

CHAPTER

18

The System and Process of Controlling

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Describe the steps in the basic control process
2. Enumerate and explain the critical control points, standards, and benchmarking
3. Illustrate applications of the feedback system
4. Understand that real-time information will not solve all the problems of management control
5. Show that feedforward control systems can make management control more effective
6. Describe some of the most widely used techniques of overall control of an enterprise
7. Recognize the use and problems of management audits by accounting firms
8. Understand the difference between bureaucratic and clan control
9. List and explain the requirements for effective controls

While leaders provide a vision for the organization and their followers, they also need to implement that vision. This means that performance

needs to adhere to plans, which requires controlling. The managerial function of **controlling** is the measurement and correction of performance in order to make sure that enterprise objectives and the plans devised to attain them are being accomplished. Planning and controlling are closely related. In fact, some writers on management think that these functions cannot be separated. It is wise to separate them conceptually, however, which is why they are discussed individually in parts 2 and 6 of this book. Still, planning and controlling may be viewed as the blades of a pair of scissors: the scissors cannot work unless there are two blades. Without objectives and plans, control is not possible because performance has to be measured against some established criteria.

Controlling The measurement and correction of performance in order to make sure that enterprise objectives and the plans devised to attain them are being accomplished.

BASIC CONTROL PROCESS

Control techniques and systems are essentially the same as controlling cash, office procedures, morale, product quality, and so on. The basic control process, wherever it is found and whatever is being controlled, involves three steps: (1) establishing standards, (2) measuring performance against these standards, and (3) correcting variations from standards and plans.

Establishment of Standards

Because plans are the yardsticks against which managers devise controls, the first step in the control process logically would be to establish plans. However, since plans vary in detail and complexity and since managers cannot usually watch everything, special standards are established. **Standards** are simply criteria of performance. They are the selected points in an entire planning program at which measures of performance are made so that

managers can receive signals about how things are going, and thus do not have to watch every step in the execution of plans.

Standards Criteria of performance.

There are many kinds of standards. Among the best are verifiable goals or objectives, as suggested in the discussion of managing by objectives (Chapter 4). You will learn more about standards later, especially those that point out deviations at critical points.

Measurement of Performance

Although such measurement is not always practicable, the measurement of performance against standards should ideally be done on a forward- looking basis so that deviations may be detected in advance of their occurrence and avoided by appropriate actions. An alert, forward- looking manager can sometimes predict probable departures from standards. In the absence of such ability, however, deviations should be disclosed as early as possible.

Correction of Deviations

Standards should reflect the various positions in an organization structure. If performance is measured accordingly, it is easier to correct deviations. Managers know exactly where, in the assignment of individual or group duties, the corrective measures must be applied.

Correction of deviations is the point at which control can be seen as a part of the whole system of management and can be related to the other managerial functions. Managers may correct deviations by redrawing their plans or by modifying their goals. (This is an exercise of the principle of navigational change.) Or they may correct deviations by exercising their organizing function through reassignment or clarification of duties. They may correct, also, by additional staffing, by better selection and training of subordinates, or by that ultimate restaffing measure-firing. Another way is to correct

through better leading-fuller explanation of the job or more effective leadership techniques.

BUSINESS ANALYTICS

A growing focus on management research and practice has been in the field of business analytics. The focus of business analytics is to make readily available advanced analysis of the treasure trove of data that organizations collect to the manager and decision maker to take better decisions for the course of the organization.¹ Often, there is a time delay from the collection of data to its analysis and its dissemination to users of this information to make key decisions for the benefit of the enterprise. Business analytics is focused on better systematizing the collection, analysis, and availability of key organizational data sets to allow the firm to act and respond more nimbly to changes in its market and competitive environment.

Some consulting firms such as ibm have built practices on helping their clients leverage the data they have collected. IBM refers to this practice as “Smarter Analytics,” with a promise to help its customer act more nimbly than their competitors with regard to identification of customer trends and the development of better business practices to reduce costs and mitigate risks.²

A focus on sustainable supply chain management has also come into play, with many large enterprises seeking to maximize efficiency and also long-term sustainability of their supply chains. This focus entails not only gathering data to analyze cost, but also methods to ensure ethical and environmentally sensitive business decisions.

CRITICAL CONTROL POINTS, STANDARDS, AND BENCHMARKING

Standards are yardsticks against which actual or expected performance is measured. In a simple operation, a manager might control through careful personal observation of the work being done. However, in most operations, this is not possible because of the

complexity of the operations and the fact that a manager has far more to do than personally observe performance for a whole day. A manager must choose points for special attention and then watch them to be sure that the whole operation is proceeding as planned.

The points selected for control should be *critical*, in the sense either being limiting factors in the operation or better indicators than other factors of whether plans are working out. With such standards, managers can handle a larger group of subordinates and thereby increase their span of management, resulting in cost savings and improvement of communication. The **principle of critical point control**, one of the more important control principles, states that effective control requires attention to those factors critical to evaluating performance against plans. Another way of controlling is comparing company performance with that of other firms through benchmarking.

Principle of critical point control Effective control requires attention to factors critical to evaluating performance against plans.

Types of Critical Point Standards

Every objective, every goal of the many planning programs, every activity of these programs, every policy, every procedure, and every budget can become a standard against which actual or expected performance might be measured. In practice, however, standards tend to be of the following types: (1) physical standards, (2) cost standards, (3) capital standards, (4) revenue standards, (5) program standards, (6) intangible standards, (7) goals as standards, and (8) strategic plans as control points for strategic control.

Physical standards

Physical standards are nonmonetary measurements and are common at the operating level, where materials are used, labor is employed, services are rendered, and goods are produced. They may reflect quantities such as labor hours per unit of output, pounds of fuel per horsepower per hour, ton miles of freight traffic carried,

units of production per machine hour, or feet of wire per ton of copper. Physical standards may also reflect quality such as hardness of bearings, closeness of tolerances, rate of climb of an airplane, durability of a fabric, or fastness of a color.

Cost standards

Cost standards are monetary measurements and, like physical standards, are common at the operating level. They attach monetary values to specific aspects of operations. Illustrative of cost standards are such widely used measures as direct and indirect costs per unit produced, labor cost per unit or per hour, material cost per unit, machine hour costs, cost per seat mile, selling cost per dollar or unit of sales, and cost per foot of oil well drilled.

Capital standards

There are a variety of capital standards, all rising from the application of monetary measurements to physical items. They have to do with the capital invested in the firm rather than with operating costs, and are therefore primarily related to the balance sheet rather than to the income statement. Perhaps, the most widely used standard for new investment as well as for overall control is return on investment. The typical balance sheet will disclose other capital standards such as the ratios of current assets to current liabilities, debt to net worth, fixed investment to total investment, cash and receivables to payables, and bonds to stocks as well as the size and turnover of inventories.

Revenue standards

Revenue standards arise from attaching monetary values to sales. They may include standards such as revenue per bus passenger mile, average sales per customer, and sales per capita in a given market area.

Program standards

A manager may be assigned to install a variable budget program, a program for formally following the development of new products, or a

program for improving the quality of a sales force. Although some subjective judgment may have to be applied in appraising program performance, timing and other factors can be used as objective standards.

Intangible standards

More difficult to set are standards not expressed in either physical or monetary measurements. What standard can a manager use for determining the competence of the divisional purchasing agent or the personnel director? What can one use for determining whether the advertising program meets both short- and long-term objectives or whether the public relations program is successful? Are supervisors loyal to the company's objectives? Such questions show the difficulty of establishing standards or goals for clear quantitative or qualitative measurement.

Goals as standards

With the present tendency for better-managed enterprises to establish an entire network of verifiable qualitative or quantitative goals at every level of management, the use of intangible standards, while still important, is diminishing. In complex program operations as well as in the performance of managers themselves, modern managers are finding that through research and thinking it is possible to define goals that can be used as performance standards. While the quantitative goals are likely to take the form of the standards outlined above, the definition of qualitative goals represents an important development in the area of standards. For example, if the program of a district sales office is spelled out to include such elements as training salespeople in accordance with a plan with specific characteristics, the plan and its characteristics themselves furnish standards that tend to become objective and therefore "tangible."

Strategic plans as control points for strategic control

Strategic control requires systematic monitoring at strategic control points and modifying the organization's strategy based on this

evaluation. As pointed out earlier, planning and controlling are closely related. Therefore, strategic plans require strategic control. Moreover, since control facilitates comparison of intended goals with actual performance, it also provides opportunities for learning, which in turn is the basis for organizational change. Finally, through the use of strategic control, one gains insights not only about organizational performance, but also about the ever-changing environment by monitoring it.

Strategic control Systematic monitoring at strategic control points and modifying the organization's strategy based on this evaluation.

Benchmarking³

Benchmarking is a concept that is now widely accepted. It is an approach for setting goals and productivity measures based on best industry practices. Benchmarking developed out of the need to have data against which performance can be measured. What should the criteria be? If a company needs six days to fill a customer's order and the competitor in the same industry needs only five days, five days does not become the standard if a firm in an unrelated industry can fill orders in four days. The four-day criterion becomes the benchmark, even when at first this seems to be an unachievable goal. The process involved in filling the order is then carefully analyzed and creative ways are encouraged to achieve the benchmark.

Benchmarking An approach for setting goals and productivity measures based on best industry practices.

There are three types of benchmarking. First, *strategic benchmarking* compares various strategies and identifies the key strategic elements of success. Second, *operational benchmarking* compares relative costs or possibilities for product differentiation. Third, *management benchmarking* focuses on support functions such as market planning and information systems, logistics, human resource management, and so on.

Three types of benchmarking: strategic, operational, and management.

The benchmarking procedure begins with the identification of what is to be benchmarked. Then, superior performers have to be selected. Data need to be gathered and analyzed, which become the basis for performance goals. During the implementation of the new approach, performance is periodically measured and corrective actions are taken at that time.

CONTROL AS A FEEDBACK SYSTEM

Managerial control is essentially the same basic control process as that found in physical, biological, and social systems. Many systems control themselves through information feedback, which shows deviations from standards and initiates changes. In other words, systems use some of their energy to feed back information that compares performance with a standard and initiates corrective action. A simple feedback system was shown in [Figure 4-1](#) in Chapter 4.

Management control is usually perceived as a feedback system similar to that which operates in the common household thermostat. This can be seen clearly in [Figure 18-1](#), which shows the feedback process in management control. This system places control in a more complex and realistic light than if it is regarded merely as a matter of establishing standards, measuring performance, and correcting for deviations. Managers do measure actual performance, compare this measurement against standards, and identify and analyze deviations. But then, to make the necessary corrections, they must develop a program for corrective action and implement this program in order to arrive at the performance desired.

Management control is usually perceived as a feedback system similar to the common household thermostat.

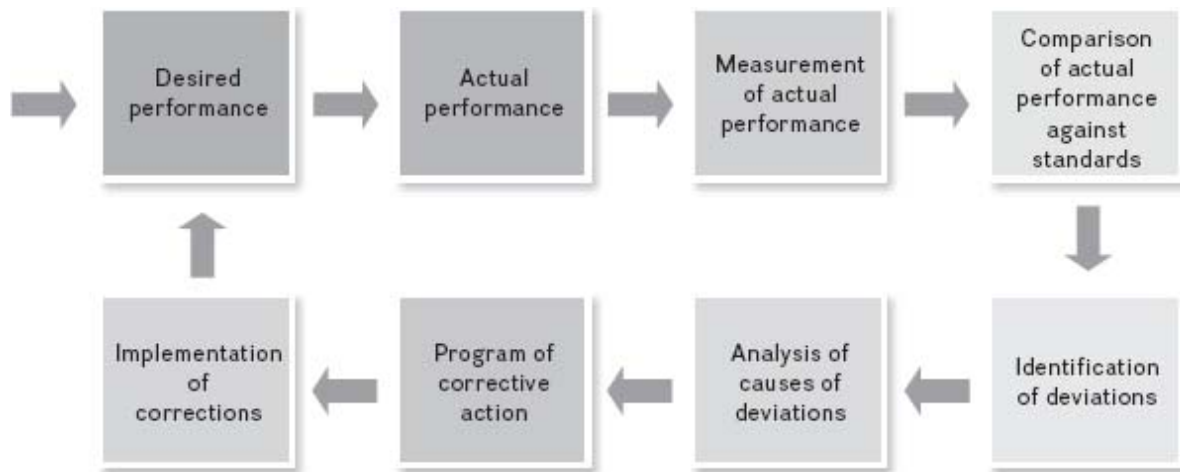


FIGURE 18-1 Feedback loop of management control

REAL-TIME INFORMATION AND CONTROL

One of the interesting advances rising from the use of the computer and from electronic gathering, transmission, and storage of data is the development of systems of **real-time information**. This is information about what is happening while it is happening. It is technically possible through various means to obtain real-time data on many operations. For years, airlines have obtained information about seat availability simply by entering a flight number, trip segment (e.g., London to New York), and date into a memory system, which immediately responds with the information. Supermarkets and department stores have electronic cash registers in operation that immediately transmit data on every sale to a central data storage facility, where inventory, sales, gross, profit, and other data can be obtained as sales occur. A factory manager can have a system that reports at any time the status of a production program in terms of such things as the production point reached, labor hours accumulated, and even whether the project is late or on time in the manufacturing process.

