

Exhibits 13.18 and 13.19 present typical reports showing the comparison of budgeted expenditures to actual expenditures.

Exhibit 13.20 presents a capital expenditure status report. This report should be prepared periodically by the manager to keep track of a project so that analysis and control may be facilitated.

A progress report should be prepared to determine if all is going as planned and what corrective action is needed, if any. A detailed evaluation of capital expenditures may not be possible when a sudden, unexpected, or important development occurs. An example is a machine breakdown resulting in a production delay on the assembly line.

Exhibit 13.17

Capital Expenditures In-process Report

Item Number	Description	Approval Amount	Initial Expected Project Completion Date	Incurred to Date	Balance for Completion	Total	Expected Variation	Favorable or Unfavorable	Expected Completion Date	Comments

Exhibit 13.18

Year-to-date Comparisons of Budget to Actual Capital Expenditures

Type	Budgeted Projects	Projects Not Budgeted	Total	Amount Budgeted	Actual Expenditures	Over (Under) Budget

Exhibit 13.19

Capital Expenditures Performance Report
Estimated vs. Actual

Department Name:
Department Number:
Authorization Number:
Description:
Today's Date:
Date Activity Began:

Item	Authorized Amount	Cumulative Actual Amount	Variance	Percent	Reason
A	$100,000	$103,000	$3,000	3%	Delay because of strike
B	80,000	81,000	1,000	1.25	Higher prices for component parts, etc.

A capital expenditures progress report monitors each project's progress and indicates any overruns or underruns. Exhibits 13.21 to 13.26 present representative reports.

Budget Revisions

Capital budgets should be revised when errors are found or circumstances change. Revisions would be required for changes in cost estimates, unexpected developments in the economy, design changes, technological developments, action by competitors, change in divisional or departmental objectives, and casualty losses.

Exhibit 13.20

Capital Expenditures Performance Report Information

Cost Information
- Budgeted Amount
- Cumulative Actual Expenditures
- Committed Amounts
- Unexpended Amount
- Expected Cost to Complete
- Variance Between Budget and Actual Amounts

Dates
- Date Began
- Expected Completion Date
- Days Delayed
- Reason for Delay

Extent of Completion
- Percent of Time Completed to Date
- Percent of Cost Completed to date

Explanatory Comments
- Quality
- Unusual Occurrences and Reasons

Special Projects

Special capital expenditures involve nonroutine, large cash outlays for major specific projects. An example is the purchase of new machinery to meet customer demand. Optional projects include equipment replacement, capital expansion, modified techniques, and new ventures. Capital expenditures should be consistent with the manager's desired return on investment.

Analysis of Capital Projects

The manager should compare the expected profit to actual profit for each capital project. There should be an evaluation of the difference between budgeted and actual capital expenditures, along with justification.

Some questions to be answered by managers include: Are specialized equipment and machinery required? If capacity is expanded, what impact will it have on warehouse space?

Control over Capital Expenditures

The manager should control individual projects from beginning to end. Capital expenditure outlays should be documented by supplier. Contractor price quotations

Exhibit 13.21

Capital Expenditures Progress Report

Item Number	Description	Amount Approved	Expected Completion Date	Cumulative Expenditures to Date	Amount Needed for Completion	Total Actual Expenditures	Budgeted Expenditures	Variance	Comments

Exhibit 13.22

ABC Manufacturing Company

Department and Cost	Authorized Amount	Cumulative Expenditures to Date	Purchase Commitments	Total Expenditures and Commitments	Balance Remaining
Research					
Salaries	$60,000	$50,000	$4,000	$54,000	$6,000
Supplies	80,000	70,000	7,000	77,000	3,000
Power	etc.				
Total					
Development					
Salaries					
Traveling					
Other					
Total					
Patent					
Legal Fees					
Application Fees					
Total					
Administrative					
Salaries					
Depreciation					
Total					

Exhibit 13.23

Capital Expenditure Projects

Project Number	Description	Actual Expenditures		Commitments and Expenditures to Date	Estimated Cost to Complete	Current Estimated Total Cost	Appropriated Amount	Over/Under Appropriation
		Current Month	Cumulative					

Exhibit 13.24

Capital Expenditure Project Status Report

Division:
Location:
Category:
Project Title:
Project Number:
Project Appropriation and Investment:

Capital Expenditure Items:
ROI:
Payback Period:
Discounted Payback Period:
Net Present Value

Total Actual Amount Approved	Actual Amount Spent to Date	Initial Budgeted Amount	Revised Budgeted Amount	Variance	Reason

Comments and Recommendation:

Preparer

Reviewer

Exhibit 13.25

Capital Expenditure Appropriation Status Report

Number	Category	Description	Order Number	Amount Appropriated	Completion Date	Estimate	Commitments	Actual Expenditures	Variance

Exhibit 13.26

Status of Capital Expenditures Appropriated

Appropriation Number	Description	Work Order Number	Appropriation	Completion Date	Initial Estimate	Outstanding Commitments	Cumulative Actual Expenditures	Estimated Cost to Complete	Total Cost	Over/Under Initial Estimate

should be reviewed for reasonableness. Competitive comparisons should be made. Contractors may be changed when cost savings arise, quality problems exist, or delivery dates are not being met.

Conclusion

The capital expenditure budget lists capital assets to be purchased, sold, or discarded. Capital expenditures may be made to replace obsolete machinery or to expand and improve operations, such as expenditures for new product lines. The manager should evaluate alternative capital proposals carefully. Further, retirement of capital assets without adequate replacement may have negative long-term effects.

14

Forecasting and Planning:
Reducing Risk in Decision Making

Management in both private and public organizations typically operates under conditions of uncertainty or risk. Probably the most important function of business is forecasting, which is a starting point for planning and budgeting. The objective of forecasting is to reduce risk in decision making.

In business, forecasts form the basis for planning capacity, production and inventory, manpower, sales and market share, finances and budgeting, research and development, and top management's strategy.

Sales forecasts are especially crucial aspects of many financial management activities, including budgets, profit planning, capital expenditure analysis, and acquisition and merger analysis.

Exhibit 14.1 illustrates how sales forecasts relate to various managerial functions of business.

Who Uses Forecasts?

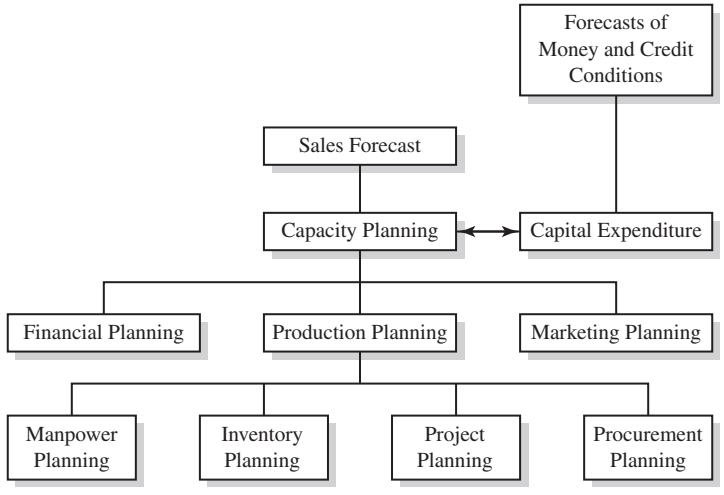
Forecasts are needed for marketing, production, purchasing, manpower, and financial planning. Further, top management needs forecasts for planning and implementing long-term strategic objectives and planning for capital expenditures. More specifically, marketing managers use sales forecasts to determine optimal sales force allocations, set sales goals, and plan promotions and advertising. Market share, prices, and trends in new product development are also required.

Production planners need forecasts in order to:

- Schedule production activities
- Order materials
- Establish inventory levels
- Plan shipments

Exhibit 14.1

Sales Forecast and Managerial Functions



Other areas that need forecasts include material requirements (purchasing and procurement), labor scheduling, equipment purchases, maintenance requirements, and plant capacity planning.

As shown in Exhibit 14.1, as soon as the company makes sure that it has enough capacity, the production plan is developed. If the company does not have enough capacity, it will require planning and budgeting decisions for capital spending for capacity expansion.

On this basis, the manager must estimate the future cash inflow and outflow. He or she must plan cash and borrowing needs for the company's future operations. Forecasts of cash flows and the rates of expenses and revenues are needed to maintain corporate liquidity and operating efficiency. In planning for capital investments, predictions about future economic activity are required so that returns or cash inflows accruing from the investment may be estimated.

Forecasts are needed for money and credit conditions and interest rates so that the cash needs of the firm may be met at the lowest possible cost. Forecasts also must be made for interest rates, to support the acquisition of new capital, the collection of accounts receivable to help in planning working capital needs, and capital equipment expenditure rates to help balance the flow of funds in the organization.

Sound predictions of foreign exchange rates are increasingly important to managers of multinational companies.

Long-term forecasts are needed for the planning of changes in the company's capital structure. Decisions on issuing stock or debt to maintain the desired financial structure require forecasts of money and credit conditions.

The personnel department requires a number of forecasts in planning for human resources. Workers must be hired, trained, and provided with benefits that are competitive with those available in the firm's labor market. Also, trends that affect such variables as labor turnover, retirement age, absenteeism, and tardiness need to be forecast for planning and decision making.

Managers of nonprofit institutions and public administrators also must make forecasts for budgeting purposes.

Hospital administrators forecast the healthcare needs of the community. In order to do this efficiently, a projection has to be made of:

- Growth in absolute size of population
- Changes in the number of people in various age groupings
- Varying medical needs these different age groups will have

Universities forecast student enrollments, cost of operations, and, in many cases, the funds to be provided by tuition and by government appropriations.

The service sector, which today accounts for two-thirds of the U.S. gross domestic product, including banks, insurance companies, restaurants, and cruise ships, needs various projections for its operational and long-term strategic planning.

Take a bank, for example. The bank has to forecast:

- Demands of various loans and deposits
- Money and credit conditions so that it can determine the cost of money it lends

Forecasting Methods

The company may choose from a wide range of forecasting techniques. There are basically two approaches to forecasting, qualitative and quantitative:

1. Qualitative approach—forecasts based on judgment and opinion
   - Executive opinions
   - Delphi technique
   - Sales force polling
   - Consumer surveys

2. Quantitative approach

   a. Forecasts based on historical data
      - Naive methods
      - Moving average
      - Exponential smoothing
      - Trend analysis
      - Decomposition of time series

b. Associative (causal) forecasts
   - Simple regression
   - Multiple regression
   - Econometric modeling

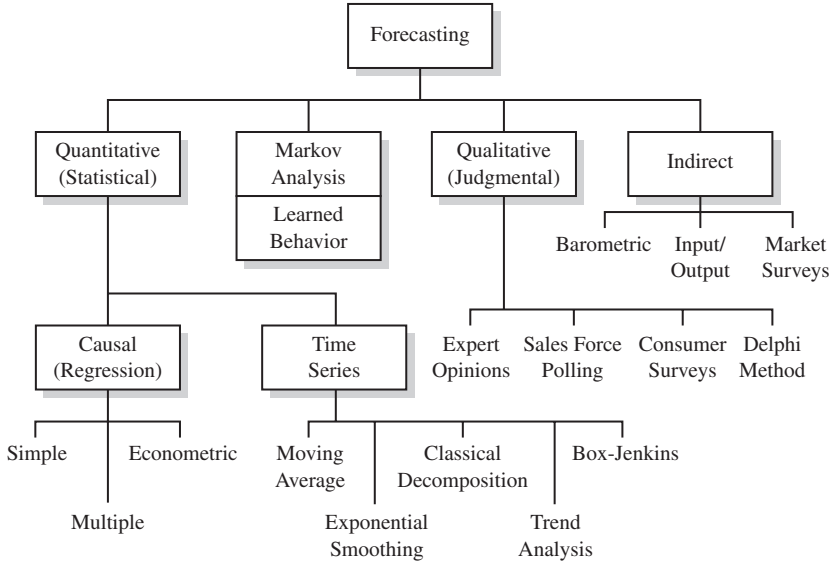
Exhibit 14.2 summarizes the forecasting methods. The list presented in the exhibit is neither comprehensive nor exhaustive. Sophisticated time series methods such as Box-Jenkins are reserved for an advanced forecasting text.

Quantitative models work superbly as long as little or no systematic change in the environment takes place. When patterns or relationships do change, by themselves, the objective models are of little use. It is here where the qualitative approach, based on human judgment, is indispensable. Because judgmental forecasting also bases forecasts on observation of existing trends, they too are subject to a number of shortcomings. The advantage, however, is that they can identify systematic change more quickly and interpret better the effect of such change on the future.

We discuss the qualitative method in this chapter. Several quantitative methods, along with their illustrations, are taken up in the next two chapters.

Exhibit 14.2

Forecasting Methods



Selection of Forecasting Method

The choice of a forecasting technique is influenced significantly by the stage of the product life cycle and sometimes by the firm or industry for which a decision is being made.

In the beginning of the product life cycle, relatively small expenditures are made for research and market investigation. During the first phase of product introduction, these expenditures start to increase. In the rapid growth stage, considerable amounts of money are involved in the decisions, so a high level of accuracy is desirable. After the product has entered the maturity stage, the decisions are more routine, involving marketing and manufacturing. These are important considerations when determining the appropriate sales forecast technique.

After evaluating the particular stages of the product and firm and industry life cycles, a further probe is necessary. Instead of selecting a forecasting technique by using whatever seems applicable, decision makers should determine what is appropriate. Some of the techniques are quite simple and rather inexpensive to develop and use. Others are extremely complex, require significant amounts of time to develop, and may be quite expensive. Some are best suited for short-term projections, others for intermediate- or long-term forecasts.

What technique or techniques to select depends on six criteria:

1. What is the cost associated with developing the forecasting model, compared with potential gains resulting from its use? The choice is one of benefit-cost trade-off.
2. How complicated are the relationships that are being forecasted?
3. Is it for short-run or long-run purposes?
4. How much accuracy is desired?
5. Is there a minimum tolerance level of errors?
6. How much data are available? Techniques vary in the amount of data they require.

Qualitative Approach

The qualitative (or judgmental) approach can be useful in formulating short-term forecasts and can also supplement the projections based on the use of any of the quantitative methods.

Four of the better-known qualitative forecasting methods are executive opinions, the Delphi method, sales-force polling, and consumer surveys.

Executive Opinions

The subjective views of executives or experts from sales, production, finance, purchasing, and administration are averaged to generate a forecast about future sales. Usually this method is used in conjunction with some quantitative method, such as trend extrapolation. The management team modifies the resulting forecast, based on their expectations.

The advantage of this approach is that the forecasting is done quickly and easily, without need of elaborate statistics. Also, the jury of executive opinions may be the only means of forecasting feasible in the absence of adequate data.

The disadvantage, however, is that of "group think." This is a set of problems inherent to those who meet as a group. Foremost among these are high cohesiveness, strong leadership, and insulation of the group. With high cohesiveness, the group becomes increasingly conforming through group pressure that helps stifle dissension and critical thought. Strong leadership fosters group pressure for unanimous opinion. Insulation of the group tends to separate the group from outside opinions, if given.

Delphi Method

This is a group technique in which a panel of experts are questioned individually about their perceptions of future events. The experts do not meet as a group, in order to reduce the possibility that consensus is reached because of dominant personality factors. Instead, the forecasts and accompanying arguments are summarized by an outside party and returned to the experts along with further questions. This continues until a consensus is reached.

This type of method is useful and quite effective for long-range forecasting. The technique is done by questionnaire format and eliminates the disadvantages of group think. There is no committee or debate. The experts are not influenced by peer pressure to forecast a certain way, as the answer is not intended to be reached by consensus or unanimity.

Low reliability is cited as the main disadvantage of the Delphi method, as well as lack of consensus from the returns.

Sales Force Polling

Some companies use as a forecast source salespeople who have continual contacts with customers. They believe that the salespeople who are closest to the ultimate customers may have significant insights regarding the state of the future market. Forecasts based on sales force polling may be averaged to develop a future forecast. Or they may be used to modify other quantitative and/or qualitative forecasts that have been generated internally in the company.

The advantages of this forecast are:

- It is simple to use and understand.
- It uses the specialized knowledge of those closest to the action.
- It can place responsibility for attaining the forecast in the hands of those who most affect the actual results.
- The information can be broken down easily by territory, product, customer, or salesperson.

The disadvantages include salespeople's being overly optimistic or pessimistic regarding their predictions and inaccuracies due to broader economic events that are largely beyond their control.

Consumer Surveys

Some companies conduct their own market surveys regarding specific consumer purchases. Surveys may consist of telephone contacts, personal interviews, or questionnaires as a means of obtaining data. Extensive statistical analysis usually is applied to survey results in order to test hypotheses regarding consumer behavior.

Common Features and Assumptions Inherent in Forecasting

As pointed out, forecasting techniques are quite different from each other. But four features and assumptions underlie the business of forecasting. They are:

1. Forecasting techniques generally assume that the same underlying causal relationship that existed in the past will continue to prevail in the future. In other words, most of our techniques are based on historical data.
2. Forecasts are rarely perfect. Therefore, for planning purposes, allowances should be made for inaccuracies. For example, the company should always maintain a safety stock in anticipation of a sudden depletion of inventory.
3. Forecast accuracy decreases as the time period covered by the forecast (i.e., the time horizon) increases. Generally speaking, a long-term forecast tends to be more inaccurate than a short-term forecast because of the greater uncertainty.
4. Forecasts for groups of items tend to be more accurate than forecasts for individual items, because forecasting errors among items in a group tend to cancel each other out. For example, industry forecasting is more accurate than individual firm forecasting.

Steps in the Forecasting Process

There are six basic steps in the forecasting process. They are:

1. Determine the what and why of the forecast and what will be needed. This will indicate the level of detail required in the forecast (e.g., forecast by region, by product), the amount of resources (e.g., computer hardware and software, manpower) that can be justified, and the level of accuracy desired.
2. Establish a time horizon, short term or long term. More specifically, project for the next year or next five years.
3. Select a forecasting technique. Refer to the criteria discussed before.
4. Gather the data and develop a forecast.

5. Identify any assumptions that had to be made in preparing the forecast and using it.
6. Monitor the forecast to see if it is performing in a manner desired. Develop an evaluation system for this purpose. If not, go back to Step 1.

Conclusion

Managers use forecasts for budgeting purposes. A forecast aids in determining volume of production, inventory needs, labor hours required, cash requirements, and financing needs. A variety of forecasting methods are available. However, consideration has to be given to cost, preparation time, accuracy, and time period. The manager must understand clearly the assumptions on which a particular forecast method is based to obtain maximum benefit.

15

Moving Averages and Smoothing Techniques:

Quantitative Forecasting

This chapter discusses several quantitative forecasting methods. The discussion includes naive models, moving averages, and exponential smoothing. Trend analysis and regressions are covered in future chapters. Qualitative methods were described in Chapter 14.

Naive Models

Naive forecasting models are based exclusively on historical observation of sales or other variables, such as earning and cash flows. They do not attempt to explain the underlying causal relationships that produce the variable being forecast.

Naive models may be classified into two groups. One group consists of simple projection models. These models require inputs of data from recent observation, but no statistical analysis is performed. The second group is made up of models that while naive, are complex enough to require a computer. Traditional methods such as classical decomposition, moving average, and exponential smoothing models are some examples.

The advantage is that it is inexpensive to develop, store data, and operate. The disadvantage is that it does not consider any possible causal relationships that underly the forecasted variable.

A simple example of a naive type:

1. Use the actual sales of the current period as the forecast for the next period. Let us the symbol Y'_{t+1} as the forecast value and the symbol Y_t as the actual value. Then

$$Y'_{t+1} = Y_t$$

2. If you consider trends, then

$$Y'_{t+1} = Y_t + (Y_t - Y_{t-1})$$

This model adds the latest observed absolute period-to-period change to the most recent observed level of the variable.

3. If you want to incorporate the rate of change rather than the absolute amount, then

$$Y'_{t+1} = Y_t \frac{Y_t}{Y_{t-1}}$$

Example 1

Consider these sales data:

Month	20X5 Monthly Sales of Product
1	$3,050
2	2,980
3	3,670
4	2,910
5	3,340
6	4,060
7	4,750
8	5,510
9	5,280
10	5,504
11	5,810
12	6,100

We will develop forecasts for January 20X6 based on the aforementioned three models:

1. $Y'_{t+1} = Y_t = \$6{,}100$

2. $Y'_{t+1} = Y_t + (Y_t - Y_{t-1}) = \$6{,}100 + (\$5{,}810 - \$5{,}504)$
$= \$6{,}100 + \$306 = \$6{,}406$

3. $Y'_{t+1} = Y_t \frac{Y_t}{Y_{t-1}}$
$= \$6{,}100 \times \frac{\$6{,}100}{\$5{,}810} = \$6{,}100\ (1.05)$
$= \$6{,}405$

The naive models can be applied, with little need of a computer, to develop forecasts for sales, earnings, and cash flows. They must be compared with more sophisticated models, such as the regression method, for forecasting efficiency.

Smoothing Techniques

Smoothing techniques are a higher form of naive models. The two typical forms are moving averages and exponential smoothing. Moving averages are the simpler of the two.

Moving Averages

Moving averages are averages that are updated as new information is received. With the moving average, a manager simply employs the most recent observations to calculate an average, which is used as the forecast for the next period.

Example 2

Assume that the marketing manager has these sales data:

Date	Actual Sales (Y_t)
Jan.1	46
2	54
3	53
4	46
5	58
6	49
7	54

In order to predict the sales for the seventh and eighth days of January, the manager has to pick the number of observations for averaging purposes. Let us consider two cases. One is a six-day moving average and the other is a three-day average.

Case 1

$$Y'_7 = \frac{46 + 54 + 53 + 46 + 58 + 49}{6} = 51$$

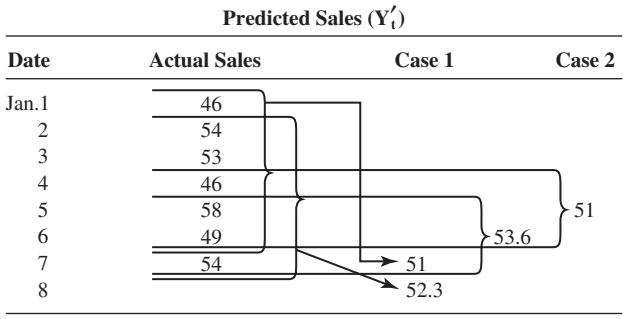
$$Y'_8 = \frac{54 + 53 + 46 + 58 + 49 + 54}{6} = 52.3$$

where Y´ = predicted

Case 2

$$Y'_7 = \frac{46 + 58 + 49}{3} = 51$$

$$Y'_8 = \frac{58 + 49 + 54}{3} = 53.6$$



In terms of weights given to observations, in Case 1, the old data received a weight of $\frac{5}{6}$ and the current observation got a weight of $\frac{1}{6}$. In Case 2, the old data received a weight of only $\frac{2}{3}$ while the current observation received a weight of $\frac{1}{3}$.

Thus, the marketing manager's choice of the number of periods to use in a moving average is a measure of the relative importance attached to old versus current data.

Advantages and Disadvantages

The moving average is simple to use and easy to understand. However, there are two shortcomings:

1. It requires users to retain a great deal of data and carry it along with them from forecast period to forecast period.
2. All data in the sample are weighted equally. If more recent data are more valid than older data, why not give them greater weight?

The forecasting method known as exponential smoothing gets around these disadvantages.

Exponential Smoothing

Exponential smoothing is a popular technique for short-run forecasting by managers. It uses a weighted average of past data as the basis for a forecast. The procedure gives heaviest weight to more recent information and smaller weight to observations in the more distant past. The reason is that the future is more dependent on the recent past than on the distant past.

The method is known to be effective when there is randomness and no seasonal fluctuations in the data. One disadvantage of the method, however, is that it does not include industrial or economic factors such as market conditions, prices, or the effects of competitors' actions.

Model

The formula for exponential smoothing is:

$$Y'_{t+1} = \alpha Y_t + (1 - \alpha)\, Y'_t$$

or in words,

$$Y'_{new} = \alpha Y_{old} + (1 - \alpha)\, Y'_{old}$$

where Y'_{new} = exponentially smoothed average to be used as the forecast
Y_{old} = most recent actual data
Y'_{old} = most recent smoothed forecast
α = smoothing constant

The higher the α, the higher weight given to the more recent information.

Example 3

Data on sales follow.

Time Period(t)	Actual Sales (1,000) (Y)
1	$60.0
2	64.0
3	58.0
4	66.0
5	70.0
6	60.0
7	70.0
8	74.0
9	62.0
10	74.0
11	68.0
12	66.0
13	60.0
14	66.0
15	62.0

To initialize the exponential smoothing process, we must have the initial forecast. The first smoothed forecast to be used can be

- First actual observations
- An average of the actual data for a few periods

For illustrative purposes, let us use a six-period average as the initial forecast Y'_7 with a smoothing constant of $\alpha = 0.40$.

$$\begin{aligned}\text{Then } Y'_7 &= (Y_1 + Y_2 + Y_3 + Y_4 + Y_5 + Y_6)/6 \\ &= (60 + 64 + 58 + 66 + 70 + 60)/6 = 63\end{aligned}$$

Note that $Y_7 = 70$. Then Y'_8 is computed as follows:

$$\begin{aligned}Y'_8 &= \alpha Y_7 + (1 - \alpha)\, Y'_7 \\ &= (0.40)\ (70) + (0.60)\ (63) \\ &= 28.0 + 37.80 = 65.80\end{aligned}$$

Similary

$$\begin{aligned}Y'_9 &= \alpha Y_8 + (1 - \alpha)\, Y'_8 \\ &= (0.40)\ (74) + (0.60)\ (65.80) \\ &= 29.60 + 39.48 = 69.08\end{aligned}$$

and

$$\begin{aligned}Y'_{10} &= \alpha Y_9 + (1 - \alpha)\, Y'_9 \\ &= (0.40)\ (62) + (0.60)\ (69.08) \\ &= 24.80 + 41.45 = 66.25\end{aligned}$$

By using the same procedure, the values of $Y'_{11}, Y'_{12}, Y'_{13}, Y'_{14}$, and Y'_{15} can be calculated.

Due to the negative and positive differences between actual sales and predicated sales, the forecaster can use a higher or lower smoothing constant α, in order to adjust the predication as quickly as possible to large fluctuations in the data series.

For example, if the forecast is slow in reacting to increased sales (i.e., if the difference is negative), the user might want to try a higher value. For practical purposes, the optimal α may be picked by minimizing what is known as the mean squared error (MSE).

$$\text{MSE} = \Sigma(Y_t - Y'_t)^2/(n - i)$$

where i = the number of observations to determine the initial forecast
in the example, i = 6)

The next table shows a comparison between the actual sales and predicted sales by the exponential smoothing method.

Comparison of Actual Sales and Predicted Sales

Time Period (t)	Actual Sales (Y_t)	Predicted Sales (Y'_t)	Difference ($Y_t - Y'_t$)	Difference^2 ($Y_t - Y'_t)^2$
1	$60.0			
2	64.0			
3	58.0			
4	66.0			
5	70.0			
6	60.0			
7	70.0	63.00	7.00	49.00
8	74.0	65.80	8.20	67.24
9	62.0	69.08	–7.08	50.13
10	74.0	66.25	7.75	60.06
11	68.0	69.35	–1.35	1.82
12	66.0	68.81	–2.81	7.90
13	60.0	67.69	–7.69	59.14
14	66.0	64.61	1.39	1.93
15	62.0	65.17	–3.17	10.05
				$307.27

in the example,

$$MSE = 307.27/(15 - 6) = 307.27/9 = 34.14$$

The idea is to select the α that minimizes MSE, which is the average sum of the variations between the historical sales data and the forecast values for the corresponding periods.

Computer and Exponential Smoothing

A nonfinancial manager will be confronted with complex problems requiring large sample data and will need to try different values of α for exponential smoothing. Virtually all forecasting software has an exponential smoothing routine. Exhibit 15.1 is a sample output from a computer program for exponential smoothing.

Notice that the best α for this particular example is .9, because it gives the least MSE.

Exhibit 15.1

Sample Output from Computer Program

```
     PLEASE ENTER THE NUMBER OF OBSERVATIONS
?10
     ENTER YOUR DATA NOW
     THE DATA SHOULD BE SEPARATED BY COMMAS.

?117,120,132,141,140,156,169,171,174,182
     ENTER THE NUMBER OF PERIODS OVER WHICH
YOU CAN COMPUTE THE AVERAGE TO BE USED AS THE FIRST
FORECAST VALUE.

?1
******* EXPONENTIAL SMOOTHING PROGRAM -SINGLE SMOOTHING *******

                  ACTUAL       ESTIMATED
        PERIOD    VALUE        VALUE          ERROR
          1       117.00          .00
          2       120.00       117.00

THE VALUE OF THE EXPONENTIAL SMOOTHER IS .1
          3       132.00       117.30         14.70
          4       141.00       118.77         22.23
          5       140.00       120.99         19.01
          6       156.00       122.89         33.11
          7       169.00       126.20         42.80
          8       171.00       130.48         40.52
          9       174.00       134.54         39.46
         10       182.00       138.48         43.52
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 255.34
 THE MEAN SQUARED ERROR IS 1136.48

THE VALUE OF THE EXPONENTIAL SMOOTHER IS .2
          3       132.00       117.60         14.40
          4       141.00       120.48         20.52
          5       140.00       124.58         15.42
          6       156.00       127.67         28.33
          7       169.00       133.33         35.67
          8       171.00       140.47         30.53
          9       174.00       146.57         27.43
         10       182.00       152.06         29.94
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 202.24
 THE MEAN SQUARED ERROR IS 690.23

THE VALUE OF THE EXPONENTIAL SMOOTHER IS .3
          3       132.00       117.90         14.10
          4       141.00       122.13         18.87
          5       140.00       127.79         12.21
          6       156.00       131.45         24.55
          7       169.00       138.82         30.18
          8       171.00       147.87         23.13
          9       174.00       154.81         19.19
         10       182.00       160.57         21.43
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 163.66
 THE MEAN SQUARED ERROR IS 447.49
```

```
THE VALUE OF THE EXPONENTIAL SMOOTHER IS .4
         3          132.00       118.20          13.80
         4          141.00       123.72          17.28
         5          140.00       130.63           9.37
         6          156.00       134.38          21.62
         7          169.00       143.03          25.97
         8          171.00       153.42          17.58
         9          174.00       160.45          13.55
        10          182.00       165.87          16.13
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 135.31
 THE MEAN SQUARED ERROR IS 308.97

THE VALUE OF THE EXPONENTIAL SMOOTHER IS .5
         3          132.00       118.50          13.50
         4          141.00       125.25          15.75
         5          140.00       133.12           6.88
         6          156.00       136.56          19.44
         7          169.00       146.28          22.72
         8          171.00       157.64          13.36
         9          174.00       164.32           9.68
        10          182.00       169.16          12.84
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 114.16
 THE MEAN SQUARED ERROR IS 226.07

THE VALUE OF THE EXPONENTIAL SMOOTHER IS .6
         3          132.00       118.80          13.20
         4          141.00       126.72          14.28
         5          140.00       135.29           4.71
         6          156.00       138.12          17.88
         7          169.00       148.85          20.15
         8          171.00       160.94          10.06
         9          174.00       166.98           7.02
        10          182.00       171.19          10.81
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 98.13
 THE MEAN SQUARED ERROR IS 174.23

THE VALUE OF THE EXPONENTIAL SMOOTHER IS .7
         3          132.00       119.10          12.90
         4          141.00       128.13          12.87
         5          140.00       137.14           2.86
         6          156.00       139.14          16.86
         7          169.00       150.94          18.06
         8          171.00       163.58           7.42
         9          174.00       168.77           5.23
        10          182.00       172.43           9.57
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 85.76
 THE MEAN SQUARED ERROR IS 140.55

THE VALUE OF THE EXPONENTIAL SMOOTHER IS .8
         3          132.00       119.40          12.60
         4          141.00       129.48          11.52
         5          140.00       138.70           1.30
         6          156.00       139.74          16.26
         7          169.00       152.75          16.25
         8          171.00       165.75           5.25
         9          174.00       169.95           4.05
        10          182.00       173.19           8.81
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 76.05
```

(*continues*)

```
 THE MEAN SQUARED ERROR IS 117.91

THE VALUE OF THE EXPONENTIAL SMOOTHER IS .9
         3         132.00       119.70          12.30
         4         141.00       133.77          10.23
         5         ???.??       ???.??          ??.??
         6         156.00       140.00          16.00
         7         169.00       154.40          14.60
         8         171.00       167.54           3.46
         9         174.00       170.65           3.33
        10         182.00       173.67           8.33
 THE TOTAL ABSOLUTE ERROR IN ESTIMATE IS 68.30
 THE MEAN SQUARED ERROR IS 102.23
          SUMMARY RESULTS



THE EXPONENTIAL SMOOTHER .1    WITH A MEAN SQUARED ERROR OF    1138.48
THE EXPONENTIAL SMOOTHER .2    WITH A MEAN SQUARED ERROR OF    690.23
THE EXPONENTIAL SMOOTHER .3    WITH A MEAN SQUARED ERROR OF    447.49
THE EXPONENTIAL SMOOTHER .4    WITH A MEAN SQUARED ERROR OF    308.97
THE EXPONENTIAL SMOOTHER .5    WITH A MEAN SQUARED ERROR OF    226.07
THE EXPONENTIAL SMOOTHER .6    WITH A MEAN SQUARED ERROR OF    174.23
THE EXPONENTIAL SMOOTHER .7    WITH A MEAN SQUARED ERROR OF    140.55
THE EXPONENTIAL SMOOTHER .8    WITH A MEAN SQUARED ERROR OF    117.91
THE EXPONENTIAL SMOOTHER .9    WITH A MEAN SQUARED ERROR OF    102.23
```

Conclusion

Various quantitative forecasting methods exist. Native techniques are based solely on previous experience. Smoothing approaches include moving averages and exponential smoothing. Moving averages and exponential smoothing employ a weighted average of past data as the means of deriving the forecast.

16

Regression Analysis:
Popular Sales Forecast System

Regression analysis is a statistical procedure for estimating mathematically the average relationship between the dependent variable and the independent variable(s). Simple regression involves one independent variable, price or advertising in a demand function, whereas multiple regression involves two or more variables, such as price and advertising together. In this chapter, we will discuss simple (linear) regression (i.e., $Y = a + bX$) to illustrate the least-squares method. Multiple regression is reserved for a forecasting text.

Least-Squares Method

The least-squares method is widely used in regression analysis for estimating the parameter values in a regression equation. The regression method includes all the observed data and attempts to find a line of best fit. To find this line, a technique called the least-squares method is used. Exhibit 16.1 shows the regression relationship.

To explain the least-squares method, we define the error as the difference between the observed value and the estimated one and denote it with u.

