CHAPTER 2

Accounting and Economics

CHAPTER OBJECTIVES

1. Explain the role of department budgets and organizational performance.
2. Explain the fundamental accounting equations and the purpose of financial statements.
3. Apply marginal decision-making.
4. Explain the different types of costs and how they impact product costs.
5. Calculate product cost based on output.

Introduction

Budgeting should strive to ensure that the maximum value is received from a set of resources. The effort to obtain the maximum value faces three primary obstacles: uncertainty, bounded rationality, and opportunism. **Uncertainty** recognizes that budgeting attempts to foretell the future, a future that changes rapidly in often unpredictable ways. **Bounded rationality** deals with the inherent limitations of the human mind, compounded by incomplete information and limited time to make decisions. Not everything can be known, and decisions must often be made quickly within the limits of our understanding. **Opportunism** recognizes that people may take every chance they get to improve their well-being and that these efforts often come at the expense of others.

Humans desire maximum satisfaction with minimum effort, and this is true whether we view humans as individuals, in groups, or as a whole. The problem is that while individuals, groups, and society pursue the same maximizing goal, the efforts of each often prevent the realization of the goals of others. Individuals often want to maximize consumption, while minimizing their effort, that is, the maximum income from the smallest amount of work. Owners of organizations want to maximize their value by obtaining the largest-possible revenues and holding down costs or creating the greatest amount of output from their resources. The desire of individuals to minimize effort runs counter to the organizational

goal of obtaining the maximum output from workers.

Societal goals add another layer of complexity to the maximizing goals of individuals and organizations. Society seeks the optimal production of goods and services and an adequate distribution of output across the population. The existence of **public goods, externalities,** and the desire for **income redistribution** complicates value calculations and does not use the value-determining mechanisms employed by individuals and organizations. Government provision of public goods and goods with positive externalities may be warranted because of **free riding,** that is, individuals receiving benefits may be unwilling to contribute to the cost of those goods, resulting in a less than optimal provision of the good. Goods with negative externalities, like pollution, may be overproduced and may force nonparticipants to bear part of the cost of their production—the opposite of free riding. Government action to restrict output or dictate production methods to reduce negative externalities is used to prevent or lessen shifting of costs to nonparticipants.

The extent of government-initiated income redistribution requires a value judgment; value in the public sector is determined in political markets, unlike private action that relies on economic markets. Resource transfers simultaneously discourage effort from higher-income groups by reducing after-tax earnings *and* lower-income groups by subsidizing their consumption. Society turns to the government to increase **social welfare** by remedying **market failures** and transferring income; government, however, is not known for either responsiveness or efficiency.

The behavior pursued by individuals in attempting to maximize their own interests may undermine both organizational and societal goals. Likewise, the actions employed by organizations can undermine the goals of society and vice versa, and the actions taken by organizations and society can undermine the goals of individuals. The tendency of individuals to minimize effort does not sit comfortably with the desire of organizations to obtain the maximum effort from employees or society's goals of economic growth and income disparity reduction.

It is sensible for individuals motivated by extrinsic rewards to reduce effort if it does not lower their income; however, shirking duties makes it impossible for organizations or society to obtain the highest-possible output from resources. On the other hand, some people believe that effort is its own reward and strive to do their best without the promise of an extrinsic reward or in the face of active opposition. Organizations attempting to maximize profit favor high-profit goods and services rather than a mix of products that some find more socially desirable (pop art versus high art or curative versus preventive care). The choice of profit-maximizing goods may lead to overproduction of goods accompanied by negative externalities and underproduction of goods with positive externalities, encouraging calls for government intervention to produce a more desirable output mix. Of course, government is itself a service, and there are questions of whether public services are over- or underprovided and whether society is receiving an adequate return on its investment in government. Should society expect more and better output from public workers?

Budgets are one way to navigate the inherent conflicts between individuals, organizations, and society and direct behavior to ensure that the maximum output (or as much as is practical) is produced from available resources. Budgets identify what can and should be produced and are a means to evaluate performance: are individuals putting in the expected effort, are for-profit and nonprofit organizations using their resources wisely, and are public agencies lessening market failures?

Budgeting has always been torn between two opposing goals. The idealistic or normative

goal is to produce a budget that maximizes value, that is, obtain the maximum output from a set of resources. The opposing view is the pragmatic goals of individuals who do not want to be pushed to the extent of their capabilities and prefer budgets that pursue lower output and supply more resources. The pragmatic view of individuals impedes the realization of the idealistic goal. If budgets that provide high wages and require less effort from workers can be constructed, so much the better; however, consumers may decide that the limited product at high prices is not worth their patronage and spend their money elsewhere.

Budgeting in organizations encompasses both competition and cooperation. Competition arises between departments as managers try to increase the size of their budgets and share of an organization's resources. Cooperation is mandatory in every organization with more than one employee, as no person or department is individually capable of producing and delivering product. Budget building is always a contest between small, tight budgets and larger, easier-to-meet budgets. While managers may see budgeting as a zero-sum game within an organization, an increase in one department's allocation must come at a cost of smaller budgets for other departments; managers should recognize that their collective success depends on their joint ability to extract more resources from the external environment. Mutual interest explains why groups with seemingly opposing interests, such as unions and management, support the same competition-suppressing initiatives such as international trade regulations.

Readers should first recognize the magnitude of the budgeting task. Large organizations are multibillion-dollar enterprises operating in rapidly changing environments. Organizations challenged by rapid changes in customers' expectations, technology, competition, and regulations must formulate plans to carry themselves into the future. The smallest Fortune 500 company in 2016, Burlington Stores, had $5.13 billion in revenue (Fortune 500, 2016). Understanding where and how $5.13 billion in sales is produced and assembling the resources to generate this revenue are monumental tasks. The ability of managers to accurately estimate revenues and expenses and manage within the budget may determine organizational and individual success or failure.

After recognizing the enormity of the budgeting challenge, the fundamental accounting equations and financial statements defining organizational performance and **net worth** are reviewed. Accounting provides the tools required to break the complex budgeting task into manageable parts. Organizational performance is the difference between revenue and expense, that is, profit or net income. The net worth of an organization, assets minus liabilities, at least in the short run, may *not* be determined by the inflow of revenues and the outflow of expenses. In the short run, the organization can have higher expenses than revenues and in extreme cases zero revenue. Such organizations, however, should have a long-range plan to not only recoup past losses but also generate substantial future profit. A start-up pharmaceutical company pursuing a patent may have zero sales revenue until the Food and Drug Administration (FDA) approves the drug for human use, a process that can take 7 years or more and $1 billion expenses. Only 0.3% of drugs become profitable (Swayne, Duncan, & Ginter, 2006, p. 438), but start-up companies can obtain funding, equity investments, and debt on the basis of their future earning prospects. These companies have long-range business plans demonstrating how they intend to build profit and net worth. Investors rely on business plans to determine whether an operation is worthy of their support and resources. For most organizations, additions and deductions from net worth are driven by the relationship between revenue and expenses.

After reviewing accounting, the discussion switches to economics to explore

marginal decision-making, cost behavior, and economies of scale. **Marginalism** explains real-world processes and is the foundation for many budgeting systems. Understanding how costs change with output is synonymous with understanding how output is produced. It is not enough to understand total inputs used and output produced (measured in dollars); astute managers should also understand how output is affected by the amount and type of inputs used, the substitutability of one input for another (the marginal rate of substitution [MRS]), and whether the optimal mix of inputs is being used. Optimality asks the following questions: Is the revenue (or benefit) produced by the output greater than or equal to the cost of resources consumed, are resources fully employed, and can costs be lowered by employing a different mix of inputs? The best outcome from the organization or society perspective is that goods and services are produced at the lowest-possible costs, while satisfying customers or clients.

In the real world, cost minimization is rarely the goal or outcome of budgeting. Managers regularly pursue the goal of budget maximization as control over more resources makes managing easier and confers power, status, and income on department heads. Budgeting is a means to an end and, ideally, a means to direct resources to their highest-value uses and maximize the well-being of humanity. Ensuring that each department obtains the maximum benefit from its resources requires different metrics, given the varying control managers exercise over products sold and inputs consumed. Budget and performance evaluation systems should hold managers accountable for the things they should control and harmless for matters beyond their control. Managers who can set the prices at which products are sold or the prices paid for inputs should be evaluated differently than managers who cannot influence input or output prices. Budgets should be the basis for performance evaluation systems that maximize organizational value and judge each manager according to the control he or she should exercise over resources.

Budgets should clearly identify organizational objectives and define success regardless of whether the organization is for profit, nonprofit, or public. Budgets should stimulate discussion, resolve questions of whether the ends chosen are appropriate, and secure the buy-in and approval of interested parties. The approved budget should provide the financial plan to guide operations and incentives to ensure that organizational goals are diligently pursued.

Budget Scope

The challenge facing management and budgeting is that organizations are large and complex social organisms, where thousands of people carry on a wide variety of activities and millions, if not billions, of dollars flow in and out. Given the scope and scale of operations, it is difficult to see the whole. No matter how hard anyone tries, it may be impossible for any single person to understand how the entire organization functions. Operating managers and specialists may only concern themselves with their areas of responsibility, but effective management requires the coordination of all parts. Many organizations suffer from **silo thinking**, the unwillingness to share information or coordinate work between departments, which reduces overall effectiveness and efficiency. Organizations should have a unified plan of operation and a system to coordinate activities, that is, a budget to maximize their chances of success.