Real-time information Information about what is happening while it is happening.

Some people see real-time information as a means of getting realtime control in areas of importance to managers—in other words, control effected at the very time information shows a deviation from plans. But reference to the management control feedback loop in [Figure 18-1](#) shows that real-time information does not, except possibly in the simplest and most unusual cases, make possible realtime control. It is possible in many areas to collect real-time data that measure performance. It may also be possible in many of these cases to compare these data with standards and even to identify deviations. But the analysis of causes of deviations, the development of programs of correction, and the implementation of these programs are likely to be time-consuming tasks.

In the case of quality control, for example, it may take considerable time to discover what is causing factory rejects and more time to put corrective measures into effect. In the more complex case of inventory control, particularly in a manufacturing company, which has many items—raw materials, component parts, goods in process, and finished goods—the correction time may be very long. Once it is learned that an inventory is too high, the steps involved in getting it back to the desired level may take a number of months. And so it goes with most other instances of management control problems; time lags are unavoidable.

This does not mean that prompt measurement of performance is unimportant. The sooner managers know that activities for which they are responsible are not proceeding in accordance with plans, the faster they can take action to make corrections. Even so, there is always the question of whether the cost of gathering real-time data is worth the few days saved. Often it is, as in the case of the airline business, in which ready information on seat availability is likely to be crucial to serving customers and filling airplanes. But in a major defense company producing one of the highest priority defense equipment items, there is little real-time information in an otherwise highly sophisticated information control system. Even for this program, it was thought that the benefit of gathering real-time data was not worth the expense because the correction process took so long.

Interview with Dan Gordon, Cofounder, Gordon Biersch Brewing Company, on Controlling for Product Quality⁴

Gordon Biersch is a brewing company founded in 1987 by Dan Gordon and Dean Biersch. The firm has emphasized authentic German-style beers with exacting quality standards throughout its history. Dan Gordon, in fact, was the first American in more than 50 years to graduate from the five-year brewing engineering program at the prestigious Technical University of Munich at Weihenstephan, West Germany. After completing his training, Gordon teamed up with Biersch to open their first brewery restaurant in Palo Alto, California, in 1988. Since then, the company expanded nationally and internationally. While the brewery restaurants have been sold to another operating group, Dan Gordon continues to brew his premium beer in accordance with strict German quality standards at a state-of-the-art facility in San Jose, California.

We asked Dan Gordon to comment on his methods of controlling for quality of production after more than 20 years of successful brewing. Mr. Gordon explained, "Before undertaking any endeavor I believe success is predicated on a significant amount of hands on experience. I truly feel our key success factor was the amount of knowledge and expertise that Dean Biersch and I had going into the brewery restaurant business. Certainly, my brewing education was tantamount to the quality of the beer, but I also had a chance to work in several German breweries and tour hundreds of others breweries to gain critical knowledge. Our competitors were mostly restaurateurs without brewing experience or glorified home brewers with little or no restaurant experience." He continued, "Our location was dynamic and we were quickly recognized as the qualitative leader in our sector of the hospitality industry and created a significant brand. Good things happen once you are considered the best." Today, Dan

Gordon continues to emphasize premium ingredients, exacting standards, and state-of-the-art production systems. This discipline, combined with his distinctive education and experience, has formed the core of his company's competitive advantage as his business has grown for over two decades.

FEEDFORWARD OR PREVENTIVE CONTROL

The time lag in the management control process shows that control must be directed toward the future if it is to be effective. It illustrates the problem of only using feedback from the output of a system and measuring this output as a means of control. It shows the deficiency of historical data, such as those received from accounting reports. One of the difficulties with such historical data is that they tell business managers in November that they lost money in October (or even September) because of something that was done in July. At this late date, such information is only a distressingly interesting historical fact.

What managers need for effective control is a system that will tell them that, in time to take corrective action, certain problems will occur if they do not do something now. Feedback from the output of a system is not good enough for control. It is little more than a postmortem, and no one has found a way to change the past.

Managers need for effective control a system that will tell them potential problems, giving them time to take corrective action before those problems occur.

Future-directed control is largely disregarded in practice, mainly because managers have been so dependent for purposes of control on accounting and statistical data. To be sure, in the absence of any means of looking forward, reference to history—on the questionable assumption that what is past is prologue—is admittedly better than no reference at all.

Feedforward in Human Systems

There are many examples of feedforward control in human systems. A motorist, for example, who wishes to maintain a constant speed going up a hill would not usually wait for the speedometer to signal a drop in speed before depressing the accelerator. Instead, knowing that the hill represents a disturbing variable in the system, the driver would probably correct this by pressing the accelerator before speed falls. Likewise, a hunter will always aim ahead of a duck's flight to correct for the time lag between a shot and a hoped-for hit.

Feedforward versus Feedback Systems

Simple feedback systems measure outputs of a process and feed into the system or the inputs of the system corrective actions to obtain the desired outputs. For most management problems, because of time lags in the correction process, this is not good enough. Feedforward systems monitor *inputs* into a process to ascertain whether the inputs are as planned; if they are not, the inputs, or perhaps the process, are changed in order to obtain the desired results. A comparison of feedforward and feedback systems is depicted in [Figure 18-2](#).

Feedforward systems monitor inputs into a process to ascertain if the inputs are as planned; if they are not, the inputs or the process is changed in order to obtain the desired results.

In a sense, a feedforward control system is really a kind of feedback system. However, the information feedback is at the *input* side of the system so that corrections can be made before the system output is affected. Also, even with a feedforward system, a manager would still want to measure the final system output, since nothing can be expected to work perfectly enough to ensure that the final output will always be exactly as desired.

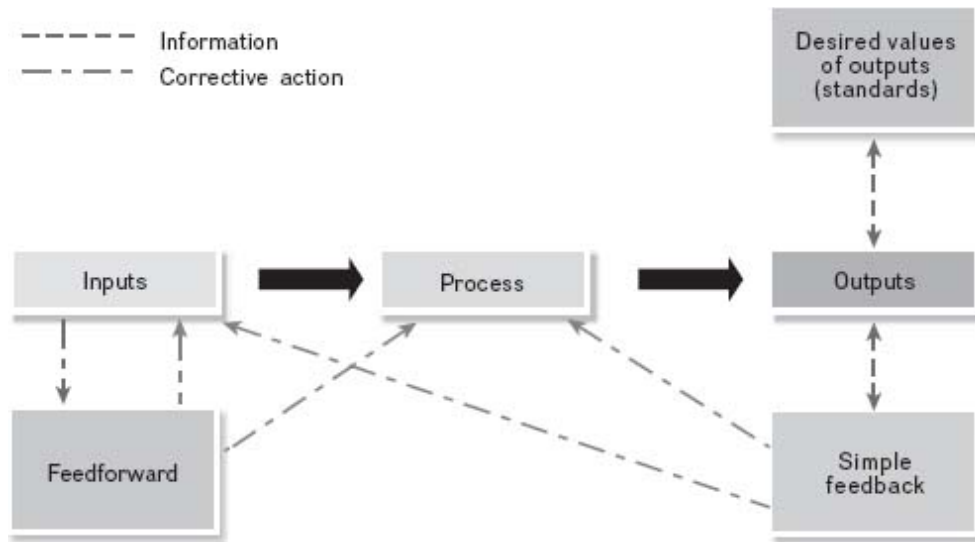


FIGURE 18-2 Comparison of simple feedback and feedforward systems Feedforward in Management

Feedforward in Management*

An idea of what feedforward means in management control can be conveyed through the example of inventory planning system. Figure 18-3 illustrates what is involved. The somewhat simplified schematic figure of input variables for inventory planning and control indicates that if managers are to exercise effective control over inventory, they must identify the variables in the system. Some of the variables have either a negative or a positive effect on inventory.

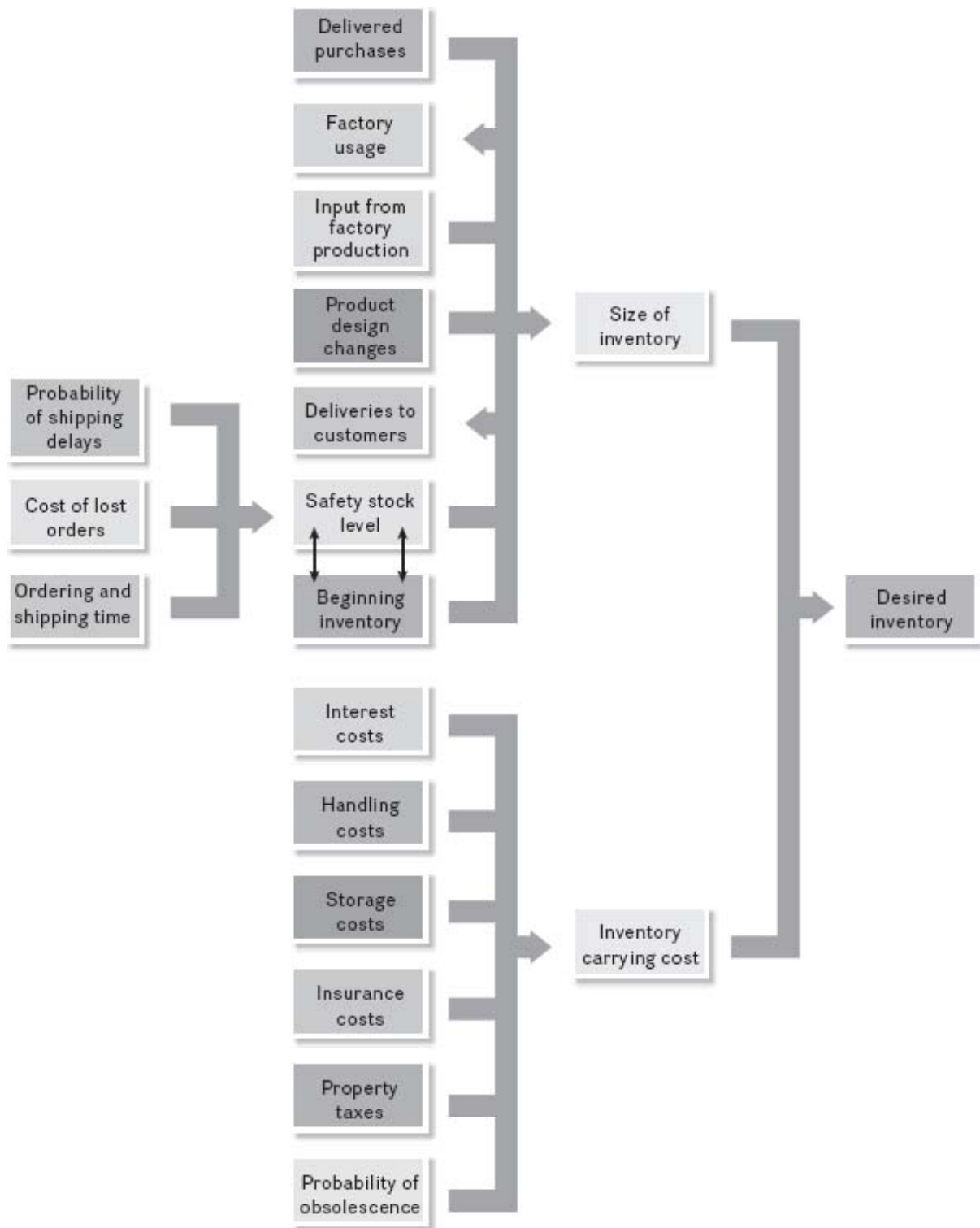


FIGURE 18-3 System of inputs for feedforward inventory control

Also, if the system of variables and their impact on a process are accurately portrayed—and each enterprise should design its own system, appropriate to the realities of its situation—a deviation from any planned input can result in an unplanned output, unless something is done about it in time. For example, in the case of the inventory model, if delivered purchases are greater than planned or if factory usage turns out to be less than planned, the result will be a higher than planned inventory, unless corrective action is taken. Of course, to make feedforward work in practice, inputs must be carefully monitored.