Symbolically, $u = Y - Y'$
where Y = observed value of the dependent variable
Y' = estimated value based on $Y' = a + bX$

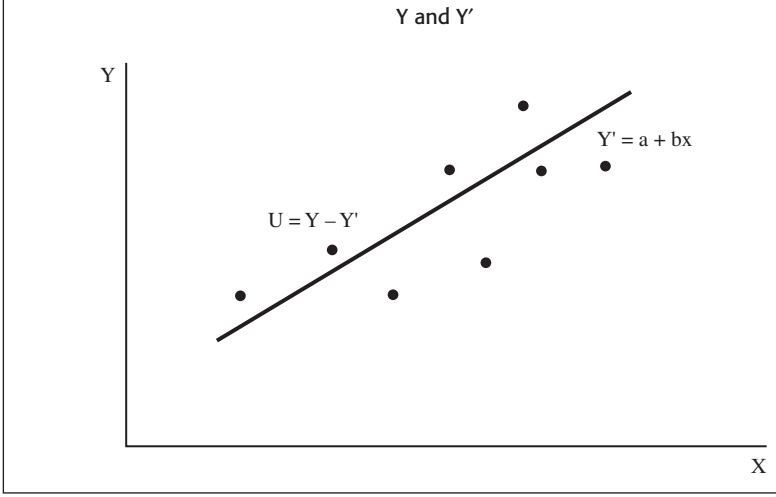
The least-squares criterion requires that the line of best fit be such that the sum of the squares of the errors (or the vertical distance in Exhibit 16.1 from the observed data points to the line) is a minimum, that is,

$$\text{Minimum: } \Sigma u^2 = \Sigma(Y - a - bX)^2$$

Using differential calculus we obtain these equations, called normal equations:

$$\Sigma Y = na + b\Sigma X$$
$$\Sigma XY = a\Sigma X + b\Sigma X^2$$

Exhibit 16.1



Solving the equations for b and a yields

$$b = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{n\Sigma X^2 - (\Sigma X)^2}$$

$$a = \overline{Y} - b\overline{X}$$

where $\overline{Y} = \Sigma X/n$ and $\overline{X} = \Sigma X/n$

Example 1

To illustrate the computations of b and a, we will refer to the data in Exhibit 16.2. All the sums required are computed and shown in the exhibit.

From Exhibit 16.2:

$$\Sigma X = 174;\ \Sigma Y = 225;\ \Sigma XY = 3,414;\ \Sigma X^2 = 2,792;\ \Sigma Y^2 = 4,359$$
$$\overline{X} = \Sigma X/n = 174/12 = 14.5;\ \overline{Y} = \Sigma Y/n = 225/12 = 18.75$$

Substituting these values into the formula for b first:

$$b = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{n\Sigma X^2 - (\Sigma X)^2} = \frac{(12)(3,414) - (174)(255)}{(12)(2,792) = (174)^2} = \frac{1,818}{3,228} = 0.5632$$

$$a = \overline{Y} - b\overline{X} = 18.75 - (0.5632)(14.5) = 18.75 - 8.1664 = 10.5836$$

Thus, $Y' = 10.5836 + 0.5632\ X$

Exhibit 16.2

Table for Example 1

Advertising X (000)	Sales Y (000)	XY	X^2	Y^2
$ 9	$ 15	135	81	225
19	20	380	361	400
11	14	154	121	196
14	16	224	196	256
23	25	575	529	625
12	20	240	144	400
12	20	240	144	400
22	23	506	484	529
7	14	98	49	196
13	22	286	169	484
15	18	270	225	324
17	18	306	289	324
$174	$225	3,414	2,792	4,359

Example 2

Assume that the advertising expense of $10 is to be expended for next year. The projected sales for the year would be computed in this way:

$$\begin{aligned} Y' &= 10.5836 + 0.5632\ X \\ &= 10.5836 + 0.5632\ (10) \\ &= \$16.2156 \end{aligned}$$

Note that ΣY^2 is not used here but rather is computed for R-squared (R^2).

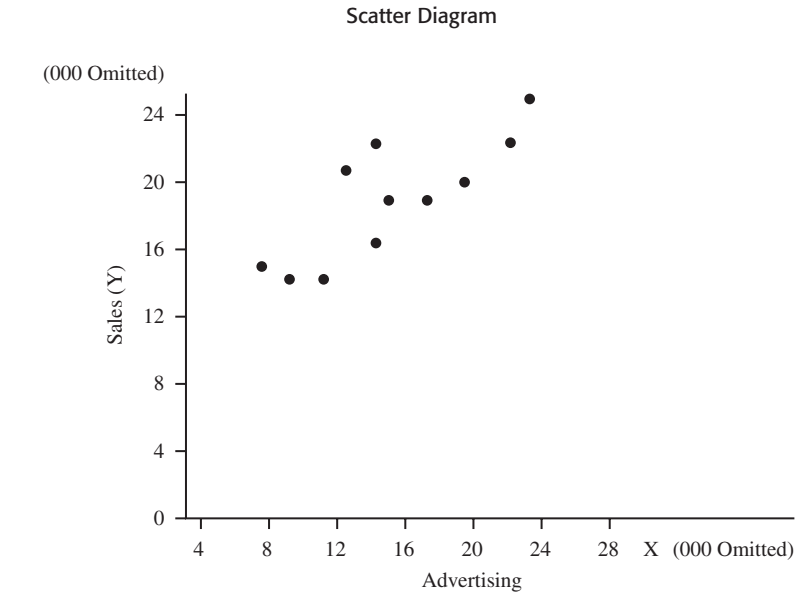
A Word of Caution

Before attempting a least-squares regression approach, it is extremely important to plot the observed data on a diagram, called the scattergraph (see Exhibit 16.3). The reason is to make sure that a linear (straight-line) relationship existed between Y and X in the past sample.

If, for any reason, a nonlinear relationship was detected in the sample, the linear relationship we assumed—Y = a + bX—would not give us a good fit.

In order to obtain a good fit and achieve a high degree of accuracy, readers should be familiar with statistics relating to regression such as R-squared (R^2) and t-value, which are discussed later.

Exhibit 16.3



Regression Statistics

Regression analysis is a statistical method. Therefore, it uses a variety of statistics to tell about the accuracy and reliability of the regression results. They include:

- Correlation coefficient (r) and coefficient of determination (R^2)
- Standard error of the estimate (S_e) and prediction confidence interval
- Standard error of the regression coefficient (S_b) and t-statistic

Each of these statistics is explained next.

Correlation Coefficient (r) and Coefficient of Determination (R^2)

The correlation coefficient r measures the degree of correlation between Y and X. The range of values it takes on is between –1 and +1. More widely used, however, is the coefficient of determination, designated R^2. Simply put, R^2 tells us how good the estimated regression equation is. In other words, it is a measure of "goodness of fit" in the regression. Therefore, the higher the R^2, the more confidence we have in our estimated equation.

More specifically, the coefficient of determination represents the proportion of the total variation in Y that is explained by the regression equation. It has the range of values between 0 and 1.

Example 3

The statement "Sales is a function of advertising expenditure with $R^2 = 70$ percent" can be interpreted as "70 percent of the total variation of sales is explained by the regression equation or the change in advertising, and the remaining 30 percent is accounted for by something other than advertising, such as price and income."

The coefficient of determination is computed as

$$R^2 = 1 - \frac{\Sigma(Y - Y')^2}{\Sigma(Y - \overline{Y})^2}$$

In a simple regression situation, however, there is a short-cut method available:

$$R^2 = \frac{[n\Sigma XY - (\Sigma X)(\Sigma Y)]^2}{\left[n\Sigma X^2 - (\Sigma Y)^2\right]\left[n\Sigma Y^2 - (\Sigma Y)^2\right]}$$

Comparing this formula with the one for b, we see that the only additional information we need to compute R^2 is ΣY^2.

Example 4

To illustrate the computations of various regression statistics, we will refer to the data in Exhibit 16.2.

Using the shortcut method for R^2,

$$R^2 = \frac{(1.818)^2}{(3,228)\left[(12)(4,359) - (225)^2\right]} = \frac{3.305,124}{(3,228)(52,308 - 50,625)}$$

$$= \frac{3.305,124}{(3,228)(1,683)} = \frac{3.305,124}{5,432,724} = 0.6084 = 60.84\%$$

This means that about 60.84 percent of the total variation in sales is explained by advertising, and the remaining 39.16 percent is still unexplained. A relatively low R^2 indicates that there is a lot of room for improvement in our estimated forecasting formula ($Y' = \$10.5836 + \$0.5632X$). Price or a combination of advertising and price might improve R^2.

Standard Error of the Estimate (S_e) and Prediction Confidence Interval

The standard error of the estimate, designated S_e, is defined as the standard deviation of the regression. It is computed as:

$$S_e = \sqrt{\frac{\Sigma(Y - Y')^2}{n - 2}} = \sqrt{\frac{\Sigma Y^2 - a\Sigma Y - b\Sigma XY}{n - 2}}$$

This statistic can be used to gain some idea of the accuracy of our predictions.

Example 5

Going back to our example data, S_e is calculated as:

$$S_e = \sqrt{\frac{4,359 - (10.5836)(225) - (0.5632)(3.414)}{12 - 2}}$$

$$= \sqrt{\frac{54.9252}{10}} = 2.3436$$

Suppose you wish to make a prediction regarding an individual Y value—such as a prediction about the sales when an advertising expense = $10. Usually, we would like to have some objective measure of the confidence we can place in our prediction. One such measure is a *confidence (or prediction) interval* constructed for Y.

A confidence interval for a predicted Y, *given a value for* X, can be constructed in this manner:

$$Y' \pm t\,S_e \sqrt{1 + \frac{1}{n} + \frac{(X_p - \overline{X})^2}{\Sigma X^2 - \frac{(\Sigma x)^2}{n}}}$$

where Y' = the predicted value of Y given a value for X
X_p = the value of an independent variable used as the basis for prediction

Note: The critical value for the level of significance employed is t. For example, for a significance level of 0.025 (which is equivalent to a 95 percent confidence level in a two-tailed test), the critical value of t for 10 degrees of freedom is 2.228 (see Table AII.1 in Appendix II). As can be seen, the confidence interval is the linear distance bounded by limits on either side of the prediction.

Example 6

To have a 95 percent confidence interval of the prediction, the range for the prediction, given an advertising expense of $10, would be between $10,595.10 and $21,836.10, determined in this way. (Note that from Example 2, Y' = $16.2156.) The confidence interval is therefore established as:

$$\$16.2156 \pm (2.228)(2.3436)\sqrt{1 + \frac{1}{12} + \frac{(10 - 14.5)^2}{2792 - (174)^2/12}}$$

$$= \$16.2156 \pm (2.228)(2.3436)(1.0764)$$
$$= \$16.2156 \pm 5.6205$$

which means the range for the prediction, given an advertising expense of $10, would be between $10.5951 and $21.8361. Note that $10.5951 = $16.2156 – 5.6205 and $21.8361 = $16.2156 + 5.6205.

Standard Error of the Regression Coefficient (S_b) and t-Statistic

The standard error of the regression coefficient, designated S_b, and the t-statistic are closely related. S_b is calculated as:

$$S_b = \frac{S_e}{\sqrt{\Sigma(X - \overline{X})^2}}$$

or in short-cut form

$$S_b = \frac{S_e}{\sqrt{\Sigma(X - \overline{X})^2}}$$

S_b gives an estimate of the range where the true coefficient will actually fall.

A definition of t-statistics (or t-value) is that it is a measure of the statistical significance of an independent variable X in explaining the dependent variable Y. It is determined by dividing the estimated regression coefficient b by its standard error S_b. It is then compared with the table t-value. (See Table AII.1 in Appendix II)

Thus, the t-statistic measures how many standard errors the coefficient is away from zero. Rule of thumb: Any t-value greater than +2 or less than –2 is acceptable. The higher the t-value, the greater the confidence we have in the coefficient as a predictor. Low t-values are indications of low reliability of the predictive power of that coefficient.

Example 7

The S_b for our example is:

$$S_b = \frac{2.3436}{\sqrt{2,792 - (14.5)(174)}}$$

$$= \frac{2.3436}{\sqrt{2,792 - 2,523}} = \frac{2.3436}{\sqrt{269}} = .143$$

$$\text{Thus, t-statistic} = \frac{b}{S_b} = \frac{.5632}{.143} = 3.94$$

Since $t = 3.94 > 2$, we conclude that the b coefficient is statistically significant. As was indicated previously, the table's critical value (cut-off value) for 10 degrees of freedom is 2.228 (from Table AII.1 in Appendix II).

Note:

- The t-statistic is more relevant to multiple regressions that have more than one b.
- R^2 tells how good the forest (overall fit) is while the t-statistic tells how good an individual tree (an independent variable) is.

Note: In summary, the table t value, based on a degree of freedom and a level of significance, is used:

- To set the prediction range—upper and lower limits—for the predicted value of the dependent variable
- To set the confidence range for regression coefficients
- As a cutoff value for the t-test

Using Regression on Excel

Spreadsheet programs such as Excel have an easy-to-use regression routine.

To utilize Excel for regression analysis, three steps need to be followed:

1. Click the *Tools* menu.
2. Click *Add-Ins.*
3. Click *Analysis ToolPak.* (If *Analysis ToolPak* is not listed as an available add-in, exit Excel, double-click the MS Excel setup icon, click *Add/Remove,* double-click *Add-ins,* and select *Analysis ToolPak.* Then restart Excel and repeat the above instruction.)

After ensuring that the *Analysis ToolPak* is available, access the regression tool by completing these three steps:

1. Click the *Tools* menu.
2. Click *Data Analysis.*
3. Click *Regression.*

Exhibit 16.4 captures the regression input dialog screen.

Exhibit 16.4

Excel Regression Input Dialog Screen

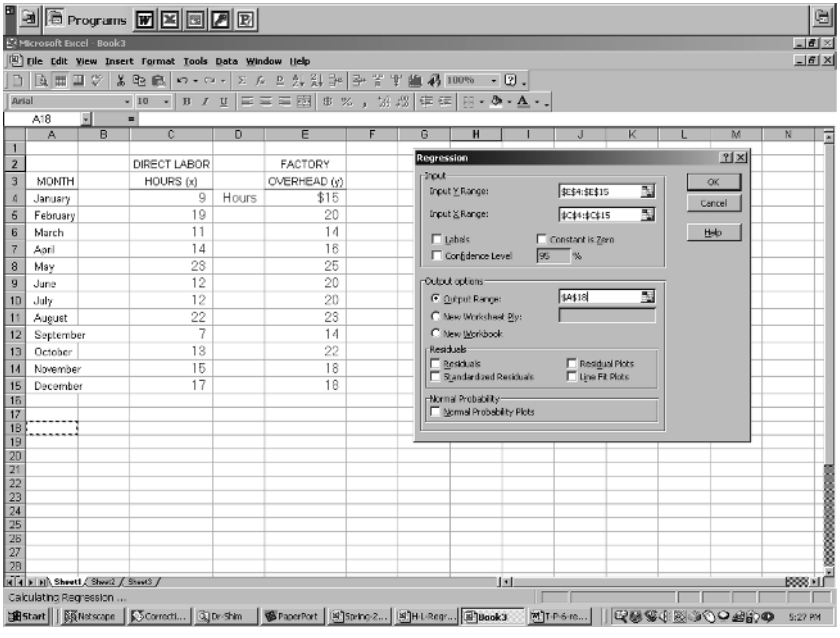


Exhibit 16.5

Excel Regression Output

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.7800
R-Squared	0.6084
Adjusted R-Squared	0.5692
Standard Error	2.3436
Observations	12

ANOVA

	df	SS	MS	F	Significance F
Regression	1	85.3243	85.3243	15.5345	0.0028
Residual	10	54.9257	5.4926		
Total	11	140.25			

	Coefficients	Standard Error	t Stat	P-value*	Lower 95%	Upper 95%
Intercept	10.583643	2.1796	4.8558	0.0007	5.7272	15.4401
DLH	0.563197	0.1429	3.9414	0.0028	0.2448	0.8816

*The P-value for X variable = .0028 indicates that we have a 0.28 percent chance that the true value of the variable coefficient is equal to 0, implying a high level of accuracy about the estimated value of 0.563197.

Exhibit 16.5 shows an Excel regression output that contains the statistics discussed so far.

Note: To obtain a scattergraph, use Excel's Chart Wizard.

The result shows:

$$Y' = 10.5836 + 0.563197X \text{ (in the form of } Y' = a + bX)$$

with R-squared ($R^2 = 0.608373 = 60.84\%$)

All of the above are the same as the ones manually obtained.

Exhibit 16.6 is the regression output from popular statistical software Minitab.

Exhibit 16.6

Minitab Regression Output

Regression Analysis

```
The regression equation is
FO = 10.6 + 0.563 DLH

Predictor      Coef         Stdev      t-ratio         p
Constant      10.584       2.180         4.86     0.000
DLH            0.5632      0.1429        3.94     0.003

s = 2.344       R-sq = 60.8%      R-sq(adj) = 56.9%

Analysis of Variance

SOURCE       DF           SS            MS         F            p
Regression    1       85.324        85.324     15.53        0.003
Error        10       54.926         5.493
Total        11      140.250
```

Conclusion

Regression analysis is the examination of the effect of a change in independent variables on the dependent variable. It is a popularly used method to forecast sales. This chapter discussed a well known estimation technique, called the least-squares method.

To illustrate the method, we assumed a simple regression, which involves one independent variable in the form of $Y = a + bX$. In an attempt to obtain a good fit, we discussed various regression statistics. These statistics tell how good and reliable the estimated equation is and help users set the confidence interval for their prediction.

Most important, we discussed how to utilize spreadsheet programs such as Excel to perform regressions, step by step. The program calculates not only the regression equation, but also all the regression statistics discussed in this chapter.

17

Cash Budgeting and Forecasting Cash Flow:

Two Pragmatic Methods

A forecast of cash collections and potential write-offs of accounts receivable is essential in cash budgeting and in judging the appropriateness of current credit and discount policies. The critical step in making such a forecast is estimating the cash collection and bad debt percentages to be applied to sales or accounts receivable balances. This chapter discusses two pragmatic methods of estimating cash collection rates (or payment proportions) and illustrates how these rates are used for cash budgeting purposes.

The first approach involves a simple average. The second, empirically tested and improved by the author, offers a more pragmatic method of estimating collection and bad debt percentages by relating credit sales and collection data. This method employs regression analysis. By using these approaches, a manager should be able to

- Estimate future cash collections from customers
- Establish an allowance for bad debts
- Provide a valuable insight into better methods of managing accounts receivable

Account Analysis

The most straightforward way to estimate collection percentages is to compute the percentages of collections realized from past months. Once the experience has been analyzed, the results can be adjusted for trends and applied to the credit sales portrayed in the sales forecast. An example illustrates the technique.

Example 1

Assume that an analysis of collection experience for August sales revealed these collection data:

Description	% of Total Credit Sales
Collected in August	2.3
September	80.2
October	9.9
November	5.1
December	.5
Cash discounts	1.0
Bad debt losses	1.0
Total	100.0

If next year's sales in August could be expected to fall into the same pattern, then application of the percentages to estimated August credit sales would determine the probable monthly distribution of collections. The same analysis applied to each month of the year would result in a reasonably reliable basis for collection forecasting. The worksheet (August column) for cash collections might look like this:

Month of Sale	% Total	Description Sales Net	August Collection
April	5	$168,000	$840
May	4.2	192,000	8,064
June	8.9	311,100	27,688
July	82.1	325,600	267,318
August	2.3	340,000	7,820
Total Collections			$311,730
Cash Discounts (July)	1.0	325,600	(3,256)
Losses	1.0	340,000	(3,400)
Total			$305,074

Regression Approach

A more scientific approach to estimating cash collection percentages (or payment proportions) is to utilize regression analysis. We know that there is typically a time lag between the point of a credit sale and realization of cash. More specifically, the lagged effect of credit sales and cash inflows is distributed over a number of periods in this way:

$$C_t = b_1S_{t-1} + b_2S_{t-2} + ..b_iS_{t-i}$$

where C_t = cash collection in month t
S_t = credit sales made in period t
$b_1, b_2, ...b_i$ = collection percentages (the same as P'_i
i = number of periods lagged

By using the regression method discussed in Chapter 16, we will be able to estimate these collection rates. We can utilize Regression of Excel or special regression packages such as SAS, Minitab and SPSS.

It should be noted that the cash collection percentages, (b_1,b_2, . . . b_i) may not add up to 100 percent because of the possibility of bad debts. Once we estimate these percentages by using the regression method, we should be able to compute the bad debt percentage with no difficulty.

Exhibit 17.1 shows the regression results using actual monthly data on credit sales and cash inflows for a real company. Equation I can be written:

$$C_t = 60.6\%(S_{t-1}) + 24.3\%(S_{t-2}) + 8.8\%(S_{t-3})$$

This result indicates that the receivables generated by the credit sales are collected at these rates: first month after sale, 60.6 percent; second month after sale, 24.3 percent; and third month after sale, 8.8 percent. The bad debt percentage is computed as 6.3 percent (100 – 93.7%).

It is important to note, however, that these collection and bad debt percentages are probabilistic variables, that is, variables whose values cannot be known with precision. However, the standard error of the regression coefficient and the t-value permit us to assess the probability that the true percentage is between specified limits. The confidence interval takes this form:

$b \pm t\, S_b$
where S_b = standard error of the coeffieient

Exhibit 17.1

Regression Results for Cash Collection (C_t)

Independent Variables	Equation I	Equation II
S_{t-1}	0.606[a]	0.596[a]
	(0.062)[b]	(0.097)
S_{t-2}	0.243[a]	0.142
	(0.085)	(0.120)
S_{t-3}	0.088	0.043
	(0.157)	(0.191)
S_{t-4}		0.136
		(0.800)
R^2	0.754	0.753
Standard Error of the estimate (S_e)	11.63	16.05
Number of monthly observations	21	20
Bad debt percentages	0.063	0.083

[a]Statistically significant at the 5% significance level.
[b]This figure in the parentheses is the standard error of the e estimate for the coefficient (S_b).

Example 2

To illustrate, assuming t = 2 as rule of thumb at the 95 percent confidence level, the true collection percentage from the prior month's sales will be

$$60.6\% \pm 2(6.2\%) = 60.6\% \pm 12.4\%$$

Turning to the estimation of cash collections and allowance for doubtful accounts, these values are used for illustrative purposes:

$$S_{t-1} = \$77.6, S_{t-2} = \$58.5, S_{t-3} = \$76.4, \text{ and forecast average monthly net credit sales} = \$75.2$$

Then the forecast cash collection for period t would be

If the manager wants to be 95 percent confident about this forecast value, then the interval would be set as:

$$C_t \pm tS_e$$
where S_e = standard error of the estimate

To illustrate, using t = 2 as a rule of thumb at the 95 percent confidence level, the true value for cash collections in period t will be

$$\$65.04 \pm 2(11.63) = \$65.04 \pm 23.26$$

The estimated allowance for uncollectible accounts for period t will be

$$6.3\% \ (\$75.2) = \$4.74$$

By using the limits discussed so far, managers can develop flexible (or probabilistic) cash budgets, where the lower and upper limits can be interpreted as pessimistic and optimistic outcomes. They also can simulate a cash budget in an attempt to determine both the expected change in cash collections for each period and the variation in this value.

In preparing a conventional cash inflow budget, the manager considers the various sources of cash, including cash on account, sale of assets, and incurrence of debt. Cash collections from customers are emphasized, since that is the greatest problem in this type of budget.

Example 3

These data are given for Erich Stores:

	September Actual	October Actual	November Estimated	December Estimated
Cash sales	$ 7,000	$ 6,000	$ 8,000	$ 6,000
Credit sales	50,000	48,000	62,000	80,000
Total sales	$57,000	$54,000	$70,000	$86,000

Past experience indicates net collections normally occur in this pattern:

- No collections are made in the month of sale.
- 80 percent of the sales of any month are collected in the following month.
- 19 percent of sales are collected in the second following month.
- 1 percent of sales are uncollectible.

We can project total cash receipts for November and December:

	November	December
Cash receipts		
Cash sales	$ 8,000	$ 6,000
Cash collections		
September sales		
50,000 (19%)	9,500	
October sales		
48,000 (80%)	38,400	
48,000 (19%)		9,120
November sales		
62,000 (80%)	———	49,600
Total cash receipts	$55,900	$64,720

Example 4

The manager of John Loyde Co. plans for the company to have a cash balance of $91,000 on March 1. Sales during March are estimated at $900,000. February sales amounted to $600,000 and January sales amounted to $500,000. Cash payments for March have been budgeted at $580,000. Cash collections have been estimated as:

- 60 percent of the sales for the month are to be collected during the month.
- 30 percent of the sales for the preceding month are to be collected during the month.
- 8 percent of the sales for the second preceding month are to be collected during the month.

The manager plans to accelerate collections by allowing a 2 percent discount for prompt payment. With the discount policy, she expects to collect 70 percent of the current sales and will permit the discount reduction on these collections. Sales of the preceding month will be collected to the extent of 15 percent with no discount allowed, and 10 percent of the sales of the second preceding month will be collected with no discount allowed.

This pattern of collection can be expected in subsequent months. During the transitional month of March, collections may run somewhat higher. However, the manager prefers to estimate collections on the basis of the new pattern so that the estimates will be somewhat conservative. She has to make two estimates:

1. Estimate cash collections for March and the cash balance at March 31 under the present policy.
2. Estimate cash collections for March and the cash balance at March 31 according to the new policy of allowing discounts.

Then she must decide whether the discount policy is desirable.

(1) and (2)

	Under the Present Policy	Under the Discount Policy
Balance, March 1	$ 91,000	$ 91,000
Collections		
From March sales	540,000 ($900,000 × 60%)	617,400*
From February sales	180,000 ($600,000 × 30%)	90,000 ($600,000 × 15%)
From January sales	40,000 ($500,000 × 8%)	50,000 ($500,000 × 10%)
Total cash available	$851,000	$848,400
Less disbursements	580,000	580,000
Balance, March 31	$271,000	$268,400

*$900,000 × 70% × 98% = $617,400

The discount policy is not desirable because under it the March 31 cash balance will be smaller, as indicated ($268,400 as compared to $271,000 under the present policy).

Cash Budget

The budget preparation process normally begins with the sales budget and continues through the preparation of pro forma financial statements. The last schedule prepared before the financial statements is the cash budget. The cash budget is a schedule of estimated cash collections and payments. The various operating budgets and the capital budget are inputs to the cash budgeting process.

The cash budget is prepared for the purpose of cash planning and control. It presents the expected cash inflow and outflow for a designated time period. The cash budget helps management keep cash balances in reasonable relationship to its needs. It aids in avoiding unnecessary idle cash and possible cash shortages.

The cash budget presents the amount and timing of the expected cash inflow and outflow for a designated time period. It is a tool for cash planning and control and should be detailed so that managers know how much is needed to run their business. If cash flows can be estimated reliably cash balances can be retained near a target level with fewer transactions.

The cash budget should be prepared for the shortest time period for which reliable financial information can be obtained. In the case of many small businesses, this may be one week. However, predicting major cash receipts and cash payments for a specific day is also possible.

The cash budget helps management keep cash balances in a reasonable relationship to needs. It aids in avoiding having unnecessary idle cash as well as avert-

ing possible cash shortages. If there is idle cash, the excess funds can be invested in short-term securities, such as U.S. Treasury bills and commercial paper, to earn a return; if the budget reveals a cash shortage, money can be borrowed, expenditures cut, or assets sold. The cash budget ensures that users will have sufficient cash funds available to the business at all times.

The cash budget also allows for review of future cash receipts and cash payments to uncover possible *patterns of cash flows.* In this way, collection and disbursement efforts can be studied to ascertain if net cash flows are being maximized. In addition, the cash budget reveals when and how much to borrow and when users will be able to pay the money back. For example, if a cash budget indicates that a significant cash outlay will be needed to buy assets (e.g., store equipment), the user may have to borrow money and determine a debt repayment schedule. In order to obtain a line of credit, lenders typically require borrowers to submit the cash budget along with financial statements.

The cash budget typically consists of four major sections:

1. The *cash receipts* section, which is cash collections from customers and other cash receipts, such as royalty income and investment income
2. The *cash disbursements* section, which comprises all cash payments made by purpose
3. The *cash surplus* or *deficit* section, which simply shows the difference between the total cash available and the total cash needed including a *minimum cash balance* if required. If there is surplus cash, loans may be repaid or temporary investments made.
4. The *financing* section, which provides a detailed account of the borrowings, repayments, and interest payments expected during the budgeting period

Cash budgets often are prepared monthly, but there are no strict rules for determining the length of the budget period. As a general rule, it should be long enough to show the effect of policies in running the small business, yet short enough so that estimates can be made with reasonable accuracy. Exhibit 17.2 shows the major components of a cash budget.

The basis for estimating cash receipts is *sales,* whether from cash sales or collections from customer balances. An incorrect sales estimate will result in erroneous cash estimates. The sales predictions also influence the projected cash outlays for manufacturing costs, because production is tied to sales. The projection of operating expenses may be tied to the suppliers' payment terms.

Exhibit 17.3 presents a monthly cash budget.

Cash Variance Analysis

Comparing estimated and actual cash figures allows managers to investigate the reasons for any significant discrepancies and to take any needed corrective action. *Variance analysis* allows managers to get a better picture of the cash position and

Exhibit 17.2

Major Cash Flow Components of a Cash Budget

Cash Inflows	Cash Outflows
Operating:	**Operating:**
Cash sales	Payroll
Collections	Inventory purchases
	Insurance
	Payments to suppliers
Nonoperating:	**Nonoperating:**
Royalties	Capital expenditures
Rents	Interest
Investments income	Loan repayments
Sale of marketable securities	Tax payments
Loan proceeds	Purchase of marketable securities

provides insight in improving cash estimates in the next budgeting period. It also aids in the periodic revision of projections. This updating typically occurs at the beginning of each budget segment (e.g., the first day of a quarter, assuming a quarterly budgeting period, or the first day of a month, assuming a monthly budgeting period). Budgets should be adjusted immediately for significant changes.

Exhibit 17.4 presents an analysis of cash budget variances.

Example 5

Exhibit 17.5 is a sample printout of a cash budget generated from Up Your Cash Flow (to be explained later in the chapter).

Cash Flow Software

Computer software allows for day-to-day cash management, forecasting and budgeting cash flows, determining cash balances, planning and analyzing cash flows, finding cash shortages, investing cash surpluses, accounting for cash transactions, automating accounts receivable and payable, and dial-up banking.

Computerization improves availability, accuracy, timeliness, and monitoring of cash information at minimal cost. Daily cash information aids in planning how to use cash balances. It enables the integration of different kinds of related cash information, such as collections on customer accounts and cash balances, and the effect of cash payments on cash balances.

Exhibit 17.3

Monthly Cash Budget

		December (actual)	November (actual)	October (actual)	January	February	March	April	May	June
Expected Sales		$510,000	$457,500	$375,000	$410,000	$385,000	$580,000	$600,000	$600,000	$625,000
Cash receipts:										
Cash sales	10%				41,000	38,500	58,000	60,000	60,000	62,500
Collection from sales:										
One month ago	75%				382,500	343,125	281,250	307,500	288,750	435,000
Two months ago	15%				68,625	56,250	61,500	57,750	87,000	90,000
Three months ago	8%				30,000	32,800	30,800	46,400	48,000	48,000
Bad debts	2%									
	100%				522,125	470,675	431,550	471,650	483,750	635,500
Other cash receipts					11,000	7,600	18,500	12,000	16,500	8,100
Beginning of month cash					80,000	29,125	4,000	17,350	38,600	17,350
Total available cash					613,125	507,400	454,050	501,000	538,850	660,950
Cash disbursements:										
Material					138,000	145,000	150,000	125,000	140,000	150,000
Labor and wages					182,000	110,000	169,000	105,000	150,000	172,000
Selling costs					175,000	169,000	181,000	168,500	177,000	165,000
General and administrative costs					46,000	49,500	48,000	47,000	47,000	43,000
Income taxes						28,500			28,500	
Capital equipment					28,000	5,200	21,200		13,000	4,800
Interest expense					15,000	16,200	17,500	16,900	16,000	14,300
Total cash disbursements					584,000	523,400	586,700	462,400	571,500	549,100
Ending cash balance (deficiency) before additional borrowing/(repayments) or (investments) redemptions					29,125	(16,000)	(132,650)	38,600	(32,650)	111,850
Bank borrowings/(repayments) (Investments)/redemptions						20,000	150,000	–	50,000	(100,000)
Ending cash balance					$ 29,125	$ 4,000	$ 17,350	$ 38,600	$ 17,350	$ 11,850

Exhibit 17.4

Cash Budget Variance Analysis

	Previous Week		Year to Date	
	Budget	**Actual**	**Budget**	**Actual**
Cash receipts				
Collection from customers	$111,000	$109,000	$ 990,000	$ 979,000
Investment income	$ 2,400	$ 2,500	$ 33,000	$ 32,500
Royalty	$ 3,000	$ 3,000	$ 60,000	$ 60,000
Total cash receipts	$116,400	$114,500	$1,083,000	$1,071,500
Cash disbursements				
Material purchases	$ 26,300	$ 18,410	$ 176,000	$ 226,000
Payroll	27,500	29,000	400,000	412,800
Property taxes	5,500	5,540	5,500	5,500
Group insurance premium	13,000	13,200	39,000	39,600
Bank note-interest	4,320	4,320	15,000	12,960
Lease payment-building	5,475	5,475	16,425	16,425
Dividend payment	1,232	1,232	3,696	3,696
Rent	6,897	6,897	20,691	20,691
Total disbursements	63,924	65,664	500,312	511,672
Net increase (decrease) in cash	$ 47,076	$ 43,336	$ 489,688	$ 467,328

Spreadsheet program software such as Lotus® 1-2-3, Microsoft's Excel, and Quattro Pro can assist in developing cash budgets and answering a variety of "what-if" questions. For example, users can see the effect on cash flow from different scenarios (e.g., the purchase and sale of different product lines).

There are computer software packages specially designed for cash budgeting and management.

For example, Up Your Cash Flow XT (www.upyourcashflow.com/) creates financial forecasts for small to midsize businesses quickly and easily. Accountants and consultants use this powerful software to provide management advice, secure financing, assist troubled businesses and offer other valuable services. Chief financial officers, controllers, and financial managers use Up Your Cash Flow XT to make fast company budgets, manage cash flow, and reach desired levels of profitability. Over 30 reports show the impact of sales, expenses, cost of sales, financing, payroll, inventory, and more—in as much detail as desired. Users can run unlimited "what-if" scenarios to see how changes in business activity affect the bottom line, compare plan to actual data to measure how close they have come to goals, and predict any cash shortfalls before they happen.

Exhibit 17.5

Your Company, Inc. Cash Collection on the Year

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Sales	$129,030	$129,030	$129,030	$129,030	$192,610	$192,610	$162,690	$129,030	$192,610	$129,030	$162,690	$192,610	$1,870,000
Previous Months December Previous Years	20,000	10,000											30,000
Collection Current Year													
Jan. 129,030 × 45;40;15	58,063	51,612	19,335										129,030
Feb. 129,030 × 45;40;15		58,063	51,612	19,335									129,030
Mar. 129,030 × 45;40;15			58,063	51,612	19,335								129,030
Apr. 129,030 × 45;40;15				58,063	51,612	19,335							129,030
May 192,610 × 45;40;15					86,675	77,044	28,891						192,610
June 192,610 × 45;40;15						86,675	77,044	28,891					192,610
July 162,690 × 45;40;15							73,210	65,076	24,404				162,690
Aug. 129,030 × 45;40;15								58,063	51,612	19,335			129,030
Sep. 192,610 × 45;40;15									86,675	77,044	28,891		192,610
Oct. 129,610 × 45;40;15										58,063	51,612	19,335	129,030
Nov. 162,690 × 45;40;15											73,210	65,076	138,286
Dec. 192,610 × 45;40;15												86,674	86,674
Total Collections	78,063	119,675	129,030	129,030	157,642	183,074	179,145	152,030	162,691	154,462	153,713	171,105	1,769,660

The assumption used for cash collection is that:
45% of the month's sales are collected in the month the sale is made.
40% of the sale is collected in the 1st month following the sale.
15% is collected in the 2nd month following the sale—in other words, 45;40;15.