To conceptualize the task that large, diversified organizations face in assembling a budget, one only needs to examine an organization chart. **FIGURES 2.1** and **2.2** provide examples of divisionally and functionally structured organizations, respectively. In **divisionally structured organizations,** activities are arranged by product line. Each product line controls all the essential activities required to design, produce, and deliver a product to a customer. Each division may be an autonomous business

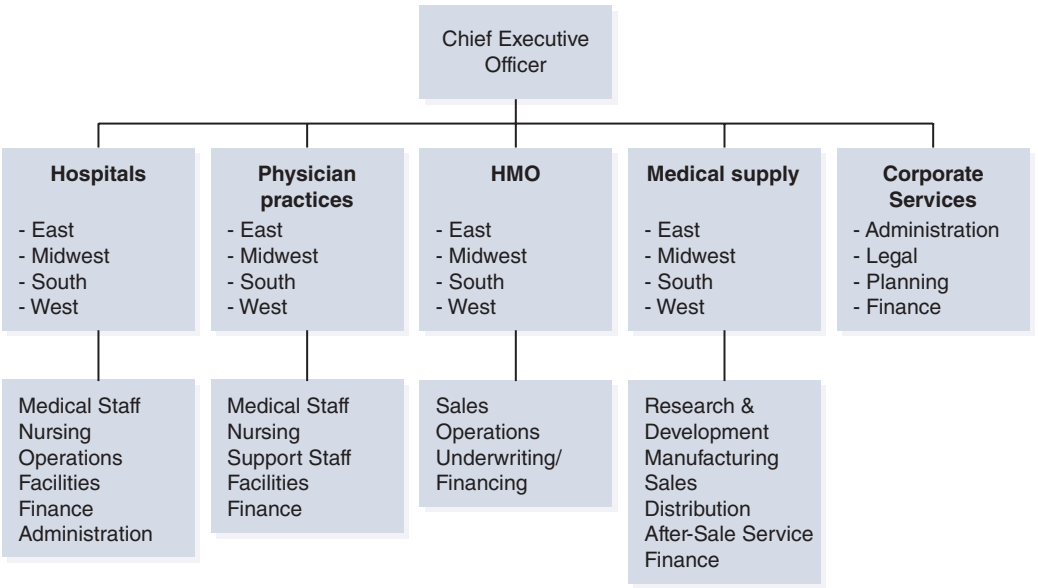

FIGURE 2.1 Divisional Organizational Structure

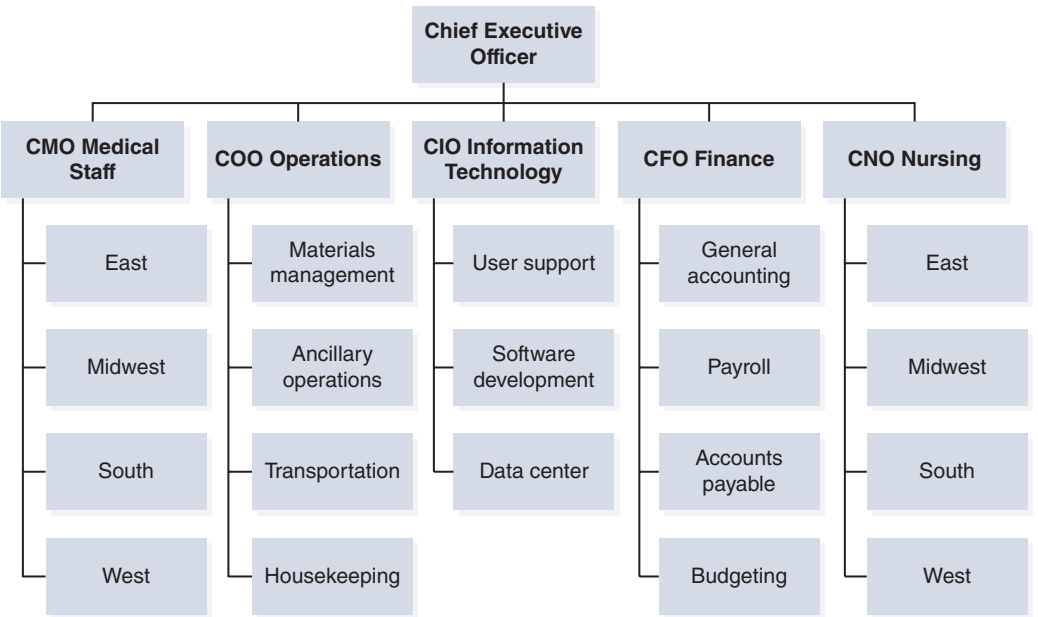

FIGURE 2.2 Functional Organization Structure

unit responsible for setting prices and generating sufficient revenues to cover its expenses plus the cost of corporate services.

The second major organizational form is a functional structure; organizations structured along functional lines consolidate all

activities of a certain type within a single unit. **Functionally structured organizations** attempt to capitalize on specialization and **economies of scale** by limiting duplication of activities across units. Functional organizations have a single unit responsible for research and development (R&D), finance, marketing, etc., reporting to a single vice president (VP) who supports all product lines. In functionally structured organizations, changes must be coordinated through multiple authority lines. Divisionally structured organizations concentrate knowledge of a particular industry or product in a single authority center to allow decision-makers to respond swiftly to changes in customer desires or market direction without seeking and obtaining the cooperation of other units. As seen in Figure 2.2, many authority lines control only expense or cost centers and have no control over revenue-generating activities. In functional organizations, it is imperative that budgets provide focus and demonstrate the interdependencies between authority lines.

The difference in philosophy is clear. In the functional structure, the belief is that a single operation (or information technology, finance, etc.) group that can produce a wide range of products will be more effective and efficient than multiple units concentrating on a single product or customer. Functional organizations operate on the belief that one center of technical expertise for medical staff affairs, nursing, or finance is more effective and efficient than having multiple small, specialized staffs. Divisionally structured organizations work on the premise that specific customers require specific solutions and that it is better to build smaller staffs with specialized knowledge of specific industries, customers, and/or products. The trade-off that organizations must make is between technical expertise and knowledge of a particular product or group of consumers. The choice of which structure is best for a particular organization should be based on the size and scope of the organization, the rate of environmental change, the degree of market competition, and other factors.

Regardless of structure, the reader can see that dozens of department budgets must be created to compile a comprehensive master budget for an organization. Each second-level (directly below the chief executive officer [CEO]) division or functional area will have dozens of departments divided by type of operation performed or customer served. In the divisional structure, it is clear that the hospital division that delivers inpatient and outpatient care may have a clear understanding of its revenues and cost but employees may be unaware of the performance of other operating units and have little understanding of the cost of corporate services and their departments' need to contribute toward defraying that cost. In the functional structure, the nursing division may not understand revenues, given that this function is handled in finance and finance may have a limited understanding of patient care processes and costs. A successful budgeting process elevates organizational interests over the parochial concerns of divisions and departments.

Organization charts demonstrate the difficulty in seeing the complete financial picture. In functionally structured organizatisons, most operating managers will see only the cost half of the picture (and a small part of that half). The medical staff and nursing units may understand their operations and expenses but may have little understanding of the costs of materials management, ancillary operations, and information technology. Similarly, support divisions and departments may have little comprehension of the costs and challenges faced by caregivers. Finance may understand revenues and input prices but be largely unaware of the complexities of medical treatment, that is, production costs. In divisionally structured organizations, each division has revenues and expenses and can be seen as a complete and distinct business unit, but division managers may not understand the allocation of corporate costs. While division managers may think

that generating revenues that are 5% or 10% greater than their expenses is adequate, they may not understand that better performance is necessary to cover corporate expenses. It is doubtful whether even the CEO has extensive experience in more than one or two areas of the organization. Should the head of a hospital be a doctor or a nurse with medical experience or a business manager who can handle planning, finance, logistics, hotel and food service functions, etc.?

The master budget aggregates all the departments' revenues and expenses into a single statement to determine whether the total organizational revenues will be greater than costs in the budget year and whether the organization can sustain over the long run. Because of the different scope of authority they hold, the reader should see the inappropriateness of evaluating the CEO, division directors, and managers in the same manner. Managers of single departments, like nursing, respiratory therapy, and human resources, should not be evaluated in the same manner, given the different outputs their departments produce and the different levels of control they exercise over output, costs, and revenues. CEOs, VPs, and division directors should also be evaluated differently as their authority expands to cover multiple or all departments. This chapter explores the tools available to direct resources to their highest-value uses, that is, the uses that generate the greatest benefit for society. Chapter 3 explores the tools and strategies managers use to maximize the size of their budgets.

The Accounting Foundation

Accounting plays the same role in the life of organizations as rules do in games. Accounting establishes the rules of the game: how performance is evaluated (how points are scored), and who is winning or losing during or at the end of a game. Budgeting, working within the confines of the system defined by accounting, sets the strategy and tactics managers plan to use in pursuing organizational objectives. Budgeting specifies which players will be fielded, what equipment they will play with, and what contributions each player is expected to provide to achieve victory. Accounting organizes data and facilitates performance evaluation. In conjunction with a budget and specific performance measures, accounting provides managers with the means to control and improve operations.

Winning in sports is simply a matter of scoring more points than your opponent scores against you. For example, in football, there are points for (PF) greater than points against (PA). In business, too, there are two primary and distinct processes to be managed, offense and defense. PF are revenue, or the value created by a team. In business, revenue (sales), or "offensive" production, requires managing labor, supplies, equipment, and facilities; in sports, the primary resource to be managed is the players. In non revenue-generating organizations, offensive production is defined as the amount of goods and services provided, such as the number of patients seen or vaccinations delivered.

PA signify what it costs the organization to produce its revenue or outputs. Production expenses, or the value consumed in production, is the "defense." The pertinent question is, are revenues greater than production costs or, for non revenue-generating organizations, is the benefit of the output produced greater than the expense incurred? Besides sales revenues and production costs, there are also the costs of special teams, including management, finance, and R&D. The question that must be answered is, is the value of the output greater than the cost of putting the team on the field? Are revenues greater than costs, that is, is value created greater than value consumed? A team that continually incurs more expenses than revenues must assess its performance: what areas of its team, offense, defense, or special teams,

are underperforming? Is lower-than-desired performance a question of not having the right people, supplies, equipment, facilities, or some combination of each?