One of the problems in all feedforward control systems is the necessity of watching for what engineers call disturbances. These are factors which have not been taken into account in the input model but which may have an impact on the system and the desired end result. Obviously, it would be impracticable to take into account in a model all inputs that might possibly affect the operation of a program. For example, the bankruptcy of a large supplier might be an unanticipated and unprogrammed input variable and would delay the shipping of supplies. Since unprogrammed events do sometimes occur and may upset a desired output, monitoring regular inputs must be supplemented by watching for and taking into account unusual and unexpected disturbances.

Requirements for Feedforward Control

The requirements for a workable feedforward control system may be summarized as:

1. Make a thorough and careful analysis of the planning and control system and identify the more important input variables.
2. Develop a model of the system.
3. Take care to keep the model up-to-date; in other words, the model should be reviewed regularly to see whether the input variables identified and their interrelationships continue to represent realities.
4. Collect data on input variables regularly and put them into the system.

5. Regularly assess variations of actual input data from planned-for inputs and evaluate the impact on the expected end result.
6. Take action. Like any other technique of planning and control, all that the system can do is indicate problems; people must obviously take action to solve them.

CONTROL OF OVERALL PERFORMANCE

Planning and control are increasingly being treated as an interrelated system. Along with techniques for partial control, control devices have been developed for measuring the overall performance of an enterprise- or an integrated division or project within it-against total goals.

There are many reasons for control of overall performance. First, just as overall planning must apply to enterprise or major division goals, so must overall control be applied. Second, decentralization of authority, especially in product or territorial divisions, creates semi-independent units, and these must be subjected to overall control to avoid the chaos of complete independence. Third, overall control permits the measurement of an integrated area manager's total effort rather than parts of it.

Many overall controls in business are, as one might expect, financial. Business owes its continued existence to profit making; its capital resources are a scarce, life-giving element. Since finance is the binding force of business, financial controls are certainly an important objective gauge of the success of plans. Moreover, sophisticated computer programs can use financial records as strategic tools.⁵

Many overall controls in business are financial.

Financial measurements also summarize, as a common denominator, the operation of a number of plans. Further, they accurately indicate total expenditure of resources in reaching goals. This is true in all forms of enterprises. Although the purpose of an educational or government enterprise is not to make monetary profits, any responsible manager must have some way of knowing what goal

achievement has cost in terms of resources. Proper accounting is important not only for business but for government as well.

Financial controls, like any other control, have to be tailored to the specific needs of the enterprise or the position. Doctors, lawyers, and managers at different organizational levels do have different needs for controlling their area of operation. Financial analyses also furnish an excellent “window” through which accomplishment in nonfinancial areas can be seen. A deviation from planned costs, for example, may lead a manager to find the causes in poor planning, inadequate training of employees, or other nonfinancial factors.

Entrepreneurial Perspective

Interview with Tom Lounibos, CEO of Soasta on Controlling⁶

How do entrepreneurial managers control their start-up firms which begin as largely unstructured, highly fluid organizations?

Tom Lounibos, the CEO of Soasta, a Silicon Valley software company, shared his experience. While privately held firms do not face the same scrutiny of public firms, they are accountable to their boards of directors. Measures such as revenue and profit are often not applicable to new ventures early in their life that are focused on building products. However, milestones for company performance do need to be set and accounted for. For example, when will the beta version of a product be complete? How many customers will use the beta version of the product? And, eventually, how many customers will pay for the product and what is the achievable price point?

With regards to sales forecasting, a clear understanding of the sales cycle is essential. Typically, higher-priced products involve a longer sales cycles of several months or longer. Revenue forecasts can only be made once this sales cycle is understood and planned for. If revenue targets are not being met, control systems to predict this revenue shortfall are necessary to allow

the company to respond on reducing planned expenditures. The advantage of launching a new venture is that entrepreneurial managers can begin with a clean slate, unencumbered from a large organizational status quo. Still, managers must build an enterprise that is responsive to the market and able to plan and control a process for meeting company milestones and market expectations.

PROFIT AND LOSS CONTROL

The income statement for an enterprise as a whole serves important control purposes, mainly because it is useful for determining the immediate revenue or cost factors that have accounted for success or failure. Obviously, if it is first put in the form of a forecast, the income statement is an even better control device, in that it gives managers a chance, before things happen to influence revenues, expenses, and consequently profits.

The Nature and Purpose of Profit and Loss Control

Since the survival of a business usually depends on profits and since profits are a definite standard against which to measure success, many companies use the income statement for divisional or departmental control. As it is a statement of all revenues and expenses for a given time, it is a true summary of the results of business operations. Profit and loss control, when applied to divisions or departments, is based on the premise that if it is the purpose of the entire business to make a profit, each part of the enterprise should contribute to this purpose. Thus, the ability of a part to make an expected profit becomes a standard for measuring its performance.

The **profit and loss statement** shows all revenues and expenses for a given time, so it is a true summary of the results of business operations.

Limitations of Profit and Loss Control

Profit and loss control suffers from the cost of the accounting and paper transactions involving intracompany transfer of costs and revenues. But the use of computers has greatly reduced this cost. Duplication of accounting records, efforts involved in allocating the many overhead costs, and the time and effort required to calculate intracompany sales can make this control costly if it is carried too far.

CONTROL THROUGH RETURN ON INVESTMENT⁷

Another control technique is that of measuring both the absolute and the relative success of a company or company unit by the ratio of earnings to investment of capital. The return on investment approach, often referred to simply as ROI, has been the core of the control system of the Du Pont Company. This yardstick is the rate of return that a company or a division can earn on the capital allocated to it. This tool therefore regards profit not as an absolute but as a return on capital employed in the business. Accordingly, the goal of a business is seen not necessarily as optimizing profits but as optimizing return from capital devoted to business purposes. This standard recognizes the fundamental fact that capital is a critical factor in almost any enterprise and, through its scarcity, limits progress. It also emphasizes the fact that the job of managers is to make the best possible use of assets entrusted to them.

Return on investment control measures both the absolute and the relative success of a company or company unit by the ratio of earnings to investment of capital.

MANAGEMENT AUDITS AND ACCOUNTING FIRMS

Although many management consulting firms have undertaken various kinds of appraisals of management systems, usually as part

of an organizational study, the greatest interest in pursuing management audits has been demonstrated by accounting audit firms. One of the significant developments has been their entry into the field of management services of a broad consultancy nature. While this has been an attractive field of expansion for these auditing companies, since they are already inside an organization and the financial information to which they have access furnishes a ready window on problems of managing, it does open the question of conflict of interest. In other words, the question is whether the same firm can be in the position of a management consultant furnishing both advice and services and still be completely objective as an accounting auditor. To be sure, accounting firms have attempted to avoid this problem by organizationally separating these two activities.

Accounting firms had enjoyed a great deal of trust, but this changed when U.S. federal prosecutors charged the accounting firm Arthur Andersen with obstruction of justice in connection with the collapse of Enron in 2002.⁸

BUREAUCRATIC AND CLAN CONTROL

Organizations exercise control in different ways. One can distinguish between two kinds of structural control: the bureaucratic and the clan control. **Bureaucratic control** is characterized by a wide use of rules, regulations, policies, procedures, and formal authority. This kind of control requires clear job descriptions, budgets, and often standardized tasks. Employees are expected to comply with the rules and regulations and may have limited opportunities for participation.

Bureaucratic control is characterized by the wide use of rules, regulations, policies, procedures, and formal authority.

Clan control, on the other hand, is based on norms, shared values, expected behavior, and other aspects relating to organization culture, which was discussed in Chapter 10.⁹ Clan control can be illustrated by the use of teams and by organizations operating in a very dynamic environment that requires quick adaptation to changes in that environment. Nokia, the largest wireless phone manufacturer in

Finland, tries to keep bureaucracy at a minimum and instead create an environment consistent with Finnish culture.

Clan control is based on norms, shared values, expected behavior, and other cultural variables.

www.nokia.com

REQUIREMENTS FOR EFFECTIVE CONTROLS

All alert managers want to have an adequate and effective system of controls to assist them in making sure that events conform to plans. It is sometimes not realized that the controls used by managers must be designed for the specific task and person they are intended to serve. While the basic process and the fundamentals of control are universal, the actual system requires special design.

Indeed, if controls are to work, they must be tailored to plans and positions, to the individual managers and their personalities, and to the needs for efficiency and effectiveness.

Tailoring Controls to Plans and Positions

All control techniques and systems should reflect the plans they are designed to follow. They should also be tailored to positions. What will be appropriate for a vice president in charge of manufacturing will certainly not be suitable for a shop supervisor. Controls should also reflect the organization structure, showing who is responsible for the execution of plans and for any deviation from them.

Tailoring Controls to Individual Managers

Controls must also be tailored to individual managers. Control systems and information are, of course, intended to help individual managers carry out their function of control. If they are not of a type that a manager can or will understand, they will not be useful. What individuals cannot understand, they will not trust. And what they do not trust, they will not use.

Designing Controls to Point up Exceptions at Critical Points

One of the most important ways of tailoring controls to the needs for efficiency and effectiveness is to design them to point up exceptions. In other words, controls that concentrate on exceptions from planned performance allow managers to benefit from the time-honored *exception principle* and detect areas that require their attention.

But it is not enough merely to look at exceptions. Some deviations from standards have little meaning, while others have a great deal. Small deviations in certain areas may have greater significance than larger exceptions in other areas. A manager might be concerned if the cost of office labor deviated from the budget by 5 percent, but might be unworried if the cost of postage stamps deviated from the budget by 20 percent.

Consequently, the exception principle should be accompanied in practice by the *principle of critical point control*. It is not enough just to look for exceptions; one must look for them at critical points. Certainly, the more that managers concentrate their control efforts on exceptions, the more efficient their control will be. But effective control requires that managers pay primary attention to things that are most important.

Efficient control requires that managers look for exceptions, while effective control requires that managers pay primary attention to things that are most important.

Seeking Objectivity of Controls

Management necessarily has many subjective elements, but whether a subordinate is doing a good job should ideally not be a matter for subjective determination. If controls are subjective, a manager's or a subordinate's personality may influence judgments of performance and make them less accurate. However, people would have difficulty dismissing control of their performance if the standards and measurements are kept up-to-date through periodic review. Effective control requires objective, accurate, and suitable standards.

McDonalds, for example, is very strict in applying and maintaining the same quality standards in all its restaurants, as you have seen in the McDonalds case discussed in Chapter 1.

www.mcdonalds.com

Ensuring Flexibility of Controls¹⁰

Controls should remain workable in the face of changed plans, unforeseen circumstances, or outright failures. If controls are to remain effective despite failure or unexpected changes of plans, they must be flexible.

If controls are to remain effective despite failure or unexpected changes of plans, they must be flexible.

The need for flexible control can readily be illustrated. A budget system may project a certain level of expenses and grant authority to managers to hire labor and purchase materials and services at this level. If, as is usually the case, this budget is based on a forecast of a certain level of sales, it may become meaningless as a system of control if the actual sales volume is considerably above or below the forecast. Budget systems have been brought into ill repute in some companies because of inflexibility in such circumstances. What is needed, of course, is a system that will reflect sales variations as well as other deviations from plans.

Fitting the Control System to the Organization Culture

To be most effective, any control system or technique must fit the organization culture. If an organization has given its employees considerable freedom and participation, a tight control system may go so strongly against the grain that it will be doomed to failure. On the other hand, if subordinates have been managed by a superior who allows little participation in decision-making, a generalized and

permissive control system will hardly succeed. People, who have little desire to participate or who are not accustomed to participating, are likely to want clear standards and measurements and specific directions. At one time, Mercedes-Benz, the luxury car maker, publicized that each of its cars underwent checks by many inspectors. But later, with a change in organization culture, a great deal of responsibility for quality was given to individual production workers.

To be most effective, any control system or technique must fit the organization culture.

www.mercedes.com

Achieving Economy of Controls

Controls must be worth their costs. Although this requirement is simple, it is often difficult to accomplish in practice. A manager may have difficulty ascertaining what a particular control system is worth or what it costs. Economy is relative, since the benefits of control vary with the importance of the activity, the size of the operation, the expense that might be incurred in the absence of control, and the contribution the system can make.