Conclusion

Two methods of estimating the expected collectible and uncollectible patterns of customer accounts were presented. The regression approach is relatively inexpensive to use because all it requires is data on cash collections and credit sales. Furthermore, credit sales values are all predetermined. Because previous months' credit sales are used to forecast cash collections, there is no need to forecast credit sales. The model allows users to make all kinds of statistical inferences about the cash collection percentages and forecast values.

The chapter also illustrated how collection rates are used for cash budgeting purposes and how the cash budget is constructed.

18

Financial Modeling:
Tools for Budgeting and Profit Planning

Many companies are increasingly using financial modeling to develop their budgets. This chapter discusses:

- What is a financial model?
- What are some typical uses of financial models?
- What are the types of financial modeling?
- How widespread is the use of financial modeling in practice?
- How do we go about building a financial model?

Chapter 19 describes the use of spreadsheets and financial modeling languages for financial modeling.

A Financial Model

A financial model, narrowly called a budgeting model, is a system of mathematical equations, logic, and data that describes the relationships among financial and operating variables. A financial model can be viewed as a subset of broadly defined corporate planning models or a stand-alone functional system that attempts to answer a certain financial planning problem.

A financial model is one in which:

- One or more financial variables appears (expenses, revenues, investment, cash flow, taxes, and earnings).
- The model user can manipulate (set and alter) the value of one or more financial variables.

- The purpose of the model is to influence strategic decisions by revealing to the decision maker the implications of alternative values of these financial variables.

Exhibit 18.1 shows a flowchart of a simplified financial planning model.

Financial models fall into two types: simulation, better known as "what-if" models, and optimization models. "What-if" models attempt to simulate the effects of alternative management policies and assumptions about the firm's external environment. They are basically a tool for management's laboratory.

Optimization models are ones in which the goal is to maximize or minimize an objective such as present value of profit or cost. Experiments are being made on multiobjective techniques, such as goal programming.

Models can be deterministic or probabilistic. Deterministic models do not include any random or probabilistic variables, whereas probabilistic models incorporate random numbers and/or one or more probability distributions for variables such as sales and costs.

Financial models can be solved and manipulated computationally to derive from them the current and projected future implications and consequences. Due to technological advances in computers (i.e., spreadsheets, financial modeling languages, graphics, database management systems, and networking), more companies are using modeling.

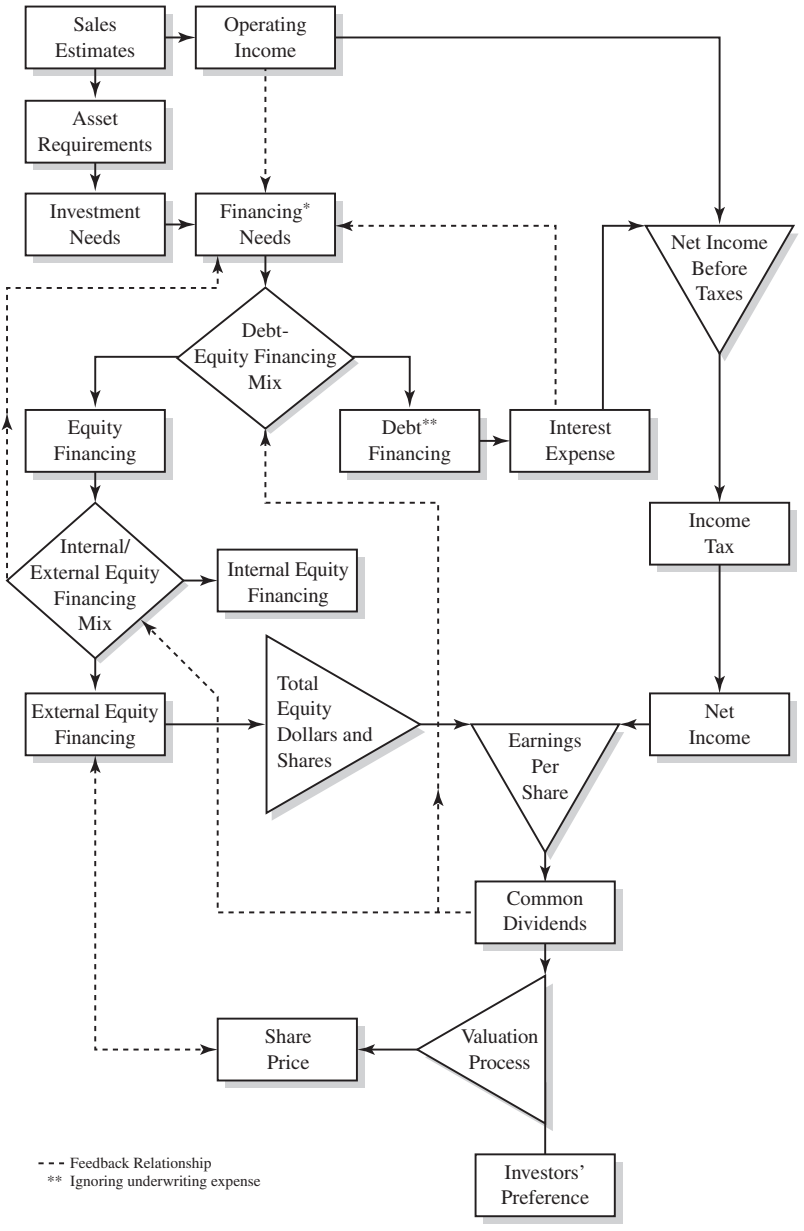
Budgeting and Financial Modeling

Basically, a financial model is used to build a comprehensive budget (i.e., projected financial statements, such as the income statement, balance sheet, and cash flow statement). Such a model can be called a budgeting model, since we are essentially developing a master budget with it. Applications and uses of the model, however, go beyond developing a budget. They include:

- Financial forecasting and analysis
- Capital expenditure analysis
- Tax planning
- Exchange rate analysis
- Analysis for mergers and acquisitions
- Labor contract negotiations
- Capacity planning
- Cost-volume-profit analysis
- New venture analysis
- Lease/purchase evaluation
- Appraisal of performance by segments
- Market analysis
- New product analysis

Exhibit 18.1

Flowchart of a Simplified Financial Planning Model



Source: Thomas Naylor, ed., *Simulation in Business Planning and Decision Making* (La Jolla, CA: Society for Computer Simulation, 1981), p. 91.

- Development of long-term strategy
- Planning financial requirements
- Risk analysis
- Cash flow analysis
- Cost and price projections

Use of Financial Modeling in Practice

The use of financial modeling, especially a computer-based financial modeling system, is in wide use. The simple reason is the growing need for improved and quicker support as a management decision support system (DSS) and wide and easy availability of computer hardware and software.

Some of the functions currently served by financial models, as described by the users, are:

- Projecting financial results under any given set of assumptions, evaluating the financial impact of various assumptions and alternative strategies, and preparing long-range forecasts
- Computing income, cash flow, and ratios for five years by months, as well as energy sales, revenue, power generation requirements, operating and manufacturing expenses, manual or automatic financing, and rate structure analysis
- Providing answers and insights into financial "what-if" questions and providing scheduling information, such as production planning
- Forecasting the balance sheet and income statement with emphasis on alternatives for the investment securities portfolio
- Projecting operating results and various financing needs, such as plant and property levels and financing requirements
- Computing manufacturing profit, any desired processing sequence through the manufacturing facilities, and simulating effect on profits of inventory policies
- Generating profitability reports of various responsibility centers
- Projecting financial implications of capital investment programs
- Showing the effect of various volume and activity levels on budget and cash flow
- Forecasting corporate sales, costs, and income by division and by month
- Providing sales revenue for budget, a basis for evaluating actual sales department performance, and other statistical comparisons
- Determining pro forma cash flow for alternative development plans for real estate projects
- Analyzing the impact of an acquisition on company earnings
- Determining economic attractiveness of new ventures, such as products, facilities, and acquisitions
- Evaluating alternatives of leasing or buying computer equipment
- Determining corporate taxes as a function of changes in price

- Evaluating investments in additional capacity at each major refinery
- Generating income statements, cash flow, present value, and discounted rate of return for potential mining ventures, based on production and sales forecasts

Supported by the expanded capabilities provided by models, many companies are increasingly successful in including long-term strategic considerations in their business plans, thus enabling them to investigate the possible impact of current decisions on the long-term welfare of the organization.

Developing Financial Models

Development of financial models essentially involves definition of variables, input parameter values, and model specification. As far as model specification goes, we will concentrate only on the simulation-type model specification in this section.

Generally speaking, the model consists of three important ingredients:

1. Variables
2. Input parameter values
3. Definitional and/or functional relationships

Definition of Variables

Fundamental to the specification of a financial model is the definition of the variables to be included. Basically, the three types of variables are policy variables (Z), external variables (X), and performance variables (Y).

Policy variables (often called control variables) are those over which management can exert some degree of control. Examples of financial variables are cash management, working capital, debt management, depreciation, tax, merger-acquisition decisions, the rate and direction of the firm's capital investment programs, the extent of its equity and external debt financing and the financial leverage represented thereby, and the size of its cash balances and liquid asset position.

Policy variables are denoted by the symbol Z in Exhibit 18.2.

External variables are the environmental variables that are external to the company and that influence the firm's decisions from outside. Generally speaking, the firm is embedded in an industry environment. This environment, in turn, is influenced by overall general business conditions.

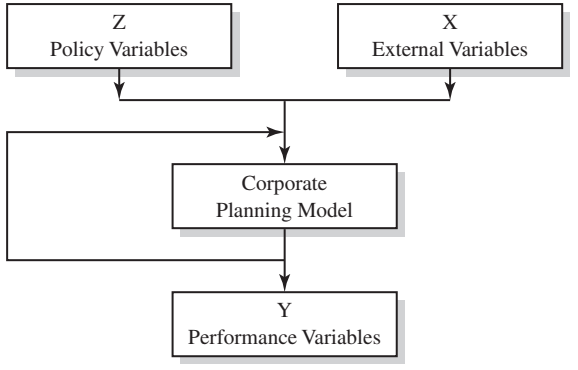
General business conditions exert influences on particular industries in several ways. Total volume of demand, product prices, labor costs, material costs, money rates, and general expectations are among the industry variables affected by the general business conditions.

The symbol X represents the external variables in Exhibit 18.2.

Performance variables, which measure the firm's economic and financial performance, usually are produced internally. We use the symbol Y in the exhibit. The Y's often are called output variables. The output variables of a financial

Exhibit 18.2

Flowchart of Variables in a Corporate Model



model would be the line items of the balance sheet, cash budget, income statement, or statement of cash flows.

How the output variables of the firm are defined will depend on the goals and objectives of management. They basically indicate how management measures the performance of the organization or some segments of it. Management is likely to be concerned with the firm's level of earnings, growth in earnings, projected earnings, growth in sales, and cash flow.

Frequently, when we attempt to set up a financial model, we face risk or uncertainty associated with particular projections. In a case such as this, we treat some of these variables, such as sales, as random variables with given probability distributions. The inclusion of random variables in the model transforms it from a deterministic model to a risk analysis model. However, the use of the risk analysis model in practice is rare because of the difficulty involved in modeling and computation.

Input Parameter Values

The model includes various input parameter values. For example, in order to generate the balance sheet, the model needs to input beginning balances of various asset, liability, and equity accounts. These input and parameter values are supplied by management. The ratio between accounts receivable and financial decision variables, such as the maximum desired debt-equity ratio, would be good examples of parameters.

Model Specification

Once we define various variables and input parameters for our financial model, we must then specify a set of mathematical and logical relationships linking the input

variables to the performance variables. The relationships usually involve either definitional equations or behavioral equations.

Definitional equations take the form of accounting identities. Behavioral equations involve theories or hypotheses about the behavior of certain economic and financial events. They must be tested and validated before they are incorporated into the financial model.

Definitional Equations Definitional equations are exactly what the term implies—mathematical or accounting definitions. For example:

$$\text{Assets} = \text{Liabilities} + \text{Equity}$$
$$\text{Net Income} = \text{Revenues} - \text{Expenses}$$

These definitional equations are fundamental definitions in accounting for the balance sheet and income statement, respectively.

Another example is:

$$\text{CASH} = \text{CASH}(-1) + \text{CC} + \text{OCR} + \text{DEBT} - \text{CD} - \text{LP}$$

This equation is a typical cash equation in a financial model. It states that ending cash balance (CASH) is equal to the beginning cash balance (CASH(–1)) plus cash collections from customers (CC) plus other cash receipts (OCR) plus borrowings (DEBT) minus cash disbursements (CD) minus loan payments (LP).

Another example is:

$$\text{INV} = \text{INV}(-1) + \text{MAT} + \text{DL} + \text{MO} - \text{CGS}$$

This equation states that ending inventory (INV) is equal to the beginning inventory (INV(–1)) plus cost of materials used (MAT) plus cost of direct labor (DL) plus manufacturing overhead (MO) minus the cost of goods sold (CGS).

Behavioral Equations Behavioral equations describe the behavior of the firm regarding the specific activities that are subject to testing and validation. The classical demand function in economics is:

$$Q = f(P) \text{ or more specifically } Q = a - bP$$

It simply says that the quantity demanded is negatively related to the price. That is to say, the higher the price, the lower the demand. However, the firm's sales are more realistically described in this way:

$$\text{SALES} = f(P, \text{ADV.}, I, \text{GNP}, Pc, \text{etc.})$$

or,

assuming linear relationship among these variables, we can specify the model as:

$$\text{SALES} = a + bP + c\text{ADV} + dI + e\text{GNP} + fPc$$

which says that the sales are affected by such factors as price (P), advertising expenditures (ADV), consumer income (I), gross national product (GNP), and prices of competitive goods (Pc).

With the data on SALES, P, ADV, I, GNP, and Pc, we will be able to estimate parameter values a, b, c, d, e, and f, using linear regression. We can test the statistical significance of each of the parameter estimates and evaluate the overall explanatory power of the model, measured by the t-statistic and R-squared, respectively.

This way we will be able to identify the most influential factors that affect the sales of a particular product. With the best model chosen, management can simulate the effects on sales of alternative pricing and advertising strategies. We can also experiment with alternative assumptions regarding the external economic factors such as GNP, consumer income, and prices of competitive goods.

Model Structure A majority of financial models that have been in use are recursive and/or simultaneious models. Recursive models are the ones in which each equation can be solved one at a time by substituting the solution values of the preceding equations into the right hand side of each equation.

An example of a recursive model is:

(1) SALES = A – B*PRICE + C*ADV
(2) REVENUE = SALES*PRICE
(3) CGS = .70*REVENUE
(4) GM = SALES – CGS
(5) OE = ~10,000 + .2*SALES
(6) EBT = GM – OE
(7) TAX = .46*EBT
(8) EAT = EBT – TAX

In this example, the selling price (PRICE) and advertising expenses (ADV) are given. A, B, and C are parameters to be estimated and

SALES = sales volume in units
REVENUE = sales revenue
CGS = cost of goods sold
GM = gross margin
OE = operating expenses
EBT = earnings before taxes
TAX = income taxes
EAT = earnings after taxes

Simultaneous models frequently are found in econometric models that require a higher level of computational methods, such as matrix inversion. An example of a simultaneous model is:

(1) INT = .10*DEBT
(2) EARN = REVENUE – CGS – OE – INT – TAX – DIV
(3) DEBT = DEBT(–1) + BOW
(4) CASH = CASH(–1) + CC + BOW + EARN – CD – LP
(5) BOW = MBAL – CASH

Note that earnings (EARN) in equation (2) is defined as sales revenue minus CGS, OE, interest expense (INT), TAX, and dividend payment (DIV). But INT is a percentage interest rate on total debt in equation (1). Total debt in equation (3) is equal to the previous period's debt (DEBT(–1)) plus new borrowings (BOW). New debt is the difference between a minimum cash balance (MBAL) minus cash. Finally, the ending cash balance in equation (5) is defined as the sum of the beginning balance (CASH(–1)), cash collection, new borrowings and earnings minus cash disbursements and loan payments of the existing debt (LP).

Even though the model presented here is a simple variety, it is still simultaneous in nature, which requires the use of a method capable of solving simultaneous equations. Very few of the financial modeling languages have the capability to solve this kind of system.

Decision Rules In addition to definitional equations and behavioral equations, the financial model may include basic decision rules specified in a very general form. The decision rules are not written in the form of conventional equations. They are described algebraically using conditional operators, consisting of statements of the type: "IF . . . THEN . . . ELSE."

For example, suppose that we wish to express this decision rule: "If X is greater than 0, then Y is set equal to X multiplied by 5. Otherwise, Y is set equal to 0." Then we can express the rule in this way:

$$Y = IF\ X\ GT\ 0\ THEN\ X^{*}5\ ELSE\ 0$$

Suppose the company wishes to develop a financing decision problem based on alternative sales scenarios. To determine an optimal financing alternative, managers might want to incorporate some decision rules into the model for a "what-if" or sensitivity analysis.

Some examples of these decision rules are:

- The amount of dividends paid is determined on the basis of targeted earnings available to common stockholders and a maximum dividend payout ratio specified by management.
- After calculating the external funds needed to meet changes in assets as a result of increased sales, dividends, and maturing debt, the amount of long-term debt to be floated is selected on the basis of a prespecified leverage ratio.
- The amount of equity financing to be raised is chosen on the basis of funds needed that are not financed by new long-term debt, but is constrained by the responsibility to meet minimum dividend payments.

In the model we have just described, simultaneity is quite evident. A sales figure is used to generate earnings, and this in turn leads to, among other items, the level of long-term debt required. Yet the level of debt affects the interest expense incurred within the current period and, therefore, earnings.

Furthermore, as earnings are affected, so are the price at which new shares are issued, the number of shares to be sold, and earnings per share. Earnings per share then feed back into the stock price calculation.

Lagged Model Structure Lagged model structure is common in financial modeling. Virtually all balance sheet equations or identities are of this type. For example:

$$\text{Capital} = \text{capital}(-1) + \text{net income} + \text{contributions} - \text{cash dividends}$$

More interestingly,

$$CC = a^{*}SALES + b^{*}SALES(-1) + C^{*}SALES(-2)$$

where CC = cash collections from customers
a = percent received in the month of sale
b = percent received in the month of following sale
c = percent received in the second month following sale

This indicates that the realization of cash lags behind credit sales. Figure 18.3 illustrates a sample financial (budgeting) model.

Exhibit 18.3

Comprehensive Financial Model

Corporate Financial Model

Balance Sheet Equations

$$\text{Cash}_t = \text{Cash}_{t-1} + \text{Cash receipts}_t - \text{Cash disbursements}_t$$

$$\text{Accounts receivable}_t = (1-a)\,\text{Sales} = (1-b-a)\,\text{Sales}_{t-1} + (1-c-b-a)\,\text{Sales}_{t-2}$$

$$\text{Inventory}_t = \text{Inventory}_{t-1} + \text{Inventory purchase}_t - \text{Variable cost per unit}\left(\frac{\text{Sales}_t}{\text{Selling price per unit}}\right)$$

$$\text{Plant} = \text{Initial Value}$$

$$\text{Accounts payable}_t = (m)\,\text{Variable selling/administrative expenses}_{t-1} + (n)\,\text{Variable selling/administrative expenses}_t + \text{Inventory purchase}_t + \text{Fixed expenses}_t$$

$$\text{Bank loan}_t = \text{Bank loan}_t + \text{Loan}_t - \text{Loan repayment}_t$$

$$\text{Common stock} = \text{Initial value}$$

$$\text{Retained earnings}_t = \text{Retained earnings}_{t-1} + \text{Net income}_t$$

Exhibit 18.3 (*continued*)

Income Statement and Cash Flow Equations

$$\text{Cash receipts}_t = (a)\,\text{Sales}_t + (b)\,\text{Sales}_{t-1} + (c)\,\text{Sales}_{t-2} + \text{Loan}_t$$

$$\text{Cash disbursements}_t = \text{Accounts payable}_{t-1} + \text{Interest}_t + \text{Loan repayments}_t$$

$$\text{Inventory purchase}_t\ [\leq 0] = \text{Variable cost per unit}\left(\frac{\text{Sales}_t + \text{Sales}_{t-1} + \text{Sales}_{t-2} + \text{Sales}_{t-3}}{\text{Selling price per unit}}\right) - \text{Inventory}_{t-1}$$

$$\text{Interest}_t = (i)\,\text{Bank loan}_t$$

$$\text{Variable cost of sales}_t = \text{Sales}_t\left(\frac{\text{Variable cost per unit}}{\text{Selling price per unit}}\right)$$

$$\text{Variable selling}_t\text{ administrative expenses}_t = (x)\,\text{Sales}_t$$

$$\text{Net income before taxes}_t = \text{Sales}_t - \text{Interest}_t + \text{Variable cost of sales}_t + \text{Variable selling/administrative expenses}_t - \text{Fixed expenses}_t - \text{Depreciation}_t$$

$$\text{Tax expense}_t\ (\geq 0) = (r)\,\text{Net income before taxes}_t$$

$$\text{Net income}_t = \text{Net income before taxes}_t - \text{Tax expense}_t$$

Input Variables (Dollars)

$\text{Sales}_{t-1,\ t-2,\ t-3}$
Loan_t
Loan repayment_t
Fixed expense_t
Depreciation_t
Selling price per unit
Variable cost per unit

Input Parameters

Accounts receivable collection patterns
a—Percent received within current period
b—Percent received with one-period lag
c—Percent received with two-period lag
$a + b + c < 1$
Lag in accounts payable cash flow
m—Percent paid from previous period
n—Percent paid from current period
$m + n = 1$
r = Tax rate
i = Interest rate
x = Ratio of variable selling/administrative expense to sales

Exhibit 18.3 (*continued*)

Initial Values (Dollars)
Plant
Common Stock
$Cash_{t-1}$
$Sales_{t-1, t-2}$
$Inventory_{t-1}$
$Retained\ earnings_{t-1}$
$Bank\ loan_{t-1}$
$Variable\ selling/administrative\ expenses_{t-1}$
$Accounts\ payable_{t-1}$

Assumptions: Time interval equals one month; accounts payable paid in full in next period; no lag between inventory purchase and receipt of goods; and no dividends paid.

Conclusion

Budgeting and financial models comprise a functional branch of a general corporate planning model. They are essentially used to generate pro forma financial statements and financial ratios. These are the basic tools for budgeting and profit planning. The financial model is a technique for risk analysis and "what-if" experiments. The model is also needed for day-to-day operational and tactical decisions for immediate planning problems.

Spreadsheet software and computer-based financial modeling software are being widely utilized for budgeting and planning in an effort to speed up the budgeting process and allow budget planners and nonfinancial managers to investigate the effects of changes in budget assumptions and scenarios.

19

Software Packages:

Computer-based Models and Spreadsheet Software

Budgeting, financial forecasting, and planning can utilize a microcomputer with a powerful spreadsheet program, templates, or add-ins. In addition, more and more companies are developing computer-based models for planning and budgeting, with powerful yet easy-to-use modeling languages such as Budget Maestro.

The models not only help build a budget for profit planning but answer a variety of "what-if" scenarios. The resulting calculations provide a basis for choice among alternatives under conditions of uncertainty.

In this chapter, we illustrate how to use the more popular ones, such as Excel and Up Your Cash Flow.

Use of a Spreadsheet Program for Financial Modeling and Budgeting

Spreadsheet programs such as Excel and a stand-alone package such as Up Your Cash Flow can be used to develop a financial model. For illustrative purposes, we present some examples of projecting an income statement.

Projecting an Income Statement

We will show how to develop a projected contribution income statement (in Case 1) and a projected traditional income statement (in Case 2) for two hypothetical firms:

Case 1

Sales for 1st month = $60,000
Cost of sales = 42% of sales, all variable
Operating expenses = $10,000 fixed plus 5% of sales
Taxes = 46% of net income
Sales increase by 5% each month

1. Based on this information, we will create a spreadsheet for the contribution income statement for the next 12 months and in total. This is shown in Exhibit 19.1.
2. We will do the same as above, assuming that sales increase by 10 percent and operating expenses = $10,000 plus 10 percent of sales. This is an example of "what-if" analysis. This is shown in Exhibit 19.2.

Case 2

Delta Gamma Company wishes to prepare a three-year projection of net income, using this information:

1. The 2004 base year amounts are:

Sales revenues	$4,500,000
Cost of sales	2,900,000
Selling and administrative expenses	800,000
Net income before taxes	800,000

2. Use these assumptions:

Sales revenues increase by 6% in 2005, 7% in 2006, and 8% in 2007.
Cost of sales increase by 5% each year.
Selling and administrative expenses increase only 1% in 2005 and will remain at the 2005 level thereafter.
The income tax rate = 46%.

We will develop a spreadsheet for the income statement for the next three years. This is shown in Exhibit 19.3.

Case 3

We will make specific assumptions as shown in Exhibit 19.4 and develop a budget using Up Your Cash Flow, shown in Exhibit 19.5.

Exhibit 19.1

	1	2	3	4	5	6	7	8	9	10	11	12	Total
Sales	$60,000	$63,000	$66,150	$69,548	$72,930	$76,577	$80,406	$84,426	$88,647	$93,080	$97,734	$102,620	$955,028
Less: VC													
Cost of sales	$25,200	$26,460	$27,783	$29,172	$30,361	$32,162	$33,770	$35,459	$37,232	$39,093	$41,048	$ 43,101	$401,112
Op. expenses	$ 3,000	$ 3,150	$ 3,308	$ 3,473	$ 3,647	$ 3,829	$ 4,020	$ 4,221	$ 4,432	$ 4,654	$ 4,887	$ 5,131	$ 47,751
CM	$31,800	$36,540	$38,367	$40,285	$42,300	$44,415	$46,635	$48,967	$51,415	$53,986	$56,686	$ 59,520	$550,916
Less: FC													
Op. Expenses	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$ 10,000	$120,000
Net income	$21,800	$26,540	$28,367	$30,285	$32,300	$34,415	$36,635	$38,967	$41,415	$43,986	$46,686	$ 49,520	$430,916
Less: tax	$10,028	$12,208	$13,049	$13,931	$14,858	$15,831	$16,852	$17,925	$19,051	$20,234	$21,475	$ 22,779	$198,221
NI after tax	$11,772	$14,332	$15,318	$16,354	$17,442	$18,584	$19,783	$21,042	$22,364	$23,753	$25,210	$ 26,741	$232,695

Exhibit 19.2

	1	2	3	4	5	6	7	8	9	10	11	12
Sales	$60,000	$66,000	$72,600	$79,860	$87,846	$96,631	$106,294	$116,923	$128,615	$141,477	$155,625	$171,187
Less: VC												
Cost of sales	$25,200	$27,720	$30,492	$33,541	$36,895	$40,585	$ 44,643	$ 49,108	$ 54,018	$ 59,420	$ 65,362	$ 71,899
Op. expenses	$ 6,000	$ 6,600	$ 7,260	$ 7,986	$ 8,785	$ 9,663	$ 10,629	$ 11,692	$ 12,862	$ 14,148	$ 15,562	$ 17,119
CM	$28,800	$38,280	$42,108	$46,319	$50,951	$56,046	$ 61,650	$ 67,815	$ 74,597	$ 82,057	$ 90,262	$ 99,288
Less: FC												
Op. Expenses	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Net income	$18,800	$28,280	$32,108	$36,319	$40,951	$46,046	$ 51,650	$ 57,815	$ 64,597	$ 72,057	$ 80,262	$ 89,288
Less: tax	$ 8,648	$13,009	$14,770	$16,707	$18,837	$21,181	$ 23,759	$ 26,595	$ 29,715	$ 33,146	$ 36,921	$ 41,073
NI after tax	$10,152	$15,271	$17,338	$19,612	$22,113	$24,865	$ 27,891	$ 31,220	$ 34,882	$ 38,911	$ 43,342	$ 48,216

Exhibit 19.3

Delta Gamma Company
Three-Year Income Projections (2004–2007)

	2004	2005	2006	2007
Sales	$4,500,000	$4,770,000	$5,103,900	$5,512,212
Cost of sales	$2,900,000	$3,045,000	$3,197,250	$3,357,113
Gross profit	$1,600,000	$1,725,000	$1,906,650	$2,155,100
Selling & adm. exp.	$ 800,000	$ 808,000	$ 816,080	$ 824,241
Earnings before tax	$ 800,000	$ 917,000	$1,090,570	$1,330,859
Tax	$ 368,000	$ 421,820	$ 501,662	$ 612,195
Earnings after tax	$ 432,000	$ 495,180	$ 588,908	$ 718,664

Exhibit 19.4

Budget Assumptions

Category	Assumptions
Sales:	*alternative 1 from book up your cash flow*
Cost of goods sold:	*use 45% of sales*
Advertising:	*5% of sales*
Automobile:	*company has 4 autos @ 1500 ea 4 × 1500 = 6000 ÷ 12 = 500 per month*
Bad debts:	*maintain @ 2% of sales—I hope!*
Business promotion:	*Prev year was $65,000. 10% increase equals $71,500 ÷ 12*
Collection costs:	*use 1000 per month*
Continuing education:	*$1000 per month*
Depreciation:	*$84,000 for year—use 7000 per month*
Donations:	*$10,000 for year = ÷ 12*
Insurance—general:	*agent said $24,000; use 2000 per month*
Insurance—group:	*15 employees @ 1500 ea = 22500 ÷ 12 = monthly #*
Insurance—life:	*600 per month*
Interest:	*expect to borrow 250m @ 15% = 37,500 ÷ 12 = 3125 per month + other borrowings*
Office supplies:	*2% of sales—and keep it there please!*
Rent:	*4000 per month*
Repairs and maintenance:	*use 400 per month*
Salaries:	*schedule the payroll per month*
Taxes and license:	*Prior year was 1.5% of sales use same this year*
Taxes, payroll:	*20$ of monthly payroll*
Telephone and utilities:	*$29000 last year. Use 33000 ÷ 12. Travel—use $1000 per month*

Exhibit 19.5

Company Budget for Period January to December

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Sales	$129,030	$129,030	$129,030	$129,030	$192,610	$192,610	$162,690	$129,030	$192,610	$129,030	$162,690	$192,610	$1,870,000
Cost of sales @ 45%	58,063	58,063	58,063	58,063	86,675	86,675	73,211	58,063	86,675	58,063	73,211	86,675	841,500
Gross profit	70,967	70,967	70,967	70,967	105,935	105,935	89,479	70,967	105,935	70,967	89,479	105,935	1,028,500
Advertising @ 5%	6,450	6,450	6,450	6,450	9,600	9,600	8,100	6,450	9,600	6,450	8,100	10,050	93,750
Automobile	500	500	500	500	500	500	500	500	500	500	500	500	6,000
Bad debts @ 2%	2,580	2,580	2,580	2,580	3,840	3,840	3,240	2,580	3,840	2,580	3,240	3,920	37,400
Business promotions	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,962	71,500
Collection costs	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Continuing education	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Depreciation	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	84,000
Donations	833	833	833	833	833	833	833	833	833	833	833	837	10,000
Dues & subscriptions	833	833	833	833	833	833	833	833	833	833	833	837	10,000
Insurance—general	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	24,000
Insurance—group	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	22,500
Insurance—life	600	600	600	600	600	600	600	600	600	600	600	600	7,200
Interest	3,125	3,125	3,125	3,125	4,375	4,375	4,375	4,450	4,450	4,450	4,450	4,450	47,875
Legal & accounting	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Office supplies @ 2%	2,580	2,580	2,580	2,580	3,840	3,840	3,240	2,580	3,840	2,580	3,240	3,920	37,400
Rent	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	48,000
Repairs	400	400	400	400	400	400	400	400	400	400	400	400	4,800
Salaries	21,000	21,000	21,000	21,000	21,000	21,000	24,833	24,833	24,833	24,833	24,833	24,835	275,000
Taxes & license @ 1.5%	1,935	1,935	1,935	1,935	2,880	2,880	2,430	1,935	2,880	1,935	2,430	2,890	28,000
Taxes, payroll	4,200	4,200	4,200	4,200	4,200	4,200	4,966	4,966	4,966	4,966	4,966	4,970	55,000
Telephone and utilities	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	33,000
Travel	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Profit	$ (1,652)	$ (1,652)	$ (1,652)	$ (1,652)	$ 25,451	$ 25,451	$ 7,546	$ (7,576)	$ 20,777	$ (7,576)	$ 7,471	$ 20,139	$ 85,075

Budgeting Software Packages

Remember that financial models essentially are used to generate pro forma financial statements and financial ratios. These are the basic tools for budgeting and profit planning. Also, the financial model is a technique for risk analysis and "what-if" experiments. The financial model is also needed for day-to-day operational and tactical decisions for immediate planning problems. For these purposes, the use of computers is essential.

Spreadsheet software and computer-based financial modeling software are widely utilized for budgeting and planning in an effort to speed up the budgeting process and allow nonfinancial managers to investigate the effect of changes in budget assumptions and scenarios. They are all English-like languages; they do not require any computer programming knowledge.

In recent years, the focus has been on moving away from spreadsheets to enterprise budgeting applications in order to make the planning and budgeting process more efficient and the data more reliable. However, the underlying process remains fundamentally unchanged; it is still about capturing and consolidating line item expenses. Several popular ones are described briefly.

Adaytum Planning

Adaytum Planning by Adaytum Software (www.adaytum.com; 1-800-262-4445) is a multiuser budgeting, planning, and forecasting system. It gives users the flexibility to:

- Update hierarchies directly from general ledger.
- Combine top-down planning with bottom-up budgeting.
- Make last-minute changes to model structure.
- Empower end users to do ad hoc modeling without information system support.

Budget Maestro v5.8

Centage's Budget Maestro (www.centage.com) is probably the best answer to distributed budgeting, strategic planning, and financial control. Budget Maestro shortens the budgeting cycle and puts users in control of the process. Its information-driven environment guides users through budgeting, planning, modeling, forecasting, resource management, consolidation, analysis, and reporting. Chief financial officers (CFOs) and budget managers can plan, analyze and manage, in ways never before possible. Budget Maestro is designed to put CFOs and financial managers in control of all aspects of managing budgets, creating financial models and building and deploying financial plans. Budget Maestro allows business managers unparalleled flexibility in analyzing cash flow and business performance throughout the enterprise. It significantly shortens budgeting and planning cycles, eliminates reeking and formatting of data, increases data accuracy and integrity, and allows users time to manage and analyze their business. It provides users the ability to perform:

- Budgeting
- Forecasting, rolling forecasts
- Planning
- "What-if" scenario building
- Payroll and benefits management
- Headcount planning
- Capital asset planning
- Debt management
- Automatic data consolidation
- Management reports
- Extensive drill-down reporting
- Income statement, balance sheet and statement of cash flows

As an alternative to spreadsheets, Budget Maestro automates many of the complex and repetitive tasks in the budgeting process while eliminating the need for creating complicated formulas and manual consolidation of multiple worksheets.