The two essential characteristics of successful organizations are **viability** and **solvency.** Viability assesses the relationship between revenue and expenses, and solvency examines the ratio of assets to liabilities. An organization with higher revenues than expenses is viable and should be able to carry on operations into the future. Solvency is the condition of having more assets than liabilities, or a positive net worth. Viability and solvency are the core accounting measures, as seen in the two fundamental accounting equations:

$$\text{Profit } (\pi) = \text{Total revenue (TR)} - \text{Total cost (TC)} \quad (2.1)$$

$$\text{Equity } (E) = \text{Total assets (TA)} - \text{Total liabilities (TL)} \quad (2.2)$$

Readers knowledgeable in accounting will recognize that these equations are the linchpins in the two major financial statements, the income statement and the balance sheet. The job of management is to largely control revenues and expenses. To paraphrase Charles Dickens (Mr. Micawber in *David Copperfield*), the difference between happiness and misery is simply making one dollar more or less than you spend. Organizations with more revenues than expenses, more money flowing in than flowing out, build net worth and have unlimited horizons. Organizations whose outflows exceed their inflows erode their net worth and, if expenses continue to exceed revenues, are on the road to **bankruptcy**. The job of a budget is to ensure that an organization's inflows equal or exceed its outflows in the upcoming fiscal year, while strategic financial planning creates budgets to predict revenues and expenses over multiyear periods (**TABLE 2.1**).

Organizations are complex organisms requiring coordination to function at the highest level of effectiveness. Management's job is to ensure that desired outputs are produced and delivered to customers or clients at a reasonable cost to maximize sales revenues or secure other funding. While the managerial goal can be stated in three words, "revenues exceeding costs," coordinating large organizations requires managing dozens, if not thousands, of people, operating and maintaining buildings and equipment, paying employees and vendors, and tracking thousands of revenue and expense accounts.

Using the accounting equation, $\pi = TR - TC$, and examining the income statement, it is easy to assess the performance of an organization. **TABLE 2.2** shows the 2-year income statement of Oyam Hospital. The income statement is divided into revenues (the top half) and expenses (the bottom half). Revenues are divided into operating and nonoperating

TABLE 2.1 Revenues, Expenses, and Net Worth

Relationship Between Revenue and Expenses	Net Worth	Implication for the Future
Revenues (cash inflow) > Expenses (cash outflow)	Equity ↑	Growth
Revenues = Expenses	No change in equity	Stable
Revenues < Expenses	Equity ↓	Contraction

TABLE 2.2 Oyam Hospital Income Statement

	2015	2016
Operating revenue	$766,473,000	$870,598,000
Nonoperating revenue	$6,535,000	$6,519,000
Total revenue	$773,008,000	$877,117,000
Salaries and wages	$311,710,000	$317,583,000
Fringe benefits	$66,007,000	$94,759,000
Supplies	$150,957,000	$160,468,000
Rent	$10,033,000	$10,353,000
Depreciation	$32,052,000	$32,247,000
Interest	$1,363,000	$819,000
Other	$150,963,000	$156,403,000
Total expenses	$723,085,000	$772,632,000
Profit	$49,923,000	$104,485,000

revenues. Operating revenue is derived from the sale of output, that is, the organization's primary line of business. Nonoperating revenue is derived from noncore activities such as investment income and rents, which are not the primary business of most healthcare organizations but arise due to the holding of financial assets (cash, marketable securities, etc.) or rental of unused space.

The bottom half, expenses, shows what the funds purchased and is known as the natural classification system. The primary expenses of an organization involve acquiring and using personnel (salaries and wages, fringe benefits), supplies, equipment and buildings (rent, depreciation), and money (interest), with an Other category for miscellaneous, lower-cost expenditures. A second reporting system, functional classification, reports expenses according to what they were used for, for example, administration, production, and sales.

In 2016, Oyam Hospital generated $877,117,000 in revenues and paid $772,632,000 in expenses for a profit of $104,485,000. The organization is viable and appears to be performing well, but we do not know how much it should earn, a topic to be covered in Chapter 12. A second way of assessing performance is to recognize that profits more than doubled from 2015, when $49,923,000 was earned. The jump in profit is attributable to management increasing

revenue by 13.5%, while holding expenses to an increase of 6.8%. The job of budgeting is to determine whether future profits will increase, decrease, or stay relatively constant. Profit signifies the value created by an organization and is a primary measure of the performance of management, that is, is the value of the output worth more than the resources consumed in its production? Nonprofit and public organizations often avoid the use of the term "profit" in favor of net income, margin, excess revenue over expenses, additions to the fund balance, etc. The critical point is that regardless of the terminology used, the difference between revenue and expense is the primary measure of the value an organization creates.

The accounting equation, $\pi = TR - TC$, is the key to predicting future performance. The accounting equation can be disaggregated into the following equation:

$$\pi = (P * Q) - (AVC * Q) - TFC \qquad (2.3)$$

Profit = Total revenue cost – Total variable cost – Total fixed cost

Equation 2.3 clarifies the roles of management and budgeting. Management must estimate revenue for the budget year on the basis of projections of prices (P) and output (Q). Projections of future revenue ($P * Q$) will be heavily influenced by past performance and anticipated events. Past performance provides a starting point for budget estimates, but forecasters should recognize that it does not guarantee future performance and that unforeseen events can substantially increase or decrease actual revenue. In organizations that do not generate revenue from the sale of goods and services, sources of funds and the amount of funds obtainable must be identified. In nonprofits, this may require estimating the proceeds of fund-raising or grants, while public organizations must forecast revenues expected from taxes on income, sales, property, etc., or deficit financing.

On the cost side, expenses must be estimated; management must determine whether an expense varies with output produced (average variable cost [AVC] $*$ Q) or is constant (total fixed costs [TFCs]). When expense varies with output, managers must determine the AVC per unit. Forecasts of variable costs, like revenues, are susceptible to two sources of variation: a manager may incorrectly estimate output (Q) or the cost per unit (AVC). TFCs, like management salaries, occupancy costs, and insurance, should be easy to forecast as they do not vary with output, although it is still important to employ the appropriate level of resources. For example, a hospital should avoid filling 50% or 110% of its beds. At 50% capacity, too much capital remains idle, and at 110%, patients may be housed in hallways because of insufficient investment. Current managers may not be accountable for prior investment decisions, but they are responsible for obtaining the maximum possible output from existing resources. The challenge managers face when excess capacity exists is to employ the resources, as intended, by increasing demand, reassigning resources to other tasks, or releasing assets.

The output of the budgeting process should be a set of **pro forma financial statements** establishing where the organization intends to be at the end of the budget period. The pro forma income statement projects revenues and expenses to determine whether the budget plan is feasible, that is, is TR $>$ TC? Equation 2.3 demonstrates that there are four primary variables to be estimated and managed in the budget: the price of outputs (P), the number of units expected to be produced and sold (Q), the average cost to produce a unit of output (AVC), and the expenses needed to produce output that do not vary with the quantity of output produced (TFC).

The budget, returning to the sports analogy, establishes the game plan and details how managers expect to reach organizational goals. Will success arise from superior offense (sales), defense (production), special teams (management, R&D, etc.), or a balanced game? Accounting provides the game statistics, such

as revenue per salesperson, cost per unit, and total profit, on a regular basis to inform managers of performance and allow them to change tactics, when necessary.

The second criterion for a healthy organization is solvency, having more assets than liabilities, a condition intimately related to the ability to generate higher revenues than expenses. When an organization's revenue exceeds its expenses, it earns a profit and builds wealth (or increases its equity). The balance sheet, **TABLE 2.3**, comprises three sections: assets (the resources the organization uses), liabilities (the resources in use not owned by the organization), and equity (the difference between assets and liabilities). The balance sheet lists assets and liabilities by **liquidity**, a measure of how quickly an asset can be converted to cash at full value.

Cash can be immediately used at full value and is listed first on the balance sheet. Other current assets such as accounts receivable are less liquid than cash as it may take 60 days or more to collect amounts customers owe to the organization or it can be sold at a discount from its current book value if immediate funds are needed. Fixed assets, including buildings and equipment, can be sold immediately, but the value received may be considerably less than their book value, so they are listed last, and the organization may be unable to recoup book value regardless of how long they are held.

Liabilities are also listed by how soon they should be paid. Current liabilities, accounts payable, should be satisfied in the short term, 90 days or less, while long-term debt such as bonds or mortgages may not come due for 30 years. The difference between assets and liabilities measures the net worth (equity) of the organization, while the difference divided by total assets reports the percentage of resources owned by the organization.

Table 2.3 shows that in 2016, Oyam Hospital controlled $638,184,000 in assets and $246,268,000 was owed to creditors, leaving a net worth of $391,916,000 (or 61.4% of the assets used by the organization were

TABLE 2.3 Oyam Hospital Balance Sheet

	2015	2016
Cash	$25,435,000	$25,270,000
Other current assets	$162,936,000	$142,851,000
Fixed assets	$520,463,000	$470,063,000
Total assets	$708,834,000	$638,184,000
Current liabilities	$28,638,000	$32,344,000
Long-term debt	$192,874,000	$213,924,000
Total liabilities	$221,512,000	$246,268,000
Equity	$487,322,000	$391,916,000

owned by the organization). If no assets are transferred out of the organization (as dividends to stockholders, transfers to affiliated organizations, etc.), profit adds to the net worth of the organization. In 2015, Oyam earned $104,485,000, which should have increased the organization's net worth by an equal amount, but the balance sheet shows a decrease in net worth of $95,406,000 ($487,322,000 – 391,916,000). The decrease was due to a transfer of $199,891,000 to related organizations. Similar to the pro forma income statement, a pro forma balance sheet should be created when the budget is finalized so that managers will know the relationship between assets and liabilities anticipated if the budget is met.

TABLE 2.4 demonstrates the desired position of an organization is cell 1, earning profit, with assets exceeding liabilities. If both conditions are not capable, earning profit while liabilities exceed assets, cell 2, is the second best position. An organization earning profit can eventually accumulate assets that exceed its debts. The obstacle organizations in this situation face is that creditors may demand immediate payment, which cannot be satisfied since total assets are lower than total liabilities. The third best position is cell 3, expenses exceed revenues but assets exceed liabilities. In this case, assets provide a temporary cushion to absorb current losses; the challenge for managers is to restructure their operations to establish profitability before the net worth is exhausted. The worst position is operating losses with liabilities exceeding assets, cell 4. In this situation, immediate shutdown may be the best option before operating losses widen the gap between assets and liabilities.