Controls must be worth their costs.

Establishing Controls that Lead to Corrective Action

An adequate system will disclose where failures are occurring and who is responsible for them, and it will ensure that corrective action is taken. Control is justified only if deviations from plans are corrected through appropriate planning, organizing, staffing, and leading. As mentioned in Chapter 13, General Electric and Motorola aim at Six Sigma quality or no more than 3.4 defects for a million operations.¹¹

An adequate control system will disclose where failures are occurring and who is responsible for them as well as ensuring that corrective action is taken.

SUMMARY

The managerial function of controlling is the measurement and correction of performance in order to ensure that enterprise objectives and the plans devised to attain them are being accomplished. It is a function of every manager, from president to supervisor.

Control techniques and systems are basically the same, regardless of what is being controlled. Wherever it is found and whatever is being controlled, the basic control process involves three steps: (1) establishing standards, (2) measuring performance against these standards, and (3) correcting variations from standards and plans. There are different kinds of standards and all should point out deviations at critical points. Performance can be measured against best industry practices, an approach known as benchmarking.

Managerial control is usually perceived as a simple feedback system similar to the common household thermostat. However, no matter how quickly information is available on what is occurring (even real-time information, which is information on what is happening as it happens), there are unavoidable delays in analyzing deviations, developing plans for taking corrective action, and implementing these programs. In order to overcome these time lags in control, it is suggested that managers utilize a feedforward control approach and not rely on simple feedback alone. Feedforward control requires designing a model of a process or system and monitoring inputs with a view to detecting future deviations of results from standards and plans, thereby giving managers time to take corrective action before problems occur.

Many overall controls are financial, one of which is profit and loss control. Another is the exercise of control through calculating and comparing return on investment. This approach is based on the idea that profit should be considered not as an absolute measure but as a return on the capital employed in a business or a segment of it. The management audit has also been used as a control device. Bureaucratic control is based on rules, regulations, policies, procedures, and formal authority. On the other hand, clan control is influenced by norms, shared values, and expected behavior.

If controls are to work, they must be specially tailored to plans and positions, to individual managers, and to the needs for efficiency and effectiveness. To be effective, controls also should be designed to point up exceptions at critical points, to be objective, to be flexible, to fit the organization culture, to be economical, and to lead to corrective action.

KEY IDEAS AND CONCEPTS FOR REVIEW

- Controlling
- Steps in controlling
 - Critical point control
 - Types of critical point standards
 - Benchmarking
 - Feedback system
 - Real-time information system
 - Feedforward control
 - Profit and loss control
 - Return on investment control
 - Management audit
 - Bureaucratic control
 - Clan control
 - Requirements for effective controls
 - Exception principle
 - Principle of critical point control

FOR DISCUSSION

1. Planning and control are often thought of as a system; control is also often referred to as a system. What do these observations mean? Can both statements be true?
2. Why is real-time information not good enough for effective control?
3. What is feedforward control? Why is it important to managers? Besides the example of inventory control mentioned in this chapter, can you think of any other areas in which feedforward would be used? Select one of these and explain how you would proceed.
4. Why do most controls of overall performance tend to be financial? Should they be? What else would you suggest?
5. "Profit and loss control is defective in that it does not emphasize return on investment; the latter is defective in that it places too great an emphasis on present results, possibly endangering future results." Discuss.
6. If you were asked to institute a system of "tailored" controls in a company, how would you go about it? What would you need to know?
7. In benchmarking, companies compare their performance with best practices. Why do you think firms that have an effective system are willing to share information with other companies?

EXERCISES/ACTION STEPS

1. Design a control system for measuring the progress that you make in your course work. Apply the feedback and feedforward concepts discussed in this chapter.

2. Interview two managers about the controls used in their companies. Can you identify standards against which performance can be accurately measured? How is performance measured against the standards and how timely is the reporting of deviations? If deviations are detected, how long does it take before corrections are made in specific situations?
3. The widespread use of analytics among organizations requires more people with education in this field. Explore the curriculum of your university to identify classes in analytics or statistics that you may want to take to enhance your capabilities in this emerging field.

INTERNET RESEARCH

1. Search the Internet for the term “feedforward control.” How does it differ from feedback control?
2. Search the Internet for the term “profit and loss statement.” What is it?

International Case

Walmart in America and around the Globe¹²

Walmart ranked number 2 in 2011 among the Fortune 500 companies after being number 1 the previous two years. The decline was partly due to declining economy and slow recovery in the United States. While the company had difficulties in the U.S. market, the international market grew. The company has one of the most sophisticated logistic systems controlled by computers. Yet, its headquarters are located in a small town in Bentonville,

Arkansas. The small-town orientation in its business approach contributed to its value-based success story.

Success did not come by accident; rather, it is based on careful planning of a unique strategy, a simple organization structure, an effective human resource policy, an inspiring leadership style initiated by founder Sam Walton, and a clever use of information technology to manage its inventory. When the company made mistakes, it learned from them. One concern is whether the strategy of invading rural areas will also work in the urban areas of the United States and in the global environment.

The Background

It all began in 1962 in a small town in Arkansas when Sam Walton noted the need for serving customers in small towns. Retailers such as Kmart and Sears focused on big towns. This created an opportunity for Walmart to fill people's needs in rural areas. This small-town orientation is reflected in the company's values, which emphasize maintaining good relationships with staff as well as suppliers. Sam Walton's values and his philosophy of simplicity and frugality live on after his death. The focus on cost savings enables the company to offer "everyday low prices," which has become a familiar company slogan.

Planning: From Small Towns to a Global Strategy

Besides the traditional stores, the company has Supercenters with a full line of groceries for one-stop family shopping. They may also include specialties shops with a vision center, tire and lubrication facilities, and photo processing. In addition, Sam's Club is a members-only warehouse club for individual and business members.

Since the early 1990s, Walmart has gone international, starting with a Sam's Club store near Mexico City. Now, Walmart operates clubs and stores worldwide in countries such as

Argentina, Brazil, Canada, China, Germany, South Korea, Mexico, Puerto Rico, and the United Kingdom, employing more than 280,000 people.

The tremendous size of the company gives it a great deal of buying power, which in turn makes it possible to offer goods at low prices, a policy that differentiates Walmart from other retailers. The company is known for its national brand strategy, which allows consumers to compare prices. In addition, Walmart has its own private labels with product offerings in apparel, health and beauty care, dog food, and other items.

In its hub and spoke distribution system, merchandise is brought to a distribution center, where it is sorted and prepared for delivery to the stores. These highly automated distribution centers operate 24 hours a day and may serve some 150 stores. Other merchandise is shipped directly from the suppliers to the stores.

Simple Organization Structure: Centralized and Decentralized

While the company's proprietary information system is centralized, the operation is decentralized, with a great deal of authority delegated to local managers in, for example, pricing the merchandise according to the local environment. The autonomy given to store managers makes them in a sense a small shopkeeper who can make decisions to adjust inventory according to local needs. Employees, called associates, are informed and celebrated at the Saturday morning meetings, where they are cheered for their accomplishments. The meetings also provide an opportunity to reinforce the notion that the customer is number 1.

Walmart's organization culture is built on three basic values promulgated by Sam Walton. It was established in 1962 and still permeates the organization. The values are (1) respect for the individual, (2) service to the customer, and (3) striving for excellence. Other factors influencing the organization culture include exceeding the expectations of customers, assisting people so that they can make a difference, quickly approaching

customers to help, doing today what can be done today rather than postponing it, and pricing for providing value to the customer.

Human Resource Management: People, the Most Important Assets

Clearly, the organization culture has an impact on the staffing function. Associates are treated with respect in this lean organization. Having a great deal of authority motivates people. Training is decentralized with management seminars offered at the distribution centers instead of at the company headquarters. The company atmosphere encourages employees to submit suggestions, many of them being implemented through the “Yes We Can Sam” suggestion system. Associates are rewarded bonuses for cost reduction through the “shrink incentive plan.” Supervisors and managers receive a salary as well as incentive compensation based on store performance. Associates can also participate in a profit-sharing plan with Walmart contributing a certain percentage.

Leadership by Example: Simple Frugality Communicated Effectively

Sam Walton provided leadership by example. His philosophy influenced his style. Once the richest person in America, he was a very frugal man, flying economy class and driving an old pickup truck. Similarly, Lee Scott, the present CEO, drives a Volkswagen Beetle. Sam Walton was a good communicator during his time as CEO, and his style was described as “management by walking and flying around” because of his frequent visits to his stores. Although he felt that trusting people and giving them responsibility was essential in managing people effectively, he also had the necessary control systems. Although Walton passed away in 1992, his legacy and philosophy still permeate his organization, as shown by the spartanly furnished headquarters in Bentonville.

Controlling a Large Organization: Sharing Information and Technologies with Suppliers

One of the key factors for Walmart's success is the inventory system that uses modern technology. The proprietary computer-controlled logistic system is considered one of the largest in America, ranking just below the Pentagon's system. The store manager can easily find out how his or her department managers are doing and which products are in high demand. Walmart's inventory turns over about twice as fast as the industry average, thus reducing inventory costs. Suppliers, who are considered a part of the Walmart family, also have access to the system and receive real-time data to help them plan for the fast-moving items.

The relationship with suppliers is, however, very businesslike. Contracts are negotiated in rooms furnished with a table and some chairs-no plush offices can be found. What is found, however, is a sign that says Walmart's buyers do not accept bribes, which could influence buying decisions.

Global Challenges for the Future¹³

Although Walmart has been successful, there are considerable challenges ahead. To continue its growth, Walmart would have to continue aggressively with opening new stores at home and abroad. In addition, product and service offerings need to be expanded, such as providing banking services as well as adding food. International expansion is another way to grow. The company has been successful in the expansion into Canada and Mexico, but other strategies have been less successful. One such example was the move into Germany, which the company did not plan carefully. Lee Scott attributes the failure to poor management. The company tries to learn from its mistakes and impresses on its associates to provide good service with a smile. In fact, a big problem for the rapidly growing company is developing competent managers and associates.

Domestically, the Walmart image has been hurt by the publicity on the impact of the big retailer on small communities.

The “60 Minutes” television program showed how small retailers of small towns could not effectively compete against the giant and were driven out of business. Still, consumers in the small communities were attracted by the everyday low prices. Walmart has also been cited for the low healthcare benefits given to its employees. Perhaps, partly to divert attention from this issue, the company drew attention to the high healthcare cost in America with a strategy of reducing drastically prices of several generic drugs in its stores, starting in Florida. While critics see this as a publicity move, consumers welcome it.¹⁴

One of Walmart’s latest attempts to remain the world’s largest retailer is to become the neighborhood grocer, which has created fear among other food stores. Food business is big business. People may shop once or more times a week for food. At the same time, they may be enticed to buy other goods Walmart has to offer.¹⁵

Walmart effectively practiced the managerial functions of planning, organizing, staffing, leading, and controlling, which led to its remarkable success, but challenges remain. Companies such as Costco and Kmart as well as foreign firms such as the French Carrefour and the German Metro (although both are much smaller than Walmart) are attempting to take business away from Walmart.

Questions

1. With a saturation of stores in the rural areas in America, can Walmart employ the same strategies for setting up stores in the cities? Why or why not? What difficulties may the company encounter?
2. Can the organization culture, which was so effective in the United States, be transferred to other countries? What changes, if any, would you suggest?
3. Could competitors copy the inventory system of Walmart?
4. Would you like to be a manager at Walmart? Why or why not?