Budget Maestro offers three editions:

1. *Desktop Edition.* This edition is ideal for the chief executive officer, CFO or controller of small to midsize organizations that have a centralized budgeting and planning process.
2. *Small Business Edition.* This edition supports up to three users operating in a collaborative environment to generate budgets, forecasts and financial reports.
3. *Enterprise Edition.* This edition is an enterprise-wide application for use by finance executives and departmental/line managers to foster a more collaborative and participatory planning environment.

Microsoft Business Solutions for Analytics—Forecaster

This is Web-based budgeting and planning solution from FRx Software (www.frxsoftware.com). Many organizations find it difficult to perform the ongoing budgeting and planning processes necessary to keep business performance on target. Financial "surprises" are met with panic, and more often than not, companies are forced to make sacrifices in places they cannot afford. The result is a direct, negative impact on their strategic objectives. But it is not for lack of trying. Finance departments simply do not have the time to combine multiple spreadsheets submitted from across the company (let alone the resources to make sure all line managers understand the importance of the budgeting and planning process, and of submitting well-planned information on time). Forecaster puts the systems and processes in place to help users immediately realize the benefits of an effective budgeting and planning process, and make it an ongoing part of the business strategy.

Host Budget v3.2

Host Budget (www.hostanalytics.com) is an integrated budgeting and planning software that provides streamlined budgeting, forecasting, reporting, and analysis.

Modules are used to automatically manage, consolidate, and change information for planning and replanning. These budgeting, forecasting, and planning modules include:

- Integration with Host's performance measurement scorecard
- SG&A budget module
- Human resources budget module
- Sales and operation planning module
- Sales forecasting module
- Capital expenditure budget module and others

Host Budget is architected for the Web so that the individuals involved in budgeting and planning can use all of the features. All users need is a Web browser to access and update the application. Microsoft Excel spreadsheets can be used online or "live" to the database for queries and updates, or users can work off-line and easily upload the Excel file later or submit via e-mail.

Because of the streamlined effects of Host Budget on an organization's budgeting process, budgets and forecasts can be refined on an ongoing basis. Managers can consider what has happened so far and can regularly look into the future aided by actual versus budgeted information along with current forecast projections in their effort to meet financial goals. Executive managers can create top-down budgets and "push down" the budget to lower levels of the organization. Line managers and department heads can create budgets from the bottom up and submit budgets for approval.

Continuous rolling forecasts can easily be created with Host Forecaster. Bi-directional data integration allows the detailed budgets to be loaded to or from other applications.

Based on best practices, Host Forecaster provides a rich set of tools to facilitate sales forecasting using standard methods including:

- Statistical forecasting
- Top-down forecasting allocated to the SKU level based on prior-year history, current estimate, last two years' average sales, and other bases
- Bottom-up forecasting for product introductions and discontinued products
- Ability to smooth forecasts to eliminate the impact of infrequent sales events

SRC Systems

Balancing flexibility and control, sophistication and ease-of-use, SRC Budgeting (www.srcsoftware.com) provides the tools needed to create and execute detailed budgets—transforming strategic goals into operational plans. SRC Budgeting simplifies not only the budgeting process, but also the sharing of data with key managers. The result is greater accuracy, enhanced accountability, and increased ownership by business units—all while dramatically reducing the time required for the planning process.

The benefits include the ability to:

- Increase collaboration while streamlining the budget process.
- Model budgets to fit the business.
- Align budgets with strategic plans and forecasts.
- Create flexible and sophisticated budgets.

With SRC Sales Planning, all deals can be tracked—not just the hot ones—and sales managers can adjust focus, training, and incentives to increase sales. Greater visibility into how leads play out at various points in the sales pipeline improves management decision-making ability. The program enables users to understand which leads are working and which ones are not and understand which products and services are in demand, identify and investigate changes and fluctuations, and take appropriate action—whether it means realigning the sales force or adjusting production and distribution.

The benefits include the ability to:

- Create a robust sales forecast.
- Make more accurate and timely planning decisions.
- Align sales, supply chain, and operations.

SRC Forecasting allows users to create timely, high-level, dimensionally independent rolling forecasts—driven by the strategic plan and translated into operational targets. SRC Forecasting streamlines and speeds the forecasting cycle, leverages a sophisticated and customizable modeling process, and helps ensure organizational alignment.

The benefits include the ability to:

- Streamline financial forecasting.
- Customize and model forecasts for accurate planning.
- Align forecasts with detailed budgets.

Latest Generation of Budgeting and Planning Software

The new budgeting and planning (B&P) software represents a giant step forward for accountants. Finance managers can use these robust, Web-enabled programs to scan a wide range of data, radically speed up the planning process, and identify managers who have failed to submit budgets. More often known as active financial planning software, this software includes applications and the new level of functionality that combine budgeting, forecasting analytics, business intelligence, and collaboration. Exhibit 19.6 lists popular B&P software. Appendix III presents a list of budgeting and planning software and provides detailed features of top B&P systems.

Exhibit 19.6

Active Financial Planning Software
Next Generation Budgeting and Planning (B & P) Software

Companies	Web Sites	Software
ABC Technologies	www.abctech.com	Oros
ActiveStrategy	www.activestrategy.com	ActiveStrategy Enterprise
Actuate	www.actuate.com	e.Reporting Suite
Adaytum Software	www.adaytum.com	e.Planning
Applix	www.applix.com	iPlanning, iTM1
Brio Technology	www.brio.com	Brio.ONE, Brio.Impact, Brio.Inform
Business Objects	www.businessobjects.com	e-Bl, BusinessObjects Auditor, BusinessObjects BW Connect, WebIntelligence
Cartesis	www.cartesis.com	Cartesis Budget Planning, Cartesis Carat, Cartesis Magnitude
Closedloop Solutions	www.closedloopsolutions.com	CHizPlan Manager, SpendCapManager, TopLine Manager
Cognos	www.cognos.com	Cognos Finance, Cognos Visualizer, Cognos Enterprise, Business Intelligence
Comshare	www.comshare.com	Management Planning and Control (MPC) Application, Comshare Decision
CorVu	www.corvu.com	CorManage, CorVu Rapid Scorecard, CorBusiness, CorPortfolio
E.Intelligence	www.eintelligence-inc.com	e.Intelligence Suite
Epicor	www.epicor.com	Epicor eIntelligence Suite
Geac	www.geac.com	Geac Smartstream Financials, Enterprise Solutions Expert Series, FRx
Great Plains Software	www.greatplains.com	eEnterprise, FRx Budget Controller, Dynamics
Hyperion	www.hyperion.com	Hyperion Financial Management, Hyperion Planning, Hyperion Essbase
J.D. Edwards	www.jdedwards.com	J.D. Edwards Financial Planning and Budgeting, Business Intelligence, OneWorld Xe
Lawson Software	www.lawson.com	Enterprise Budgeting SEA Applications—including E-Scorecard; Analytic Extensions
Longview Solutions	www.longview.com	Khalix
MIS-AG	www.misag.com	MIS Alea Decisionware, MIS DelaMiner, Collaborative Analytic Processing
NextStrat	www.nextstrat.com	NextStrat Strategic Implementation Portal (NextSIP)
Oracle	www.oracle.com	Oracle Strategic Enterprise Management (SEM)
OutlookSoft	www.outlooksoft.com	OutlookSoft Financial Planning and Analysis (FPA), OutlookSoft Enterprise Analytic Portal
PeopleSoft	www.peoplesoft.com	Enterprise Performance Management (EPM), PeopleSoft Balanced Scorecard, PeopleSoft Enterprise Warehouse, PeopleSoft eBusiness Analytics, PeopleSoft Activity-Based Management
SAP	www.sap.com	SAP Strategic Enterprise Management (SEM), SAP Financial Analyzer Business Intelligence with mySAP.com
SAS Institute	www.sas.com	SAS Total Financial Management, Strategic Vision, SAS/Warehouse Administrator, SAS Enabling Technology (OLAP)
Silvon	www.silvon.com	Stratum
SRC Software	www.srcsoftware.com	Budget Advisor, Payroll Planner, Information Advisor

Conclusion

Computer-based models and spreadsheet software are in wide use for budgeting in an effort to speed up the process and allow budget analysts to investigate the effects of changes in budget assumptions.

Financial models comprise a functional branch of a general corporate planning model. They are essentially used to generate pro forma financial statements and financial ratios. These are the basic tools for budgeting and profit planning.

The financial model is a technique for risk analysis and "what-if" experiments. The model is also needed for day-to-day operational and tactical decisions for immediate planning problems.

20

Capital Budgeting:
Selecting the Optimum Long-term Investment

Capital budgeting relates to planning for the best selection and financing of long-term investment proposals. Capital budgeting decisions are not equally essential to all companies. The relative importance of this function varies with company size, the nature of the industry, and the growth rate of the firm. As a business expands, problems regarding long-range investment proposals become more important. Strategic capital budgeting decisions can turn the tide for a company.

The types of scarce resources that may be committed to a project include cash, time of key personnel, machine hours, and floor space in a factory. When estimating costs for a proposed project, the allocation of the company's scarce resources must be converted in terms of money.

The two broad categories of capital budgeting decisions are *screening decisions* and *preference decisions.* Screening decisions relate to whether a proposed project satisfies some current acceptance standard. For instance, a company may have a policy of accepting cost reduction projects only if they provide a return of, say, 15 percent.

Preference decisions apply to selecting from *competing* courses of action. For example, a company may be looking at four different manufacturing machines to replace an existing one. The selection of the best machine is referred to as a preference decision.

The basic types of investment decisions involve selections between proposed projects and replacement decisions. Selection requires judgments concerning future events of which one has no direct knowledge. One has to consider timing and risk. The task is to minimize chances of being wrong. To help deal with uncertainty, one may use the risk-return trade-off method. Discounted cash flow methods are more realistic than methods that do not take into account the time value of

money in appraising investments. Consideration of the time value of money becomes more essential in inflationary periods.

Planning for capital expenditures requires one to determine the optimal proposal, the number of dollars to be spent, and the amount of time required for completion. An appraisal is needed of current programs, evaluating new proposals, and coordinating interrelated proposals within the company. In planning a project, consideration should be given to time, cost, and quality, which all interreact. For control, a comparison should be made between budgeted cost and time compared to actual cost and time.

Capital budgeting decisions must conform to the cash position, financing strategy, and growth rate. Will the project provide a return exceeding the long-range expected return of the business? Projects must be tied into the company's long-range planning, taking into account corporate strengths and weaknesses. The objectives of the business and the degree to which they depend on economic variables (e.g., interest rate, inflation), production (e.g., technological changes), and market factors must be established. Also, the capital budget may have to be adjusted after considering financial, economic, and political concerns. But consideration should be given to sunk and fixed costs that are difficult to revise once the initial decision is made.

Recommendation: Use cost/benefit analysis. Is there excessive effort for the proposal? Can it be performed internally, or must it be done externally (e.g., make or buy)? Is there a more efficient means and less costly way of accomplishing the end result? Further, problem areas must be identified. An example is when long-term borrowed funds are used to finance a project where sufficient cash inflows will not be able to meet debt at maturity.

Suggestion: Measure cash flows of a project, using different possible assumed variations (e.g., change in selling price of a new product). By modifying the assumptions and appraising the results, one can see the sensitivity of cash flows to applicable variables. An advantage is the appraisal of risk in proposals based on varying assumptions. An increase in risk should result in a higher return rate.

Taxes have to be considered in making capital budgeting decisions because a project that looks good on a before-tax basis may not be acceptable on an after-tax basis. Taxes have an effect on the amount and timing of cash flows.

"What-if" questions are often the most crucial and difficult with regard to the capital expenditure budget, and informed estimates are needed for the major assumptions. Spreadsheets can be used to analyze the cash flow implications of acquiring fixed assets.

Once an investment proposal is approved, there has to be an implementation of controls over expenditures and a reporting system regarding the project's status. Expenditures should be traced to the project and controls in place, ensuring the expenditures are in conformity with the approved investment proposal. Continuous monitoring will show how well the project is doing, relative to the original plan.

Factors to Consider in Determining Capital Expenditures

- Rate of return
- Budget ceiling
- Probability of success
- Competition
- Tax rate
- Dollar amounts
- Time value of money
- Risk
- Liquidity
- Long-term business strategy
- Forecasting errors

Types of Capital Budgeting Decisions to Be Made

- Cost reduction program
- Undertaking an advertising campaign
- Replacement of assets
- Obtaining new facilities or expanding existing ones
- Merger analysis
- New and existing product evaluation
- No profit investments (e.g., health and safety)

Exhibit 20.1 shows a typical project application form, while Exhibit 20.2 presents an advice of project change. In Exhibit 20.3, we see an appropriation request.

This chapter discusses the various capital budgeting methods, including accounting rate of return, payback, discounted payback, net present value, profitability index, and internal rate of return. Consideration is given to contingent proposals, capital rationing, and nondiscretionary projects. The incorporation of risk into the analysis is also considered.

Net present value, internal rate of return, and profitability index are equally effective in selecting economically sound, independent investment proposals. But the payback method is inadequate because it does not consider the time value of money. For mutually exclusive projects, net present value, internal rate of return, and profitability index methods are not always able to rank projects in the same order. It is possible to come up with different rankings under each method. Risk should be taken into account in the capital budgeting process, using probabilities, simulation, and decision trees.

Exhibit 20.1

Project Application

DEPARTMENT NAME	APPLICATION NO.
DEPARTMENT CODE _____ FUNCTION CODE _____	OFFENSIVE ☐ DEFENSIVE ☐
PROJECT TITLE	
DESCRIPTION/OBJECTIVES	

EXPENDITURE AMOUNTS

FISCAL YEAR	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	TOTAL
20					
20					
20					
20					
20					
TOTAL					

DATE	SUBMITTED BY
COMMENTS	

_____
For The Division

Exhibit 20.2

Advice on Project Change

DEPARTMENT NAME	DATE
DEPARTMENT CODE	APPROPRIATION REQUEST NO.

PROJECT TITLE

EXPENDITURE AMOUNTS

	ORIGINAL AUTHORIZED	LATEST ESTIMATE	INCREASE (DECREASE)
CAPITAL			
EXPENSE			
TOTAL			

AMOUNT SPENT TO DATE $ _____ AMOUNT COMMITTED TO DATE _____

WHY IS THIS NEW AMOUNT BEING REQUESTED?

_____ PROJECT SPONSOR

_____ DEPARTMENT/AREA SUPERVISOR

PROJECT TO BE CONTINUED ☐

REVISED REQUEST REQUIRED ☐

SEE COMMENT ON REVERSE SIDE ☐

FINAL APPROVER _____

DATE _____

Exhibit 20.3

Appropriation Request

ORIG. DEPT. NAME	DEPT. CODE	APPROPRIATION NO.
BUDGET CAPITALIZED ☐ EXPENSED ☐	PROJECT APPLIC. NO.	
ACCOUNTING CODE	PROJECT APPL TOT. EXP. $	APPROPRIATION TOTAL $
DESCRIPTION		
PURPOSE		
CURRENT FACILITIES		
PROPOSED FACILITIES		
COST JUSTIFICATION (SAVINGS/BENEFITS)		

PROPOSED EXPENDITURES		APPROVALS		DATE
Equipment Cost	_____	Originator	_____	_____
Material Cost	_____		_____	_____
Installation Costs:	_____		_____	_____
External Services	_____	Dept/Area Suprv.	_____	_____
Internal Services	_____	V. President	_____	_____
Miscellaneous Costs	_____	Controller	_____	_____
Freight	_____	Division Head	_____	_____
Taxes	_____	CEO	_____	_____
Total	_____	Bd. of Dir.	_____	_____

Accounting (Simple) Rate of Return

Accounting rate of return (ARR) measures profitability from the conventional accounting standpoint by comparing the required investment (sometimes average investment) to future annual earnings.

Rule of thumb: Select the proposal with the highest ARR.

Example 1

Initial investment $\$8,000$

Life 15 years

Cash inflows per year $\$1,300$

$$\text{Depreciaption} = \frac{\text{Cost} - \text{Salvage value}}{\text{Life}} = \frac{\$8,000}{15} = \$533$$

$$\text{ARR} = \frac{\text{Cash inflows per year} - \text{Depreciaption}}{\text{Initial investment}}$$

$$\frac{\$1,300 - \$533}{\$8,000} = \frac{\$767}{\$8,000} = 9.6\%$$

If you use average investment, ARR is

$$\text{ARR} = \frac{\$767}{\$8,000 / 2} = \frac{\$767}{\$4,000} = 19.2\%$$

Note: When average investment is used, rather than the initial investment, accounting rate of return is doubled.

Advantages of ARR

- Easy to comprehend and calculate
- Considers profitability
- Numbers relate to financial statement presentation
- Considers full useful life

Disadvantages of ARR

- Ignores time value of money
- Uses income data rather than cash flow data

Note: In an automated environment, the cost of the investment would include engineering, software development, and implementation.

Payback Period

Payback is the number of years it takes to recover an initial investment. Payback assists in evaluating a project's risk and liquidity, faster rate of return, and earlier recoupment of funds. A benefit of payback is that it permits companies that have a cash problem to evaluate the turnover of scarce resources in order to recover, earlier, those funds invested. In addition, there is likely to be less possibility of loss from changes in economic conditions, obsolescence, and other unavoidable risks when the commitment is short term.

Supporters of the payback period point to its use where preliminary screening is more essential than precise figures, in situations where a poor credit position is a major factor, and when investment funds are exceptionally scarce. Some believe that payback should be used in unstable, uncertain industries subject to rapid technological change because the future is so unpredictable that there is no point in guessing what cash flows will be more than two years from now.

A company may establish a limit on the payback period beyond which an investment will not be made. Another business may use payback to choose one of several investments, selecting the one with the shortest payback period.

Advantages of Payback

- Easy to use and understand
- Effectively handles investment risk
- Good approach when a weak cash-and-credit position influences the selection of a proposal
- Can be used as a supplement to other more sophisticated techniques, since it does indicate risk

Disadvantages of Payback

- Ignores the time value of money
- Does not consider cash flows received after the payback period
- Does not measure profitability
- Does not indicate how long the maximum payback period should be
- Penalizes projects that result in small cash flows in their early years and heavy cash flows in their later years

Warning: Do not select a proposal simply because the payback method indicates acceptance. One still has to use the discounting methods, such as present value and internal rate of return.

Example 2

You are considering a new product. It will initially cost $250,000. Expected cash inflows are $80,000 for the next five years. You want your money back in four years.

$$\text{Payback period} = \frac{\text{Initial investment}}{\text{Annual cash inflow}} = \frac{\$250,000}{\$80,000} = 3.125$$

Because the payback period (3.125) is less than the cutoff payback period (4), you should accept the proposal.

Example 3

You invest $40,000 and receive these cash inflows:

Year 1 $15,000
Year 2 20,000
Year 3 28,000

$$\text{Payback period} = \frac{\$40,000}{\text{Year 1} \quad \text{Year 2} \quad \text{Year 3}} = 2.18 \text{ years}$$

$$\underbrace{\$15,000 + \$20,000}_{\$35,000} + \frac{\$5,000}{\$28,000}$$

2 Years + .18

If there are unequal cash inflows each year, to determine the payback period, just add up the annual cash inflows to come up with the amount of the cash outlay. The answer is how long it takes to recover the investment.

Payback Reciprocal

Payback reciprocal is the reciprocal of the payback time. This often gives a quick, accurate estimate of the *internal rate of return (IRR)* on an investment when the project life is more than twice the payback period and the cash inflows are uniform every period.

Example 4

ABC Company is contemplating three projects, each of which would require an initial investment of $10,000, and each of which is expected to generate a cash inflow of $2,000 per year. The payback period is five years ($10,000/$2,000) and the payback reciprocal is 1/5, or 20 percent. The table of the present value of an annuity of $1 shows that the factor of 5.00 applies to these useful lives and internal rates of return:

Useful Life	IRR
10 years	15%
15	18
20	19

The payback reciprocal is 20 percent as compared with the IRR of 18 percent when the life is 15 years, and 20 percent as compared with the IRR of 19 percent when the life is 20 years. This shows that the payback reciprocal gives a reasonable approximation of the IRR if the useful life of the project is at least twice the payback period.

Discounted Payback Period

Before looking at discounted cash flow methods, it should be pointed out that there is less reliability with discounted cash flow analysis where there is future uncertainty, the environment is changing, and cash flows themselves are hard to predict.

Take into account the time value of money by using the discounted payback method. The payback period will be longer using the discounted method because money is worth less over time.

How to Do It: Discounted payback is computed by adding the present value of each year's cash inflows until they equal the investment.

Example 5

Assume the same facts as in Example 3 and a cost of capital of 10 percent.

$$\text{Discounted payback} = \frac{\text{Initial cash outlay}}{\text{Discounted annual cash inflows}}$$

$$\frac{\$40,000}{\text{Year 1} \quad \text{Year 2} \quad \text{Year 3}}$$

$$\begin{array}{lll} \$15,000 & + \$20,000 & + \$28,000 \\ \times .9091* & \times .8264 & \times .7513 \\ \$13,637 & + \$16,528 & + \$21,036 \end{array}$$

$$\begin{array}{rl} \$30,165 + & \$\ 9,835 \\ & \$21,036 \\ 2 \text{ years} + & .47 = 2.47 \text{ years} \end{array}$$

*Present value of $1 from AI.3 = pv 1 F

Net Present Value

The present value method compares the present value of future cash flows expected from an investment project to the initial cash outlay for the investment. Net cash flows are the difference between forecasted cash inflow received because of the investment with the expected cash outflow of the investment. Use as a discount rate the minimum rate of return earned by the company on its money. As reported in the June 2004 issue of *Management Accounting*, 45 percent of manufacturers used discount rates of between 13 percent and 17 percent and more than 20 percent used discount rates of over 19 percent.

A company should use as the discount rate its cost of capital.

Rule of thumb: Considering inflation and the cost of debt, the anticipated return should be about 10–13 percent.

Note: The net present value method discounts all cash flows at the cost of capital, thus implicitly assuming that these cash flows can be reinvested at this rate.

An advantage of net present value is that it considers the time value of money. A disadvantage is the subjectivity in determining expected annual cash inflows and expected period of benefit.

Recommendation: If a proposal is supposed to provide a return, invest in it only if it provides a positive net present value. If two proposals are mutually exclusive

(acceptance of one precludes the acceptance of another), accept the proposal with the highest present value.

Note: In an advanced automated environment, the terminal value requires managers to forecast technological, economic, operational, strategic, and market developments over the investment's life so that a reasonable estimate of potential value may be made.

Caution: Using the return rate earned by the company as the discount rate may be misleading in certain cases. It may be a good idea to look at the return rate investors earn on similar projects. If the minimum rates selected are based on the company's return on average projects, an internal company decision will occur that helps to increase the corporate return. Yet if the company is earning a very high rate of return, one will take a lot of good projects and also leave some good ones. What if the project left would really enhance value?

If the corporate return rate is below what investors can earn elsewhere, one deludes oneself in believing it is an attractive investment. The project may involve below-normal profitability, lower per-share value, and result in lower creditor and investor ratings of the firm.

The net present value method typically provides more reliable signals than other methods. By employing net present value and using best estimates of reinvestment rates, the most advantageous project can be selected.

Example 6

You are considering replacing Executive 1 with Executive 2. Executive 2 requires a payment on contract signing of $200,000. He will receive an annual salary of $330,000. Executive 1's current annual salary is $140,000. Executive 2 is superior in talent. You expect there will be an increase in annual cash flows from operations (ignoring salary) of $350,000 for each of the next 10 years. The cost of capital is 12 percent.

As indicated below, because there is a positive net present value, Executive 1 should be replaced with Executive 2.

Year	Explanation	Amount	× Factor =	Present Value
0	Contract signing bonus	$–200,000	× 1	$–200,000
1–10	Increased salary ($300,000 – $140,000	–160,000	× 5.6502[a]	– 904,032
1–10	Increase in annual cash flow from operations	+350,000	× 5.6502[a]	1,977,570
	Net present value			$ 873,538

[a]Present value of an ordinary annuity factor for 10 years and an interest rate of 12 percent. (Table AI.4)

Example 7

You own a business for which you have received a $1 million offer. If you do not sell, you will remain in business for eight years and will invest another $50,000 in your firm. If you stay, you will sell your business in the eighth year for $60,000.

You expect yearly sales to increase by 50 percent from its current level of $500,000. Direct material is proportional to sales. Direct labor is proportional to sales, but will increase by 30 percent for all labor. Variable overhead varies with sales and annual fixed overhead will total $70,000, including depreciation. Straight-line depreciation will increase from $7,000 to $10,000. At the end of eight years, all fixed assets will be fully depreciated. Selling and administrative expenses are assumed to remain constant. The cost of capital is 14 percent.

Your current year's income statement is

Sales		$500,000
Less: Cost of sales		
Direct material	$100,000	
Direct labor	120,000	
Variable overhead	50,000	
Fixed overhead	65,000	335,000
Gross margin		$165,000
Less: Selling and administrative expenses[a]		40,000
Net income		$125,000

[a]Includes your salary of $20,000.

Your forecasted income statement for each of the next eight years is

Sales $500,000 × 1.5		$750,000
Less: Cost of sales		
Direct material $100,000 × 1.5	$150,000	
Direct labor $120,000 × 1.5 × 1.3	234,000	
Variable overhead $50,000 × 1.5	75,000	
Fixed overhead	70,000	529,000
Gross margin		$221,000
Less: Selling and administrative expenses		$ 40,000
Net income		$181,000

Your annual cash flow from operations is

Net income	$181,000
Add: Depreciation	10,000
Salary	20,000
Annual cash flow from operations	$211,000

A comparison of your alternatives follows.

Sell business	+$1,000,000
Stay in business	

Year	Explanation	Amount	× Factor	= Present Value
0	Investment in assets	$– 50,000	× 1	$– 50,000
1–8	Annual cash inflow	+211,000	× 4.6389	+978,808
8	Sales price of business	+ 60,000	× 0.3506	+ 21,036
	Net present value			$+949,844

Because the net present value is higher to sell the business ($1 million) than staying in business ($949,844), you should sell now.

Example 8

You are considering replacing an old machine with a new one. The old machine has a book value of $800,000 and a remaining life of 10 years. The expected salvage value of the old machine is $50,000, but if you sold it now, you would obtain $700,000. The new machine costs $2 million and has a salvage value of $250,000. The new machine will result in annual savings of $400,000. The tax rate is 50 percent, and the cost of capital is 14 percent. Use straight-line depreciation. You have to determine whether to replace the machine.

The net increase in annual cash flow is

	Net Income	Cash Flow
Annual savings	$400,000	$400,000
Less: Incremental depreciation		
New machine $\frac{\$2,000,000 - \$250,000}{10} = \$175,000$		
Old machine $\frac{\$800,000 - \$50,000}{10} = \$75,000$		
Incremental depreciation	100,000	
Income before tax	300,000	
Tax, 50%	150,000	150,000
Income after tax	$150,000	
Net cash inflow		$250,000

The net present value is

Year	Explanation	Amount	× Factor	Present Value
0	Cost of new machine	$–2,000,000	× 1.000	$–2,000,000
0	Sale of old machine	700,000	× 1.000	700,000
1	Investment tax credit	200,000	× .877	175,400
1	Tax benefit from loss on sale of old machine	50,000	× .877	43,850
1–10	Yearly increases in cash flows	250,000	× 5.216	1,304,000
10	Incremental salvage value	200,000	× .270	54,000
				$ 102,100

The replacement of the old machine with a new machine should be made because of the resulting positive net present value.

Deciding whether to lease or purchase involves comparing the leasing and purchasing alternatives.

Example 9

You have decided to acquire an asset costing $100,000, with a life of five years and no salvage value. The asset can be purchased with a loan or it can be leased. If leased, the lessor wants a 12 percent return. Lease payments are made in advance at the end of the year prior to each of the 10 years. The tax rate is 50 percent and the cost of capital is 8 percent.

$$\text{Annual lease payment} = \frac{\$100,000}{1 + 3.3073} = \frac{\$100,000}{4.3073}$$

$$= \$23,216 \text{ (rounded)}$$

Year	Lease Payment	Tax Savings	After-tax Cash Outflow	Factor	Present Value
0	$23,216		$23,216	1.0000	$23,216
1–4	23,216	$11,608[a]	11,608	3.3121	38,447
5		11,608	(11,608)	.6806	(7,900)
					$53,763

[a] $23,216 \times 50\% = \$11,608$

If you buy the asset, you will take out a 10 percent loan. Straight-line depreciation is used with no salvage value.

$$\text{Depreciation} = \frac{\$100,000}{5} = \$20,000$$

$$\text{Annual loan payment} = \frac{\$100,000}{3.7906} = \$26,381$$

The loan amortization schedule is

Year	Loan Payment	Beginning-of-year Principal	Interest[a]	Principal[b]	End-of-year Principal
1	$26,381	$100,000	$10,000	$16,381	$83,619
2	26,381	83,619	8,362	18,019	65,600
3	26,381	65,600	6,560	19,821	45,779
4	26,381	45,779	4,578	21,803	23,976
5	26,381	23,976[c]	2,398	23,983[c]	

[a] 10% × beginning-of-year principal.
[b] Loan payment – interest.
[c] Slight difference due to rounding.

The computation of the present value of borrowing is

Year	(1) Loan Payment	(2) Interest	(3) Depreciation	(4) Total Deduction	(5) Tax Saving	(6) Cash Outflow	(7) PV Factor at 8%	(8) PV of Cash Outflow
1	$26,381	$10,000	$20,000	$30,000	$15,000	$11,381	.9259	$10,538
2	26,381	8,362	20,000	28,362	14,181	12,200	.8573	10,459
3	26,381	6,560	20,000	26,560	13,280	13,101	.7938	10,400
4	26,381	4,578	20,000	24,578	12,289	14,092	.7350	10,358
5	26,381	2,398	20,000	22,398	11,199	15,182	.6806	10,333
								$52,088

(4) = (2) + (3)
(5) = (4) × 50%
(6) = (1) – (5)
(8) = (6) × (7)

The present value of borrowing ($52,088) is less than the present value of leasing ($53,763). Thus, the asset should be bought.

Profitability Index

The *profitability (ranking) index,* also called excess present value index, or cost-benefit ratio, is a net instead of an aggregate index and is employed to differentiate the initial cash investment from later cash inflows. If a company has budget constraints, proposals of different dollar magnitude can be ranked on a comparative basis. Use the index as a means of ranking projects in descending order of attractiveness.

$$\text{Profitability index} = \frac{\text{Present value of cash inflows}}{\text{Present value of cash outflows}}$$

Rule of thumb: Accept a proposal with a profitability index equal to or greater than 1.

Caution: A higher profitability index does not always coincide with the project with the highest net present value.

Key point: The internal rate of return and the net present value approaches may give conflicting signals, when competing projects have unequal times. The profitability index gives the correct decision, however, and is superior under these circumstances.

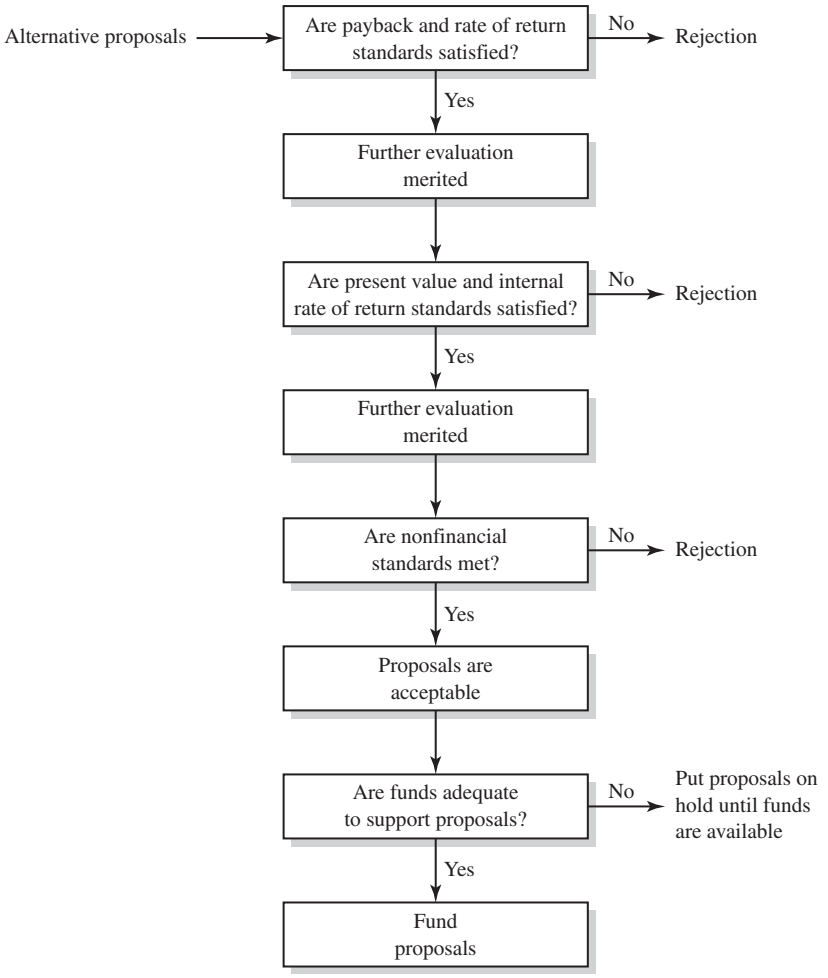
Capital rationing takes place when a business is not able to invest in projects having a net present value greater than or equal to zero. Typically, the firm establishes an upper limit to its capital budget based on budgetary constraints.

Note: With capital rationing, the project with the highest ranking index, rather than net present value, should be selected for investment.

Exhibit 20.4 shows the capital rationing decision process.

Exhibit 20.4

Flowchart of Variables in a Corporate Model



Example 10

You have this information regarding two proposals:

	Proposal A	Proposal B
Initial investment	$100,000	$10,000
Present value of cash inflows	500,000	90,000

The net present value of proposal A is $400,000 and that of proposal B is $80,000. Based on net present value, proposal A is better. However, this is very misleading when a budget constraint exists. In this case, proposal B's profitability index of 9 far surpasses proposal A's index of 5. Thus, the profitability index should be used in evaluating proposals when budget constraints exist. The net result is that proposal B should be selected over proposal A.

Example 11

Projects	Investment	Present Value	Profitability Index	Ranking
A	$ 70,000	$112,000	1.6	1
B	100,000	145,000	1.45	2
C	110,000	126,500	1.15	5
D	60,000	79,000	1.32	3
E	40,000	38,000	.95	6
F	80,000	95,000	1.19	4

The budget constraint is $250,000. You should select projects A, B, and D as indicated by these calculations;

Project	Investment	Present Value
A	$ 70,000	$112,000
B	100,000	145,000
D	60,000	79,000
	$230,000	$336,000

where

$$\text{Net present value} = \$336{,}600 - \$230{,}000 = \$106{,}000$$

Unfortunately, the profitability index method has some limitations. One of the more serious is that it breaks down whenever more than one resource is rationed.