The problem in many organizations is that managers have difficulty in envisioning the total operation, given their focus on their departments and lack of knowledge of other functions and departments. The master budget is a means to incorporate managers into the larger organization by allowing them to see the entire financial plan for future years. The income statement and balance sheet, Tables 2.2 and 2.3, demonstrate that even with accounting tools, comprehending the magnitude of the dollars involved adds yet another level of complexity to management and budgeting processes.

TABLE 2.4 Viability and Solvency

	Balance Sheet		
		Assets ≥ Liabilities	**Assets ≥ Liabilities**
Income Statement	**Revenue ≥ Expenses**	Viable and solvent	Viable but insolvent (profit provides ability to achieve solvency in time)
	Revenue < Expenses	Non viable but solvent (accumulated wealth provides ability to absorb losses while working toward viability)	Non viable and insolvent

Economics and Marginal Decision-Making

The goal of budgeting is to maximize the value of an organization by allocating resources to areas where they generate the greatest benefit. Maximizing value is an easy-to-state goal, but what does it mean and how is it done? When consumers shop, they attempt to maximize their satisfaction from spending a given amount of money. While many people do not see themselves as consciously evaluating the benefit of one good versus all the other goods and services that can be purchased, it is clear that some analysis, weighing of goods against one another, is carried on continuously to navigate the tens of thousands of potential purchases consumers could make.

Budgeting is an attempt to establish a conscious, forward-looking mechanism that produces the same result for an organization as the conscious and subconscious weighing processes individual consumers engage in daily. Organizations and their owners, employees, and customers want the greatest-possible enjoyment from a limited amount of resources, and there is a vast range of inputs (labor, land, and capital) an organization can purchase. The question is, how do managers get the most value from the resources they command?

Complicating resource allocation decisions is the fact that inputs have widely different prices and capabilities. When making a purchase, the consumer asks himself or herself, "Is the satisfaction I get from a good or service worth what I have to pay for it?" More precisely, the question is, can another good or service provide greater satisfaction per dollar expended than the one under consideration, that is, what is the opportunity cost of the purchase? Few people explicitly calculate the benefits received with the price paid for a good or service and then evaluate this ratio against the ratios of other goods and services, but the process occurs nonetheless. We all have developed short-hand mechanisms for comparing goods that allows us to shop effectively—imagine how difficult shopping at Walmart would be if you had to compare all the items offered, when the average store stocks 120,000 items and a supercenter, 142,000 (Walmart, 2005).

Economics provides a procedure to compare one item against others and determine what must be given up to acquire a good or service to simplify purchasing decisions. An easy way to think of this weighing process is that if good X provides twice as much satisfaction as good Y, how much more should a consumer be willing to pay for good X? Without any calculation, it is easy to see that a consumer should be willing to pay twice as much for good X as for good Y. If good X is offered at a price less than twice the price of good Y, then X is the better buy. The consumer could buy one unit of good X, get as much satisfaction as two units of good Y, and have money left over for other purchases. Conversely, if good X is more than twice the price of good Y, the consumer could buy two units of good Y, get the same satisfaction as consuming one unit of good X, and have money left over. Few people go through the mathematics, but everyone, at some level, compares what he or she receives from an expenditure and what he or she could have received.

The weighing process managers face in the budgeting process is similar to consumers' purchasing decisions. The budget allocation process is, perhaps, simplest for for-profit organizations. For-profits exist to maximize profits, and their basis for a decision is whether the per dollar return generated by one investment exceeds the return of alternative investments. The value-maximizing decision rule does not mean that organizations allocate their money to investments that generate the highest dollar return. An organization will not necessarily invest in a machine or market that returns $1 million (investment A) over another that returns $500,000 (investment B). The critical factor is the relationship between the dollar

return and the size of the investment. Assume investment A requires an outlay of $10 million and investment B $4 million. Investment A costs more than twice investment B does and its return is only two times higher, so investment B provides a larger return per dollar spent.

Another way of assessing value is to calculate **return on investment (ROI)** by dividing profit by the investment:

$$\text{Investment A} = \frac{\$1{,}000{,}000}{\$10{,}000{,}000} = 10.0\%$$

$$\text{Investment B} = \frac{\$500{,}000}{\$4{,}000{,}000} = 12.5\%$$

Changes in profit (the numerator) and/or the cost of either investment (the denominator) could change the decision. Assume the cost of investment B increases to $5,500,000 rather than $4,000,000. Investment B's ROI falls to 9.1% ($500,000/$5,500,000), and it is now less desirable than the 10.0% return achievable with investment A.

Of course, investments have different degrees of risk, and higher-risk projects must provide higher returns to attract investors, but we will assume away this complication. Assuming risk is the same for all projects, for-profits allocate their funds to alternatives with the highest ROI until their funds are exhausted or ROI is less than the cost of acquiring funds. Most people can conceptualize the organization's budgeting and investment process more easily than the purchasing decisions of individuals undertaken to maximize their satisfaction. Maximizing ROI appears simpler than maximizing satisfaction, because ROI can be quantified in dollars, a readily understood metric. Satisfaction, on the other hand, is an inscrutable idea—what is a unit of satisfaction, and how is it measured? The marginal decision-making sidebar provides an example of maximizing consumer satisfaction.

TABLE 2.5 shows the six projects an organization could invest in, and its **cost of capital,** the cost of using money, is 6.0%. Deciding which projects to undertake is determined by calculating the ROI for each project. After the ROI is calculated, the projects are sorted from the highest ROI to the lowest and graphed. The projects that will be invested in are determined by the availability of funds, the expected ROI, and the cost of capital.

TABLE 2.5 Calculating Return on Investment

Project	Investment	Profit	Return on Investment (%)
A	$10,000,000	$1,000,000	10.00
B	$4,000,000	$500,000	12.50
C	$500,000	$80,000	16.00
D	$1,750,000	−$25,000	−1.43
E	$1,500,000	$135,000	9.00
F	$6,500,000	$350,000	5.38

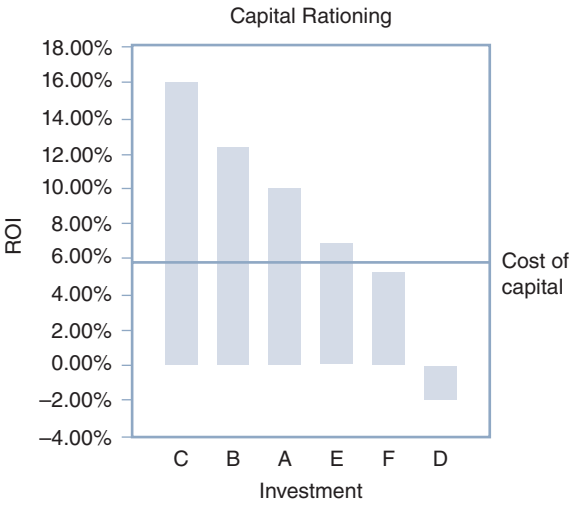

FIGURE 2.3 Ranking Investments

FIGURE 2.3 demonstrates that the first investment that should be undertaken is C, given that it has the highest ROI of 16.0%. If $16,250,000 in funding can be raised, projects C, B, A, and E should be undertaken ($500,000 + $4,000,000 + $10,000,000 + $1,500,000). Project F should *not* be invested in as its ROI, 5.38%, is less than the cost of acquiring money, 6.00%. Similarly, D should not be invested in, even if interest rates drop to zero, as it will not return the funds invested. While financial analysis rules projects F and D out of consideration, there may be extenuating circumstances, such as critical community need, that may impel organizations to undertake projects that will not return their investment.

While Table 2.5 and Figure 2.3 approached a project as a single cash outlay, budgeting operations require higher levels of granularity. A department or an investment does not comprise a single resource, so managers need to look at the contributions of individual inputs. Managers may have to decide between employing labor or equipment or between workers with different levels of skill and wage rates to accomplish work.

To construct a budget, managers should quantify the cost and productivity of the inputs that can be used to produce the desired output or fulfill the required tasks. Managers must make multiple choices between different types of labor, supplies, equipment, and facilities that have different capabilities, while recognizing the complementary nature of these inputs, that is, no input can complete a job alone. The first step toward employing an optimal set of inputs is to calculate the amount of output a set of inputs can produce.

TABLE 2.6 shows the maximum output that can be produced from different combinations of inputs with a budget of $1 million. It also shows the **marginal product (MP)**, the change in output attributable to increasing an input by one unit, while holding other inputs constant. Of course, some inputs require proportional increases in other inputs; it would be silly to increase labor if the additional workers had no supplies to work with. Adding labor may not require additional equipment or space if the present equipment and building are not fully utilized. Table 2.6 calculates the **marginal revenue product (MRP)**, the change in total revenue attributable to increasing one input by one unit, while holding all other inputs constant, that is, MP * Output price, $1000.

In Table 2.6, the manager must employ the minimum level of each resource to produce

SIDEBAR: Marginal Decision-Making

John Doe has a budget of $100, and the table given provides the total and (marginal) satisfaction he receives from consuming one unit of a good. What collection of goods should he purchase to obtain the highest-possible satisfaction with his $100 budget?

Quantity	Ribeyes $10/lb.	Apples $4/lb	Shoes $60/pair	Movies $10/ticket
1	32 (32)	8 (8)	270 (270)	40 (40)
2	60 (28)	15 (7)	390 (120)	70 (30)
3	82 (22)	21 (6)	470 (80)	88 (18)
4	96 (14)	26 (5)	500 (30)	93 (5)
5	100 (4)	30 (4)	500 (0)	90 (0)

Purchasing one pair of shoes and four pounds of ribeye provides 366 units of satisfaction (270 + 96) and costs $100. Purchasing a pair of shoes, one pound of ribeye, one movie ticket, and five pounds of apples produces 372 units of satisfaction (270 + 32 + 40 + 30), providing greater satisfaction than a pair of shoes and four pounds of ribeye for the same $100. Instead of willy-nilly adding up the satisfaction from various combinations of goods, economics offers a simple means to maximize satisfaction: purchase the goods that provide the highest satisfaction per dollar spent until the budget constraint is met. The following table reinterprets the first table by dividing marginal satisfaction by price.