5. What should Walmart do to be successful in other countries?
6. How can Walmart control the global enterprise?

REFERENCES

1. Ron Kohavi, Neal Rothleder, Evangelos Simoudis, "Emerging Trends in Business Analytics", *ACM* 45 (8): 45-48, 2002.
2. Please see IBM.com/analytics.
3. Robert C. Camp, "Learning from the Best Leads to Superior Performance," in Arthur A. Thompson, Jr., A. J. Strickland III, and Tracy Robertson Kramer (eds.), *Readings in Strategic Management*, 5th ed. (Chicago: Irwin, 1995), pp. 518-524; Y. K. Shetty, "Aiming High: Competitive Benchmarking for Superior Performance," *ibid.*, pp. 525-535; J. M. Juran, "A History of Managing for Quality in the United States, Part 2," *Quality Digest*, December 1995, p. 40; Charles J. Burke, "10 Steps to Best-Practices Benchmarking," *Quality Digest*, February 1996, pp. 23-28. For benchmarking in Europe, see www.benchmarking-in-europe.com, accessed November 17, 2011.
4. Interview conducted by email and in person with Dan Gordon of Gordon Biersch Brewing Company on August 16 and August 24, 2009, by Mark Cannice.
5. Phillip L. Zweig, John Verity, Stephanie Anderson Forrest, Greg Burns, Rob Hof, and Nicole Harris, "Beyond Bean-Counting," *Business Week*, October 28, 1996, pp. 130-132.
6. Interview conducted with Mr. Tom Lounibos, CEO of Soasta, by Mark Cannice on January 9, 2007.
7. See also W. Brian Arthur, "Increasing Returns and the New World of Business," *Harvard Business Review*, July-August 1996, pp. 100-109.
8. Wendy Zellner and Dan Carney, "The Price of Victory over Andersen," *Business Week*, July 1, 2002, p. 38; Joseph Weber, "The Lingering Lessons of Andersen's Fall," *ibid.*, p. 39; Mike France and Dan Carney, "Why Corporate Crooks Are Tough to

Nail,” *ibid.*, pp. 35-37; Joseph Nocera, “System Failure,” *Fortune*, June 24, 2002, pp. 62-74. See also Arthur Andersen, www.arthurandersen.com, accessed November 17, 2011, and “Enron,” www.enron.com, accessed November 17, 2011.

9. William Ouchi described clans as a control system. The characteristics of a clan culture can be found in “Managing Corporate Culture through Reward Systems” by Jeffrey Kerr and John W. Slocum, Jr., in *The Academy of Management Executive*, November 2005, pp. 132-133.
10. See also Mary C. Lacity, Leslie P. Willcocks, and David F. Feeny, “IT Outsourcing: Maximize Flexibility and Control,” *Harvard Business Review*, May-June 1995, pp. 84-94.
11. See also the articles in the various issues of *Quality Digest*. For example, Steve Fleming and E. Lowry Manson, “Six Sigma and Process Simulation,” *Quality Digest*, March 2002, pp. 35-39 and “New to Lean Six Sigma,” http://www.isixsigma.com/sixsigma/six_sigma.asp, accessed November 17, 2011; “What Is Six Sigma?” <http://www.isixsigma.com/new-to-six-sigma/getting-started/what-six-sigma/>, accessed May 14, 2014.
12. “Walmart, Wal around the World,” *The Economist*, December 8, 2001, pp. 55-57; “Walmart Stores, Inc.,” Harvard Business School Case 9-794-024, rev. August 6, 1996; “Walmart,” www.walmartstores.com, accessed November 17, 2011; “H. Lee Scott Jr., Walmart Stores,” *Business Week*, January 14, 2002, p. 71; see also Charles Fishman, *The Wall-Mart Effect*, Stratford: Penguin Press, 2006; the book has been reviewed by Daniel T. Gillepsie in *Academy of Management Learning & Education*, September 2006, pp. 378-379; “Walmart,” <http://www.walmart.com>, accessed May 14, 2014; Charles Fishman, “The Walmart Effect and a Decent Society: Who Knew Shopping Was So Important,” *The Academy of Management Perspective*, August 2006, pp. 6-25. See also other articles in *The Academy of Management Perspective*, August 2006. 2. Walmart stores, <http://money.cnn.com/magazines/fortune/fortune500/2012/snapshots/2255.html>, accessed May 14, 2015.

13. See also Peter Drucker, "The Next Society," *The Economist*, November 3, 2001, Insert pp. 3-20. Also, "The Next Society," <http://www.economist.com/node/770819>, accessed May 14, 2014.
14. "Walmart - High Risk, High Reward," *The Economist*, October 14, 2006, p. 32; and <http://www.economist.com/node/8038249>, accessed May 14, 2014.
15. Brian O'Keefe, "Meet Your New Neighborhood Grocer," *Fortune*, May 13, 2002, pp. 93-96; Robert Berner and Stephanie Anderson Forest, "Walmart Is Eating Everybody's Lunch," *Business Week*, April 15, 2002, p. 43.

* Sometimes called preliminary control or steering control.

CHAPTER

19

Control Techniques and Information Technology

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Explain the nature of budgeting and the types of budgets
2. Describe zero-base budgeting
3. Discuss non-budgetary control devices
4. Explain time-event network analysis as a major technique of planning and control
5. Understand the nature and applications of information technology
6. Recognize the importance of computers in handling information
7. Explain the opportunities as well as challenges created by the new information technology
8. Discuss the digital economy as well as developments in e-commerce and m-commerce
9. Understand customer relationship management

Although the basic nature and purpose of management control does not change, a variety of tools and techniques have been used over the years to help managers control. As this chapter will show, all these techniques are, in the first instance, tools for planning. They illustrate

the fundamental truth that the task of controls is to make plans succeed; naturally, in doing so, controls must reflect plans and planning must precede control.

THE BUDGET AS A CONTROL DEVICE

A widely used device for managerial control is the budget.* Indeed, it has sometimes been assumed that budgeting is *the* device for accomplishing control. However, many non-budgetary devices are also essential.

The Concept of Budgeting¹

Budgeting is the formulation of plans for a given future period in numerical terms. As such, budgets are statements of anticipated results, either in financial terms—as in revenue and expense as well as capital budgets—or in nonfinancial terms—as in budgets of direct labor hours, materials, physical sales volume, or units of production. It has sometimes been said that, for example, financial budgets represent the “dollarizing” of plans.

Budgeting The formulation of plans for a given future period in numerical terms.

Entrepreneurial Perspective

In New Ventures, Cash is King

While well-established businesses closely budget, track, and report numerous financial measures of their business operations, entrepreneurs that lead new ventures are more focused on their cash flow. This is because in a new venture, cash is usually limited and the planning of cash outlays and receipts is essential to the venture's survival. Issues such as collection of customer receipts, negotiation of extended payment terms to suppliers, and

establishing lines of credit with lenders can make or break a new enterprise. Controlling the flow of cash in financing, operations, and investment is always on the entrepreneur's mind as she/he plots her company's strategy for growth in the short and long term.

We asked a leading Silicon Valley venture capitalist, Elton Sherwin of Ridgewood Capital, how he controls the firms in his portfolio. Mr. Sherwin indicated that he uses the budget to control the companies in his portfolio. Specifically, he asks three questions: "1. Have they raised enough money? 2. Are they spending the right amount of money? 3. Are they spending money on the right things?"

Dangers in Budgeting

Budgets are used for planning and control. Unfortunately, some budgetary control programs are so complete and detailed that they become cumbersome, meaningless, and unduly expensive. In addition, budgetary control may be used for the wrong reasons.

How often have you heard managers say "This is a good idea, but it's not in my budget"? Budgets often control the wrong things. They measure inputs but ignore outputs such as product quality and customer satisfaction. These items are difficult to measure, yet they may be the key to success or failure of the business. Managers may make unwise decisions to meet the budget, especially if incentive pay is given for staying within the budget. They may not invest in research and development, make capital investment for productivity, or invest in activities that will eventually result in greater market share because these investments do not show immediate results. Some of these items should be included in the long-range plan rather than in the one-year budget. Real savings may come from more efficient machines, new products, or other creative ideas, not from adhering to the budget.

Zero-Base Budgeting

One type of budgeting is **zero-base budgeting**. The idea behind this technique is to divide enterprise programs into "packages" composed of goals, activities, and needed resources, and then to calculate the costs

for each package from the ground up. By starting the budget of each package from base zero, budgeters calculate costs afresh for each budget period; thus, they avoid the common tendency in budgeting of looking only at changes from a previous period.

Zero-base budgeting Dividing enterprise programs into packages composed of goals, activities, and needed resources, and then calculating the costs for each package from base zero.

This technique has generally been applied to so-called support areas rather than to actual production areas, on the assumption that there is room for discretion in expenditures for most programs in areas such as marketing, research and development, personnel, planning, and finance. The various programs thought to be desirable are costed and reviewed in terms of their benefits to the enterprise, and are then ranked in accordance with those benefits and selected on the basis of which package will yield the benefit desired.

The principal advantage of this technique is, of course, the fact that it forces managers to plan each program package afresh. As managers do so, they review established programs and their costs in their entirety along with newer programs and their costs.

TRADITIONAL NON-BUDGETARY CONTROL DEVICES

Of course, there are many traditional control devices not connected with budgets, although some may be related to and used with budgetary controls. Among the more important are the use of statistical data of many aspects of the operation, special reports and analyses of specific areas, the operational audit and independent appraisal by a staff of internal or external auditors, and personal observation such as managing by walking around.

TIME-EVENT NETWORK ANALYSES

Another planning and control technique is the time-event network analysis called the program evaluation and review technique (PERT).

Before the development of PERT, there were other techniques designed to assess how the parts of a program fit together during the passage of time and events.

Gantt Charts

The first of these techniques was the chart system developed by Henry L. Gantt early in the 20th century that culminated in the bar chart bearing his name ([Figure 19-1](#)). Although simple in concept, this chart, showing time relationships between the “events” of a production program, has been regarded as revolutionary in management. What Gantt recognized was that total program goals should be regarded as a series of interrelated supporting plans (or events) that people can comprehend and follow. The most important developments of control reflect this simple principle as well as basic principles of control such as picking out the more critical elements of a plan to watch carefully.

Gantt chart A bar chart that shows the time relationships between the “events” of a production program.

Milestone Budgeting

As a result of the development of further techniques from the principles of the Gantt chart and with better appreciation of the network nature of programs, “milepost” or “milestone” budgeting and PERT were devised, contributing to better planning and control of many projects and operations. Milepost or milestone budgeting breaks a project down into controllable pieces and then carefully follows them. Even relatively simple projects contain a network of supporting plans or projects. In this approach to control, milestones are defined as identifiable segments. When accomplishment of a given segment occurs, costs or other results can be determined.

Innovative Perspective

Planning and Control in Engineering

The best way to plan and control an engineering project is to break it down into a number of events such as completion of preliminary drawings, an experimental model, a package design, a packaged prototype, and a production design. Or a project might be broken down vertically into subprojects, (e.g., the design of a circuit, a motor, a driving mechanism, a sensing device, a signal feedback device, and similar components) that can be completed individually, in a time sequence so that components are ready when needed. Milestone budgeting allows a manager to see a complex program as a series of simpler parts and thus to maintain some control through knowing whether a program is succeeding or failing.