A more general approach to solving capital rationing problems is the use of *mathematical* (or zero-one) programming. Here the objective is to select the mix of projects that maximizes the net present value subject to a budget constraint.

Example 12

Using the data given in Example 11, we can set up the problem as a mathematical programming one. First, we label project A as X_1, B as X_2, and so on; the problem can be stated:

$$\begin{aligned}\text{Maximize NPV} = {} & \$42,000X_1 + \$45,000X_2 + \$16,500X_3 \\ & + \$19,000X_4 - \$2,000X_5 + \$15,000X_6\end{aligned}$$

subject to

$$\$70,000X_1 + \$100,000X_2 + \$110,000X_3 + \$60,000X_4 + \$40,000X_5 + \$80,000X_6 \leqq \$250,000$$

$$X_i = 0,1 \ (i = 1, 2, \ldots 6)$$

Using the mathematical program solution routine, the solution to this problem is

$$X_1 = 1, \quad X_2 = 1, \quad X_4 = 1$$

and the net present value is $106,000. Thus, projects A, B, and D should be accepted.

Contingent Proposals

A contingent proposal is one that requires acceptance of another related one. Hence, the proposals must be looked at together. A profitability index for the group is computed.

Example 13

Proposal	Present Value of Cash Outflow	Present Value of Cash Inflow
A	$160,000	$210,000
B	60,000	40,000
Total	$220,000	$250,000

$$\text{Profitability index} = \frac{\$250,000}{\$220,000} = 1.14$$

Internal Rate of Return (Time-Adjusted Rate of Return)

The internal rate of return (IRR) is the return earned on a given proposal. It is the discount rate equating the net present value of cash inflows to the net present value of cash outflows to zero. The internal rate of return assumes cash inflows are reinvested at the internal rate.

This method involves trial-and-error computations. However, the use of a computer or programmable calculator simplifies the internal rate-of-return process.

The internal rate of return can be compared with the required rate of return (cutoff or hurdle rate).

Rule of thumb: If the internal rate of return equals or exceeds the required rate, the project is accepted. The required rate of return is typically a company's cost of capital, sometimes adjusted for risk.

Advantages of IRR

- Considers the time value of money
- More realistic and accurate than the accounting rate of return method

Disadvantages of IRR

- Difficult and time consuming to compute, particularly when there are uneven cash flows
- Does not consider the varying size of investment in competing projects and their respective dollar profitabilities
- When there are multiple reversals in the cash flow stream, the project could yield more than one IRR.

To solve for internal rate of return where unequal cash inflows exist, use the trial-and-error method while working through the present value tables.

Five Guidelines

1. Compute net present value at the cost of capital, denoted here as r_1.
2. See if net present value is positive or negative.
3. If net present value is positive, use a higher rate (r_2) than r_1. If net present value is negative, use a lower rate (r_2) than r_1. The exact internal rate of return at which net present value equals zero is somewhere between the two rates.
4. Compute net present value using r_2.
5. Perform interpolation for exact rate.

Example 14

A project costing $100,000 is expected to produce these cash inflows:

Year	
1	$50,000
2	30,000
3	20,000
4	40,000

Using trial and error, you can calculate the internal rate:

Year	10%	Present Value	16%	Present Value	18%	Present Value
1	.909	$ 45,450	.862	$ 43,100	.847	$ 42,350
2	.826	24,780	.743	22,290	.718	21,540
3	.751	15,020	.641	12,820	.609	12,180
4	.683	27,320	.552	22,080	.516	20,640
		$+112,570		$+100,290		$+ 96,710
Investment		–100,000		–100,000		–100,000
Net present value		$ –12,570		$ +290		$ –3,290

The internal rate of return on the project is a little more than 16 percent, because at that rate the net present value of the investment is approximately zero.

If the return on the investment is expected to be in one lump sum after a period of two years, you can use the Present Value of $1 table (Table AI.3) to find the internal rate.

Example 15

You are considering two mutually exclusive investment proposals. The cost of capital is 10 percent. Expected cash flows are:

Project	Investment	Year 1	Year 6
A	$10,000	$12,000	
B	10,000		$20,000

Internal rates of return are

$$\text{Project A:} = \frac{\$10,000}{\$12,000} = .8333$$

Looking across one year on the table, .8333 corresponds to an internal rate of 20 percent.

$$\text{Project B:} = \frac{\$10,000}{\$20,000} = .5000$$

Looking across six years on the table, .5000 corresponds to an internal rate of 12 percent. Project A should be selected because it has a higher internal rate of return than project B.

If the cash inflows each year are equal, the internal rate of return is computed first by determining a factor (which happens to be the same as the payback period) and then looking up the rate of return on the Present Value of an Annuity of $1 table (Table AI.4).

Example 16

You invest $100,000 in a proposal that will produce annual cash inflows of $15,000 a year for the next 20 years.

$$\text{Factor} = \frac{\$100,000}{\$15,000} = 6.6667$$

Refer to the Present Value of an Annuity of $1 table. Looking across 20 years, we find that the factor closest to 6.6667 is 6.6231 in the 14 percent column. Therefore the internal rate is about 14 percent.

Example 17

Initial Investment	$12,950
Estimated life	10 years
Annual cash inflows	$3,000
Cost of capital	12%

The internal rate of return calculation follows, including interpolation to get the exact rate.

$$\text{PV of annuity factor} = \frac{\$12,950}{\$3,000} = 4.317$$

The value 4.317 is somewhere between 18 percent and 20 percent in the 10-year line of the Present Value of an Annuity of $1 table. Using interpolation you get

		Present Value of Annuity Factor
18%	4.494	4.494
IRR		4.317
20%	4.192	
Difference	.302	.177

Therefore,

$$\text{IRR} = 18\% + \frac{.177}{.302}(20\% - 18\%)$$
$$= 18\% + .586(2\%) = 18\% + 1.17\% = 19.17\%$$

Because the internal rate of return (19.17 percent) exceeds the cost of capital (12 percent), the project should be accepted.

Can a Computer Help?

Spreadsheet programs can be used in making IRR calculations. For example, Excel has a function IRR (*values*, *guess*). Excel considers negative numbers as cash outflows (such as the initial investment) and positive numbers as cash inflows. Many financial calculators have similar features. As in Example 13, suppose you want to calculate the IRR of a $12,950 investment (the value –12950 entered in year 0 that is followed by 10 monthly cash inflows of $3,000). Using a guess of 12 percent (the value of 0.12), which is in effect the cost of capital, your formula would be @IRR (values, 0.12) and Excel would return 19.15 percent, as shown below.

Year 0	1	2	3	4	5	6	7	8	9	10
$(12,950)	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
IRR = 19.15%										
NPV = $4,000.67										

Note: The Excel formula for NPV is NPV (discount rate, cash inflow values) + I, where I is given as a negative number.

Nondiscretionary Projects

Some investments are made because of necessity rather than profitability (e.g., pollution control equipment, safety equipment). Here there will be solely a negative cash flow. Hence, discretionary projects must earn a return rate in excess of the cost of capital to make up for the losses on nondiscretionary projects.

Example 18

A company's cost of capital is 14 percent and $30 million of capital projects, 25 percent of which are nondiscretionary projects. It thus has to earn $4.2 million per year (14% × $30 million). The $22.5 million of discretionary projects ($30 million – 25%) must earn 18.7 percent ($4.2 million/$22.5 million) rather than 14 percent to achieve the overall corporate earnings goal of $4.2 million.

Comparison of Methods

In general, the discounting cash flow methods (net present value, internal rate of return, and profitability index) come to the same conclusions for competing proposals. But these methods can give different rankings to mutually exclusive proposals in certain cases. Any one of these conditions can cause contradictory rankings:

- Project lives of different duration
- A higher cost for one project relative to another
- The trend in cash flow of one project that is the reverse of that of another

One of these characteristics of the company also may produce conflicting rankings:

- Future investment opportunities are expected to be different from at present, and the investor knows whether they will be better or worse.
- There is capital rationing, a maximum level of funding for capital investments.

The major cause for different rankings of alternative projects under present value and internal rate of return methods relates to the varying assumptions regarding the reinvestment rate employed for discounting cash flows. The net present value method assumes cash flows are reinvested at the cost of capital rate.

The internal rate of return method assumes cash flows are reinvested at the internal rate.

Key point: The net present value method typically provides a correct ranking because the cost of capital is a more realistic reinvestment rate.

Recommendation: Which method is best for a business really depends on which reinvestment rate is nearest the rate the business can earn on future cash flows from a project.

Note: The board of directors usually reviews the company's required rate of return each year and may increase or decrease it, depending on the company's current rate of return and cost of capital.

The minimum rate of return required for a proposal may be waived in a situation where the proposal has significant future benefit (research and development), applies to a necessity program (safety requirement), and has qualitative benefit (product quality).

Example 19

Assume:

	Cash Flows					
Project	**0**	**1**	**2**	**3**	**4**	**5**
A	$(100)	$120				
B	(100)					$201.14

Computing internal rate of return and net present value at 10 percent gives these different rankings:

	Internal Rate of Return	Net Present Value
A	20%[a]	9.09
B	15%	24.90

[a]From Present Value of $1 table (Table AI3), the IRR for a factor of $.8333 \left(\frac{\$100}{\$120}\right)$ is 20 percent.

Contradictory rankings can occur under three conditions:

1. Projects have different life expectancies.
2. Projects have different sizes of investment.
3. Projects have cash flows that differ over time. For example, the cash flows of one project increase over time, while those of another decrease.

The contradictions result from different assumptions with respect to the reinvestment rate on cash flows from the projects.

The NPV method discounts all cash flows at the cost of capital, thus implicitly assuming that these cash flows can be reinvested at this rate.

The IRR method implies a reinvestment rate at IRR. Thus, the implied reinvestment rate will differ from project to project.

The NPV method generally gives correct ranking, because the cost of capital is a more realistic reinvestment rate. Thus, project B would be chosen over project A.

Capital Budgeting Process

Questions that should be asked in the capital budgeting process are:

- How is risk incorporated into the analysis?
- Is risk versus return considered in choosing projects?
- Prior to making a final decision, are all the results of the capital budgeting techniques considered and integrated?
- In looking at a proposal, are both dollars and time considered?
- Is the proposal consistent with long-term goals?
- Does each project have a cost/benefit analysis?
- Do managers know which are the most profitable proposals and products? How much business is in each?
- Are there projects of an unusual nature?
- Do managers periodically track the performance of current programs in terms of original expectations?
- In the capital budgeting process, are qualitative factors, such as marketing, production, and economic and political variables, also considered?
- Has the proposal been considered incorporating the company's financial health?
- What is the quality of the project?
- Given the current environment, are capital investments adequate?
- Are managers risk prone or risk averse?
- Is the discounted payback method being used?
- How are probable cash flows computed?
- How do managers come up with the expected life?

To look at the entire picture of the capital budgeting process, a comprehensive example is provided.

Example 20

You are deciding whether to buy a business. The initial cash outlay is $35,000. You will receive annual net cash inflows (excluding depreciation) of $5,000 per year for 10 years. The cost of capital is 10 percent. The tax rate is 50 percent. Should you buy this business?

The annual cash inflow follows.

	Years 1–10	
	Net Income	**Cash Flow**
Annual cash savings	$5,000	$+5,000
Depreciation ($35,000/10)	3,500	
Income before tax	$1,500	
Tax, 50%	750	– 750
Net Income	$ 750	
Net cash flow		$+4,250

Average rate of return on investment:

$$\frac{\text{Net income}}{\text{Average investment}} = \frac{\$750}{\$35,000 / 2} = \frac{\$750}{\$17,500} = 4\%$$

Payback period:

$$\frac{\text{Initial investment}}{\text{Annual net cash inflow}} = \frac{\$35,000}{\$4,250} = 8.2 \text{ years}$$

Net present value:

Year	**Explanation**	**Amount**	×	**Factor**	=	**Present Value**
0	Initial investment	$–35,000	×	1		$–35,000
1–10	Annual net cash inflow	+ 4,250	×	6.1446		26,095
	Net present value					$ –8,905

Profitability index:

$$\frac{\text{Present value of cash inflow}}{\text{Present value of cash outflow}} = \frac{\$26,095}{\$35,000} = .74$$

Internal rate of return:

$$\text{Factor} = \frac{\text{Initial outlay}}{\text{Annual cash inflow}} = \frac{\$35,000}{\$4,250} = 8.2$$

Referring to the Present Value of an Annuity of $1 table (Table AI.4), look for the intersection of 10 years and a factor of 8.2. Looking up the column, we find 4 percent, which is the internal rate.

Conclusion: The business should not be bought for four reasons:

1. An average rate of return of 4 percent is low.
2. The payback period is long.
3. The net present value is negative.
4. The internal rate of return at 4 percent is less than the cost of capital at 10 percent.

Capital Budgeting and Inflation

The accuracy of capital budgeting decisions depends on the accuracy of the data regarding cash inflows and outflows. For example, failure to incorporate price-level changes due to inflation in capital budgeting situations can result in errors in the prediction of cash flows and thus in incorrect decisions.

Typically, the nonfinancial manager has two options in dealing with a capital budgeting situation with inflation.

1. Restate the cash flows in nominal terms and discount them at a nominal *cost of capital (minimum required rate of return).*
2. Restate both the cash flows and cost of capital in *constant* terms and discount the constant cash flows at a constant cost of capital.

The two methods are basically equivalent.

Example 21

A company has these projected cash flows estimated in real terms:

	Real Cash Flows (000s)			
Period	0	1	2	3
	–100	35	50	30

The nominal cost of capital is 15 percent. Assume that inflation is projected at 10 percent a year. Then the first cash flow for year 1, which is $35,000 in current dollars, will be $35{,}000 \times 1.10 = \$38{,}500$ in year 1 dollars. Similarly the cash flow for year 2 will be $50{,}000 \times (1.10)^2 = \$60{,}500$ in year 2 dollars, and so on. By discounting these nominal cash flows at the 15 percent nominal cost of capital, you come up with this net present value:

Period	Cash Flows	Present Value Factor	Present Values
0	–100	1.000	– 100
1	38.5	.870	33.50
2	60.5	.756	45.74
3	39.9	.658	26.25
		Net present value =	5.49 or $5,490

Instead of converting the cash flow forecasts into nominal terms, we could convert the cost of capital into real terms by using this formula:

$$\text{Real cost of capital} = \frac{1 + \text{nominal cost of capital}}{1 + \text{inflation rate}} - 1$$

In the example, this gives

$$\text{Real cost of capital} = \frac{(1+.15)}{(1+.10)}$$

$$= \frac{1.15}{1.10} = 0.045 \text{ or } 4.5 \text{ percent}$$

We will obtain the same answer except for rounding errors ($5,490 versus $5,580).

Period	Cash Flows	Present Value Factor $1(1 + .045)^n$	Present Values
0	–100	1.000	–100
1	35	$\frac{1}{(1+0.45)^2} = .957$	33.50
2	50	$\frac{1}{(1+0.45)} = .916$	45.80
3	30	$\frac{1}{(1+0.45)^3} = .876$	26.28
		Net present value = 5.58 or $5,580	

Postaudit Project Review

The postaudit (postcompletion) project review is a second aspect of reviewing the performance of the project. A comparison is made of the actual cash flow from operations of the project with the estimated cash flow used to justify the project.

The postaudit project review is helpful for several reasons. First, managers who propose projects will be more careful before recommending a project. Second, it will identify managers who are repeatedly optimistic or pessimistic regarding cash flow estimates. How reliable are the proposals submitted and approved? (Perhaps additional investments can be made that result in even greater returns.) Top management will be better able to appraise the bias that may be expected when a certain manager proposes a project.

The postaudit review also gives an opportunity to:

- Reinforce successful projects.
- Strengthen or salvage problem projects.
- Stop unsuccessful projects before excessive losses occur.
- Enhance the overall quality of future investment proposals.

In conducting a postaudit, the same technique should be employed that was used in the initial approval process, to maintain consistency in evaluation. For example, if a project was approved using present value analysis, the identical procedures should be implemented in the postaudit review.

According to the management-by-exception principle, the managers responsible for the original estimates should be asked to furnish a complete explanation of any significant differences between estimates and actual results.

Recommendation: For control reasons, project performance appraisal should not be conducted by the group that proposed the project. Internal auditors should be given this responsibility. A review report should be issued. Typically, only projects above a specified dollar amount require postaudit, periodic evaluation, or both.

Capital Budgeting and Nonprofit Organizations

With regard to nonprofit institutions, the only real problem in using capital budgeting is the selection of an appropriate discount rate. Some nonprofit entities employ the interest rate on special bond issues (e.g., building a school) as the discount rate. Others employ the interest rate that could be earned by putting money in an endowment fund instead of spending it on capital improvements. Discount rates arbitrarily established by governing boards also are used.

Caution: Guard against using an excessively low discount rate. This may result in accepting projects that will not be profitable. To guard against this problem, the Office of Management and Budget promulgates a discount rate of at least 10 percent on all projects to be considered by federal government units (Office of Management and Budget Circular No. A-94, March 1972).

Recommendation: In the case of nonprofit units such as schools and hospitals, the discount rate should be the average rate of return on private sector investments. The average discount rate will provide more meaningful results than using a specific interest rate on a special bond issue or the interest return on an endowment fund.

Risk and Uncertainty

Risk analysis is important in making capital investment decisions because of the significant amount of capital involved and the long-term nature of the investments being considered. The higher the risk associated with a proposed project, the greater the return rate that must be earned on the project to compensate for that risk.

Managers must consider the interrelation of risk among all investments. By properly diversifying, the best combination of expected net present value and risk can be obtained.

Note: Do not automatically reject a high-risk project. For example, a new product with much risk may be accepted if there is a chance of a major breakthrough in the market. The business may be able to afford a few unsuccessful new products if one is developed for extraordinary return.

Probabilities can be assigned to expected cash flows based on risk. The probabilities are multiplied by the monetary values to derive the expected monetary value of the investment. A probability distribution function can be generated by computer.

Rule of thumb: The tighter the probability distribution of expected future returns, the lower is the risk associated with a project.

Several methods to incorporate risk into capital budgeting are

- Risk-adjusted discount rate
- Standard deviation and coefficient of variation
- Certainty equivalent
- Semivariance
- Simulation
- Sensitivity analysis
- Decision (probability) trees

Other means of adjusting for uncertainty include

- Decreasing the expected life of an investment
- Use of pessimistic estimates of cash flow
- Comparison of the results of optimistic, pessimistic, and best-guess estimates of cash flows

Risk-Adjusted Discount Rate

Risk can be included in capital budgeting by computing probable cash flows on the basis of probabilities and assigning a discount rate based on the riskiness of alternative proposals.

Using this approach, an investment's value is determined by discounting the expected cash flow at a rate allowing for the time value of money and for the risk associated with the cash flow. The cost of capital (discount rate) is adjusted for a project's risk. A profitable investment is indicated by a positive net present value. Using this method, one judges the risk class of the proposed capital investment and the risk-adjusted discount rate appropriate for that class.

Suggestion: If results are doubtful, they be checked by estimating the cost of capital of other companies specializing in the type of investment under consideration.

Example 22

You are evaluating whether to accept proposal A or B. Each proposal mandates an initial cash outlay of $12,000 and has a three-year life. Annual net cash flows, as well as expected probabilities, are:

Proposal A:

Expected Annual Cash Inflow	Probability
$ 5,800	.4
6,400	.5
7,000	.1

Proposal B:

Expected Annual Cash Inflow	Probability
$ 3,400	.3
8,000	.5
11,000	.2

The inflation rate and interest rate are estimated at 10 percent. Proposal A has a lower risk because its cash flows show greater stability than those of proposal B. Since proposal A has less risk, it is assigned a discount rate of 8 percent, while proposal B is assigned a 10 percent discount rate because of the greater risk.

Proposal A:

Cash Inflow	Probability	Probable Cash Flow
$5,800	.4	$2,320
6,400	.5	3,200
7,000	.1	700
Expected annual cash inflow		$6,220

Proposal B:

Cash Inflow	Probability	Probable Cash Flow
$ 3,400	.3	$1,020
8,000	.5	4,000
11,000	.2	2,200
Expected annual cash inflow		$7,220

Proposal A:

Year	Explanation	Amount		Factor	Present Value
0	Initial investment	$–12,000	×	1	$–12,000
1–3	Annual cash inflow	+6,220	×	2.5571[a]	+16,030
	Net present value				$ +4,030

Proposal B:

Year	Explanation	Amount		Factor	Present Value
0	Initial investment	$–12,000	×	1	$–12,000
1–3	Annual cash flow	+7,220	×	2.4869[b]	–17,955
	Net present value				$ +5,995

[a]Using an 8 percent discount rate (Table AI.4).
[b]Using a 10 percent discount rate (Table AI.4).

Even though project B has more risk, it has a higher risk-adjusted net present value. Project B should thus be selected.

Standard Deviation and Coefficient of Variation

Risk is a measure of dispersion around a probability distribution. It is the variability of cash flow around the expected value. Risk can be measured in either absolute or relative terms. First, the expected value, $\bar{A}$ is

$$\bar{A} = \sum_{i=1}^{n} A_i p_i$$

where
A_i = the value of the ith possible outcome
p_i = the probability that the ith outcome will take place
n = the number of possible outcomes

Then the absolute risk is determined by the standard deviation

$$\sigma = \sqrt{\sum_{i=1}^{n} (A_i - \bar{A})^2 p_i}$$

The relative risk is expressed by the coefficient of variation:

$$\frac{\sigma}{\bar{A}}$$

Example 23

You are considering investing in one of two projects. Depending on the state of the economy, the projects would provide these cash inflows in each of the next five years:

Economic Condition	Probability	Proposal A	Proposal B
Recession	.3	$1,000	$ 500
Normal	.4	2,000	2,000
Boom	.3	3,000	5,000

We now compute the expected value ($\bar{A}$), the standard deviation (σ), and the coefficient of variation ($\sigma/\bar{A}$).

Proposal A:

A_i	p_i	$A_i p_i$	$(A_i - \bar{A})$	$(A_i - \bar{A})^2$
$1,000	.3	$ 300	–$1,000	$1,000,000
2,000	.4	800	0	0
3.000	.3	900	1,000	1,000,000
		$\bar{A}$ = $2,000		σ^2 = $2,000,000

Because $\sigma^2 = \$2{,}000{,}000$, $\sigma = \$1{,}414$. Thus

$$\frac{\sigma}{\bar{A}} = \frac{\$1,414}{\$2,000} = .71$$

Proposal B:

A_i	ρ_i	$A_i\rho_i$	$(A_i - \bar{A})$	$(A_i - \bar{A})^2$
$ 500	.3	$ 150	$–1,950	$ 3,802,500
2,000	.4	800	– 450	202,500
5,000	.3	1,500	2,550	6,502,500
		$\bar{A} = \$2{,}450$		$\sigma^2 = \$10{,}507{,}500$

Since, $\sigma^2 = \$10{,}507{,}500$, $\sigma = \$3{,}242$. Thus,

$$\frac{\sigma}{\bar{A}} = \frac{\$3,242}{\$2,450} = 1.32$$

Therefore, proposal A is relatively less risky than is proposal B, as measured by the coefficient of variation.

Certainty Equivalent

The certainty equivalent approach relates to utility theory. One specifies at what point the company is indifferent to the choice between a certain sum of dollars and the expected value of a risky sum. The certainty equivalent is multiplied by the original cash flow to obtain the equivalent certain cash flow. Then normal capital budgeting is used. The risk-free rate of return is employed as the discount rate under the net present value method and as the cutoff rate under the internal rate of return method.

Example 24

A company's cost of capital is 14 percent after taxes. Under consideration is a four-year project that will require an initial investment of $50,000. These data also exist:

Year	After-tax Cash Flow	Certainly Equivalent Coefficient
1	$10,000	.95
2	15,000	.80
3	20,000	.70
4	25,000	.60

The risk-free rate of return is 5 percent.
Equivalent certain cash inflows are

Year	After-tax Cash Inflow	Certainly Equivalent Coefficient	Equivalent Certain Cash Inflow	Present Value Factor at 5%	Present Value
1	$10,000	.95	$ 9,500	.9524	$ 9,048
2	15,000	.80	12,000	.9070	10,884
3	20,000	.70	14,000	.8638	12,093
4	25,000	.60	15,000	.8227	12,341
					$44,366

Net Present Value:

Initial investment	$–50,000
Present value of cash inflows	+44,366
Net present value	$ –5,634

Using trial and error, you arrive at an internal rate of 4 percent.

The proposal should be rejected because of the negative net present value and an internal rate (4 percent) less than the risk-free rate (5 percent).

Semivariance

Semivariance is the expected value of the squared negative deviations of the possible outcomes from an arbitrarily chosen point of reference. Semivariance appraises risks applicable to different distributions by referring to a fixed point designated by the manager. In computing semivariance, positive and negative deviations contribute differently to risk, whereas in computing variance, a positive and negative deviation of the same magnitude contributes equally to risk.

Key point: Because there is an opportunity cost of tying up capital, the risk of an investment is measured principally by the prospect of failure to earn the return.

Simulation

Probability distributions for a number of variables (e.g., investment outlays or unit sales) are obtained when doing a simulation. Selecting these variables from the distributions at random results in an estimated net present value. Because a computer is used to generate many results using random numbers, project simulation is expensive.

Sensitivity Analysis

Forecasts of many calculated net present values and internal rates of return, under various alternatives, are compared to identify how sensitive net present value or internal rate of return is to changing conditions. One determines whether one or more than one variable significantly affects net present value, once that variable is changed. If net present value is materially changed, one is dealing with a much riskier asset than was originally forecast. Sensitivity analysis provides an immediate financial measure of possible errors in forecasts. It focuses on decisions that may be sensitive.

Sensitivity analysis can take various forms. For example, a financial manager may want to know how far annual sales can decline and still break even on the investment. Sensitivity analysis also can be used to test the sensitivity of a decision to estimates of selling price and per-unit variable cost.

Key point: Sensitivity analysis provides managers with an idea of the degree to which unfavorable occurrences like lower volumes, shorter useful lives, or higher costs are likely to affect the profitability of a project. It is employed due to the uncertainty of dealing with actual situations.

Decision Tree

A decision (probability) tree graphically shows the sequence of possible outcomes. The capital budgeting tree shows cash flows and net present value of the project under different possible circumstances.

Advantages:

- Shows possible outcomes of the contemplated project
- Makes users more cognizant of adverse possibilities
- Depicts the conditional nature of later years' cash flows

Disadvantage:

- Many problems are too complex to allow for a year-by-year depiction. For example, a three-year project with three possible outcomes following each year has 27 paths.

Example 25

You want to introduce one of two products. The probabilities and present values of expected cash inflows are

Product	Investment	Present Value of Cash Inflows	Probability
A	$225,000		
		$450,000	.4
		200,000	.5
		–100,000	.1
B	80,000		
		320,000	.2
		100,000	.6
		–150,000	.2

	Initial Investment (1)	Probability (2)	PV of Cash Inflows (3)	PV of Cash Inflows (2) × (3) = (4)
		.40	$450,000	$180,000
		.50	200,000	100,000
Product A	$225,000	.10	–100,000	–10,000
				$270,000
or				
		.20	$320,000	$ 64 ,000
Product B		.60	100,000	60,000
	$ 80,000	.20	–150,000	–30,000
				$ 94,000

Net present value:

Product A: $270,000 – $225,000 = $45,000

Product B: $94,000 – $80,000 = $14,000

Product A should be selected.

Correlation of Cash Flows over Time

When cash inflows are independent from period to period, it is fairly easy to measure the overall risk of an investment proposal. In some cases, however, especially with the introduction of a new product, the cash flows experienced in early years affect the size of the cash flows in later years. This is called the *time dependence of cash flows*, and it has the effect of increasing the risk of the project over time.

Example 26

Janday Corporation's after-tax cash inflows (ATCI) are time dependent, so that year 1 results ($ATCI_1$) affect the cash flows in year 2 ($ATCI_2$) as follows:

If $ATCI_1$ is $8,000 with a 40 percent probability, the distribution for $ATCI_2$ is

0.3	$ 5,000
0.5	10,000
0.2	15,000

If $ATCI_1$ is $15,000 with a 50 percent probability, the distribution for $ATCI_2$ is

0.3	$10,000
0.6	20,000
0.1	30,000

If $ATCI_1$ is $20,000 with a 10 percent chance, the distribution for $ATCI_2$ is

0.1	$15,000
0.8	40,000
0.1	50,000

The project requires an initial investment of $20,000, and the risk-free rate of capital is 10 percent.

The company uses the expected net present value from decision tree analysis to determine whether the project should be accepted. The analysis is:

Time 0		Time 1		Time 2	NPV at 10 %	Joint Probability	Expected NPV
			.3	$ 5,000	$–8,595[a]	.12[b]	$–1,031
		$ 8,000	.5	10,000	–4,463	.20	–893
			.2	15,000	–331	.08	–26
	.4		.3	$10,000	$1,901	.15	285
$–20,000	.5	$15,000	.6	20,000	10,165	.30	3,050
			.1	30,000	18,429	.05	921
	.1		.1	$15,000	$10,576	.01	106
		$20,000	.8	40,000	21,238	.08	2,499
			.1	50,000	39,502	.01	395
						1.00	$5,306

$$^{a}\text{NPV} = \text{PV} - \text{I} = \$8,000\ \text{PVIF}_{10,1} + \$5,000\ \text{PVIF}_{10,2} - \$20,000$$
$$= \$8,000(.9091) + \$5,000(.8264) - \$20,000$$
$$= \$-8,595$$

[b] Joint probability of the first path = (.4)(.3) = .12

Since the NPV is positive ($5,306), Janday Corporation should accept the project.

Normal Distribution and NPV Analysis: Standardizing the Dispersion

With the assumption of *independence* of cash flows over time, the expected NPV would be

$$\text{NPV} = \text{PV} - \text{I}$$
$$= \sum_{t=1}^{n} \frac{\overline{A}_t}{(1+r)^t} - \text{I}$$

The standard deviation of NPVs is

$$\sigma = \sqrt{\sum_{t=1}^{n} \frac{\sigma_t^2}{(1+r)^{2t}}}$$

The expected value ($\overline{A}$) and the standard deviation σ give a considerable amount of information by which to assess the risk of an investment project. If the

probability distribution is *normal,* some probability statement regarding the project's NPV can be made.

Example: The probability of a project's NPV providing an NPV of less than or greater than zero can be computed by standardizing the normal variate x:

$$z = \frac{x - NPV}{\sigma}$$

where

x = the outcome to be found
NPV = the expected NPV
z = the standardized normal variate whose probability value can be found in Exhibit 20.5

Example 27

Assume an investment with these data:

	Period 1	Period 2	Period 3
Expected cash inflow ($\bar{A}$)	$5,000	$4,000	$3,000
Standard deviation(σ)	1,140	1,140	1,140

Assume that the firm's cost of capital is 8 percent and the initial investment is $9,000. Then the expected NPV is

$$\begin{aligned} NPV &= PV - I \\ &= \frac{\$5.000}{(1+.08)} + \frac{\$4.000}{(1+.08)^2} + \frac{\$3.000}{(1+.08)^3} - \$9,000 \\ &= \$5,000(PVIF_{8.1}) + \$4,000(PVIF_{8.2}) + \$3,000(PVIF_{8.3}) - \$9,000 \\ &= \$5,000(.9259) + \$4,000(.8573) + \$3,000(.7938) - \$9,000 \\ &= \$4,630 + \$3,429 + \$2,381 - \$9,000 = \$1,440 \end{aligned}$$

The standard deviation about the expected NPV is

$$\begin{aligned} \sigma &= \sqrt{\sum_{t=1}^{n} \frac{\sigma_t^2}{(1+r)^{2t}}} \\ &= \sqrt{\frac{\$1,140^2}{(1+.08)^2} + \frac{\$1,140^2}{(1+.08)^4} + \frac{\$1,140^2}{(1+.08)^6}} \\ &= \sqrt{\$2,888,411} = \$1,670 \end{aligned}$$

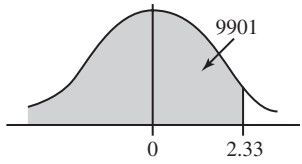
The probability that the NPV is less than zero is then

$$z = \frac{x - NPV}{\sigma} = \frac{0 - \$1,440}{\$1,670} = -.862$$

The area of normal distribution, that is, z standard deviations to the left or right of the mean, may be found in Exhibit 20.5. A value of z equal to –.862 falls in the area between 0.1949 and 0.1922. Therefore, there is approximately a 19 percent chance that the project's NPV will be zero or less. Putting it another way, there is

Exhibit 20.5

Normal Probability Distribution Table



Areas Under the Normal Curve

Z	0	1	2	3	4	5	6	7	8	9
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7703	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9278	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9430	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9648	.9656	.9664	.9671	.9678	.9686	.9693	.9700	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9762	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9874	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.	.9987	.9990	.9993	.9995	.9997	.9998	.9998	.9999	.9999	1.0000

a 19 percent chance that the internal rate of return on the project will be less than the risk-free rate.

Conclusion

Capital budgeting is the selection of the optimum, alternative, long-term, investment opportunity. It tells where to put corporate resources. It involves the calculation of how many years it takes to get money back, the return earned on a proposal, and the net present value of cash flows to be derived.

21

Zero-base Budgeting:

Priority Budgeting for Best Resource Allocation

Zero-base budgeting (ZBB) can be used by nonfinancial managers to identify, plan, and control projects and programs. It enhances effectiveness and efficiency. There is a matching of service levels to available resources. Each manager must justify a budget request in detail, beginning with the zero balance. It can lower production, service, and operating costs.

ZBB is a *priority* form of budgeting, ranking activities such as products and services. It may be used by managers to review and analyze programs, proposals, activities, and functions to increase profitability, enhance efficiency, or lower costs. ZBB results in the optimum allocation of company resources. There exists an input-output relationship.

ZBB considers the objectives of the activity and how they are to be accomplished. The failure to fund an activity may result in adverse consequences that have to be taken into account. For example, the failure to produce a particular product may adversely effect the sales of related products in the company's overall product line.

Managers who benefit from using ZBB include production managers, purchase managers, marketing executives, general managers and other administrative staff, engineers, research managers, personnel managers, operations research staff, attorneys, and economists. For example, ZBB can be used by marketing managers to appraise competing alternative product lines, formulate an advertising strategy, evaluate salesperson performance, and establish and monitor marketing priorities. A cost/benefit analysis should be undertaken for each sales program in terms of staff, product, and territory. The objectives of each subunit (e.g., department, responsibility center) should be consistent with the overall goals of the company.

This chapter discusses the ZBB process, its effects, activity units, decision packages, ranking proposals, and project (program) budgets.

Zero-base Budgeting Process

ZBB begins with a zero balance and formulates objectives to be achieved. All activities are analyzed for the current year. The manager may decide to fund an existing project at the same level as last year after the review. However, it is most likely that funding will be increased or decreased, based on new information. It is also possible that an alternative way may be used for that project, based on current cost or time considerations.

The ZBB approach sets *minimum* funding amounts for each major activity (e.g., product, service). Amounts above the minimum level must be fully *justified* in order to be approved by upper management. Each program, product, or service is looked at *each year* to determine its benefit. If an activity cannot be supported as having value, it is *not* funded. The manager is *not* concerned with the *past* but rather looks at the current and future viability. The manager, in effect, discards the deadwood. Programs with inefficiencies, waste, and anything that no longer makes financial sense are dropped.