Marginal Satisfaction per Price				
Quantity	Ribeyes $10/lb	Apples $4/lb	Shoes $60/pair	Movies $10/ticket
1	3.20[3]	2.00	4.50[1]	4.00[2]
2	2.80[5]	1.75	2.00	3.00[4]
3	2.20	1.50	1.33	1.80
4	1.40	1.25	0.50	0.50
5	0.40	1.00	0.00	0.00

Purchasing goods with the highest marginal satisfaction per dollar invested means that a pair of shoes is purchased first(1), followed by a movie ticket(2), one pound of ribeye(3), a second movie ticket(4), and, finally, a second pound of ribeye(5). Total satisfaction is 400 units (270 + 40 + 32 + 30 + 28), selecting the highest-satisfaction goods per dollar spent ensures that no other combination of goods can produce greater satisfaction, given the budget constraint.

TABLE 2.6 Output, Marginal Product, Marginal Revenue Product, and Input Selection

Total Output

	Labor	Supplies	Equipment	Building	Land
Input price	$50,000	$50,000	$150,000	$200,000	$200,000
Input Quantity	**/Worker**	**Each**	**Each**	**Each**	**/10 acres**
1	100	100	300	400	400
2	250	200	570	400	400
3	350	300	810	400	400
4	425	400	1020	400	400
5	475	500	1200	700	700

Marginal product $\left(\text{Total output}_{n+1} - \text{Total output}_{n}\right)$, productivity of each additional input employed

	Labor	Supplies	Equipment	Building	Land
Input price	$50,000	$50,000	$150,000	$200,000	$200,000
Input Quantity	**/Worker**	**Each**	**Each**	**Each**	**/10 acres**
1	100 (100 – 0)	100	300	400	400
2	150 (250 – 100)	100	270	–	–
3	100 (350 – 250)	100	240	–	–
4	75 (425 – 350)	100	210	–	–
5	50 (475 – 425)	100	180	300 (2)	300 (2)

Marginal revenue product (MP ∗ *P*), revenue generated by each additional input employed

(continues)

TABLE 2.6 Output, Marginal Product, Marginal Revenue Product, and Input Selection *(continued)*

Total Output

	Labor	Supplies	Equipment	Building	Land
Input price	$50,000	$50,000	$150,000	$200,000	$200,000
Input Quantity	**/Worker**	**Each**	**Each**	**Each**	**/10 acres**
1	$100,000 (100 * $1000)	$100,000	$300,000	$400,000	$400,000
2	$150,000 (150 * $1000)	$100,000	$270,000	–	–
3	$100,000 (100 * $1000)	$100,000	$240,000	–	–
4	$75,000 (75 * $1000)	$100,000	$210,000	–	–
5	$50,000 (50 * $1000)	$100,000	$180,000	$300,000	$300,000

Input selection (MRP/Input price), revenue generated per dollar invested in input

	Labor	Supplies	Equipment	Building	Land
Input price	$50,000	$50,000	$150,000	$200,000	$200,000
Input Quantity	**/Worker**	**Each**	**Each**	**Each**	**/10 acres**
1	$2.00 ($100,000/$50,000)	$2.00[a]	$2.00[a]	$2.00[a]	$2.00[a]
2	$3.00 ($150,000/$50,000)	$2.00[a]	$1.80[a]	–	–
3	$2.00 ($100,000/$50,000)	$2.00[a]	$1.60	–	–
4	$1.50 ($75,000/$50,000)	$2.00	$1.40	–	–
5	$1.00 ($50,000/$50,000)	$2.00	$1.20	$1.50	$1.50

[a]Input mix selection.

While the MRP identifies the increase in revenue due to adding inputs, it provides only half the information needed to determine whether inputs should be increased. The second factor is how much it costs to acquire an input. It is easy to see that inputs should not be employed that produce less revenue than their acquisition cost; however, in most cases, the choice managers must make is among inputs that produce more revenue than their input cost. To determine the most efficient input mix, managers should employ inputs that produce the highest revenue per dollar expended, that is, MRP divided by the input price until funds are exhausted or inputs generate less revenue than their acquisition cost.

output. If any of the five inputs is missing, no output can be produced. Organizations may have supplies, equipment, buildings, and land, but without labor, orders cannot be taken, machines cannot be set up, and, subsequently, output will be zero. The current building and land can support the production of 700 units of output and are fixed inputs as long as the total output is 700 units or less. After the minimum level of complementary inputs are in place (costing $650,000), the manager must decide which additional inputs to employ to expand output. Economics dictates that the greatest value will be created if the remaining $350,000 is allocated to inputs with the highest MRP per dollar invested in the input. The first input that should be increased is labor; the second unit of labor increased revenue by $150,000, costs $50,000, and has the highest MRP/input price. Given $300,000 remains to be spent, the manager should purchase additional labor (third increment, +$50,000), supplies (second and third increments, +$100,000), and equipment (second increment, $150,000). Should available funds decrease, the second increment of equipment should be foregone as its MRP/input price, $1.80, is less than the MRP/input price for the third increments of labor or supplies, $2.00. Selecting the inputs with the highest MRP per dollar invested ensures that resources produce the maximum-possible value.

Continuing operations as they are, that is, the status quo, is only acceptable if processes are effective and efficient. If effectiveness or efficiency has not been maximized, managers should explore ways to improve quality and/or reduce cost. Managers should focus on what could be rather than continue what is. Managers must understand what inputs produce, what inputs costs, and how much outputs sell for in order to build better systems. Only then can they ask whether a different mix of inputs will produce better output and greater value.

Cost Behavior

The size of a budget should depend on the relationship between outputs and inputs, that is, how revenue (or benefit) changes with changes in costs. The distribution of fixed and variable costs is essential to determining whether the price of output exceeds the AVC and justifies production. Fixed costs are expenses that do not change with output, that is, the same amount of an input is used and the same amount is paid regardless of the level of output. Variable costs are expenses that change with output, that is, as output increases, more inputs are used and higher costs are incurred. In the real world, costs are more complicated, so four types of cost will be discussed: fixed, variable, variable with a fixed component, and stepwise.

Fixed costs are expenses associated with employing resources that do not change with output: the same amount of a resource is used, and the same expense is incurred for a wide range of output. That is, more or less of the resource is not consumed as the quantity of output produced changes. Examples of fixed costs include senior management salaries, rent, interest expense, and/or depreciation on buildings and equipment. Only one CEO or chief financial officer (CFO) is required regardless of output. Likewise, buildings owned or rented will not change over a wide range of output in the short run. While the amount of fixed inputs should not change with output, the efficiency of operations will be determined by the level of output produced, and managers should strive to make the maximum use of fixed resources.

If the annual rent is $200,000 and 100 units of output are produced, the average fixed cost (AFC) per output is equal to $2000. The AFC falls to $500 per unit when 400 units are demanded and produced. The AFC graph in **FIGURE 2.4** demonstrates the impact of spreading fixed costs over different levels of output.

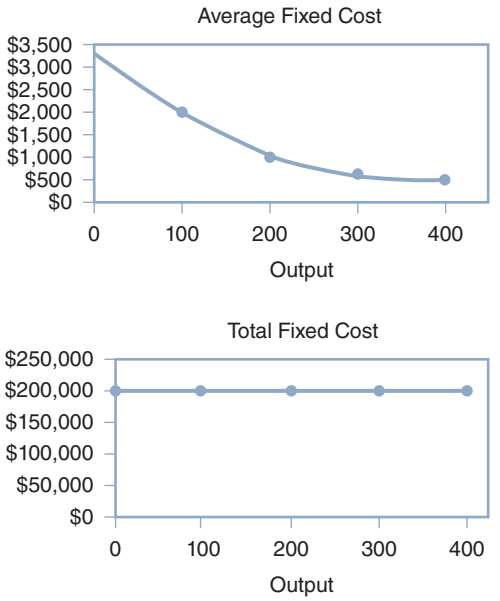

FIGURE 2.4 Average and Total Fixed Costs

When production involves a single fixed-cost resource, the average cost of output is minimized when the TFC is spread over the maximum output. Fixed costs (or resources) are not infinitely spreadable, that is, at some level of output, it becomes impossible for management to oversee operations, machinery to produce additional units of output, or the current space to contain operations, and additional fixed resources must be added.

From management's perspective, fixed costs are sunk costs and should only affect decision-making when reinvestment, renewal, or recommitment is an option; at all other times, these costs must be paid. While TFCs are noncontrollable in the short run, this does not mean that managers cannot influence the contribution these costs have on the total cost of output. When the quantity of output is variable, managers can determine how efficiently fixed resources are utilized.

Variable costs are expenses associated with inputs whose use changes with output. The quantity of variable resources used and their cost can be zero when no output is produced, and the quantity of resources consumed and their cost increase proportionately with increases in output. In a hospital, the costs of building and furnishing a nursing unit (depreciation) will be incurred even if the unit is empty, but the organization may not have to incur any labor costs or utility (lighting, heating, and cooling) expenses if it closes the unit.