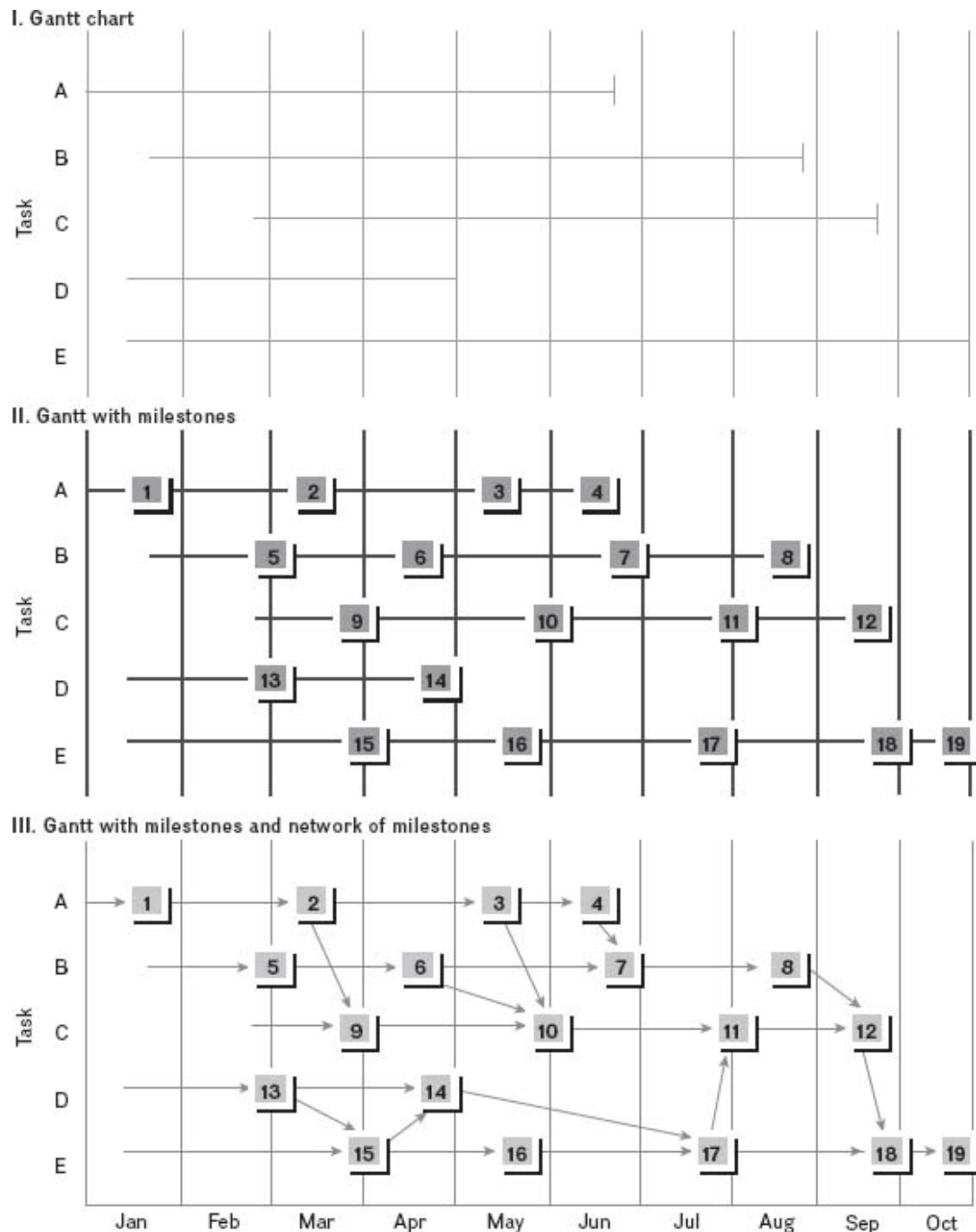


FIGURE 19-1 Transition from a Gantt chart to PERT

The Gantt chart is the scheduled time of accomplishing a task, such as procurement (task A), and the related schedules of doing other tasks, such as manufacture of parts (task B). When each of these tasks is broken down into milestones, such as the preparation of purchase specifications (task A-1), and when network relationships between the milestones of each task to those of other tasks are worked out, the result provides the basic elements of a PERT chart.

Program Evaluation and Review Technique*

Developed by the Special Projects Office of the U.S. Navy, PERT was first formally applied to the planning and control of the Polaris Weapon System in 1958 and worked well in expediting the completion of that program. For a number of years, it was so enthusiastically received by the armed services that it became virtually a required tool for major contractors and subcontractors in the armament and space industry. Although PERT is no longer much heard of in defense and space contracts, its fundamentals are still essential tools of planning and control. Moreover, in a host of nongovernmental applications, including construction, engineering and tooling projects, and even such simple tasks as the scheduling of activities to produce monthly financial reports, PERT or its companion network technique, the critical path method, may be used.

Major features of PERT

PERT is a time-event network analysis system in which the various events in a program or project are identified, with a planned time established for each. These events are placed in a network showing the relationships of each event to the other events. In a sense, PERT is a variation of milestone budgeting ([Figure 19-1](#)).

PERT A time-event network analysis system in which the various events in a program or project are identified, with a planned time established for each.

[Figure 19-2](#) shows a PERT flowchart for the major assembly of an airplane. This example illustrates the basic nature of PERT. Each circle represents an *event*—a supporting plan whose completion can be measured at a given time. The circles are numbered in the order in which the events occur. Each arrow represents an *activity*—the time-consuming element of a program, the effort that must be made between events. *Activity time*, represented by the numbers beside the arrows, is the time required to accomplish an event.

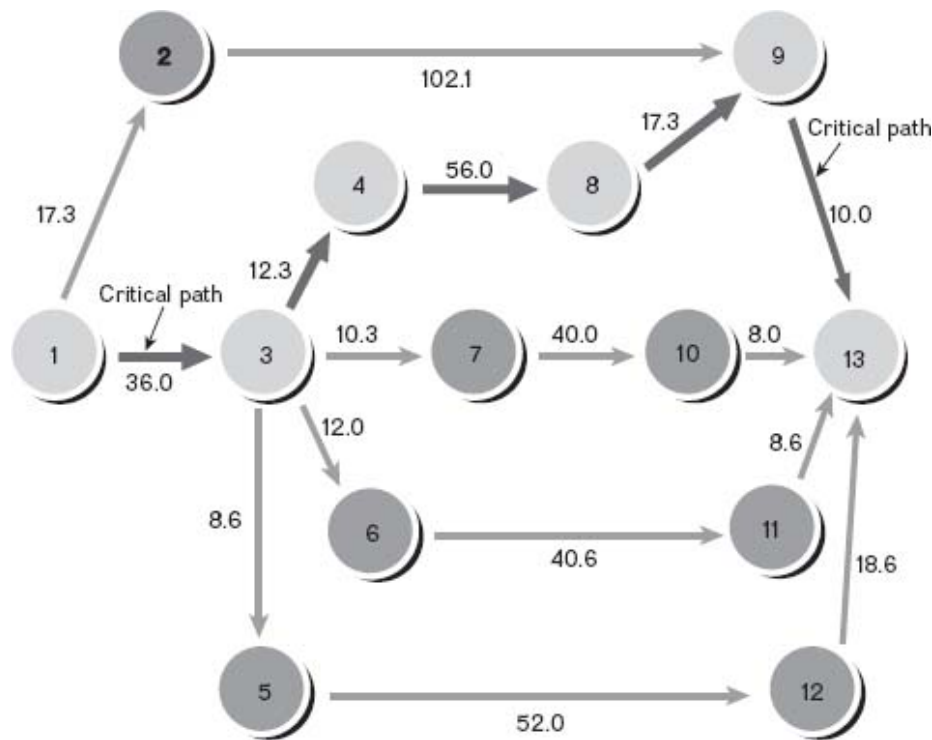


FIGURE 19-2 PERT flowchart

Events (major milestones of progress) in the major assembly of an airplane (shown with time in weeks): (1) order program go-ahead; (2) initiate engine procurement; (3) complete plans and specifications; (4) complete fuselage drawings; (5) submit GFAE* requirements; (6) award tail assembly subcontract; (7) award wings subcontract; (8) complete manufacture of fuselage; (9) complete assembly of fuselage engine; (10) receive wings from subcontractors; (11) receive tail assembly from subcontractors; (12) receive GFAE; (13) complete aircraft.

*GFAE: government-furnished airplane equipment.

In this example, only a single time is shown for each activity, but in the original PERT program there were three *time estimates*: “optimistic” time, an estimate of the time required if everything goes exceptionally well; “most likely” time, an estimate based on the time the project engineer really believes is necessary for the job; and “pessimistic” time, a time estimate based on the assumption that some logically conceivable bad luck, other than a major disaster, will be encountered. These estimates are often included in PERT because it is very difficult, in many engineering and development projects, to estimate time accurately. When several estimates are made, they are usually

averaged, with special weight given to the most likely estimate; a single estimate is then used for calculations.

Critical path The sequence of events that takes the longest time and that has zero (or the least) slack time.

The next step is to compute the *critical path*, which is the sequence of events that takes the longest time and that has zero (or the least) slack time. In [Figure 19-2](#), the critical path comprises events 1-3-4-8-9-13. Over this path, the activity time for this sequence of events is 131.6 weeks; if promised delivery is in 135 weeks, even this critical path will have been completed 3.4 weeks ahead of time. Some of the other paths are almost as long as the critical path. For example, the path 1-2-9-13 is 129.4 weeks. This is not unusual in PERT charts, and it is customary to identify several crucial paths in order of importance. Although the critical path has a way of changing as key events are delayed in other parts of the program, identifying it at the start makes possible close monitoring of this particular sequence of events to ensure that the whole program is on schedule.

Typical PERT analyses involve hundreds or thousands of events. Even though smaller PERT analyses can be done manually, estimates indicate that when more than 200-300 events are involved, it is virtually impossible to handle the calculations without a computer.

Strengths and weaknesses of PERT

There are five important advantages of PERT. First, it forces managers to plan because it is impossible to make a time-event analysis without planning and seeing how the pieces fit together. Second, it forces planning all the way down the line because each subordinate manager must plan the event for which he or she is responsible. Third, it concentrates attention on critical elements that may need correction. Fourth, it makes possible a kind of forward-looking control; a delay will affect succeeding events and possibly the whole project, unless the manager can make up the time by shortening the time allocated to some action in the future. Fifth, the network system with its subsystems enables managers to aim reports and pressure for action at the right spot and level in the organization structure at the right time.

PERT also has certain limitations. Because of the importance of activity time to its operation, the technique is not useful when a program is nebulous and no reasonable “guesstimates” of schedule can be made. Even in this case, however, insurance can be “bought” by such practices as putting two or more groups of people to work on an event when costs permit. A major disadvantage of PERT is its emphasis on time only, not on costs. While this focus is suitable for programs in which time is of the essence or in which, as so often is the case, time and costs have a close, direct relationship, the tool is more useful when considerations other than time are introduced into the analysis. (There is, however, another program called PERT/cost that does consider costs.)

INFORMATION TECHNOLOGY²

The developments in information technology greatly facilitate organizational control at a relatively low cost. The systems model of management (Chapter 1) shows that communication is needed for carrying out managerial functions and for linking the organization with its external environment. Communication and the management information system (MIS) are the linkage that makes managing possible.

At the outset, one has to realize the distinction between data and information. *Data* are the raw facts that may not be very useful until they become *information*, that is, after they are processed and become meaningful and understandable by the receiver (see also the communication model in Chapter 17). While this applies to interpersonal communication, it is also true for information technology.

Information technology encompasses a variety of technologies, including various kinds of hardware (e.g., computers, printers), software (e.g., operating systems, word or data processing), and computing and communication technologies (e.g., telecommunication, database management). In fact, new technologies are rapidly developing, such as 4G, the fourth generation of wireless technology, expanding and enhancing the capabilities of information technology. Even before 4G was widely implemented, the fifth-generation (5G) technology developed.

Information technology has promoted the development of MIS. The definition of the term **MIS** varies. It is defined here as a formal system of gathering, integrating, comparing, analyzing, and dispersing information internal and external to the enterprise in a timely, effective, and efficient manner to support managers in performing their jobs. MIS has to be tailored to specific needs and may include routine information such as monthly reports; information that points out exceptions, especially at critical points; and information necessary to predict the future.

Management information system A formal system of gathering, processing, and dispersing information internal and external to the enterprise in a timely, effective, and efficient manner to support managers in their jobs.

Electronic equipment permits fast and economical processing of huge amounts of data. The computer can, with proper programming, process data toward logical conclusions, classify them, and make them readily available for use. As noted earlier, data do not become information until they are processed into a usable form that informs.

Expansion of Basic Data

The focus of attention on management information, coupled with its improved processing, has led to the reduction of long-known limitations. Managers have recognized for years that traditional accounting information, aimed at the calculation of profits, has been of limited value for control. Yet, in many companies, this has been virtually the only regularly collected and analyzed type of data. Managers need all kinds of non-accounting information about the external environment, such as social, economic, political, and technical developments. In addition, they need non-accounting information on internal operations. The information should be qualitative as well as quantitative.

While not nearly enough progress has been made in meeting these requirements, the computer, plus operations research, has led to an enormous expansion of available managerial information. One sees this especially in relation to data on marketing, competition, production and distribution, product costs, technological change and development,

labor productivity, and goal accomplishment. When readers of *The Economist* were asked what kind of technology would influence economic activity, the vast majority listed information technology.³

Information Indigestion and Intelligence Services

Managers who have experienced the impact of better and faster data processing are justly concerned about the danger of “information indigestion.” With their appetite for figures whetted, the data originators and processors are turning out material at an almost frightening rate. Managers are complaining that they are being buried under printouts, reports, projections, and forecasts that they do not have time to read or cannot understand or which do not fill their particular needs.

One attempt at solving the problem of information overload is the establishment of intelligence services and the development of a new profession of intelligence experts. The service is provided by specialists who know (or find out) what information managers need and who know how to digest and interpret such information for managerial use. Some companies have established organizational units under such names as “administrative services” or “management analyses and services” for making information understandable and useful.