The ZBB process involves:

- Developing assumptions
- Ranking proposals
- Appraising and controlling
- Preparing the budget
- Identifying and evaluating decision units

Zero-base Budgeting Effects

The manager must consider the negative effect, if any, of not accepting a proposed project. For example, if the production manager does not buy a certain type of machine, that will cause quality problems with the product.

Activity Units

Managers should have control over the activities in their responsibility unit. They must be thoroughly familiar with how their department functions and what resources are needed for staff and money. Activities should be detailed to show work flow.

The *activity unit* is an important cost element of ZBB. It is the lowest unit within the company for which a budget is prepared. An activity unit may represent a function, program, organizational unit, or line item. A manager is typically accountable for the performance of a unit. Decision units include research and development, quality control, computer services, legal, engineering, production, marketing, and personnel.

There are alternative operating modes for activity units, including centralizing the activity, decentralizing the functions, integrating the operations, expanding or reducing activities, and eliminating the function.

Productivity and effectiveness measures should be utilized. The manager should consider financial information, workload, and established standards.

Measures of performance include:

- *Production control*—number of manufacturing trouble spots and poor productivity
- *Quality control*—number of rejections and other deficiencies
- *Regional marketing manager*—number of lost accounts and reasons for their loss

Control measures include:

- Quarterly output appraisal, using predetermined performance standards
- Quarterly modifications to the budget, based on current information
- Comparing actual cost and time to budgeted cost and time for variance determination

Decision units should be compared within the company, particularly those that are comparable in size (e.g., number of workers, total assets, and revenue).

Priority should be given to activities that must conform to legal requirements, industry practice, or other constraints.

Decision Packages

The first major step in ZBB is the development of decision packages for existing and new programs. The decision package contains a description of the project, specific measures, and employee responsibilities. The package includes the manager's recommended way of producing a product or rendering a service in terms of cost and time. Alternative ways of performing the activity are also specified. For example, improving the quality will increase the cost. Further, reducing the time also may increase the cost because of overtime pay.

A decision package contains this information:

- Description of the activity and reasons to carry it out
- Statement of objectives and benefits to be derived
- The plan to achieve the program
- The priorities established
- Cost and time estimates along with evaluation
- Alternative methods of achieving the activity stated in cost and time
- Measures of output

- Resources needed, including physical and personnel support from other responsibility centers
- Legal, technical, and operational aspects
- Risk considerations

Decision packages must be reviewed carefully for possible deficiencies. Managers should assure themselves that the packages are complete and independent. Further, decision packages should *not* cross functional and organizational lines. If information is missing or packages are lumped together, misleading conclusions may be drawn.

A decision package can be either *mutually exclusive or incremental.* The former are alternative options, meaning that the acceptance of one precludes the acceptance of another. Incremental packages involve additional effort levels. For example, one package may necessitate 3,000 labor hours per month while another may require 3,500 hours for that month.

Decision packages may cover either a short-term or long-term period. A matching of resources with objectives is necessary. Emphasis should be placed on higher return areas.

The format of decision packages should be standardized. Upper management has to approve the decision packages formulated by managers.

Ranking Proposals

In ranking proposals, upper management will rely heavily on the recommendations made by managers who have a keen knowledge of their decision units. Quantitative and qualitative factors must be considered. A cost/benefit analysis should be performed for each decision unit.

The ranking of decision packages goes in the order of decreasing benefit. The manager must identify those products or services that are the most crucial. The highest priority should be assigned to the *minimum* increment of service below which the unit cannot operate effectively.

Top management performs the final ranking after obtaining initial recommendations of managers within the company's divisions, departments, and cost centers. If a manager's recommendations are rejected, he or she should be notified why.

A dollar cutoff must be established for programs depending on budgetary constraints. For example, an 80 percent cutoff may be set, so if the programs total $1 million, only $800,000 is in available funds. The manager should also rank nonfunded packages, in the event that additional funds become available at a later date.

A low-priority item may later become a high-priority one because of changed circumstances. For example, the political climate may change due to a new legislature, governor, mayor, or president. Priorities may change during the year, so adjustments may be necessary.

Different ranking techniques may be used, such as single standard, voting, and major category. Single standard is best for similar packages. All packages are

evaluated based on only one feature, such as revenue, earnings, return on investment, net present value, amount saved, and cost/benefit ratio. This approach is not suitable for dissimilar packages because it may not incorporate an essential aspect, such as health and safety.

Under the voting method, there is a voting committee. Each member appraises the decision packages. The packages then are discussed at the committee meeting. The ranking is based on a committee vote.

Under the major category approach, decision packages are classified into areas. Decision packages are then ranked by categories, with more important ones receiving greater emphasis. A category promising rapid growth may receive 10 times the funding of a questionable category of high risk and limited earning potential.

Once fund allocation has been decided on, detailed budgets are drawn up. These budgets usually are based on incremental activities incorporated on the ranking table.

Example 1

A company prepares a decision package for each product department managers wish to produce. There are 150 decision packages for all existing and proposed products. An illustration for a decision package for product A to be manufactured in Department X is presented in Exhibit 21.1.

Each of the 150 products from different departments is submitted by managers to senior management, who will appraise them. There is a budget constraint, so some products will not be funded. The decision package for product A may be flatly rejected. If approved, the manager may be able to produce it either as recommended or in one of the alternative paths. The alternative may be chosen because it involves lower cost or a faster completion date. By specifying alternatives, innovation and better methods may result.

Exhibit 21.1

Product A—Decision Package

	Alternative A	$200,000	1 year
	Recommended Way	$250,000	6 months
	Alternative B	$350,000	2 months

Project (Program) Budgets

A program may be by division, department, or segment within the department. A program budget is the estimated cost of conducting an activity or function. Program activities include products or services, research and development, capital assets and facilities, maintenance, marketing, training, engineering, and government contracts. A program budget provides functions for a specific activity such as quality control and marketing research.

After a goal is identified, the program and steps to achieve that goal are specified. There is an evaluation of alternatives to ascertain the most productive and least costly manner to achieve program objectives. Resources must be allocated to programs and projects.

A project should be segregated into major activities or tasks, which should then be subdivided into specific subactivities. Program budgeting examines the tasks needed to complete a program, the manpower required, and the time period for each activity.

Program budgeting includes planning, programming, and budgeting. It accumulates data and reviews the detailed plans. It contains a mix of resources, including staff, equipment, raw materials, and capital to achieve the desired objective within a reasonable time period. Alternatives are appraised. There is a downward progression of the decision-making process. There is an emphasis on output goals of products and services rather than input goals. The budgeting is future-oriented, examining the effect of current decisions on future results.

Program budgets are used for programs or projects of a one-time, long-term nature involving large cash outlays. Any potential problems should be anticipated. Responsibility should be assigned for particular activities. Adjustments to the plan may be required.

A cost/benefit analysis should be undertaken for programs. There should be a ranking of programs in priority order. Program interrelationships must be identified.

There should be a tracing of costs to individual projects, products, services, or individuals. This may be accomplished by assigning project numbers and having staff enter code numbers into the computer when supplies are requisitioned, expenses incurred, and salary payments made.

Work packages have to be approved by segment managers. An illustrative work-authorization form appears in Exhibit 21.2.

A time sheet is prepared for project activities. Estimated and actual times are compared to see if deadlines are being met. There should be a time schedule for each stage of the project. This schedule should cover the phases of planning, programming, and budgeting. Activities should be timed and scheduled, using the program evaluation and review technique (PERT). Work should be inspected at key points.

Exhibit 21.2

Work-Authorization Form

Project:

Work package number:

Issue date:

Revision date and number

		Cost	Center
Material			

	Hours	Cost	Center
Labor			

Conclusion

A cost/benefit analysis must be undertaken to see if the benefits derived from ZBB are worth the costs incurred. Because of the costs and time required, ZBB should be conducted over a span of years (e.g., three years) instead of one year. An annual evaluation is not cost effective.

ZBB is a continual process because decision packages must be revised for unexpected events.

22

Managers' Performance:
Evaluation on the Division Level

Divisional reports should describe performance and indicate whether objectives are being accomplished.

A segment is a part or activity of an organization from which a manager derives cost or revenue data. Examples of segments are sales territories, individual stores, service centers, manufacturing plants, sales departments, product lines, geographic areas, and types of customers.

Analysis of segmental performance assists in determining the success or failure of the divisional manager and his division. Performance reports should include industry and competitor comparisons. They also should match cycles of major business lines, activities, and geographic areas.

Performance measures consider the contribution of the division to profit and quantity as well as whether the division meets the overall goals of the company. It is difficult to compare profit of different segments, especially when they are of different sizes or provide different kinds of products or services. Measures of divisional performance for a particular segment should be compared to previous periods, other segments, and predetermined standards.

Profit planning by segments applies to selecting from alternative uses of company resources to accomplish a target profit figure. It requires that the profitability of each segment be measured to see the overall profitability of all feasible combinations or alternatives.

Appraising Manager Performance

In appraising manager performance, one must determine which factors were under the manager's control (e.g., advertising budget) and which factors were not (e.g., economic conditions). Comparison should be made of one division in the company to other divisions as well as of a division in the company to a similar division in a competing company. Appraisal also should be made of the risk and

earning potential of a division. Graphic presentation shows comparisons of an historical, current, or prognostic nature.

Importance of Measuring Performance of Divisional Manager

- Assists in formulating management incentives and controlling operations to meet corporate goals
- Directs upper management attention to where it would be most productive
- Determines whom to reward for good performance
- Determines who is not doing well so corrective action may be taken
- Provides job satisfaction, because the manager receives feedback

In decentralization, profit responsibility is assigned to subunits. The lower the level where decisions are made, the greater is the decentralization. It is most effective in organizations where cost and profit measurements are necessary and is most successful in organizations where subunits are totally autonomous. Decentralization is in different forms, including functional, geographical, and profit.

Advantages of Decentralization

- Top management has more time for strategic planning.
- Decisions are made by managers with the most knowledge of local conditions.
- There is greater managerial input in decision making.
- Managers have more control over results, resulting in better motivation.

Disadvantages of Decentralization

- Managers become narrow-sighted and look solely at the division rather than at the company as a whole.
- Duplication of services can result.
- There is an increased cost in obtaining additional information.

For comparison purposes, replacement cost instead of historical cost should be employed. It furnishes a relative basis of comparison because it represents the comparable necessary investment at the end of a reporting period. Evaluating replacement cost assists in comparing asset valuation to current productivity. If replacement cost cannot be determined, valuation can be based on the present value of future net cash flows.

The major method of analyzing divisional performance is by responsibility center, which consists of revenue center, cost center, profit center, and investment center.

Responsibility Center

A responsibility center is a segment of a company in which controls are used to appraise the manager's performance. These controls include costs, revenues, and investment funds, and a center may be responsible for all three or one.

Responsibility accounting is the system for collecting and reporting revenue and cost information by responsibility centers. It operates on the premise that managers should be held responsible for their performances, those of their subordinates, and all activities within their centers. It is both a planning and a control technique. Responsibility accounting, also called *profitability accounting* and *activity accounting*, has these advantages:

- It facilitates delegation of decision making.
- It helps management promote the concept of management by objective, in which managers agree on a set of goals. The manager's performance is then evaluated based on attainment of these goals.
- It permits effective use of the concept of *management by exception.*

Exhibit 22.1 shows responsibility centers within an organization. Exhibit 22.2 presents an organization chart. Exhibit 22.3 depicts responsibility accounting at various levels.

Exhibit 22.1

Responsibility Centers Within a Company

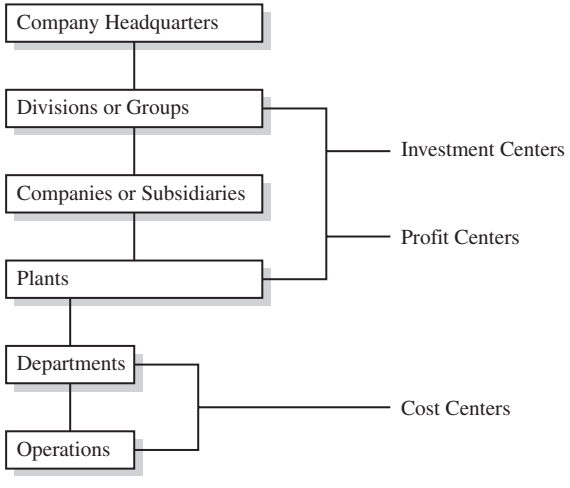


Exhibit 22.2

Organization Chart of a Company

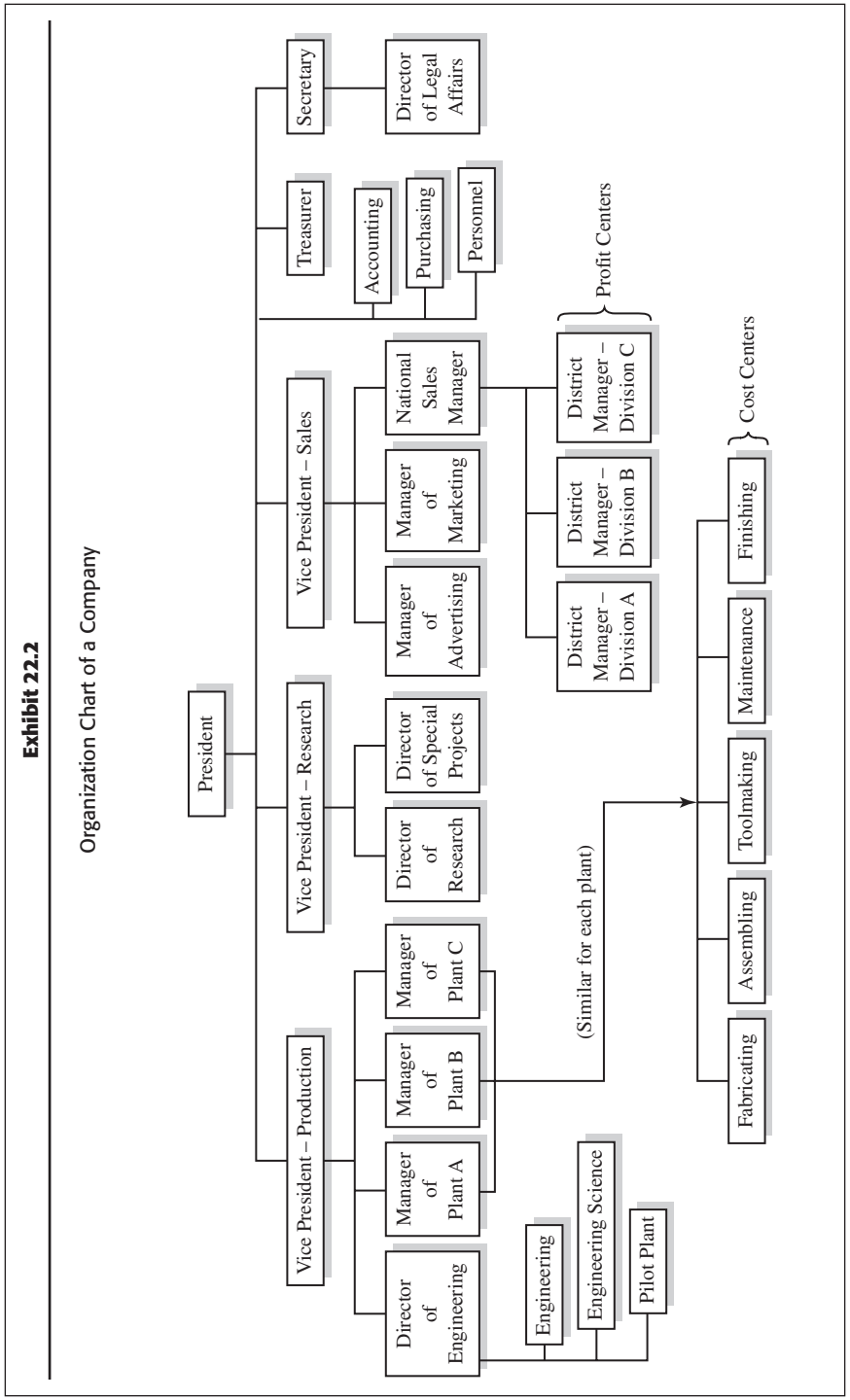


Exhibit 22.3

Paul Burgers
Responsibility Accounting at Various Levels
(in thousands)

Northern California District Manager Monthly Responsibility Report	Budget		Variance: Favorable (Unfavorable)	
Operating income of branches and district manager office expense:	*This Month*	*Year to Date*	*This Month*	*Year to Date*
District manager office expense	–145	–605	–8	–20
Berkeley branch	475	1728	–3	–11
Palo Alto branch	500	1800	19	90
Oakland branch	310	1220	31	110
Others	600	2560	47	130
Operating income	1740	6703	86	299

Berkeley Branch Manager Monthly Responsibility Report	Budget		Variance: Favorable (Unfavorable)	
Operating income of stores and branch manager office expense:	*This Month*	*Year to Date*	*This Month*	*Year to Date*
Branch manager office expense	–20	–306	–5	4
Store X	48	148	–1	–5
Store Y	64	226	9	9
Store Z	38	160	4	10
Others	345	1500	–10	–29
Operating income	475	1728	–3	–11

Store Y Manager Monthly Responsibility Report	Budget		Variance: Favorable (Unfavorable)	
Sales and expenses:	*This Month*	*Year to Date*	*This Month*	*Year to Date*
Sales	170	690	8	12
Food expense	40	198	5	14
Supplies	15	62	–3	–2
Payroll	24	98	–4	–5
Repairs & Maintenance	5	21	1	–2
General	12	45	—	–2
Depreciation	10	40	—	—
Total expenses	106	464	–1	3
Operating income	64	226	9	9

Responsibility centers can be found in both centralized and decentralized organizations. A profit center often is associated with a decentralized organization and a cost center with a centralized one. However, this is not always the case.

There are lines of responsibility. Exxon Mobil, for example, is organized primarily by business functions: exploitation, refining, and marketing. General Mills is organized by product lines.

Revenue Center

A revenue center is responsible for obtaining a target level of sales revenue. An example is a district sales office. The performance report for a revenue center should contain the budgeted and actual sales for the center by product, including evaluation. Usually the manager of the center is responsible for marketing a product line. But a revenue center typically has a few costs (e.g., salaries, rent). Hence, a revenue center is responsible mostly for revenues and only incidentally for some costs, typically not product costs.

A revenue center approach is most suitable to a sales manager, who is responsible for sales volume, selling price, and total sales. If actual sales exceed budgeted sales, the sales manager is doing something right.

Sales analysis may involve prior sales performance, looking at sales trends over the years, and comparing actual sales to budgeted sales.

In a service business, some performance measures include billable time, average billing rate, and cost per hour of employee time.

Accountability for departmental sales revenue assumes the manager has authority to determine product sales prices.

Cost Center

A cost center is typically the smallest segment of activity or responsibility area for which costs are accumulated. This approach usually is employed by departments rather than divisions. A cost center has no control over sales or marketing activities. Departmental profit is difficult to derive because of problems in allocating revenue and costs.

A cost center is a department whose head has responsibility and accountability for costs incurred and for the quantity and quality of products or services. For example, the personnel manager is accountable for costs incurred and the quality of services rendered. The production manager compares expected and actual costs and quantities as a measure of productivity.

Examples of cost centers are a maintenance department and fabricating department in a manufacturing company.

Although a cost center may be relatively small, it also can be very large, such as an administrative area of an entire factory. Some cost centers may consist of a number of smaller cost centers.

A cost center is basically responsible for direct operational costs and meeting production budgets and quotas. Authority and responsibility must be under the control of the department head, usually a foreman.

In the cost center approach, budgeted cost is compared to actual cost. Variances are investigated, necessary corrective action is taken, and efficiencies are accorded recognition. This topic is covered in detail in Chapter 8.

The cost center approach is useful when a manager has control over costs at a specified operating level. Use this approach when problems arise in relating financial measures to output.

Cost center evaluation is most suitable for accounting and financial reporting, legal, computer services, marketing, personnel, and public relations.

Provision should exist for chargebacks, where appropriate. For example, if a quality control department made an error in its evaluation of product quality, leading to acceptance by the purchasing department, the quality control department should be charged with the increased costs to improve the purchased goods.

The cost center approach may be appropriate for nonprofit and governmental units where budgetary appropriations are assigned. A manager's performance depends on his or her ability to achieve output levels, given budgetary constraints.

When looking at a manager's performance, relevant costs are those incremental costs over which he or she has control. Incremental costs are those expenditures that would not exist if the center were abandoned. Allocated common costs (e.g., general administration) should not be included in appraising manager performance. Such costs should, however, be allocated in determining the profit figure for the entire division. Cost allocation must conform to goal congruence and autonomy and should be applied consistently among divisions.

Cost center evaluation will not be worthwhile unless reliable budget figures exist. If a division's situation significantly changes, an adjustment to the initial budget is necessary. In such a case, actual cost should be compared with the initial budget figure (original goal) and the revised budget. Flexible budgets should be prepared that allow examination of costs incurred at different levels of capacity. For example, figures can be budgeted for expected capacity, optimistic capacity, and pessimistic capacity.

When a transfer occurs between cost centers, the transfer price should be based on actual cost, standard cost, or controllable cost. Transfer price is the price charged between divisions for a product or service. Using actual cost may pass cost inefficiencies onto the next division. There is no incentive for the transferer to control costs. Using standard cost corrects the problem of transferring cost inefficiencies. It should be noted that standard cost includes allocated fixed cost, which might be subjective.

A good transfer price is a controllable cost. Charge the cost center with actual controllable cost and credit it with standard controllable cost for the assembled product or service to other divisions.

In evaluating administrative functions, prepare performance reports that examine such dollar indicators as executive salaries and service department costs. The

reports also should look at nondollar measures such as number of files handled, phone calls taken, and invoices processed.

In appraising a cost center, look at the ratio of indirect to direct personnel. This ratio reveals the division manpower planning and control.

Manpower needs are based on the individual unit's variable activities and needs. There should be a proper relationship between indirect and direct labor so that services generate maximum profitability. A high ratio of indirect labor may mean the division is top-heavy in administrative and clerical staff.

Example 1

The indirect personnel to direct personnel ratio averaged about 45 percent each month over a six-month period. This is favorable because management has maintained a fairly consistent relationship between direct and indirect personnel.

In order to appraise the effectiveness of employee staff in generating divisional revenue, these ratios may be computed:

- Sales to direct manpower
- Sales to total number of employees
- Sales to total dollar salaries of employees

Higher ratios are desirable because they indicate favorable employee performance in generating sales. For example, an increasing trend in revenue per employee indicates greater productivity. A decline in the ratios may be due to lower sales because of external factors beyond the control of the division manager.

Cost reduction measures may be implemented *without* having a negative long-term effect on the company. Such measures may improve short-term profitability. Short-term cost cutting measures may include:

- Marketing
  - Paying salespeople on a commission basis instead of a fixed salary
  - Using distributors rather than direct selling
- Manufacturing
  - Hiring per-diem laborers rather than subcontracting the work
  - Buying raw materials outside rather than producing them. When the quantity of the product required is relatively low, it is typically better to buy from the outside. Once production exceeds a specified level, the company can increase profitability by doing its own manufacturing.
  - Using parts rather than subassemblies as raw materials

Profit Center

A profit center is a responsibility unit that measures the performance of a division, product line, or geographic area. Net income and contribution margin can be computed for a center, which typically does not have significant amounts of invested capital. The profit center approach enhances decentralization and provides units for decision-making purposes.

Use it for a self-contained division—with its own manufacturing and distribution facilities—when there are a limited number of interdivision transfers. The profit reported by the division is basically independent of other divisions' operating activities. Divisional earnings should not be increased by any action reducing overall corporate profitability.

A profit center also should be used when divisional managers have decision-making authority for quantity and mix of goods or services manufactured. With a profit center, net income is determined as if the division were a separate economic entity and the manager is more cognizant of outside market considerations. Profit may be expressed as net income, contribution margin, gross profit, controllable profit, and incremental profit. Examples of profit centers are an auto repair center in a department store and an appliance department in a retail store.

In some instances, profit centers are formed when the product or service is used solely within the company. For example, the computer department may bill each of the firm's administrative and operating units for computing services.

It is not essential that fixed costs be allocated, so contribution margin may be a good indicator of divisional performance. If each division meets its target contribution margin, excess contribution margin will be adequate to cover general corporate expenses.

A contribution margin income statement can evaluate divisional and managerial performance. It also aids in computing selling price, the price to accept for an order given, an idle capacity situation, output levels, maximization of resource uses, and break-even analysis.

The contribution margin income statement is illustrated in Exhibit 22.4

Controllable costs are under the division manager's control. They are the incremental costs of operating a division. In effect, they are costs that could have been avoided by the company if the division was closed. Noncontrollable costs are common to a group of divisions that are rationally allocated to them.

A difficulty with the profit center idea is that profit is calculated after subtracting noncontrollable costs or costs not directly related to divisional activity that have been arbitrarily allocated. The ensuing profit figure may be erroneous. However, cost allocation is required, since divisions must incorporate nondivisional costs that have to be met before the company will show a profit.

It is important to recognize that while an uncontrollable income statement item is included in appraising the performance of a profit center, it should *not* be used in evaluating the performance of the manager. An example is the effect of a casualty loss.

Exhibit 22.4

Contribution Margin Income Statement for Divisional Performance Evaluation

Sales
Less variable production cost of sales
Manufacturing contribution margin
Less variable selling and administrative expenses
Contribution margin
Less controllable fixed costs (i.e., salesperson salaries)
Controllable contribution margin by manager (measures performance of the segment manager)
Less uncontrollable fixed costs (i.e., depreciation, property taxes, insurance)
Segment contribution margin (measures performance of the division)
Less unallocated costs to divisions (excessively difficult to allocate objectively or illogical to allocate, such as the president's salary, corporate research)
Income before taxes (measures performance of the company in its entirety)

A profit center manager should be responsible for not only profit and loss items attributable directly to the division, but also costs incurred outside of the center (e.g., headquarters, other divisions) for which the center will be billed directly. The manager also should be responsible for an expense equal to the company's interest rate times controllable working capital. This charge will take into account trade-offs between working capital levels and profits. For example, increased inventory balances will mean fewer losses from stock-outs. The manager is the only person who comprehends these trade-offs. (For a greater discussion of this topic, see John Dearden, "Measuring Profit Center Managers," *Harvard Business Review,* September-October 1987, pp. 84–88.)

Advantages of the profit center approach are that it creates competition in a decentralized company, provides goal congruence between a division and the company, and aids performance evaluation. A drawback is that profits can be "massaged," because expenses may be shifted among periods. Examples of discretionary costs, where management has wide latitude, are research and repairs. Also, not considered are the total assets employed in the division to obtain the profit.

Example 2

You can sell a product at its intermediate point in Division A for $170 or its final point in Division B at $260. The outlay cost in Division A is $120, while the outlay cost in Division B is $110. Unlimited product demand exists for both the intermediate product and the final product. Capacity is interchangeable. Division performance is

	Division A	Division B
Selling Price	$170	$260
Outlay Cost—A	(120)	(120)
Outlay Cost—B	____	(110)
Profit	$ 50	$ 30

Sell at the intermediate point because of the higher profit.

Other measures in appraising nonprofit divisional performance are:

- Ratios between cost elements and assets to appraise effectiveness and efficiency
- Productivity measures, including input-output relationships. An example is labor hours in a production run. We have to consider the input in terms of time and money and the resulting output in terms of quantity and quality. Does the maintenance of equipment ensure future growth? Another example is the utilization rate of facilities.
- Personnel development (e.g., number of promotions, turnover)
- Market measures (e.g., market share, product leadership, growth rate, customer service)
- Product leadership indicators (e.g., patented products, innovative technology, product quality, safety record)
- Human resource relationships (e.g., employee turnover rate, customer relations, including on-time deliveries)
- Social responsibility measures (e.g., consumer medals)

Profit center managers are *not* doing their job if they milk operations for a profit now but fail to provide for future profit growth. Examples are cutting back on research and development, advertising, sales promotion, and repairs and maintenance. If these costs are reduced, the current year's division profit will be higher but the long-term results will be disastrous. Long-term profitability can be ensured by introducing new products, improving marketing channels and contacts, employee training, expanding plant facilities, and computerization.

Investment Center

An investment center is a responsibility center that has control over revenue, cost, and investment funds. It is a profit center whose performance is evaluated on the basis of the return earned on invested capital. Corporate headquarters and product line divisions in a large decentralized organization are examples of investment centers. They are widely used in highly diversified companies.

A divisional investment is the amount placed in that division, under division management control. Two major performance indicators are return on investment and residual income. We should use available total assets in these measures to take

into account all assets in the division, whether used or not. By including nonproductive assets in the base, the manager is motivated either to retain or sell them. Assets assigned to a division include direct assets in the division and allocated corporate assets. Assets are reflected at book value. Include facilities being constructed in the investment base, if the division is committing the funds for the new asset.

Distinguish between controllable and noncontrollable investment. Although the former is helpful in appraising a manager's performance, the latter is used to evaluate the entire division. Controllable investment depends on the degree of a division's autonomy. Thus, an investment center manager accepts responsibility for both the center's assets and its controllable income.

In obtaining divisional investment, there has to be an allocation of general corporate assets to that division. These allocated assets are not considered part of controllable investment. Assets should be allocated to divisions on the basis of measures (e.g., area occupied).

The allocated investment should be part of the division's investment base, but not as an element of controllable investment. Do not allocate general corporate assets attributable to the company as a whole (e.g., security investments). Do not allocate an asset if it requires excessive subjectivity.

The optimal way to assign cash to a division is to agree on a cash level that meets the minimum needs of the division. If cash is held in excess of this level, there should be an interest income credit using current interest rates. Because the division typically earns a higher return rate on investment than the prevailing interest rate, it will voluntarily return excess cash to the company. This policy maximizes the overall corporate return. Accounts receivable should be assigned to divisions based on sales. Finished goods should be included in the asset base. The division manager has control over it because he or she determines the production level on the basis of expected sales. Excessive finished goods inventory is partly due to a division's inadequate planning.

Use the opportunity cost of funds tied up in inventory that could be invested elsewhere for a return in determining divisional profit. Plant and equipment should be allocated on the basis of square footage.

The valuation of assets can be based on book value, gross cost, consumer price index (CPI) adjusted cost, replacement cost, or sales value. Typically, historical cost measures are employed in practice because of availability and consistency with balance sheet valuation.

Using book value for asset valuation will artificially increase divisional return on investment as assets become older, because the denominator using book value becomes lower over time. Gross cost corrects for this decline in value, but it still does not consider inflationary cost increases. However, an advantage of using gross book value to value assets is that it is not affected by changes in expansion rates.

CPI adjusted value takes into account changing price levels.

Replacement cost is ideal because it truly reflects the current prices of assets. Alternative ways exist to determine replacement cost (e.g., present value of future

cash flows, specific price index of item, and current market value). Inventory accounted for using last in first out (LIFO) should be adjusted to the first in first out FIFO) basis or the replacement value, so that inventory is stated at current prices.

Current liabilities should be subtracted in determining the asset base because division financing policy depends on the decision of upper management.

Return on Investment

Net income determination for return on investment (ROI) purposes requires that divisional earnings measurements:

- Should not be tied to operational efficiency and quality of managerial decisions of other segments
- Should include all items over which the divisional manager has control
- Should not be increased because of any action that negatively affects current or future profits

ROI is a superior indicator when the investment employed is outside of the manager's determination. But if a manager can significantly determine the capital employed, the return rate is a weakened tool.

$$\text{ROI} = \frac{\text{Net income}}{\text{Available total assets}}$$

Alternative measures are

$$\frac{\text{Operating profit}}{\text{Available total assets}}$$

$$\frac{\text{Controllable operating profit}}{\text{Controllable net investment}\\ \text{(Controllable assets} - \text{Controllable liabilities)}}$$

With respect to the last measure, depreciation is a controllable cost since changes in the asset base are controllable by the division manager. Excluded from controllable investment is equipment the manager wants to sell but is unable to because the company is trying to get an alternative use by another division or central headquarters. Transfer this asset from the division's controllable investment base. Also, controllable fixed assets allocated to divisions (e.g., research facilities, general administrative offices) should be excluded from controllable investment.

Assets have to be allocated to divisions on some rational basis. Actual cash at each location is known. Home office cash typically is allocated to plants based on sales or cost of sales. Usually accounts receivable are segregated by division or plant, but, if not, they may be allocated based on sales. Inventories and fixed assets are generally identified (e.g., account coding) to a specific plant or division. Other fixed assets (e.g., home/office building, equipment trucking, research facilities) may be allocated to plants and divisions based on services rendered. Building may

be allocated based on physical space. Prepaid expenses, deferred charges, and other assets may be allocated based on sales or cost of sales.

Idle facilities should be included in the investment base when the inactivity of the assets is caused by a division not attaining the budgeted share of the actual market or results from insufficient maintenance.

ROI for each division enables management to appraise divisions from the view of efficient utilization of resources allocated to each division. Divisional management effectiveness is assessed and related to salary and/or bonuses. To work effectively, managers should have control over operations and resources.

Advantages of ROI

- Focuses on maximizing a ratio instead of improving absolute profits
- Highlights unprofitable divisions
- Can be used as a base against which to evaluate divisions within the company and to compare the division to a comparable division in a competing company
- Assigns profit responsibility
- Aids in appraising divisional manager performance
- When a division maximizes its ROI, the company similarly maximizes its ROI
- Places emphasis on high-return items
- Represents a cumulative audit or appraisal of all capital expenditures incurred during a division's existence
- Serves as a guideline to the division manager in analyzing discounted cash flow internal rates of return for proposed capital expenditures
- Broadest possible measure of financial performance. Because divisions are often geographically disbursed internationally, division managers are given broad authority in using division assets and acquiring and selling assets.
- Helps make the goals of the division manager coincide with those of corporate management

Disadvantages of ROI

- Focuses on maximizing a ratio instead of improving absolute profits
- Alternative profitability measures could be used in the numerator besides net income (e.g., gross profit, contribution margin, segment margin).
- Different assets in the division must earn the same return rate regardless of the assets' riskiness.
- To boost profits, needed expenditures may not be incurred (e.g., repairs, research). Here, look at the ratio over time of discretionary costs to sales.
- A division may not want to acquire fixed assets because doing so will lower its ROI.

- A labor-intensive division generally has a higher ROI than a capital-intensive one.
- ROI is a static indicator and does not show future flows.
- A lack of goal congruence may exist between the company and a division. For instance, if a company's ROI is 12 percent, a division's ROI is 18 percent and a project's ROI is 16 percent the division manager will not accept the project because it will lower his or her ROI, even though the project is best for the entire company.
- It ignores risk.
- ROI emphasizes short-run performance instead of long-term profitability. To protect the current ROI, a manager is motivated to reject other profitable investment opportunities.
- ROI may not be completely controllable by the division manager because of the existence of committed costs. The inability to control ROI may be a problem in distinguishing between the manager's performance and the performance of the division as an investment.
- If the projected ROI at the beginning of the year is set unrealistically high, it could result in discouragement of investment center incentive.

Managers should not be criticized for a disappointing ROI if they do not have significant influence over the factors making up the ROI.