There is often a one-to-one relationship between variable inputs and output. Assume it takes 12.5 hours of nursing time to treat an inpatient. If the average nursing wage is $40 per hour and staff are effectively employed, the cost per output will be a constant $500 per admission (**FIGURE 2.5**). When 100 inpatients are served, the total variable cost (TVC) will be $50,000, and if the number of inpatients increases to 400, the TVC will be $200,000,

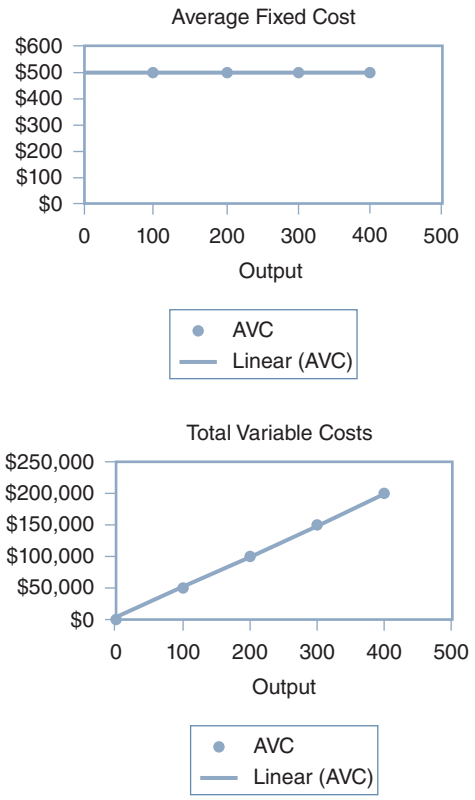

FIGURE 2.5 Average and Total Variable Costs

assuming no inputs are wasted. Examples of variable costs include production (piecework) salaries, sales commissions, and supplies. Blood products and pharmaceuticals are variable costs, where the total cost incurred should be determined by the number of inpatients served; of course, the total cost per patient will be higher than necessary if blood products or drugs beyond their expiration dates must be discarded or pharmaceuticals are diverted.

Variable costs with a minimum charge (**FIGURE 2.6**) are resources with a minimum cost component (licensing fee, connection charge) and a per unit consumed component (usage charge). Economics calls this pricing structure **two-part tariff**. Examples of two-part pricing structures include on-call pay, where nurses must be paid 10% of their hourly rate for being on call outside their regular hours and one and a half times their hourly wage when they work in excess of 40 hours a week; utilities, such as gas, water, and telephone, where there is a monthly connect fee and use charge; and country club memberships, where there are initiation fees, annual dues, and monthly restaurant fees.

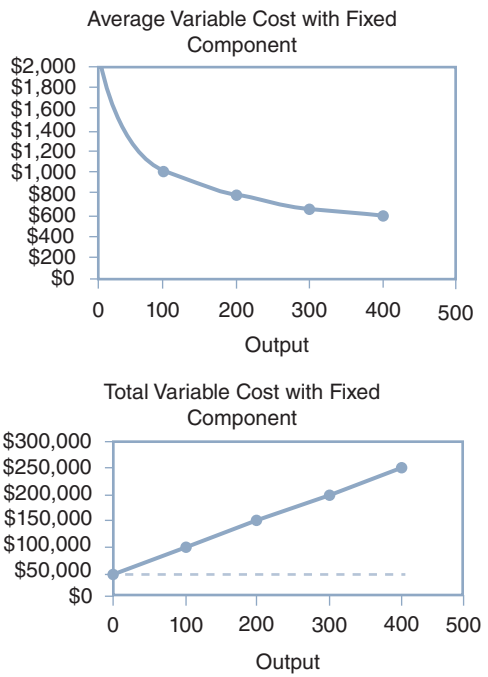

FIGURE 2.6 Average and Total Variable with Fixed Component

The average cost of a variable resource with a fixed component behaves similar to a fixed-cost resource in that managers have an incentive to spread the fixed component over a high volume to achieve a per unit cost that approaches the AVC for a purely variable resource. That is, the fixed component should be spread over the maximum number of units to push its per unit cost as close to zero as possible, leaving only the usage fee as the relevant expense. Another commonly incurred cost is overtime; overtime paid at the hourly wage rate plus 50% is incurred when hourly employees work more than 40 hours in a week. Assuming productivity is constant, outputs produced by a worker earning $40 an hour and producing two units per hour after they have completed their 40-hour workweek will increase the labor component to $30.00 per unit versus $20.00.

Step costs are "lumpy" resources that must be purchased in discrete quantities and may or may not have a minimum cost component. For example, an emergency room may be required to maintain a minimum staff around the clock regardless of whether there are any patients (zero output); a restaurant, on the other hand, could incur no salary expense at zero output by scheduling no staff and remaining closed. As soon as the restaurant decides to open its doors, it will require a minimum staffing level—hostess/host, server, cook, and dishwasher. Similarly, an organization may maintain a minimum four-hour pay rule for all employees called in to work. That is, once an employee comes to work, he or she will be paid for at least four hours, even if he or she is sent home because of lack of work before 4 hours are completed. Whether an organization requires minimum staffing or it doesn't, managers need to determine how many units of output the staff can handle (or produce) before more resources (labor,

machinery, space) are required. **FIGURE 2.7** shows the average and total costs for the labor decision given in Table 2.6. The first worker can produce 100 units, two workers can produce 250, and so on.

If 101 (or 251) units of output were required, the cheapest method of producing one more unit would be by utilizing overtime. Managers must decide when is it cheaper (more efficient) to stretch existing labor by paying overtime (time and a half) or hiring additional workers (step costs). Often on-call staff or pool (registry) nurses have a minimum number of hours paid when they are called in. Managers should be cognizant of the breakeven point, that is, when is it cheaper to pay overtime, and when should additional help be called in?

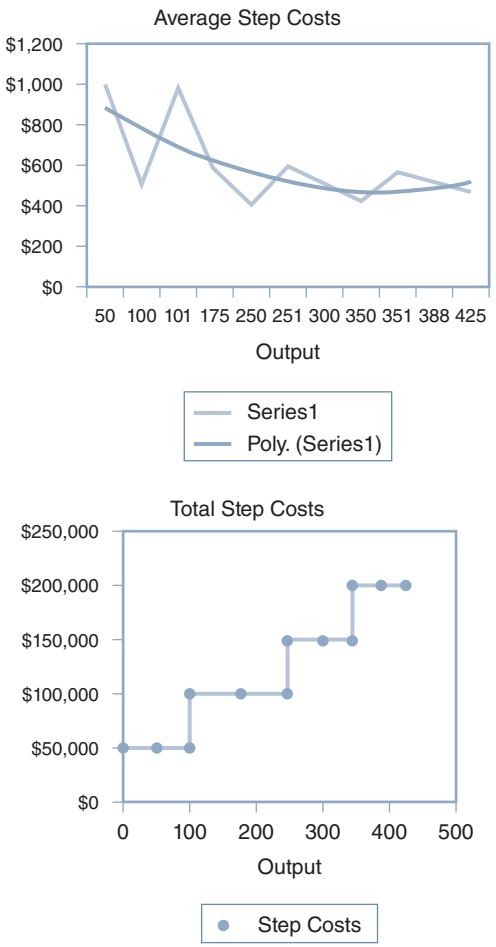

FIGURE 2.7 Average and Total Step Costs

The question revolves around the number of hours of work to be done, the overtime pay differential, and the cost of on-call workers. Assume workers earn $15.00 per hour; therefore, overtime is paid at $22.50 per hour. On-call workers earn the same $15.00 per hour but will be paid for a minimum of 4 hours every time they are called in. The breakeven number of hours is as follows:

$$\begin{aligned}
&\text{Overtime wage} * \text{Required number of hours} = \text{On-call wage} * \text{Minimum guaranteed hours} \\
&\$22.50 * x \text{ hours} = \$15.00 * 4 \text{ hours} \\
&x = \frac{\$60}{\$22.50} = 2.67 \text{ hours, or 2 hours and 40 minutes}
\end{aligned}$$

If there is more than 2 hours and 40 minutes of work to be performed, it is cheaper to call in additional staff; when work can be completed in under 2 hours and 40 minutes, overtime should be paid. Examples of step costs include labor, equipment, and facilities.

Variable costs, variable costs with a fixed component, and step costs are marginal costs, that is, an increase in output generates additional expenses the organization must pay. The job of management should be to ensure that the marginal costs of producing output are less than or equal to the marginal revenue (or benefit) it creates.

No discussion of cost behavior is complete without relating input use and cost to output, more specifically how output changes when more inputs are used. Economists hold that most systems are characterized by **diminishing marginal returns**. Diminishing marginal returns occur when an additional unit of a variable input, such as labor, given a fixed factor, such as equipment or facilities, produces less output than prior units. That is, productivity falls as more and more units of the variable factor are employed in conjunction with a fixed factor.

FIGURE 2.8 demonstrates that diminishing marginal returns, initial expenditures for a variable input such as labor, increase the quantity of output produced more than later expenditures. As an individual or organization increases spending on an input, later expenditures produce less output because they have less fixed inputs to work with. Diminishing marginal returns are introduced because some people believe that spending additional money on an endeavor will produce returns comparable to earlier expenditures—this is not often true. In this example, diminishing returns occur because additional units of labor utilize a fixed amount of equipment and facilities, and as investment per worker declines (each worker has less equipment to work with), the output of the added labor declines. Beyond a given point, the curve flattens out, suggesting that additional input expenditures will produce little or no additional benefit. It is entirely possible that if additional resources are added, they will reduce rather than increase output—too many cooks in the kitchen.

Diminishing returns also occur in preventive health programs; early dollars should be spent on those in the high-risk groups most susceptible to the disease or condition. The first expenditures spent on those most likely to contract a disease or those who will experience the greatest reaction to a disease will produce the highest benefit by either preventing the disease or minimizing its consequence. Expansion of prevention programs leads to serving people who are less likely to contract a disease, may have less reaction to a disease, or may be more difficult and expensive to identify and/or treat; thus, benefit declines as costs increase. The overuse of antibiotics and pain medications has given rise to negative returns due to increases in antibiotic-resistant bacteria and addiction. Diminishing marginal returns stand as a warning: spending more money does not ensure value is created.

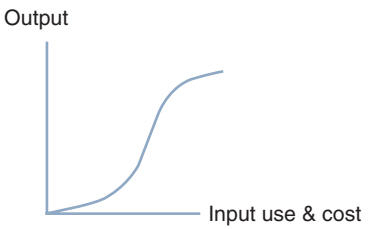

FIGURE 2.8 Diminishing Marginal Returns

Economies of Scale

Understanding how the cost of individual inputs changes is vital to determining the total cost and average total cost (ATC). Organizations have costs that increase proportionately with output, like supplies. Each additional unit produced requires a set amount of a resource and increases cost by a fixed amount, and fixed costs that do not change with output like facility costs. The relationship between labor costs and output is intricate, given how workers are employed and given the inability to store unused labor. Management must balance the incentive to produce the highest-possible output to spread fixed costs, since no additional cost is incurred against the potential jumps in variable costs due to overtime or step costs, to ensure that increases in output cover their production costs.