Managing by the Numbers⁴

Since its early days of the development of managerial thought, attempts have been made to numberize managing. Frederick Taylor, the father of scientific management, aimed at improving productivity and efficiency (Chapter 1). Similarly, operations management focused on the activities necessary for producing goods and services (Chapter 20). Various tools were used to quantify activities and tasks. Edward Deming, the quality guru, used statistical tools to improve quality (Chapter 1). More recently, the Six Sigma tool (see GE’s Jack Welch in Chapter 13) focused on quality and customer satisfaction. More recently, attempts are made to model workers in large organizations such as IBM by using concepts such as “numerati.” The idea is to build mathematical models of people in a large organization.

Modeling organization people may be illustrated by a project using numerati concepts in a worldwide organization such as IBM. Thus, the job may be described in numerical terms, and so would be the skills needed. People may be drawn from different organizational units located around the world. The budget would also be stated in numbers. To find suitable people, numerical profiles can be searched in a huge data base. For this complex project, concepts such as described in the book *The Numerati* authored by Stephen Baker may be employed. The attempt is to quantify human variables through the uses of very large data bases by combining factors to achieve productivity and efficiency. These data bases may consist of employees' emails, cell phone conversations, electronic calendars, and computer messages. These bits of data may also identify informal networks.

But this approach must be accompanied by words of caution: People may resist being treated as numbers. They may feel that their privacy has been violated and they want to be treated as dignified human beings, not as commodities. The approach may recall the negative aspects of industrial engineering and companies may be perceived as the BIG BROTHER.

As pointed out in the discussion on the management theory jungle (Chapter 1), numerical approaches to management such as the mathematical or "management science approach" or the reengineering or total quality approaches made great contributions to the development of management thought, but still many human variables cannot be quantified. The authors of this book as well as most management textbook authors recognize that the best approach is to organize management knowledge according to the managerial functions of planning, organizing, staffing, leading, and controlling—the framework of this book.

OPPORTUNITIES AND CHALLENGES CREATED BY INFORMATION TECHNOLOGY

Preventing the unauthorized use of information is just one of many challenges created by information technology. Other challenges as well as opportunities brought by information technology include analytics in

managing, speech recognition devices, telecommuting, computer networks, the Internet, and other topics.

overcoming resistance to the use of computers, adapting speech recognition devices, telecommuting, installing computer networks, and using the Internet.

Analytics in Managing⁵

In its simplest term, analytics is the science of analysis. Analytics uses computer technology, statistics, and operations research to solve business and other problems. Business may use statistical data and quantitative analysis to arrive at decisions. Data is raw material, but to be really useful, data needs to be converted to information that informs people.

Analytics, for example, may be applied to portfolio analysis used by banks to scrutinize accounts in terms of value, risk, and other factors. A bank loan may be more risky in certain geographic locations than in others.

Innovation through Analytics

The wide application of the Internet by organizations to collect and manage data has created a sea of information, much of which has not been effectively analyzed or leveraged. Analytics is a rising field in which sophisticated statistical algorithms are used to analyze the mountains of data available in order to help organizations improve their customer service and operate more efficiently. In a recent *Harvard Business Review* article, Thomas Davenport argues that some organizations are competing on analytics.⁶ Davenport identified 11 organizations that he classified as full-bore analytics competitors, as analytics was key to their overall enterprise strategy. Firms such as Amazon, Marriott, and UPS leverage a company-wide focus on the collection, analysis, and application of customer and operational information to improve how they do business in terms of better customer service to drive additional revenues or to cut operations costs out of their business model. He argues for executive support for this

enterprise approach in order to build a company culture that accepts and leverages analytics to improve their business processes.

Analytics is a rising field in which sophisticated statistical algorithms are used to analyze the mountain of data available in order to help organizations improve their customer service and operate more efficiently.

The findings from the application of analytics to organizational data also may lead to innovation in how the customer experience is improved through more customized products and services. While the innovation process may begin with observing customer behavior, the rigorous analysis of customer data will help to confirm optimal strategies to enhance the customer experience with better crafted products and services and pricing that increase customer retention and profitable revenue growth.

Computer Networks

The widespread use of stand-alone computers often results in duplication of efforts. The database in the mainframe or the minicomputer, for example, may not be accessible from the desktop computer. Therefore, computer networks have been developed that link workstations with each other, with larger computers, and with peripheral equipment. The interconnection allows users at several workstations to communicate with each other as well as to access other computers. Moreover, workstations can be connected to costly hardware that may be underutilized by a single user. For example, laser printers or tape backup units for saving data files can be shared.

There are many other applications of computer networks such as e-mail and the collection, dissemination, and exchange of data, information, and knowledge. Although computer networking is still in its infancy, new technological developments are rapidly changing the system of information handling.

Cisco's Approach to "Convergence"⁷

Technology undergoes rapid changes as illustrated by convergence, meaning integrating computers, entertainment systems, and the Internet. Many players are in that market ranging from Apple, to Hewlett-Packard to Microsoft, to Sony, and to Cisco. Cisco's competitive strengths are in networking gear, for example, with the Linksys product. To focus on the customer, Cisco introduced the Linksys Wireless Home Audio multiroom system. Other Cisco brands include large screen TV set up boxes by Scientific Atlanta and Flip by Pure Digital producing very simple video cameras. By combining Cisco's strengths in networking, the company hopes to take advantage of the current networking trend.

The Internet

Internet is the largest network of computers. Actually, it is a network of networks which range from large formal networks at AT&T to informal ones that can be accessed by anyone. The Internet started at the U.S. Department of Defense in 1969, with the purpose of linking it with military research contractors and universities conducting research for the military. Now, governments, universities, companies, and anyone with a computer and a modem can use the Internet. Private persons often use online service such as Google, Yahoo, and other companies to send and receive e-mail, "chat" with other people anywhere in the world, and retrieve information from online libraries, newspapers, and other sources. Anyone with Internet connection can check the weather forecast or sports results. Internet is also an excellent tool for conducting company research, preparing a term paper, and doing business such as buying products from Yahoo.⁸ Another common use of the Internet is for discussion on bulletin boards of any topics, ranging from computer assistance to hobbies and sports events. Building online communities is another common use of the Internet.⁹

Other Types of Networks

Besides the Internet, there are other types of networks. The **intranet** is a network that applies computer and Internet technologies to an organization or selected groups within the organization. Similarly, the **extranet** also uses computer and Internet technologies, but it connects selected users inside as well as outside the organization. For example, a purchasing agent may be linked to certain vendors for conducting selling and buying transactions.

Groupware

Networks facilitate the management process and other business activities. A group of people on a network can collaborate over long distances at the same time using **groupware**. This software allows a document to be shown to several users on their monitors and for them to comment or make changes to the document. Thus, people who may be located in different parts of the world can collaborate on the same task simultaneously.

Groupware Software that enables a group of people on a network to collaborate over long distances at the same time.

Freeware: The Search for a Business Model¹⁰

There is no general agreement on the **freeware** term. It usually pertains to a fully functional software with no cost to the user. However, restrictions may be imposed on the user-only for personal use and not for commercial purposes. Note that freeware is different from shareware, which requires the user to pay after an initial period or to upgrade to extra functionality.

Freeware usually pertains to a fully functional software with no cost to the user

Today, much information that previously cost money can now be obtained free. For example, Wikipedia is a web-based free encyclopedia based on the collaboration of contributors. Many websites replace agents or provide access to companies. Trading websites replaced agents, Turbo Tax, the accounting software, replaced

accountants, and the search engines replaced travel agents. There are also other free websites. For example, on the iPhone or iPod Touch, one can listen to music for free on Pandora; on Hulu, one can see movies for free; and Skype allows free phoning. YouTube is a video sharing website that is used by individuals and organizations. For example, in 2009 the Vatican entered the technology world with its own website on YouTube (<http://de.youtube.com/vatican?hl=en>). The program is available in several languages. So, what is the business model for those companies who provide free access to their products or services?

The traditional model was as follows: First, it started with an idea, and then money was raised to bring the idea to the market. If successful, additional money was obtained to expand the business, and finally a big company bought the entrepreneurial product or service. However, during the financial global meltdown in 2008, it became difficult to raise money and companies were searching for new business models. The popular Facebook has many customers, but it was also ineffective in raising advertising money. The widely used YouTube was also struggling. One may also be wondering how Microsoft could compete in markets where word processors and spreadsheets are available for free. Microsoft created a web version of its business software and made it available for free to small and young enterprises that are less than three years old and have revenues of less than \$1 million. The hope was that as the firms grow, they will buy and use Microsoft's programs.

While users of software benefit from the freebees, companies are struggling to find a profitable business model.

Information Security¹¹

With the growing use of information technology, the concern for security also increases. Not only businesses but also individuals are vulnerable to computer break-ins or interception or alteration of electronic transmissions. A hacker (someone who breaks into a computer) may alter or even destroy bank or other records. Protection of computers can be afforded through encryption, whereby a secret code is used to scramble the message so that it is not readable. The use of a firewall also provides some protection. Firewalls come as software programs

(e.g., Norton Personal Firewall or Zone Alarm Pro) or as hardware such as the Ethernet router. A great variety of antivirus programs protect against computer viruses or worms, which may cause extensive damage to computers and networks. Of additional concern are the people who work with information systems in organizations. They need to be responsible, be trained, and be held accountable for their behavior with severe penalties attached for breaching security. Individuals and companies also should protect data by regularly making backup copies and storing them in a secure place, perhaps outside their place of work.

THE DIGITAL ECONOMY, E-COMMERCE, AND M-COMMERCE

Alan Greenspan, chairman of the U.S. Federal Reserve Board, one of the most influential persons in the world of finance, stated in 1999: “The newest innovations, which we label information technology, have begun to alter the manner in which we do business and create value, often in ways not readily foreseeable even five years ago.” **E-commerce-**business transactions on the Web-is changing the way we do business.

The Emerging Digital Economy ¹²

Information technology affects most aspects of business and personal life. While computer power is growing rapidly, its price is dropping dramatically. The Ford Taurus car of today has more computing power than the million-dollar mainframe computer in the Apollo space program. Information technology raises productivity not only in the production and distribution of goods, but also in services. Productivity improvement, in turn, results in higher living standards. This new technology impact is global, increasing competition and innovation. The ability to easily process vast amounts of data in research and development has shortened the development time of new products, speeding up their introduction to the market. ¹³

One of the major impacts of the Internet is on the way business is conducted. Relationships with suppliers and customers are changing dramatically. Telecommunication and information technology have

contributed greatly to the longest peacetime economic expansion in the United States. The investment in those technologies finally paid out. Today, we have e-everything: e-mail, e-commerce, e-business, e-cash (use of smart cards and digital cash), e-travel, e-finance, e-loan, e-music, e-books, e-stamps, and many more.

The economic gains of e-commerce come from the lower costs of online companies (when compared to brick and mortar firms with physical stores), reduction in distribution costs, and the elimination of intermediaries. Buyers benefit from being able to compare prices and select the best choice from the comfort of their home or office. How can the brick and mortar businesses with their higher costs compete with e-businesses? Stores like Kmart and Walmart now also transact their business through the Web, becoming “clicks and mortar” or “clicks and bricks” companies. This means you can make purchases with a click of the mouse or by physically visiting their stores.

The Internet facilitates four kinds of transactions (Figure 19-3). These transactions are:

	Consumer	Business
Consumer	C2C eBay (auction)	C2B Priceline (“you name the price” travel offers)
Business	B2C Amazon (books, etc.) Travelocity (travel)	B2B Ford, General Motors, DaimlerChrysler (manufacturers to suppliers)

FIGURE 19-3 Matrix for e-commerce

Adapted from “E-Commerce Survey,” *The Economist*, February 26, 2000, Insert p. 11.

1. *Business to consumer (B2C)*. Ordering books or other items from Amazon.com or buying a computer from Dell online are examples of B2C transactions. The Safeway grocery store delivers Web-ordered groceries to customers’ home.
2. *Consumer to business (C2B)*. An example of C2B transaction is the bidding for airline tickets by would-be flyers through Priceline.

com.

3. *Consumer to consumer (C2C)*. The eBay auction website offers C2C transactions, through which individuals can sell items.
4. *Business to business (B2B)*. B2B transactions are probably going to have the greatest impact on the economy. For example, the two largest car manufacturers, General Motors (GM) and Ford, plan to transfer all purchasing to the Web within the next few years. GM claims that its website will be the world's largest virtual marketplace. So, what could this mean to the consumer in the future? Ford and GM may build cars to order for delivery in just a few days, just like you order today customized computers from Dell.¹⁴ It is possible that GM and Ford will become virtual companies with expertise in car design and brand marketing.