Example 6

You are concerned about your company's current return on investment. Your company's income statement for year 20X5 follows.

Sales 100,000 units (@$10)	$1,000,000
Cost of Sales	300,000
Gross Margin	$ 700,000
Selling and General Expenses	200,000
Income Before Taxes	$ 500,000
Taxes(40%)	200,000
Net Income	$ 300,000

On December 31, total assets available consist of current assets of $300,000 and fixed assets of $500,000.

You forecast that sales for 20X6 will be 120,000 units at $11 per unit. The cost per unit is estimated at $5. Fixed selling and general expenses are forecast at $60,000 and variable selling and general expenses are anticipated to be $1.50 per unit. Depreciation for the year is expected to be $30,000.

Forecasted earnings for 20X6 are calculated in this way:

Sales 120,000 (@$11)			$1,320,000
Cost of Sales 120,000 (@$5)			600,000
Gross Margin			$ 720,000
Selling and General Expenses:			
Fixed		$ 60,000	
Variable 120,000 (@$1.50)		180,000	
Total			240,000
Income Before Tax			480,000
Tax(40%)			192,000
Net Income			$ 288,000

The investment expected at December 31, 20X6 is:		
Ratio of current assets to sales in 20X5:		
$300,000/$1,000,000		30%
Expected current assets at December 31, 20X6:		
$30% × $1,320,000		$396,000
Expected fixed assets at December 31, 20X6:		
Book value on January 1	$500,000	
Less: Depreciation of 20X6	30,000	170,000
Total Investment		$866,000

$$\text{ROI} = \frac{\$288.000}{\$866,000} = 33.3\%$$

Residual Income

The optimal measure of divisional performance is residual income, which equals divisional net income less minimum return times average available total assets.

Example 7

Divisional earnings are $250,000, average available total assets are $2,000,000, and the cost of capital is 9 percent.

Residual income equals	
Divisional net income	$250,000
Less minimum return × Average available total assets	
9% × $2,000,000	$180,000
Residual income	$ 70,000

The minimum rate of return is based on the company's overall cost of capital adjusted for divisional risk. The cost of capital should be periodically calculated and used because of shifts in the money rate over time.

Residual income may be projected by division, center, or specific program to ensure that the company's rate of return on alternative investments is met or improved on by each segment of the business.

By looking at residual income, we are assured that segments are not employing corporate credit for less return than could be obtained by owning marketable securities or through investment in a different business segment.

A target residual income may be formulated to act as the division manager's objective. The trend in residual income to total available assets should be examined in appraising divisional performance. (See Exhibit 22.5.)

Exhibit 22.5

Residual Income Statement
for Divisional Evaluation Purposes

Sales	$1,200,000	
Transfers at market value to other divisions	400,000	
Total		$1,600,000
Less		
Variable cost of goods sold and transferred	$800,000	
Variable divisional expenses	200,000	
Total		1,000,000
Variable income		$600,000
Less		
Controllable divisional overhead	$200,000	
Depreciation on controllable plant and equipment	110,000	
Property taxes and insurance on controllable fixed assets	40,000	
Total		$350,000
Controllable operating income		$250,000
Add		
Nonoperating gains	$300,000	
Nonoperating losses	20,000	
Net nonoperating gains		280,000
Total		$530,000
Less interest on controllable investment		30,000
Controllable residual income		$500,000
Less		
Uncontrollable divisional overhead (e.g., central advertising)	$40,000	
Incremental central expenses chargeable to the division	10,000	
Interest on noncontrollable investment	50,000	
Total		$100,000
Residual income before taxes		$400,000
Less income taxes (40%)		160,000
Net residual income after taxes		$240,000

A division manager's performance should be appraised on the basis of controllable residual income. A manager should not be penalized for uncontrollable matters. To evaluate a division, we use net residual income after taxes. This is a key figure, because it aids in the decision to make new investments or withdrawals of funds in that division.

Advantages of Residual Income

- The same asset may be required to earn the same return rate throughout the company, regardless of the division where the asset is located.
- Different return rates may be employed for different types of assets, depending on riskiness.
- Different return rates may be assigned to different divisions, depending on the risk associated with those divisions.
- It provides an economic income, taking into account the opportunity cost of tying up assets in the division.
- It identifies operating problem areas.
- It precludes the difficulty that a division with a high ROI would not engage in a project with a lower ROI even though it exceeds the overall corporate ROI rate. This is because residual income maximizes dollars instead of a percentage. It motivates divisional managers to take into account all profitable investments. Unprofitable investments are not included.

Disadvantages of Residual Income

- Assignment of a minimum return involves estimating a risk level that is subjective.
- It may be difficult to determine the valuation basis and means of allocating assets to divisions.
- If book value is used in valuing assets, residual income will artificially increase over time, since the minimum return times total assets becomes lower as the assets become older.
- It cannot be used to compare divisions of different sizes. Residual income tends to favor the larger divisions due to the large amount of dollars involved.
- It does not furnish a direct decision criterion for capital expenditures, which have to be based on incremental cash flows, rather than incremental profits.
- Since it is a mixture of controllable and uncontrollable elements, there is no segregation.

Computerized reports should be prepared at critical points for timely managerial action. Such instances may occur when a product's contribution margin percent is below target or when a product is behind the scheduled days to produce it.

Reports showing excessive age of inventory should be prepared so needed action may be taken, such as price reduction, package deals, or other promotions.

Nonfinancial managers must make key marketing and general business decisions. Examples are changes in sales mix, pricing, production, product expansion or contraction, territory evaluation, and customer analysis.

Conclusion

It is essential to evaluate a segment's performance to identify problem areas. Factors that are controllable or not controllable by the division manager must be considered. The various means of evaluating performance include cost center, profit center, revenue center, and investment center. The calculations for each method, along with proper analysis, are vital in appraising operating efficiency. Managers should understand the advantages and disadvantages of each method as well as when each is most appropriate.

The manager should be familiar with the profit and loss statements by territory, commodity, method of sale, customer, and salesperson. The profit and loss figures will indicate areas of strength and weakness.

The establishment of a realistic transfer price is essential in order to properly evaluate divisional performance and to arrive at appropriate product costing and profitability.

23

Budgeting for Service Organizations:

Special Features

A budget is important to meet goals and objectives. Most discussions of the budgetary process tend to focus on manufacturing firms. However, more businesses are becoming engaged in nonmanufacturing activities today, and such businesses can benefit greatly from a properly designed budgetary planning and control system. Budgeting may be used by a service business (which does not have merchandise inventory). For example, an airline may budget the average occupancy rate for seats and passenger miles. A hotel may budget the occupancy rate for rooms and the cost per room. For the most part, the budgeting methods and procedures described for manufacturing companies also apply to service businesses.

Special attention should be devoted to budgetary planning and control techniques in the service industry for two reasons. First, planning and control are critical functions in all businesses, whether they produce and sell goods or provide services. Many service businesses have become more competitive in recent years. This increase in competition can be attributed to many things, such as the growth of the economy and the increase in demand for specialized services. When competition increases, planning and control become even more important.

Second, the practice of budgeting is probably not as well developed in service companies as it is in manufacturing firms. In manufacturing industries, budgeting is forced on the business by the need to keep sales and production coordinated. A manufacturing firm's investment in inventory forces the company to plan.

In service companies, however, the business activity largely requires human effort, and personal services generally are performed after the orders are received. The investment in inventory as we know it in manufacturing does not exist. There is no production activity. As a result, the management of a service company may not see the same need for planning and control.

Because budgeting is a planning and control system, the techniques applied to service companies will be very similar to those applied to manufacturing companies. The service company must not only develop an overall budget or profit plan for the year but also must establish good budgetary control that follows a well-thought-out plan of organization. The major difference in budgeting nonmanufacturing activities relates to the types of costs incurred and therefore to the control techniques applied. In most service industries, the major cost element is that of personnel, reflected in salaries, wages, commissions, bonuses, and fringe benefits. Because of this fact, budgeting techniques are concerned primarily with planning the use of personnel and with controlling personnel effectiveness.

A professional service business sells the employees' expertise. Emphasis is given to labor productivity and controlling overhead costs. Pricing policies are budgeted based on a daily rate, an hourly rate, a fixed rate for the job, or a contingent fee based on, for example, the dollar value of property sold, a court settlement, or sales price.

Problems may occur if there are inadequate numbers of qualified workers or insufficient capital facilities to meet customer demand. It is important that employee time be used productively. A productivity report should be prepared of sales dollars generated per professional and the associated direct costs. The format of the report is:

Revenue generated
Less: Direct costs
Residual profit
Less: Overhead
Profit

A service business relies heavily on its reputation for fast and quality service. Otherwise, customers will switch to competitors. Rendering poor quality for short-term opportunities has disastrous long-term effects. It is best to grow at a steady, quality rate.

A service company must place a premium on defining the operations required to produce a service profitably and on assigning responsibility for planning and controlling such operations efficiently. For example, whereas receivables and inventories are two current asset areas for planning and control emphasis in a manufacturing company, most service companies regard only receivables as an important current asset. So emphasis on points of cost control and specific balance sheet items may shift between the two types of business concerns. The underlying concept of budgeting, however, does not change.

For growing service companies, a common six-step pattern is observed while implementing a budgetary system:

1. A profit or target for the company is established.
2. An annual plan is developed that indicates expected revenues and expenses by the organizational segments and in total, by month.
3. The cash budget is established.

4. A planned statement of financial position is developed and tested against selected standards.
5. Actual performance is measured against plan by specific levels of management position.
6. Corrective action is taken as deemed necessary.

Service companies typically have prepared budgets for departmental expenses and have tracked these expenses against plan. However, budgetary control should extend to profit centers, where accountability for revenues as well as costs can be placed. Keeping personnel costs well within the limits set for planned revenues is critical in order to achieve net income objectives.

In a professional service firm, such as a certified public accounting firm, law practice, consulting business, or advertising agency, revenue dollars may be identified specifically to specific individuals. The revenue and direct costs per individual may be determined. Indirect costs are budgeted separately and allocated based on revenue. These businesses are labor intensive and have high variable cost structures.

In service companies, investments in inventories, plant, and equipment typically are relatively small, but the planning and control techniques still should extend to the statement of financial position so that acceptable financial ratios are maintained. However, it is difficult to control a business with high long-term capital investment, such as transportation companies, computer service business, and leasing companies.

Service businesses should make long-term commitments for salaries and facilities *only* if they are confident of future sales. Otherwise, if future sales fall off, the high fixed costs will hurt profits.

This chapter presents the budgeting aspects of certain airlines and hotels.

Airlines

Airlines face a problem of perishable services. Airlines have systems known as yield management systems that constantly adjust what fares are available and the number based on sales. For example, if an airline's Los Angeles-to-New York seats are selling very briskly, the system will severely limit or eliminate discounted seats. However, the inverse is also true; if a flight is selling slowly, the amount of discounted fares available will increase to stimulate sales. The goal of the yield management system is to maximize revenue, taking into account that if the seat goes unsold, it is a lost revenue opportunity.

Hotels

The calculation of sales volume and unit price is much more difficult for hotels than for manufacturers. Hotels have a maximum capacity of rooms each night and annually, like a factory's production capacity. However, the demand for a hotel's rooms can vary greatly from day to day, month to month, and year to year.

For hotels, it is very difficult to predict sales and average unit selling price. Historical data can be of some help, but they do not take into account many environmental factors, such as the economy, new competitors, aging facililties, bad weather, unstable governments, fluctuating currencies, and current travel trends.

Reservations forecasting is much more art (and luck) than a science. Modern computer systems have done little to improve accuracy of hotel room sales. One problem is that a hotel room is a perishable commodity. If it is not sold one night, the potential value for that time is lost forever.

Hotels also try to maximize their revenues per room, but an airline system will not work. Airlines deal with one customer occupying one seat on a flight. Hotels, however, have customers staying different lengths of time, staying longer than they have reserved, and departing early; they also have no-shows. Hotels do not have fare products like airlines, they have market segments. The hotel's goal is to book as many of the next highest paying segments, and so on. The results of this can be a small number of rooms allocated to a low-paying market group. A hotel's reservation system does not function like an airline's; the number of each market segment is not adjusted automatically for yield maximization.

Hotels, like airlines, can refuse potential business. If a hotel is projected to be full or near full, it will stop taking reservations or will stop selling highly discounted rates. If there are cancellations, these rooms stand the chance of going unsold (not producing revenue). Hotels also may refuse potential discounted reservations because they think they can sell the remaining rooms to full-paying clients, taking a chance that these rooms will not sell at all. For these reasons, hotels as well as airlines overbook. They gamble that they will have a sufficient amount of no-shows and cancellations to accommodate everyone, which is not always the case. A projected sales budget for hotels is presented in Exhibit 23.1.

To estimate the gross sales, multiply the projected number of rooms in each category by the averaged rate paid by each market segment. A sample rate structure is presented in Exhibit 23.2.

Having estimated in the budget that Monday XX, 20XX, the projected room revenue is $29,125 on a projected occupancy of 81 percent.

Exhibit 23.1

Hotel Projected Sales Budget

	MON	TUES	WED	THUR	FRI	SAT	SUN
Leisure	50	60	60	70	100	100	40
Corporate	75	80	80	50	10	10	60
Government	100	90	90	50	10	10	50
Group	100	70	120	120	40	60	70
Total Rooms	325	300	350	290	160	180	220
(%)	81%	75%	88%	73%	40%	45%	55%

Average (%) for the week: 65% (based on a 400-room hotel)

Exhibit 23.2

Sample Hotel Rate Structure

Market Segment	Rates	Avg. Rate Paid
Leisure	$100–130	$120
Corporate	$ 80–115	$ 95
Government	$ 75–105	$ 90
Group	$ 60– 90	$ 70

Monday's revenues would look like this:

Leisure	(50) ($120) = $ 6,000
Corporate	(75) ($ 95) = $ 7,125
Government	(100) ($ 90) = $ 9,000
Leisure	(100) ($ 70) = $ 7,000
	$29,125

Projected sales are done on a daily, monthly, and annual basis. The sales are monitored very closely because they are selling a perishable commodity. If a slow period is projected from reports and bookings, management will really push to try to sell these rooms. Often rates are reduced (especially on weekends, when business travel is low) to try to stimulate sales. It is hoped that this action will provide at least a minimal amount of revenue. The notion of reducing rates is somewhat tricky when dealing with image. Additionally, hotels that are located in areas of high competition (i.e., Anaheim, California) use rates as one of their competitive weapons.

From the sales budget one can develop a projected cash collections schedule. Doing this is not as straightforward for a hotel as for a manufacturer. When a manufacturer sells its finished goods to a retailer or wholesaler, generally, they have terms such as net 30. It knows from past experience that it will collect X percent one month after the sale, Y percent in the second month, Z percent in the third, while leaving some percentage uncollected as bad debt.

Hotels have different cash collection patterns. Most individual customers pay for their charges with a credit card. After the charges have been processed, each individual amount is credited electronically to the hotel. However, one does not know exactly what percentage of guests will charge their accounts or pay some other way, by check or cash.

Groups, corporate, and government accounts can all pay individually on departure, or more likely, all charges will go to a master account. On the group's departure, the master account can be processed and billed to the company. This would occur when a group only has one function and does not have a running account. However, for most accounts of this type, there is a running total, and the company is billed monthly for charges the group has incurred during the period.

As everyone knows, some companies, especially big corporations and the government, can be very slow in paying their bills. This fact must be taken into consideration when projecting cash collections estimation. One last monkey wrench in this whole system is advance deposits. Many groups and individuals are required to leave advance deposits to guarantee space. This will make the estimation of cash collections even more difficult because one does not know where and when these deposits will occur.

The next step for a manufacturer is to construct a production budget. However, this would not be appropriate for a service firm, as service firms are not building anything, they are selling a service (e.g., lodging). The sales budget and the production budget are identical for service businesses.

From the production budget a manufacturer then develops a direct materials budget, direct labor budget, and overhead budget. A hotel would do this a little differently. It can construct a direct materials budget, but it is somewhat difficult to estimate. For a hotel, the direct materials budget would primarily be the food and beverage that it sells. The demand for the food and beverage is difficult to exactly estimate, but a ballpark figure can be calculated.

A direct labor budget is probably one of hotel's most critical budgets, along with the sales budget. Hotels, especially full-service luxury resorts, are very labor intensive. Based on projected sales, hotels can budget their expected labor costs. When the actual budgeted period has begun, these figures are watched very closely for any variations. Each department seeks a target productivity. Any difference between the budgeted figure and the actual numbers will be investigated.

Overhead for a hotel is like a factory. Any cost that is not direct labor or direct materials will be accounted for as overhead. A hotel overhead can be broken down into two main categories:

1. Rooms overhead
2. Food and beverage overhead

These two areas are the main revenue centers for most hotels. There is a fine line between what costs can be direct labor or materials, or overhead. It falls to management to classify each cost.

The next step for a manufacturer is to develop a cost of goods sold budget. For a manufacturer, this budget is helpful in setting prices and estimating gross income. For a hotel, this budget step would yield only minimal benefit. Hotels do not produce products, as we all know; they provide services. A cost of goods sold budget would provide a hotel with the cost of major departments, such as rooms and food and beverage.

Now the selling and administrative (S&A) expense budget would be compiled. This budget is as helpful to a manufacturer as a hotel. All organizations need to know their selling expenses. The selling expenses are combined with general administrative costs. This budget combines both fixed and variable S&A costs such as insurance, rent, office salaries, sales salaries, and commissions.

Now different parts of the budget are combined into the budgeted income statement. This statement summarizes the various component projections of revenue and expenses for the budget period. This is usually an annual budget; however, for better control, it may be done quarterly or even monthly. This budget subtracts variable expenses from sales to obtain a contribution margin. Then it subtracts fixed expenses to arrive at operating income, less interest expenses providing income before taxes. Income taxes are subtracted to produce the goal: net income.

A cash budget also needs to be prepared. This budget will signal when there will be cash surpluses or shortages. This budget is very important; remember, a company can go broke while making a profit. By having this budget available, one will know when funds are available for investment growth or expansion, or when funds are needed just to pay the bills.

When all the budgets have been completed, a budgeted balance sheet can be compiled. The balance sheet is constructed by adjusting the balance sheet from the period that just ended. The budgeted balance sheet serves three primary purposes:

1. It can disclose potentially unfavorable financial conditions.
2. It allows management to perform a number of different ratio calculations.
3. It highlights future resources and obligations.

Conclusion

This chapter addresses the special features of the service industry. Special attention should be devoted to budgetary planning and control techniques in the service industry for two reasons. First, many service businesses have become more competitive in recent years. When competition increases, planning and control become even more important.

Second, the practice of budgeting is probably not as well developed in service companies as it is in manufacturing firms. In service companies, the business activity largely requires human effort, and personal services are generally performed after the orders are received. The major cost element is that of personnel, being reflected in salaries, wages, commissions, bonuses, and fringe benefits. Because of this fact, budgeting techniques are primarily concerned with planning the use of personnel and with controlling personnel effectiveness.

APPENDIX I

Present and Future Value Tables

Table AI.1

Future Value of $1

Number of Years	Interest Rate																			
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
1	1.0100	1.0200	1.0300	1.0400	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000	1.1200	1.1400	1.1500	1.1600	1.1800	1.2000	1.2400	1.2800	1.3200	1.3600
2	1.0201	1.0404	1.0609	1.0816	1.1025	1.1236	1.1449	1.1664	1.1881	1.2100	1.2544	1.2996	1.3225	1.3456	1.3924	1.4400	1.5376	1.6384	1.7424	1.8496
3	1.0303	1.0612	1.0927	1.1249	1.1576	1.1910	1.2250	1.2597	1.2950	1.3310	1.4049	1.4815	1.5209	1.5609	1.6430	1.7280	1.9066	2.0972	2.3000	2.5155
4	1.0406	1.0824	1.1255	1.1699	1.2155	1.2625	1.3108	1.3605	1.4116	1.4641	1.5735	1.6890	1.7490	1.8106	1.9388	2.0736	2.3642	2.6844	3.0360	3.4210
5	1.0510	1.1041	1.1593	1.2167	1.2763	1.3382	1.4026	1.4693	1.5386	1.6105	1.7623	1.9254	2.0144	2.1003	2.2878	2.4883	2.9316	3.4360	4.0075	4.6526
6	1.0615	1.1262	1.1941	1.2653	1.3401	1.4185	1.5007	1.5869	1.6771	1.7716	1.9738	2.1950	2.3131	2.4364	2.6996	2.9860	3.6352	4.3980	5.2899	6.3275
7	1.0721	1.1487	1.2299	1.3159	1.4071	1.5036	1.6058	1.7138	1.8280	1.9487	2.2107	2.5023	2.6600	2.8262	3.1855	3.5832	4.5077	5.6295	6.9826	8.6054
8	1.0829	1.1717	1.2668	1.3686	1.4775	1.5938	1.7182	1.8509	1.9926	2.1436	2.4760	2.8526	3.0590	3.2784	3.7589	4.2998	5.5895	7.2058	9.2170	11.703
9	1.0937	1.1951	1.3048	1.4233	1.5513	1.6895	1.8385	1.9990	2.1719	2.3579	2.7731	3.2519	3.5179	3.8030	4.4355	5.5198	6.9310	9.2234	12.166	15.916
10	1.1046	1.2190	1.3439	1.4802	1.6289	1.7908	1.9672	2.1589	2.3674	2.5937	3.1058	3.7072	4.0456	4.4114	5.2338	6.1917	8.5944	11.805	16.059	21.646
11	1.1157	1.2434	1.3842	1.5395	1.7103	1.8983	2.1049	2.3316	2.5084	2.8531	3.4785	4.2262	4.6524	5.1173	6.1759	7.4301	10.657	15.111	21.198	29.439
12	1.1268	1.2682	1.4258	1.6010	1.7959	2.0122	2.2522	2.5182	2.8127	3.1384	3.8960	4.8179	5.3502	5.9360	7.2876	8.9161	13.214	19.342	27.982	40.037
13	1.1381	1.2936	1.4685	1.6651	1.8856	2.1329	2.4098	2.7196	3.0658	3.4523	4.3635	5.4924	6.1528	6.8858	8.5994	10.699	16.386	24.748	36.937	54.451
14	1.1495	1.3195	1.5126	1.7317	1.9799	2.2609	2.5785	2.9372	3.3417	3.7975	4.8871	6.2613	7.0757	7.9875	10.147	12.839	20.319	31.691	48.756	74.053
15	1.1610	1.3459	1.5580	1.8009	2.0789	2.3966	2.7590	3.1722	3.6425	4.1772	5.4736	7.1379	8.1371	9.2655	11.973	15.407	25.195	40.564	53.358	100.71
16	1.1726	1.3728	1.6047	1.8730	2.1829	2.5404	2.9522	3.4259	3.9703	4.5950	6.1304	8.1372	9.3576	10.748	14.129	18.488	31.242	51.923	84.953	136.96
17	1.1834	1.4002	1.6528	1.9479	2.2920	2.6928	3.1588	3.7000	4.3276	5.0545	6.8660	9.2765	10.761	12.467	16.672	22.186	38.740	66.461	112.13	186.27
18	1.1961	1.4282	1.7024	2.0258	2.4066	2.8543	3.3799	3.9960	4.7171	5.5599	7.6900	10.575	12.375	14.462	19.673	26.623	48.038	85.070	148.02	253.33
19	1.2081	1.4568	1.7535	2.1068	2.5270	3.0256	3.6165	4.3157	5.1417	6.1159	8.6129	12.055	14.231	16.776	23.214	31.948	59.567	108.89	195.39	344.53
20	1.2202	1.4859	1.8061	2.1911	2.6533	3.2071	3.8697	4.6610	5.6044	6.7275	9.6463	13.743	16.366	19.460	27.393	38.337	73.864	139.37	257.91	468.57
21	1.2324	1.5157	1.8603	2.2788	2.7860	3.3996	4.1406	5.0338	6.1088	7.4002	10.803	15.667	18.821	22.754	32.323	46.005	91.591	178.40	340.44	637.26
22	1.2447	1.5460	1.9161	2.3699	2.9253	3.6035	4.4304	5.4365	6.6586	8.1403	12.100	17.861	21.644	26.186	38.142	55.206	113.57	228.35	449.39	866.67
23	1.2572	1.5769	1.9736	2.4647	3.0715	3.1897	4.7405	5.8715	7.2579	8.9543	13.552	20.361	24.891	30.376	45.007	66.247	140.83	292.30	593.19	1178.6
24	1.2697	1.6084	2.0328	2.5633	3.2251	4.0489	5.0724	6.3412	7.9111	9.8497	15.178	23.212	29.625	35.236	53.108	79.496	174.63	394.14	783.02	1602.9
25	1.2824	1.6406	2.0938	2.6658	3.3864	4.2919	5.2474	6.8458	8.6231	10.834	17.000	26.461	32.918	40.874	62.668	95.396	216.54	478.90	1033.5	2180.0
26	1.2953	1.6734	2.1566	2.7725	3.5557	4.5497	5.8074	7.3964	9.3992	11.918	19.040	30.166	37.856	47.414	73.948	114.47	268.51	612.99	1364.3	2964.9
27	1.3082	1.7069	2.2213	2.8834	3.7335	4.8223	6.2139	7.9881	10.245	13.110	21.324	34.389	43.535	55.000	87.259	137.37	332.95	784.63	1800.9	4032.2
28	1.3213	1.7410	2.2879	2.9897	3.9201	5.1117	6.6488	8.6271	11.167	14.421	23.883	39.204	50.065	63.800	102.96	164.84	412.86	1004.3	2377.2	5483.8
29	1.3345	1.7758	2.3566	3.1187	4.1161	5.4184	7.1143	9.3173	12.172	15.863	26.749	44.693	57.575	74.008	121.50	197.81	511.95	128.5	3137.9	7458.0
30	1.3478	1.8114	2.4273	3.2434	4.3219	5.7435	7.6123	10.062	13.267	17.449	29.959	50.950	66.211	85.849	143.37	237.37	634.81	1645.5	4142.0	10143.
40	1.4889	2.2080	3.2620	4.8010	7.0400	10.285	14.974	21.724	31.409	45.259	93.050	188.88	267.86	378.72	750.37	1469.7	5455.9	19426	66520	•
50	1.6446	2.6916	4.3839	7.1067	11.467	18.420	29.457	46.901	74.357	117.39	289.00	700.23	1083.6	1670.7	3927.3	9100.4	46890	•	•	•
60	1.8167	3.2810	5.8916	10.519	18.679	32.987	57.946	101.25	176.03	304.48	897.59	2595.9	4383.9	7370.1	20555	56347	•	•	•	•

Table AI.2

Future Value of an Annuity of $1

Number of Years	Interest Rate																			
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500	2.0600	2.0700	2.0800	2.0900	2.1000	2.1200	2.1400	2.1500	2.1600	2.1800	2.2000	2.2400	2.2800	2.3200	2.3600
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836	3.2149	3.2464	3.2781	3.3100	3.3744	3.4396	3.4725	3.5056	3.5724	3.6400	3.7776	3.9184	4.0624	4.2096
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746	4.4399	4.5061	4.5731	4.6410	4.7793	4.9211	4.9934	5.0665	5.2154	5.3680	5.6842	6.0156	6.3624	6.7251
5	5.1010	5.2040	5.3091	5.4163	5.5256	5.6371	5.7507	5.8666	5.9847	6.1051	6.3528	6.6101	6.7424	6.8771	7.1542	7.4416	8.0484	8.6999	9.3983	10.146
6	6.1520	6.3081	6.4684	6.6330	6.8019	6.9753	7.1533	7.3359	7.5233	7.7156	8.1152	8.5355	8.7537	8.9775	9.4420	9.9299	10.980	12.135	13.405	14.798
7	7.2135	7.4343	7.6625	7.8983	8.1420	8.3938	8.6540	8.9228	9.2004	9.4872	10.089	10.730	11.066	11.413	12.141	12.915	14.615	16.533	18.695	21.126
8	8.2857	8.5830	8.8923	9.2142	9.5491	9.8975	10.259	10.636	11.028	11.435	12.299	13.232	13.726	14.240	15.327	16.499	19.122	22.163	25.678	29.731
9	9.3685	9.7546	10.159	10.582	11.026	11.491	11.978	12.487	13.021	13.579	14.775	16.085	16.785	17.518	19.085	20.798	24.712	29.369	34.895	41.435
10	10.462	10.949	11.463	12.006	12.577	13.180	13.816	14.486	15.192	15.937	17.548	19.337	20.303	21.321	23.521	25.958	31.643	38.592	47.061	57.351
11	11.566	12.168	12.807	13.486	14.206	14.971	15.783	16.645	17.560	18.531	20.654	23.044	24.349	25.732	28.755	32.150	40.237	50.398	63.121	78.998
12	12.682	13.412	14.192	15.025	15.917	16.869	17.888	18.977	20.140	21.384	24.133	27.270	29.001	30.850	34.931	39.580	50.894	65.510	84.320	108.43
13	13.809	14.680	15.617	16.626	17.713	18.882	20.140	21.495	22.953	24.522	28.029	32.088	34.351	36.786	42.218	48.496	64.109	84.852	112.30	148.47
14	14.947	15.973	17.086	18.291	19.598	21.015	22.550	24.214	26.019	27.975	32.392	37.581	40.504	43.672	50.818	59.195	80.496	109.61	149.23	202.92
15	16.096	17.293	18.598	20.023	21.578	23.276	25.129	27.152	29.360	31.722	37.279	43.842	47.580	51.659	60.965	72.035	100.81	141.30	197.99	276.97
16	17.257	18.639	20.156	21.824	23.657	25.672	27.888	30.324	33.003	35.949	42.753	50.980	55.717	60.925	72.939	87.442	126.01	181.86	262.35	377.69
17	18.430	20.012	21.761	23.697	25.840	28.212	30.840	33.750	36.973	40.544	48.883	59.117	65.075	71.673	87.068	105.93	157.25	233.79	347.30	514.66
18	19.614	21.412	23.414	25.645	28.132	30.905	33.99	37.450	41.301	45.599	55.749	68.394	75.836	84.140	103.74	128.11	195.99	300.25	459.44	700.93
19	20.810	22.840	25.116	27.671	30.539	33.760	37.379	41.446	46.018	51.159	63.439	78.969	88.211	98.603	123.41	154.74	244.03	385.32	607.47	954.27
20	22.019	24.297	26.870	29.778	33.066	36.785	40.995	45.762	51.160	57.275	72.052	91.024	102.44	115.37	146.62	186.68	303.60	494.21	802.86	1298.8
21	23.239	25.783	28.676	31.969	35.719	39.992	44.865	50.442	56.764	64.002	81.698	104.76	118.81	134.84	174.02	225.02	377.46	633.59	1060.7	1767.3
22	24.471	27.299	30.536	34.248	38.505	43.392	49.005	55.456	62.873	71.402	92.502	120.43	137.63	157.41	206.34	271.03	469.05	811.99	1401.2	2404.6
23	25.716	28.845	32.452	36.617	41.430	46.995	53.436	60.893	69.531	79.543	104.60	138.29	159.27	893.60	244.48	326.23	582.62	1040.3	1850.6	3271.3
24	26.973	30.421	34.426	39.082	44.502	50.815	58.176	66.764	76.789	88.497	118.15	158.65	184.16	213.97	289.49	392.48	723.46	1332.6	2443.8	4449.9
25	28.243	32.030	36.459	41.645	47.727	54.864	63.249	73.105	84.700	98.347	133.33	181.87	212.79	249.21	342.60	471.98	898.09	1706.8	3226.8	6052.9
26	29.525	33.670	38.553	44.311	51.113	59.156	68.676	79.954	93.323	109.18	150.33	208.33	245.71	290.08	405.27	567.37	1114.6	2185.7	4260.4	8233.0
27	30.820	35.344	40.709	47.084	54.669	63.705	74.483	87.350	102.72	121.09	169.37	238.49	283.56	337.50	479.22	681.85	1383.1	2798.7	5624.7	11197.9
28	32.129	37.051	42.930	49.967	58.402	68.528	80.697	95.338	112.96	134.20	190.69	272.88	327.10	392.50	566.48	819.22	1716.0	3583.3	7425.6	15230.2
29	32.450	38.792	45.218	52.966	62.322	73.689	87.346	103.96	124.13	148.63	214.58	312.09	377.16	456.30	669.44	984.06	2128.9	4587.6	9802.9	20714.1
30	34.784	40.568	47.576	56.084	66.438	79.058	94.460	113.28	136.30	164.49	241.33	356.78	434.74	530.31	790.94	1181.8	2640.9	5873.2	12940	28172.2
40	48.886	60.402	75.401	95.025	120.79	154.76	199.63	259.05	337.88	442.59	767.09	1342.0	1779.0	2360.7	4163.2	7343.8	22728	63977	•	•
50	64.473	84.579	112.79	152.66	209.34	290.33	406.52	573.76	815.08	1163.9	2400.0	4994.5	7217.7	10435	21813	45497	•	•	•	•
60	81.669	114.05	163.05	237.90	353.58	533.12	813.52	1253.2	1944.7	3034.8	7471.6	18535	29219	46057	•	•	•	•	•	•

Table AI.3

Present Value of $1

Number of Years	Interest Rate																			
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.8929	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576	0.7353
2	0.9803	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.7972	0.7695	0.7561	0.7432	0.7182	0.6944	0.6504	0.6104	0.5739	0.5407
3	0.9706	0.9423	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7118	0.6750	0.6575	0.6407	0.6086	0.5787	0.5245	0.4768	0.4348	0.3975
4	0.9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6355	0.5921	0.5718	0.5523	0.5158	0.4823	0.4230	0.3725	0.3294	0.2923
5	0.9515	0.9057	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5674	0.5194	0.4972	0.4761	0.4371	0.4019	0.3411	0.2910	0.2495	0.2149
6	0.9420	0.8880	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5066	0.4556	0.4323	0.4104	0.3704	0.3349	0.2751	0.2274	0.1890	0.1580
7	0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	0.4523	0.3996	0.3759	0.3538	0.3139	0.2791	0.2218	0.1776	0.1432	0.1162
8	0.9235	0.8535	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4039	0.3506	0.3269	0.3050	0.2660	0.2326	0.1789	0.1388	0.1085	0.0854
9	0.9143	0.8368	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3606	0.3075	0.2843	0.2630	0.2255	0.1938	0.1443	0.1084	0.0822	0.0628
10	0.9053	0.8203	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	0.3220	0.2697	0.2472	0.2267	0.1911	0.1615	0.1164	0.0847	0.0623	0.0462
11	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.2875	0.2366	0.2149	0.1954	0.1619	0.1346	0.0938	0.0662	0.0472	0.0340
12	0.8874	0.7885	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	0.2567	0.2076	0.1869	0.1685	0.1372	0.1122	0.0757	0.0517	0.0357	0.0250
13	0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2292	0.1821	0.1625	0.1452	0.1163	0.0935	0.0610	0.0404	0.0271	0.0184
14	0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	0.2046	0.1597	0.1413	0.1252	0.0985	0.0779	0.0492	0.0316	0.0205	0.0135
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.1827	0.1401	0.1229	0.1079	0.0835	0.0649	0.0397	0.0247	0.0155	0.0099
16	0.8528	0.7284	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1631	0.1229	0.1069	0.0930	0.0708	0.0541	0.0320	0.0193	0.0118	0.0073
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1456	0.1078	0.0929	0.0802	0.0600	0.0451	0.0258	0.0150	0.0089	0.0054
18	0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799	0.1300	0.0946	0.0808	0.0691	0.0508	0.0376	0.0208	0.0118	0.0068	0.0038
19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1161	0.0829	0.0703	0.0596	0.0431	0.0313	0.0168	0.0092	0.0051	0.0029
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	0.1037	0.0728	0.0611	0.0514	0.0365	0.0261	0.0135	0.0072	0.0039	0.0021
25	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1460	0.1160	0.0923	0.0588	0.0378	0.0304	0.0245	0.0160	0.0105	0.0046	0.0021	0.0010	0.0005
30	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0994	0.0754	0.0573	0.0334	0.0196	0.0151	0.0116	0.0070	0.0042	0.0016	0.0006	0.0002	0.0001
40	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0318	0.0221	0.0107	0.0053	0.0037	0.0026	0.0013	0.0007	0.0002	0.0001	•	•
50	0.6080	0.3715	0.2281	0.1407	0.0872	0.0543	0.0339	0.0213	0.0132	0.0085	0.0035	0.0014	0.0009	0.0006	0.0003	0.0001	•	•	•	•
60	0.5504	0.3048	0.1697	0.0951	0.0535	0.0303	0.0173	0.0099	0.0057	0.0033	0.0011	0.0004	0.0002	0.0001	•	•	•	•	•	•

Table AI.4

Present Value of an Annuity of $1

Number of Years	Interest Rate																		
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.8929	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
2	1.9704	1.9415	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355	1.6901	1.6467	1.6257	1.6052	1.5656	1.5278	1.4568	1.3916	1.3315
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2.4018	2.3216	2.2832	2.2459	2.1743	2.1065	1.9813	1.8684	1.7663
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.0373	2.9137	2.8550	2.7982	2.6901	2.5887	2.4043	2.2410	2.0957
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3.7908	3.6048	3.4331	3.3522	3.2743	3.1272	2.9906	2.7454	2.5320	2.3452
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7655	4.6229	4.4859	4.3553	4.1114	3.8887	3.7845	3.6847	3.4976	3.3255	3.0205	2.7594	2.5342
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064	5.0330	4.8684	4.5638	4.2883	4.1604	4.0386	3.8115	3.6046	3.2423	2.9370	2.6775
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	4.9676	4.6389	4.4873	4.3436	4.0776	3.8372	3.4212	3.0758	2.7860
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.3282	4.9464	4.7716	4.6065	4.3030	4.0310	3.5655	3.1842	2.8681
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.6502	5.2161	5.0188	4.8332	4.4941	4.1925	3.6819	3.2689	2.9304
11	10.3676	9.7858	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951	5.9377	5.4527	5.2337	5.0286	4.6560	4.3271	3.7757	3.3351	2.9776
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361	7.1607	6.8137	6.1944	5.6603	5.4206	5.1971	4.7932	4.4392	3.8514	3.3868	3.0133
13	12.1334	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7.4889	7.1034	6.4235	5.8424	5.5831	5.3423	4.9095	4.5327	3.9124	3.4272	3.0404
14	13.0037	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667	6.6282	6.0021	5.7245	5.4675	5.0081	4.6106	3.9616	3.4587	3.0609
15	13.8651	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8.0607	7.6061	6.8109	6.1422	5.8474	5.5755	5.0916	4.6755	4.0013	3.4834	3.0764
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9.4466	8.8514	8.3126	7.8237	6.9740	6.2651	5.9542	5.6685	5.1724	4.7296	4.0333	3.5026	3.0882
17	15.5623	14.2919	13.1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.1196	6.3729	6.0472	5.7487	5.2223	4.7746	4.0591	3.5177	3.0971
18	16.3983	14.9920	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.2497	6.4674	6.1280	5.8178	5.2732	4.8122	4.0799	3.5294	3.1039
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	4.0967	3.5386	3.1090
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285	8.5436	7.4694	6.6231	6.2593	8.9288	5.3527	4.8696	4.1103	3.5458	3.1129
25	22.0232	19.5235	19.4131	15.6221	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770	7.8431	6.8729	6.4641	6.0971	5.4669	4.9476	4.1474	3.5640	3.1220
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737	9.4269	8.0552	7.0072	6.5660	6.1772	5.5168	4.9789	4.1601	3.5693	3.1242
40	32.8347	27.3555	23.1148	19.7928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7791	8.2438	7.1050	6.6418	6.2335	5.5482	4.9966	4.1659	3.5712	3.1250
50	39.1961	31.4236	25.7298	21.4822	18.2559	15.7619	13.8007	12.2335	10.9617	9.9148	8.3045	7.1327	6.6605	6.2463	5.5541	4.9995	4.1666	3.5714	3.1250
60	44.9550	34.7609	27.8656	22.6235	18.9293	16.1614	14.0392	12.3766	11.0480	9.9672	8.3240	7.1401	6.6651	6.2492	5.5553	4.9999	4.1667	3.5714	3.1250

APPENDIX II

Statistical Table

Table AII.1

t-Distribution Table

Values of t

d.f.	t0.100	t0.050	t0.025	t0.010	t0.005	d.f.
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
Inf.	2.282	1.645	1.960	2.326	2.576	Inf.