Employees are generally hired and paid for a 40-hour week, and when there is insufficient work to fill 40 hours, employees are idle and the labor cost per output increases. On the other hand, if more than 40 hours are needed to complete work, wages are paid at time and a half. **FIGURE 2.9** assumes that an employee is paid $20 per hour and produces one unit of output in 24 minutes (or 100 units per week). The average labor cost reaches a minimum of $8.00 per unit at 100 units per week where the employee is fully employed; any change in output increases the cost per output. If output falls to 90 units, the average labor cost increases to $8.89 ($800/90). If output increases to 110, the average labor cost increases to $8.36 ([$800 + $120]/110, or 4 hours of overtime at $30/hour). For a single employee, it is easy to see that efficiency requires having enough work

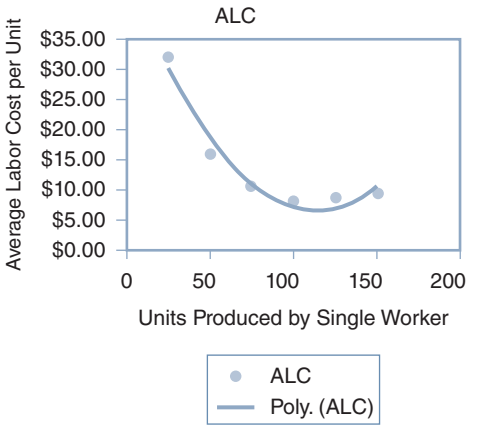

FIGURE 2.9 Average Labor Cost

to keep the employee busy and the per unit cost increases rapidly as idle time or overtime increases.

Not only is it important to keep individual employees fully employed to keep costs low, there is also an optimal number of employees needed to allocate duties efficiently. Adam Smith (1776, p. 13) noted that a pin factory could produce more output if the various tasks required to create pins were allocated to different employees. **Specialization** is the idea that an employee concentrating on a single or a small number of tasks will be more productive than if he or she has to shift between multiple activities. In Smith's example, a single employee performing every one of the 18 tasks required to produce a pin could make 20 pins per day. After the separate tasks of drawing wire, cutting, pointing, etc., were distributed among 10 employees, a single employee, as part of the team, could produce 4800 pins per day—employee productivity increased by 240-fold.

As seen in Table 2.6, a single worker can produce 100 units but two workers can produce 250 units—a gain due to specialization driving the labor component from $8.00 per unit to $6.40 (**FIGURE 2.10**). Past a certain point, employing additional workers leads to inefficiency as the capital per worker is reduced (too many employees using too little equipment) and management becomes more difficult.

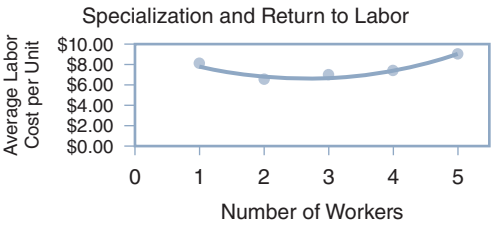

FIGURE 2.10 Specialization and Returns to Labor

These coordination problems lead to declining productivity: when two workers are employed, average productivity is 125 units per worker (250 units/2 workers), but when three workers are employed, average productivity falls to 116.67 (350/3) and labor cost increases to $6.86 per unit.

The example in Table 2.6 and Figure 2.10 demonstrate that to minimize cost per output, managers must employ the correct amount of a resource for the anticipated volume of output. The question is not what the appropriate level of use is for a single input but, rather, what the appropriate level of use is for all inputs, or what the cost-efficient scale of operations is. **Economies of scale** examine how average cost per unit changes with an increase in output. An economy of scale (or increasing returns to scale) reflects the situation in which a percentage increase in output results in a lower rate of increase in the ATC. Economies of scale exist if increasing output by 10% results in less than a 10% increase in the ATC.

FIGURE 2.11 demonstrates that the ATC declines with increases in output up to $Q^{optimal}$, which is the result of spreading fixed costs over a higher output. After $Q^{optimal}$, the cost per unit increases as additional variable inputs are needed to produce more output. The situation to the right of $Q^{optimal}$ is a diseconomy of scale (or decreasing return's to scale), where costs increase faster than output. The goal of managers should be to operate in the flat part of the curve, where costs are minimized and changes in output in either direction will have negligible effects on the ATC, that is, constant returns to scale.

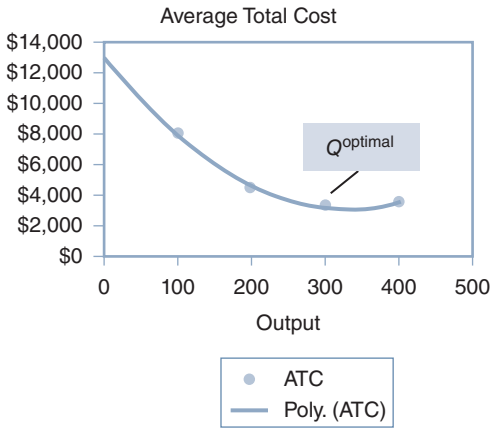

FIGURE 2.11 Economies of Scale

Another way to envision increasing returns to scale is that the percentage change in output is higher than the percentage change in inputs used in production $\left(\%\Delta Q_{output} > \%\Delta Q_{all\ inputs}\right)$ because of gains from specialization (less nonproductive task shifting and the ability to utilize techniques that were unavailable/nonoptimal at smaller output). At constant returns to scale, the change in output equals the change in inputs $\left(\%\Delta Q_{output} = \%\Delta Q_{all\ inputs}\right)$. In large organizations, coordination and accountability problems may drive decreasing returns to scale, that is, the inability to effectively manage resources may result in output growth that is less than the increase in input use $\left(\%\Delta Q_{output} < \%\Delta Q_{all\ inputs}\right)$.

The *2017 Almanac of Hospital Financial and Operating Indicators* provides a concrete example of economies of scale (Optum360°, 2016). **TABLE 2.7** reports the average cost per discharge by bed size, which reaches a minimum for hospitals with 100–199 beds. **FIGURE 2.12** demonstrates the U-shaped economy-of-scale curve showing that the smallest and largest hospitals have costs that are 25% to 39% higher than hospitals with 100–199 beds.

The challenge for management is to identify and manage the correct set of resources for the anticipated volume of output. Managers should (i) maintain full employment of resources (no idle time or waste) and (ii) allocate resources to their best uses, that is, obtain the maximum contribution from each resource by assigning each to the task or tasks the resource is best suited for, while minimizing transitions. In any task, there is a problem of too small and too big; in small work groups, where employees perform a variety of tasks, costs may be higher than necessary because of the inability of the employees to do a single or a small number of tasks enough to maximize proficiency. Higher-than-necessary costs arise in large work groups from idle time, inflexibility, congestion, control, and transition problems.

TABLE 2.7 Hospital Economies of Scale

Bed Size	Cost per Discharge
<25	$11,568
25–99	$9,401
100–199	$9,239
200–299	$10,319
300–399	$11,286
>400	$12,851

Organizational Architecture

Organizational architecture is a management system designed around decision rights (who has the authority to make decisions), compensation and reward systems (what employees receive for increasing the value of the organization), and performance reporting systems (which employee actions increase or decrease the value of the organization). Chapter 1 posed the question, does a budget

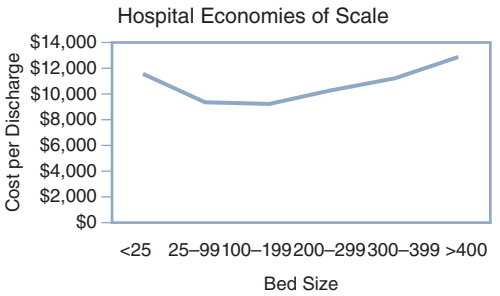

FIGURE 2.12 Hospital Economies of Scale

encourage effort, economy, and innovation or shirking, waste, and the status quo? Budgets can encourage either encourage effort, economy, and innovation or shirking, waste, and the status quo, so budgets and performance evaluation systems should be designed to recognize the factors managers can and should control, and establish incentives that advance the goals of the organization. The brief review of organization charts in Figures 2.1 and 2.2 demonstrates that different managers have different levels of authority over organizational resources—some only control inputs, while others decide what outputs will be produced, still others set the prices at which outputs are sold, and senior executives determine where future investments are made.

Budgets and performance evaluation systems should set goals that reward managers for effectively managing the resources at their command and explicitly recognize that different types of departments should be evaluated on the basis of the level of authority managers are given. Organizational architecture supplies the theoretical foundation for different types of budgeting systems. At the lower levels of an organization, managers typically control inputs and are responsible for producing goods and services that may or may not produce revenue. Lower-level departments are classified as cost, expense, or revenue centers on the basis of what they produce. Lower-level managers generally are not responsible for profitability. Questions of profit arise at the division level; while department managers may only produce part of the final product, the division-level manager (or division director) is responsible for bringing the product to market and should be evaluated not only on production but also on sales—satisfying the consumer. Given the expanded responsibility of division managers, their operations are classified as profit centers. The responsibility of VPs extends beyond current operations to include what the organization will do in the future. Senior executives should be evaluated for investments that maximize the future value of the organization, and their areas of responsibility are labeled investment centers. The relationship between budgeting and performance evaluation systems and the five types of responsibility centers is discussed as follows.

Cost Centers

Cost center managers decide the mix of inputs (labor, supplies, equipment, etc.) employed to produce output and should be evaluated on efficiency, minimizing the cost per unit or maximizing output for a given budget. Output and quality must be measureable, that is, what the department produces must be easy to quantify (count) and it should be easy to distinguish acceptable from unacceptable output. A compensation system that rewards individuals for the number of units produced creates an incentive to maximize output. If quality is not measured, an output-based compensation system can encourage fast and flawed work. To maximize firm value, compensation and evaluation systems must ensure that output simultaneously satisfies consumers and minimizes costs. Cost center managers have no authority over sales, revenues, or profits, and hence, their budgets and performance should not be determined by fluctuation in these factors. Evaluating managers on the basis of efficiency should be used when managers can (i) measure quantity, understand cost functions, and set output levels and rewards, (ii) assess quality, and (iii) know the optimal input mix and have authority over input use (Brickley, Smith, &

Zimmerman, 1997, p. 324). Flexible and activity-based budgets may be most appropriate for cost center managers.

Expense Centers

Expense center managers decide the mix of inputs to be used to produce output, but output is subjective, for example, human resource functions, finance, and R&D. In human resources, the quality of new hires (or the screening and training processes) may only be apparent years down the line. Similarly, the quality of financial analysis or research may be known years in the future when the investment matures and its costs and benefits can be calculated. The problem with expense centers is that it is difficult to determine whether the right amount of inputs are being consumed relative to the output produced. In cost centers, where quantity and quality are measurable, charge-back systems are often used to establish control. Downstream departments that consume the goods and services "pay" their costs, and if these users can go and purchase inputs outside the organization when internal costs become too great, the upstream departments face market discipline and must maintain efficiency.

Unlike cost centers, the subjectivity of the quantity and quality of output in expense centers makes it difficult to establish charge-back systems for users that could discourage them from overusing the service. Departments that are not charged for use of services provided by other departments tend to overuse services. Brickley et al. (1997, p. 325) note that the costs of expense centers, typically overhead departments, have a tendency to grow faster than the organization as a whole, suggesting they may exploit the lack of a clear input/output relationship to increase their resource use and budgets. Evaluating performance and control often relies on benchmarking to similar-size organizations (is the human resource, finance, and/or R&D staff larger or smaller than similar-size organizations?) or placing the department under the control of its largest user. The goal is to minimize cost for the level of service provided or maximize services for a fixed budget. Activity-based budgets may be most appropriate in this situation. One problem that arises when expense centers are placed under the control of its largest user is that the department may subsequently limit services to other departments to reduce cost.

Revenue Centers

Revenue center managers are tasked with selling a product or service (marketing, selling, and distribution) and may have limited authority to set prices. To maximize the value of the organization, managers should maximize revenue at a given price or quantity—the economic rule of equalizing marginal revenue and marginal cost. Revenue center managers control their input mix, that is, type of sales staff, amount spent on advertising, etc. Evaluating managers for equating marginal revenues and marginal costs should be used when the managers understand (i) the optimal price–quantity combination, (ii) the optimal product mix (does not allow sales staff to focus on high-revenue versus high-profit products), and (iii) the demand function of customers (Brickley et al., 1997, p. 326). Program budgeting and zero-base budgets may be most appropriate for revenue centers.

Profit Centers

Profit center managers decide the input mix, product mix, and prices and should be evaluated on the difference between actual and expected profits. A profit center is typically a set of cost, expense, and revenue centers. Complications, that is, profit shifting, can arise because of transfer pricing and allocation of overhead issues. In addition, there is the issue of interdependencies among business units and firm-wide profit. Program or zero-base budgets may provide the most effective monitor of managerial prowess.

Investment Centers

Investment center managers decide the input mix, product mix, output prices, and capital expenditures. An investment center is typically a set of profit centers, and the job of investment center managers, typically the C-suite, is to allocate funds to the most profitable profit centers. Investment center managers should be evaluated on the ROI and residual income (subtracting opportunity costs). Evaluation should also include assessment of risk assumed, that is, fluctuation in the ROI. Investment center managers are responsible for the profitability of the entire organization and should be evaluated on the master budget and realized profit. Program and zero-base budgets, again, provide the optimal structure to highlight and monitor decision-making effectiveness.

Whereas the managers of investment and profit centers should be evaluated on future and current profitability, managers of cost and revenue centers should be assessed on the cost per output produced or sold (throughput/output), while expense center managers should be evaluated on what is achieved compared to similarly funded departments (outcomes). Rational budgeting and performance evaluation systems must recognize the resources managers control, and establish incentives for managers to pursue organizational goals.

Summary

This chapter demonstrates that budgeting is a complex task encompassing a variety of operations and requiring the estimation of millions, if not billions, of dollars of revenue and expenses. Accounting provides a simple system to create budgets and determine how organizations are performing. Is the organization viable? Does the pro forma income statement show that revenues will exceed expenses if the budget is followed? If the budget is followed, will the organization be in a stronger position at the end of the fiscal year, and will the organization be solvent?

Marginal decision-making, cost behavior, and the way costs are combined are examined to explore operating expenses and identify how managers can minimize production costs. Spreading fixed costs over the highest amount of output minimizes the AFC, but only reduces the ATC if increases in variable costs do not offset the reduction in AFCs. Managers must understand how output changes with increases in variable inputs (MP), how cost increases with increases in inputs (cost behavior), and how the ATC changes with increases in output, given fixed resources (economies of scale) to determine whether consuming more resources benefits the organization.

Organizational architecture recognized the essential role played by incentives, decision rights, and monitoring systems in ensuring an organization's goals are pursued by its managers. Budgeting and performance evaluation systems should recognize the things a manager has authority over and build monitoring and compensation systems that track and reward senior and lower-level managers for maximizing the value of the organization.

Key Terms and Concepts

Balance sheet
Bankruptcy
Bounded rationality
Cost of capital
Diminishing marginal returns
Divisional organization structure
Economies of scale
Externality
Fixed costs
Free riding
Functional organization structure
Income redistribution
Income statement
Liquidity
Marginalism
Market failure
Marginal product
Marginal revenue product
Net worth (equity)
Opportunism
Organizational architecture
Pro forma financial statements
Public good
Return on investment (ROI)
Silo thinking

Social welfare
Solvency
Specialization
Step costs
Two-part tariff
Uncertainty
Variable costs
Viability

Discussion Questions

1. Describe the goals of individuals, organizations, and society and how they interact.
2. What are the major challenges in preparing a budget for a large organization?
3. Explain the two accounting equations, including their purpose and relationship with the income statement and balance sheet.
4. Explain why the ATC tends to initially decrease as output increases and eventually increase.
5. Describe the differences between cost, expense, revenue, profit, and investment centers.

Problems

1. Calculate the ROI for each project and state which projects should be undertaken if the interest rate is 5%.

Project	Investment	Profit	ROI
A	$8,000,000	$1,000,000	_____
B	$5,000,000	$500,000	_____
C	$2,500,000	–$100,000	_____
D	$3,750,000	$250,000	_____
E	$4,000,000	$300,000	_____
F	$12,000,000	$1,250,000	_____
G	$6,500,000	$400,000	_____

2. Calculate the ROI for the following five projects. The total cost includes the initial investment. Which projects should be undertaken if the organization has a spending constraint of $7,000,000 and its cost of capital is 6%?
3. Assume you are the business manager for an outpatient surgical center that currently employs two surgeons. The table given provides the expected change in the annual surgical volume if additional surgeons are hired. If the salary for the to-be-hired surgeons is $200,000 and the practice earns $100

Project	Investment	Total revenue	Total cost	Profit	ROI
A	$3,000,000	$5,500,000	$5,000,000	_____	_____
B	$2,400,000	$4,000,000	$3,800,000	_____	_____
C	$1,350,000	$2,400,000	$2,300,000	_____	_____
D	$1,500,000	$3,200,000	$3,000,000	_____	_____
E	$2,000,000	$3,800,000	$3,700,000	_____	_____

per surgery after all other expenses (staffing, supplies, equipment/building costs, etc.) have been paid, how many additional surgeons should be added?

Surgeons	Total Surgeries
0	0
1	2,070
2	5,175
3	8,901
4	12,006
5	14,076
6	15,525

4. Given an output price of $500, the total output (in the body of the table), the quantity of each input (in rows), the price of inputs (in columns), and a budget of $1,200,000, calculate the MP and MRP for each input. Which resources in what quantities should be employed to maximize the value of the firm?
5. Assume the total cost for an appendicitis operation comprises supplies (AVC), the surgical team (step cost), and building and equipment (AFC). Calculate the ATC. What is the most efficient (minimum ATC) output quantity, given the costs in the table? What should be the cost to produce 900 operations?

Low Skill Labor	High Skill Labor	Low Capacity Supplies, Equipment	High Capacity Equipment	Building and Land		
Input	$30,000	$50,000	$20,000	$100,000	$400,000	$500,000
1	64	120	50	250	1,000	1,350
2	130	220	98	475	–	–
3	200	300	144	675	–	–
4	266	360	186	850	–	–
5	330	400	228	1,000	–	–

Output	Average Variable Cost	Step Cost	Total Fixed Cost	Average Total Cost
0	$0	$50,000	$500,000	_____
150	$1,000	$100,000	$500,000	_____
300	$950	$100,000	$500,000	_____
450	$1,000	$100,000	$500,000	_____
600	$1,200	$200,000	$500,000	_____
750	$1,500	$200,000	$500,000	_____
900	$1,800	$300,000	$500,000	_____

References

Brickley, J. A., Smith, C. W., & Zimmerman, J. L. (1997). *Managerial economics and organizational architecture*. Chicago, IL: Irwin.

Fortune 500. (2017). Retrieved September 6, 2017, from http://beta.fortune.com/fortune500/list

Optum360°. (2016). *2017 Almanac of hospital financial and operating indicators*. Chicago, IL: Author.

Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. Chicago, IL: University of Chicago Press.

Swayne, L. E., Duncan, W. J., & Ginter, P. M. (2006). *Strategic management of health care organizations* (6th ed.). San Francisco, CA: Jossey Bass.

Walmart. (2005). Our Retail Divisions. Retrieved August 23, 2016, from http://corporate.walmart.com/_news_/news-archive/2005/01/07/our-retail-divisions