The t-value describes the sampling distribution of a deviation from a population value divided by the standard error.

Degrees of freedom (d.f.) are in the first column. The probabilities indicated as subvalues of t in the heading refer to the sum of a one-tailed area under the curve that lies outside the point t.

For example, in the distribution of the means of samples of size n = 10, d.f. = n – 2 = 8; then 0.025 of the area under the curve falls in one tail outside the interval t ± 2.306.

APPENDIX III

Top Providers of Budgeting and Planning Systems

Company and Product	Dashboard/ Scorecard Included	CPM Suite Offered	Variance Tracking Graphic	Variance E-mail Alert	Pricing	Special-Purchase Programs
Actuate Actuate Information Applicative Platform www.actuate.com	Yes	No	Customizable	Yes	Starts at $35K per CPU, or $495 per named user	Occasionally offer 2-for-1 deals on product purchase
ALG Software Predicate Planning www.algsoftware.com	Yes	Yes	Color coding	Yes	Based on application, number of modelers, and number of Web users	N/A
Applix TM1 (8.0) www.applix.com	Yes	Yes	Traffic light	Yes	Server, per user	Multicopy discounts existing-client discounts
Cartesis Cartesis Magnitude (8.3) www.Cartesis.com	Yes	Yes	Color coding, formatting capabilities	No	Base price, plus per-user price	None
Centage Budget Maestro (5.7) www.centage.com	No	Yes	Color coding	No	Per user	Volume discounts for enterprise level; entry-level pricing for smaller organizations
CODAGroup CODA-planning www.coda.com	Yes	Yes	Customizable	Yes	Per user	Various
Cognos Cognos Enterprise Planning Series (7.1) www.cognos.com	Yes	Yes	Traffic light, sorting, balanced scorecard	Yes	Sold on user and server basis. Typical configuration start at $100K for 25 users and up	Case-by-case basis
FRx Software Forecaster 6.7 www.frx.soft.com	No	Yes	Conditional formatting	No	Begins at $7,500; based on number of licensed users	Large-user-base pricing available

Geac Computer Geac Performance Management (6.0) www.geac.com	Yes	Yes	Traffic light, charts, graphs	Yes	Server and per-user basis	Entry-level pricing for smaller organizations; volume discounts available
Host Analytics Host Business Performance Management Suite www.hostanalytics.com	Yes	Yes	Percentage, absolute, graphic and conditional color coding with drill-down and weighting on variable; all user-definable	Yes	Server based (unlimited users) or per named user	Professional service programs; multiapplication suite programs
Hyperion Solutions Hyperion Business Performance Mgmnt. Suite (3.0) www.hyperion.com	Yes	Yes	Customizable (color coding, graphics), with drill-down capabilities	Yes	Per application and per user, with different levels of user	Technical support, documentation, training, and professional services
INEA Performance Management Suite www.ineacorp.com	Yes	Yes	Yes	Yes	Based on size of company and volume	Yes
Longview Solutions Khalix (3.4) www.longview.com	Yes	Yes	Traffic light, highlighting (variances can be reported in absolute, percentage, or graphical format)	Yes	Licensed by business function (e.g., forecasting), not by number of users, copies, or hardware platform	May be licensed on a perpetual basis or on a monthly service-fee agreement
Oracle Oracle Financial 11i, Oracle Sales Analyzer 11i www.oracle.com	No*	Yes	Stop-light analysis and conditional (ranking and exception) based analysis	Yes	$1,495 per application user	Flexible metrics and licensing options
OutlookSoft Everest (4.0) www.outlooksoft.com	Yes	NA	Conditional formatting (red for negative, black for positive)	No	Begins at $3,500 per user (minimum of 50 users)	Hotline and online support, plus documentation; training includes CBT, Web-based, and customized live programs

(*continues*)

Company and Product	Dashboard/ Scorecard Included	CPM Suite Offered	Variance Tracking Graphic	Variance E-mail Alert	Pricing	Special-Purchase Programs
PeopleSoft PeopleSoft Business Planning and Budgeting (8.8) www.peoplesoft.com	Yes	Yes	Scorecard solutions use colors and symbols to indicate status	Yes	Server, per users, or other (company size, etc.)	Value pricing based on size of organization
Prophix Software Prophix (4.2) www.prophix.com	No	No	Traffic light with drill-down capabilities	No	Begins at $7,000 for first 10 users, $5,000 for each subsequent 10; enterprise product at $16,000 for first 10 users, $5,000 for each subsequent 10	Multicopy discounts
SAP Strategic Enterprise Management www.sap.com	Yes	Yes	Traffic light	Yes	Based on specific customer needs	N/A
SAS Institute SAS Financial Management Solutions (3.2) www.sas.com	No	Yes	Text indicators or traffic light	No	Base price for software license, plus a per-user cost	Some customers may benefit from multiple-solution discounts
Satori Group ProCube (6.0) www.satorigroupinc.com	Yes	Yes	Customizable (color coding, graphics), with drill-down capabilities	Yes	Based on product and number of users	Yes
SRC Software SRC Performance Management www.srcsoftware.com	Yes	Yes	Flexible and user definable	Yes	Based on number of products and users	Yes

*Available through related modules.
Note: All listed programs have consolidation/reporting capabilities.
Source: CFO.com

Glossary of Budgeting and Planning Terms

Active Financial Planning Software Budgeting and planning software that includes applications and the new level of functionality that combine budgeting, forecasting analytics, business intelligence, and collaboration. Finance managers can use these robust, Web-enabled programs to scan a wide range of data, radically speed up the planning process, and identify managers who have failed to submit budgets.

Administrative Budget A formal and comprehensive financial plan through which management can control day-to-day business affairs and activities.

Allotment Part of an appropriation that may be encumbered or expended during an allotment period, which is usually less than one fiscal year. Bimonthly and quarterly allotment periods are most common.

Analysis of Variances Analysis and investigation of causes for variances between standard costs and actual costs. It is also called variance analysis. A variance is considered favorable if actual costs are less than standard costs. It is unfavorable if actual costs exceed standard costs.

Annual Budget A budget prepared for a calendar or fiscal year. *See also* Long-range Budget.

Balanced Budget A budget in which total expenditures equal total revenue. An entity has a budget surplus if expenditures are less than tax revenues. It has a budget deficit if expenditures are greater than tax revenues.

B-E Chart *See* Break-even Chart.

Break-even Analysis Analysis that determines the break-even sales, which is the level of sales where total costs equal total revenue. *See* Contribution Margin Analysis.

Break-even Chart The chart where sales revenue, variable costs, and fixed costs are plotted on the vertical axis while volume, x, is plotted on the horizontal axis. The break-even point is the point where the total sales revenue line intersects the total cost line.

Break-even Sales The sales that result in there being no profit or loss, also called break-even point. It is the sales volume, in units or in dollars, where total sales revenue equals total costs. Thus, zero profit results. *See also* Break-even Analysis.

Budget A quantitative plan of activities and programs expressed in terms of the assets, equities, revenues, and expenses that will be involved in carrying out the plans or in other quantitative terms, such as units of product or service. The budget expresses the organizational goals in terms of specific financial and operating objectives. *See also* Master (Comprehensive) Budget.

Budget Control Budgetary actions carried out according to a budget plan. Through the use of a budget as a standard, an organization ensures that managers are implementing its plans and objectives. Their activities are appraised by comparing their actual performance against budgeted performance. Budgets are used as a basis for rewarding or punishing them, or perhaps for modifying future budgets and plans.

Budget Variance 1. Any difference between a budgeted figure and an actual figure. 2. Flexible budget variance. This is the difference between actual factory overhead costs and standard (flexible budget) costs, multiplied by the standard units of activity allowed for actual production. The budget variance is used in the two-way analysis of factory overhead. It includes the fixed and variable spending variances and the variable overhead efficiency variance which are used in the three-way analysis.

Budgeting Fund Annual budgets of estimated revenues and expenditures prepared for most governmental funds. The approved budgets of such funds are recorded in budgetary accounts in the accounting system to provide control over revenues and expenditures.

Budgeting Models Mathematical models that generate a profit planning budget. The models help planners and budget analysts answer a variety of "what-if" questions. The resultant calculations provide a basis for choice among alternatives under conditions of uncertainty.

Capital Budget A budget or plan of proposed acquisitions and replacements of long-term assets and their financing. A capital budget is developed by using a variety of capital budgeting techniques, such as the payback method, the net present value (NPV) method, or the internal rate of return (IRR) method. *See also* Capital Budgeting.

Capital Budgeting The process of making long-term planning decisions for capital investments. There are typically two types of investment decisions: (1) Selecting new facilities or expanding existing facilities. Examples include investments in long-term assets, such as property, plant, and equipment, and re-

source commitments in the form of new product development, market research, refunding of long-term debt, and introduction of a computer. (2) Replacing existing facilities with new facilities. Examples include replacing a manual bookkeeping system with a computerized system and replacing an inefficient lathe with one that is numerically controlled.

Capital Expenditure Budget A budget plan prepared for individual capital expenditure projects. The time span depends on the project. Capital expenditures to be budgeted include replacement, acquisition, or construction of plants and major equipment. *See also* Capital Budgeting.

Capital Rationing The problem of selecting the mix of acceptable projects that provides the highest overall net present value (NPV), where a company has a limit on the budget for capital spending. The profitability index is used widely in ranking projects competing for limited funds.

Cash Budget A budget for cash planning and control, presenting expected cash inflow and outflow for a designated time period. The cash budget helps management keep cash balances in reasonable relationship to its needs. It aids in avoiding idle cash and possible cash shortages.

Cash Flow Forecasting Forecasts of cash flow, including cash collections from customers, investment income, and cash disbursements.

Causal Forecasting Model A forecasting model that relates the variable to be forecast to a number of other variables that can be observed.

Coefficient of Determination A statistical measure of how good the estimated regression equation is, designated as R^2 (read as R-squared). Simply put, it is a measure of "goodness of fit" in the regression. Therefore, the higher the R-squared, the more confidence we can have in our equation.

Comprehensive Budget *See* Master (Comprehensive) Budget.

Continuous Budget An annual budget that continues to the earliest one month or period and adds the most recent one month or period, so that a 12 month or other periodic forecast is always available.

Contribution Margin (CM) The difference between sales and the variable costs of the product or service, also called marginal income. It is the amount of money available to cover fixed costs and generate profits.

Contribution Margin Analysis Also called *cost-volume-profit (CVP) analysis.* Deals with how profits and costs change with a change in volume. More specifically, it looks at the effects on profits of changes in such factors as variable costs, fixed costs, selling prices, volume, and mix of products sold. By studying the relationships of costs, sales, and net income, management is better able to cope with many planning decisions.

Contribution (Margin) Income Statement An income statement that organizes the cost by behavior. It shows the relationship of variable costs and fixed costs, regardless of the functions with which a given cost item is associated.

Contribution Margin (CM) Ratio The contribution margin (CM) as percentage of sales.

Contribution Margin (CM) Variance The difference between actual contribution margin per unit and the budgeted contribution margin per unit, multiplied by the actual number of units sold. If the actual CM is greater than the budgeted CM per unit, a variance is favorable. Otherwise, it is unfavorable. CM variance = (actual CM per unit – budgeted CM per unit) × actual sales

Control Concept A concept that ensures that actions are carried out or implemented according to a plan or goal.

Corporate Planning Model An integrated business planning model in which marketing and production models are linked to the financial model. Corporate planning models are the basic tools for risk analysis and "what-if" experiments.

Correlation The degree of relationship between business and economic variables such as cost and volume. Correlation analysis evaluates cause/effect relationships. It looks consistently at how the value of one variable changes when the value of the other is changed. A prediction can be made based on the relationship uncovered. An example is the effect of advertising on sales. A degree of correlation is measured statistically by the coefficient of determination (R-squared).

Correlation Coefficient (r) A measure of the degree of correlation between the two variables. The range of values it takes is between –1 and +1. A negative value of r indicates an inverse relationship. A positive value of r indicates a direct relationship. A zero value of r indicates that the two variables are independent of each other. The closer r is to +1 and –1, the stronger the relationship between the two variables.

Cost Behavior Patterns The way a cost will react or respond to changes in the level of activity. Costs may be viewed as variable, fixed, or mixed (semivariable). A mixed cost is one that contains both variable and fixed elements. For planning, control, and decision purposes, mixed costs need to be separated into their variable and fixed components, using such methods as the high-low method and the least-squares method. An application of the variable-fixed breakdown is a break-even and contribution margin analysis.

Cost/Benefit Analysis An analysis to determine whether the favorable results of an alternative are sufficient to justify the cost of taking that alternative. This analysis is widely used in connection with capital expenditure projects.

Cost Control The steps taken by management to ensure that the cost objectives set down in the planning stage are attained and to ensure that all segments of the organization function in a manner consistent with its policies. For effective cost control, most organizations use standard cost systems, in which the actual costs are compared to standard costs for performance evaluation and the deviations are investigated for remedial actions. Cost control also is concerned with feedback that might change any or all of the future plans, the production method, or both.

Cost Effective The most cost-effective program would be the one whose cost/benefit ratio is the lowest among various programs competing for a given amount of funds. *See also* Cost/Benefit Analysis.

Cost-Volume Formula cost function in the form of

$$Y = a + bX$$

where Y = the semivariable (or mixed) costs to be broken up
X = any given measure of activity such as volume and labor hours
a = the fixed cost component
b = the variable rate per unit of X

The formula is used for cost prediction and flexible budgeting purposes.

Cost-Volume-Profit Analysis *See* Contribution Margin Analysis.

Decision Support System (DSS) A branch of the broadly defined management information system (MIS). It is an information system that provides answers to problems and that integrates the decision maker into the system as a component. The system utilizes such quantitative techniques as regression and financial planning modeling. DSS software furnishes support to the accountant in the decision-making process.

Delphi Method A qualitative forecasting method that seeks to use the judgment of experts systematically in arriving at a forecast of what future events will be or when they may occur. It brings together a group of experts who have access to each other's opinions in an environment where no majority opinion is disclosed.

Dependent Variable A variable whose value depends on the values of other variables and constants in some relationship. For example, in the relationship $Y = f(X)$, Y is the dependent variable. Market price of stock is a dependent variable influenced by various independent variables, such as earnings per share, debt-equity ratio, and beta. *See also* Independent Variable.

Direct Labor Budget A schedule for expected labor cost. Expected labor cost is dependent on expected production volume (production budget). Labor requirements are based on production volume multiplied by direct labor hours per unit. Direct labor hours needed for production are then multiplied by direct labor cost per hour to derive budgeted direct labor costs.

Direct Materials Budget A budget that shows how much material will be required for production and how much material must be bought to meet this production requirement. The purchase depends on both expected usage of materials and inventory levels.

Discounted Cash Flow (DCF) Techniques Methods of selecting and ranking investment proposals, such as the net present value (NPV) and internal rate of return (IRR) methods where time value of money is taken into account.

DSS See Decision Support System.

Efficiency Variance Difference between inputs (materials and labor) that were actually used and inputs that should have been used (i.e., standard quantity of inputs allowed for actual production), multiplied by the standard price per unit. *See also* Materials Quantity (Usage) Variance, Labor Efficiency Variance.

Exponential Smoothing A forecasting technique that uses a weighted moving average of past date as the basis for a forecast. The procedure gives heaviest

weight to more recent information and smaller weight to observations in the more distant past. The method is effective when there is random demand and no seasonal fluctuations in the data. The method is a popular technique for short-run forecasting.

Factory Overhead Budget A schedule of all expected manufacturing costs except for direct material and direct labor. Factory overhead items include indirect material, indirect labor, factory rent, and factory insurance. Factory overhead may be variable, fixed, or a combination of both.

Favorable Variance The excess of standard (or budgeted) costs over actual costs. *See also* Standard Cost System, Variance.

Financial Budget A budget that embraces the impacts of the financial decisions of the firm. It is a plan including a budgeted balance sheet, which shows the effects of planned operations and capital investments on assets, liabilities, and equities. It also includes a cash budget, which forecasts the flow of cash and other funds in the business.

Financial Model A functional branch of a general corporate planning model. It is essentially used to generate pro forma financial statements and financial ratios. A financial model is a mathematical model describing the interrelationships among financial variables of the firm. It is the basic tool for budgeting and budget planning. Also, it is used for risk analysis and "what-if" experiments. Many financial models today use special modeling languages such as Budget Maestro or spreadsheet programs such as Excel. *See also* Corporate Planning Model.

Financial Projection An essential element of planning that is the basis for budgeting activities and estimating future financing needs of a firm. Financial projections (forecasts) begin with forecasting sales and their related expenses.

Fixed Budget *See* Static (Fixed) Budget.

Fixed Overhead Variance The difference between actual fixed overhead incurred and fixed overhead applied to production.

Flash Report A report that provides the highlights of key information promptly to the responsible nonfinancial manager. An example is an exception report, such as performance reports, that highlight favorable or unfavorable variances. A flash report allows managers to take a corrective action for an unfavorable variance.

Flexible (Variable) Budget A budget based on different levels of activity. It is an extremely useful tool for comparing the actual cost incurred to the cost allowable for the activity level achieved. It is dynamic in nature rather than static.

Flexible Budget Formula *See* Cost-Volume Formula.

Flexible Budget Variance *See* Budget Variance.

Flexible Budgeting *See* Flexible (Variable) Budget.

Forecast 1. A projection or an estimate of future sales, revenue, earnings, or costs. *See also* Sales Forecasting. 2. A projection of future financial position and operating results of an organization. *See also* Financial Projection.

Goodness of Fit A degree to which a model fits the observed data. In a regression analysis, the goodness of fit is measured by the coefficient of determination (R-squared).

Independent Variable A variable that may take on any value in a relationship. For example, in a relationship Y = f(X), X is the independent variable. Independent variables that influence sales are advertising and price. *See also* Dependent Variable.

Internal Rate of Return (IRR) The rate earned on a proposal. It is the rate of interest that equates the initial investment (I) with the present value (PV) of future cash inflows. That is, at IRR, I = PV, or NPV (net present value) = 0.

Investment Center A responsibility center within an organization that has control over revenue, cost, and investment funds. It is a profit center whose performance is evaluated on the basis of the return earned on invested capital.

Judgmental (Qualitative) Forecast A forecasting method that brings together, in an organized way, personal judgments about the process being analyzed.

Labor Efficiency Variance The difference between the amount of labor time that should have been used and the labor that actually was used, multiplied by the standard rate.

Labor Rate (Price) Variance Any deviation from standard in the average hourly rate paid to workers, multiplied by the hours worked.

Labor Variance The difference between the actual costs of direct labor and the standard costs of direct labor. Labor variance is divided into labor rate variance and labor efficiency variance.

Least-squares Method A statistical technique for fitting a straight line through a set of points in such a way that the sum of the squared distances from the data points to the line is minimized.

Linear Regression A regression that deals with a straight-line relationship between variables. It is in the form of Y = a + bX, whereas nonlinear regression involves curvilinear relationships, such as exponential and quadratic functions. *See also* Regression Analysis.

Long-range Budget Projections that cover more than one fiscal year. It is also called strategic budgeting. The five-year budget plan is the most commonly used. *See also* Annual Budget.

Management by Exception A management concept or policy by which management devotes its time to investigating only those situations in which actual results differ significantly from planned results. The idea is that management should spend its valuable time concentrating on the more important items (i.e., the shaping of the company's future strategic course).

Management by Objective (MBO) A system of performance appraisal having these characteristics: (1) It is a formal system in that each manager is required to take certain prescribed actions and to complete certain written documents, and (2) the manager and subordinates discuss the subordinate's job description, agree to short-term performance targets, discuss the progress made toward

meeting these targets, and periodically evaluate the performance and provide the feedback.

Management Control System A system under which managers ensure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's goals.

Management Information System (MIS) A computer-based or manual system that transforms data into information useful in the support of decision making.

Master (Comprehensive) Budget A plan of activities expressed in monetary terms of the assets, equities, revenues, and costs that will be involved in carrying out the plans. Simply put, a master budget is a set of projected or planned financial statements.

Material Requirement Planning (MRP) A computer-based information system designed to handle ordering and scheduling of dependent-demand inventories, such as raw materials, component parts, and subassemblies, which will be used in the production of a finished product.

Materials Price Variance The difference between what is paid for a given quantity of materials and what should have been paid, multiplied by actual quantity of materials used.

Materials Purchase Price Variance *See* Materials Price Variance.

Materials Quantity (Usage) Variance The difference between the actual quantity of materials used in production and the standard quantity of materials allowed for actual production, multiplied by the standard price per unit.

Materials Variance The difference between the actual costs of materials and the standard costs of materials. Materials variance is divided into materials price variance and materials quantity variance.

Mean Squared Error (MSE) A measure of accuracy computed by squaring the individual error for each item in a data set and then finding the average or mean value of the sum of those squares. The mean squared error gives greater weight to large errors than to small errors because the errors are squared before being summed.

Modeling Languages Usually, English-like programming languages that are used to solve a specific task and generate various reports based on the solution and analysis. For example, financial planning modeling languages, such as Integrated Financial Planning System (IFPS), are computer software packages that help planners develop a financial model in English terms, do not require any computer programming knowledge, perform various analyses such as "what-if" analysis, and further generate pro forma financial reports.

Moving Average For a time series, an average that is updated as new information is received. With the moving average, the manager employs the most recent observations to calculate an average, which is used as the forecast for the next period.

Multiple Regression A statistical procedure that attempts to assess the relationship between the dependent variable and two or more independent vari-

ables. For example, sales of Coca-Cola are a function of various factors, such as price, advertising, taste, and the prices of its major competitors. For forecasting purposes, a multiple regression equation falls into the category of a causal forecasting model. *See also* Regression Analysis.

Naive Forecast A forecast obtained with a minimal amount of effort and data manipulation and based solely on the most recent information available. One such naive method would be to use the most recent datum available as the future forecast.

Net Present Value (NPV) The difference between the present value (PV) of cash inflows generated by the project and the amount of the initial investment (I).

Net Present Value Method A method widely used for evaluating investment projects. Under the net present value method, the present value (PV) of all cash inflows from the project is compared to the initial investment (I).

Operational (Operating) Budget A budget that embraces the impacts of operating decisions. It contains forecasts of sales, net income, the cost of goods sold, selling and administrative expenses, and other expenses.

Payback Period The length of time required to recover the initial amount of a capital investment.

Planning The selection of short- and long-term objectives and the drawing up of tactical and strategic plans to achieve those objectives. After deciding on a set of strategies to be followed, the organization needs more specific plans, such as locations, methods of financing, and hours of operation. As these plans are made, they will be communicated throughout the organization. When implemented, the plans will serve to coordinate the efforts of all parts of the organization toward the company's objectives.

Pro Forma Balance Sheet A budgeted balance sheet.

Pro Forma Income Statement A budgeted income statement.

Product Mix *See* Sales Mix.

Production Budget A schedule for expected units to be produced. It sets forth the units expected to be manufactured to satisfy budgeted sales and inventory requirements. Expected production volume is determined by adding desired ending inventory to planned sales and then subtracting beginning inventory.

Profit Center The unit in an organization that is responsible for revenues earned and costs incurred. The manager of a profit center has control over revenues and costs, as well as attempts to maximize profit.

Profit Planning A process of developing a profit plan that outlines the planned sales revenues and expenses and the net income or loss for a time period. Profit planning requires preparation of a master budget and various analysis for risk and "what-if" scenarios. Tools for profit planning include the cost-volume-profit (CVP) analysis and budgeting.

Profit Variance A difference between actual profit and budgeted profit. Profit, whether it is gross profit in absorption costing or contribution margin in direct costing, is affected by sales price, sales volume, and costs.

Profit-Volume Chart A chart that determines how profits vary with changes in volume. Profits are plotted on the vertical axis while units of output are shown on the horizontal axis.

Profitability Index The ratio of the total present value (PV) of future cash inflows to the initial investment (I).

Projected (Budgeted) Balance Sheet A schedule for expected assets, liabilities, and stockholders' equity. It projects a company's financial position at the end of the budgeting year. A budgeted balance sheet discloses unfavorable financial conditions that management may want to avoid, serves as a final check on the mathematical accuracy of all other budgets and highlights future resources and obligations.

Projected (Budgeted) Income Statement A summary of various component projections of revenues and expenses for the budget period. It indicates the expected net income for the period.

P-V Chart *See* Profit-Volume Chart.

Quantitative Forecasting A technique that can be applied when information about the past is available, if that information can be quantified and if the pattern included in past information can be assumed to continue into the future.

R-Squared *See* Coefficient of Determination.

Regression Analysis A statistical procedure for estimating mathematically the average relationship between the dependent variable (e.g., sales) and one or more independent variables (e.g., price and advertising).

Regression Coefficients When a dependent measure Y is regressed against a set of independent measures X_1 through X_k, the manager wishes to estimate the values of the unknown coefficients by least-squares procedures. For example, in a linear regression equation $Y = a + bX$, a and b are regression coefficients. Specifically, a is called y-intercept or constant, while b is called a slope.

The properties of these regression coefficients can be used to understand the importance of each independent variable (as it related to Y) and the interrelatedness among the independent variables (as they relate to Y).

Regression Equation (Model) A forecasting model that relates the dependent variable (e.g., factory overhead) to one or more independent variables (e.g., direct labor hours and machine hours).

Residual A synonym for error. It is calculated by subtracting the forecast value from the actual value to give a residual or error value for each forecast period.

Responsibility Accounting The collection, summarization, and reporting of financial information about various decision centers (responsibility centers) throughout an organization.

Responsibility Center A unit in the organization that has control over costs, revenues, or investment funds. Responsibility centers are classified as cost centers, revenue centers, profit centers, and investment centers.

Risk Analysis The process of measuring and analyzing the risks associated with financial and investment decisions. Risk refers to the variability of expected returns (earnings or cash flows).

Sales Budget An operating plan for a period expressed in terms of sales volume and selling prices for each class of product or service. Preparation of a sales budget is the starting point in budgeting, since sales volume influences nearly all other items.

Sales Forecasting A projection or prediction of future sales. It is the foundation for the quantification of the entire business plan and a master budget. Sales forecasts serve as a basis for capacity planning, budgeting, production and inventory planning, manpower planning, and purchasing planning.

Sales Mix The relative proportions of the product sold.

Sales Price Variance The difference between actual selling price per unit and the budgeted selling price per unit, multiplied by the actual number of units sold.

Sales Volume Variance The difference between the actual number of units sold and the budgeted number, multiplied by the budgeted selling price per unit. It is also called sales quantity variance.

Simple Regression A regression analysis that involves one independent variable. For example, the demand for automobiles is a function of its price only. *See also* Multiple Regression, Regression Analysis.

Simulation An attempt to represent a real life system via a model to determine how a change in one or more variable affects the rest of the system. It is also called "what-if" analysis. *See also* Financial Model, Simulation Model.

Simulation Model A "what-if" model that attempts to simulate the effects of alternative management policies and assumptions about the firm's external environment. It is basically a tool for management's laboratory.

Slope The steepness and direction of the line. More specifically, the slope is the change in Y for every unit change in X.

Standard A quantitative expression of a performance objective, such as standard hours of labor allowed for actual production or a standard purchase price of materials per unit. Sometimes the terms "standard" and "budget" are used interchangeably.

Standard Cost System A system by which production activities are recorded at standard costs and variances from actual costs are isolated.

Standard Costs Production or operating costs that are carefully predetermined. A standard cost is a target cost that should be attained.

Standard Error of the Estimate The standard deviation of the regression. The statistic can be used to gain some idea of the accuracy of our predictions.

Standard Error of the Regression Coefficient A measure of the amount of sampling error in a regression coefficient.

Standard Hours Allowed The standard time that should have been used to manufacture actual units of output during a period. It is obtained by multiplying actual units of production by the standard labor time.

Standard Labor Rate The standard rate for direct labor that includes not only base wages earned but also an allowance for fringe benefits and other labor-related costs.

Standard Materials Price The standard price per unit for direct materials. It reflects the final, delivered cost of the materials, net of any discounts taken.

Standard Quantity Allowed The standard amount of materials that should have been used to manufacture units of output during a period. It is obtained by multiplying actual units of production by the standard material quantity per unit.

Static (Fixed) Budget A budget based on one level of activity (e.g., one particular volume of sales or production).

Strategic Planning The implementation of an organization's objectives. Strategic planning decisions will have long-term impacts on the organization while operational decisions are day-to-day in nature.

t-test In regression analysis, a test of the statistical significance of a regression coefficient. It involves basically two steps:

(1) Compute the t-value of the regression coefficient: t-value = coefficient/standard error of the coefficient.

(2) Compare the value with the t table value. High t-values enhance confidence in the value of the coefficient as a predictor. Low values (as a rule of thumb, under 2.0) are indications of low reliability of the coefficient as a predictor. *See also* t-value.

t-value A measure of the statistical significance of an independent variable b in explaining the dependent variable Y. It is determined by dividing the estimated regression coefficient b by its standard error.

Template A worksheet or computer program that includes the relevant formulas for a particular application but not the data. It is a blank work sheet that we save and fill in with the data as needed for a future forecasting and budgeting application.

Time Series A chronologically arranged sequence of values of a particular variable.

Variable Otherhead Efficiency Variance The difference in actual and budgeted variable overhead costs that are incurred due to inefficient use of indirect materials and indirect labor.

Variable Overhead Spending Variance The difference in actual and budgeted variable overhead costs that results from price changes in indirect materials and indirect labor and insufficient control of costs of specific overhead items.

Variance The difference of revenues, costs, and profit from the planned amounts. One of the most important phases of responsibility accounting is establishing standards in costs, revenues, and profit and establishing performance by comparing actual amounts with the standard amounts. The differences (vari-

ances) are calculated for each responsibility center, analyzed, and unfavorable variances are investigated for possible remedial action.

"What-if" Analysis *See* Simulation.

Zero-base Budgeting (ZBB) A planning and budgeting tool that uses cost/benefit analysis of projects and functions to improve resource allocation in an organization. Traditional budgeting tends to concentrate on the incremental change from the previous year. It assumes that the previous year's activities and programs are essential and must be continued. Under zero-base budgeting, however, cost and benefit estimates are built up from scratch, from the zero level, and must be justified.

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