Covisint, the joint venture between Ford, GM, DaimlerChrysler, and Renault/Nissan, could become the exchange where suppliers trade with each other.¹⁵ There is concern that this may lead to monopolistic practices, which may prompt the U.S. Justice Department to investigate.

www.covisint.com

In the airline business, another battle takes shape. The five largest U.S. airlines-Continental, Delta, Northwest, United, and American Airlines-have a common website called Orbitz.com. This site collides with the traditional travel agents as well as with online travel agents such as Travelocity and Expedia (a Microsoft company) by trying to undercut their prices.¹⁶

www.orbitz.com

Three-quarters of all e-commerce is conducted in the United States, from which 90 percent of all commercial websites originated.¹⁷ However, the country with the most Internet hosts per inhabitant is Finland; the United States ranks second. Among the world's most admired companies identified by *Fortune* magazine, many are in the information technology business.¹⁸ Here are some familiar names: Microsoft, Dell, Cisco Systems, Intel, Nokia, and Lucent Technologies. However, in 2002, some of the so-called dot-com companies fell out of

favor with investors. Outside the information technology industry, many firms use sophisticated technologies to gain a competitive advantage, including Walmart, General Electric, and Ford.

www.nokia.com

www.lucent.com

M-Commerce and Wireless Communications

While e-commerce is changing the way business is conducted, wireless communications and m-commerce (mobile commerce) are emerging to take it further. Japan and Europe have the leading edge in this area. However, Europe lags behind Japan, even though m-commerce and wireless applications are expected to increase greatly in Europe in the coming years. Companies such as BellSouth, Motorola, Qualcomm, Ericsson, Lucent, Nokia, and Microsoft are trying to exploit opportunities in wireless communications. Wireless applications may include business transactions, provision of financial and travel information, and community sites for chatting or sending e-postcards.

www.palm.com

The developments in e-business, e-commerce, and m-commerce provide great opportunities for enterprises. Managers need to observe the trends and develop strategies to take advantage of the new technologies.

Customer Relationship Management¹⁹

Customers are the reason for an organization's existence. Therefore, to be successful, enterprises need to focus on the needs of their customers. Customer relationship management (CRM) addresses this need. Companies are also faced with the need for a system that reduces costs and coordinates sales and marketing and service efforts to provide a positive experience for their customers such as handling complaints. It is through the CRM system that data is collected on customers in a centralized data base.

CRM means promoting interactions between the customer and the organization by collecting, analyzing, and using the information to better serve the client.

There is no agreed upon definition of CRM. In broad terms, CRM means promoting interactions between the customer and the organization by collecting, analyzing, and using the information to better serve the client. CRM is not new, but it has gone through various overlapping stages. The beginning of CRM probably can be traced to Siebel Systems Inc. in 1993. In the 1990s, CRM approaches were accompanied by a number of failures. At stage 1, the emphasis was on marketing processes; stage 2 focused on customer relationships; stage 3 utilized the Internet for reevaluating the processes, redesigning systems, and self-service. It is in stage 4 that more attention is given to the specific needs of the customers.

Professor Raab and his colleagues view CRM as being based on three pillars: technology, organization, and personnel which are the foundation of customer orientation, customer satisfaction, customer retention, and customer profitability.²⁰ Another way of looking at the process of CRM is that an effective use of personnel, technology, and organization lead to customer orientation, product quality, customer satisfaction, customer retention, customer value, and eventually to company success.

CRM is used by many organizations. At Marriott, for example, it is used to boost sales, manage the Marriott Rewards program, and for the Broadsystem that expands the company's marketing program. The travel industry has extensively used programs for managing the relationships with its customers. For example, CRM has been employed by companies such as Southwest Airlines, JetBlue, Best Western, British Airways, Delta, American Airlines, Alaska Airlines, Walt Disney, Travelocity, and Expedia.

There are also concerns and limitation of CRM. For one, large investments are required for building and maintaining the system. Hardware and software are required and so is the costly training of the system's users. Customers are also concerned about their privacy and that the collected information could be misused.

Clearly, CRM is not a cure-all for solving all the problems in the relationships between an organization and its customers. However,

certain steps can help make the system succeed. Careful planning is certainly necessary. Also, since the installation of the systems requires organizational changes, people need to be prepared for the cultural adjustment. In many cases, it might not be wise to begin with a costly comprehensive system. Instead, a company may start with a pilot program and incrementally enlarge the system. At any rate, for companies to remain competitive or better to achieve a competitive edge, they may utilize CRM for systematically staying in contact with their customers who are the reason for the organization's success.

SUMMARY

A variety of tools and techniques have been used to help managers control. These techniques are generally, in the first instance, tools for planning, and they illustrate the fact that controls must reflect plans. Some of these tools have long been used by managers, others are refinements. One of the older control devices is the budget. Budgeting is the formulation of plans for a given future period in numerical terms. There are also dangers in budgeting. Budgeting is made much more precise by zero- base budgeting, in which programs are divided into "packages." The costs for each package are calculated from a base of zero. In order to make budgetary control effective in practice, managers must always realize that budgets are tools and not intended to replace managing. Among the traditional non-budgetary control devices are statistical data and their analyses, special reports and analyses, the operational audit, and personal observation.

One of the techniques of planning and control is the time-event network analysis. The PERT is a refinement of the original Gantt chart, which was designed to show, in bar chart form, the various tasks that must be done and when, in order to accomplish a program. PERT is also a refinement of milestone budgeting, in which the tasks that have to be done are broken down into identifiable and controllable pieces called milestones. When milestones are connected to form a network and the time required to complete each milestone is identified, the result is a PERT/time-

event network. Using the sequences of events and the times required for them, one can determine the critical path, which is the sequence that takes the longest time and has zero (or the least) slack time. Despite the advantages of PERT, there are also weaknesses.

The MIS is a formal system of gathering, integrating, comparing, analyzing, and dispersing information internal and external to the enterprise in a timely, effective, and efficient manner to support managers in their work. MIS allows the expansion of data, but also can lead to information indigestion. Still, the new technologies facilitate managing by the numbers, using Twitter, applying analytics to managing, using speech recognition devices, facilitating telecommuting, creating computer networks, and using the Internet effectively. Individuals benefit from freeware, but this approach is still searching for a profitable business model. Clearly, information technology not only changed businesses and private transactions, but it also increased security concerns.

The digital economy changed, if not revolutionized, e-commerce and m-commerce (mobile commerce). It changed, for example, the relationships between businesses and between businesses and the consumers. It even leads to consumer to consumer relationships, as illustrated by eBay ([Figure 19.3](#)). The interaction between businesses and customers is further enhanced by CRM.

KEY IDEAS AND CONCEPTS FOR REVIEW

- Budgeting
- Types of budgets
- Budgeting problems
- Zero-base budgeting
- Non-budgetary control devices
- Gantt chart
- Milestone budgeting
- Program evaluation and review technique (PERT), critical path

- Information technology
- Management information system
- Managing by the numbers
- Analytics
- Speech recognition devices
- Telecommuting
- Computer networks
- Internet
- Other types of networks
- Freeware
- Information security
- Emerging digital economy
- E-commerce: B2C, C2B, C2C, B2B
- M-commerce and wireless communications
- Customer relationship management

FOR DISCUSSION

1. The techniques of control appear to be as much techniques of planning as they are of control. In what ways is this true? Why would you expect it to be so?
2. If you were going to institute a program of special control reports and analyses for a top manager, how would you go about it?
3. PERT is a management invention that takes basic principles and knowledge and, through design to get a desired result, comes up with a useful technique of planning and control. Analyze PERT with this in mind.
4. Give examples of how information technology has affected you.
5. Do you use Twitter? If you do, how do you use it? What are the advantages/ disadvantages in using Twitter?
6. How will e-commerce affect you in the future on buying or selling of goods and services?

7. How would you feel about your personal data being stored in the CRM system of the organization with which you are doing business?

EXERCISE/ACTION STEPS

1. Prepare a budget for your studies at the university. What are the advantages in preparing a budget? What are some problems?
2. Select an organization that you know and show how it uses computers or conducts e-commerce.
3. Select a firm in which you have an interest in working for and conduct a balanced score card analysis from publicly available information. Given your analysis, do you believe the organization is on the road to continued success? What operational activities in organizational learning, internal processes, customer perception, and financial measures might you suggest that the organization pursue in order to obtain its strategic objective?
4. Identify two enterprise software applications that may help organizations better control their costs and operations. Describe them to the class and give examples of their use.

Innovation Case

Amazon.com-One of the Most Innovative Companies under the Leadership of Entrepreneur Jeff Bezos²¹

Amazon.com under the leadership of Jeff Bezos, an extraordinary entrepreneur, is one of the most innovative companies. The company started as an electronic bookseller, but now includes

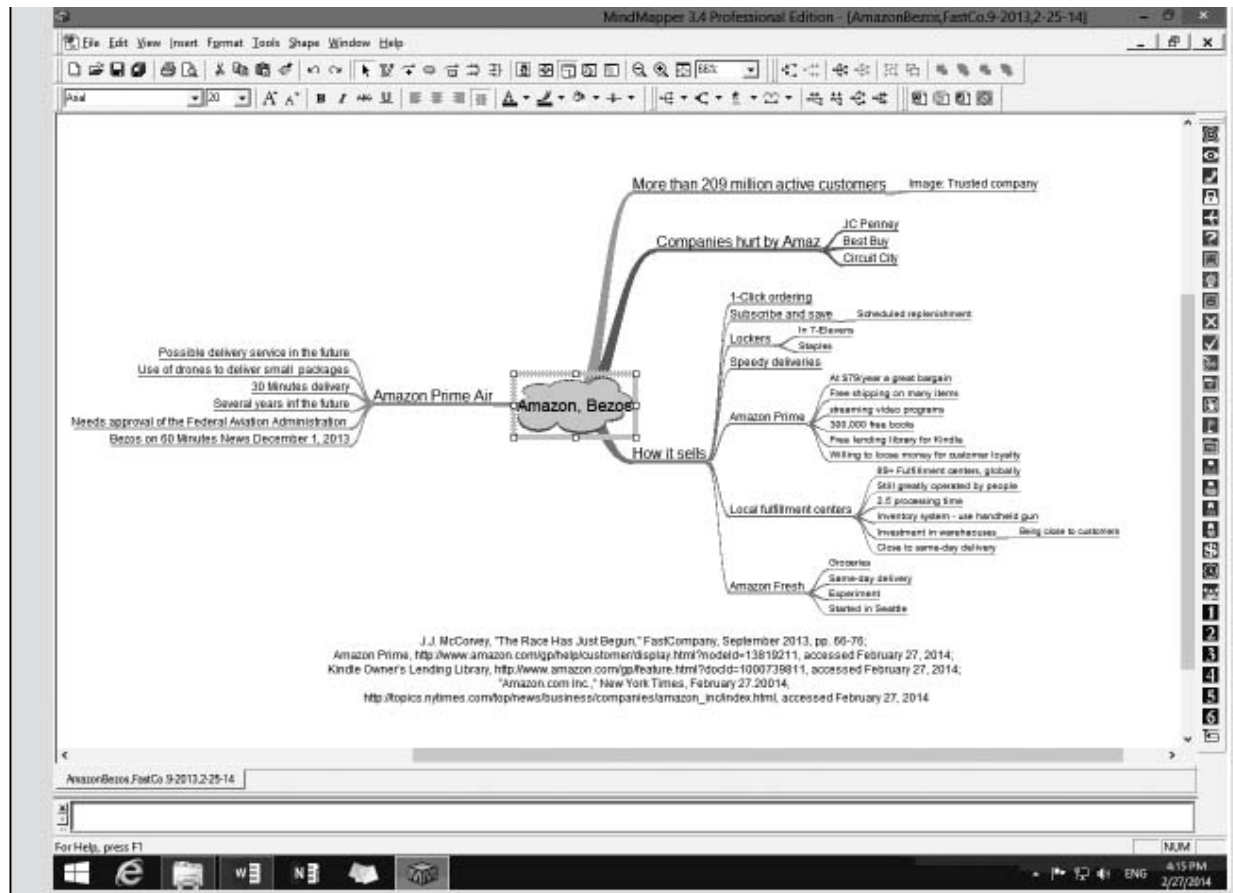
selling many products delivered around the world. The company with some 209 million customers is taking away business from established companies such as JC Penney, Best Buy, and Circuit City. Amazon's way of selling, however, is very different from those companies (although they also have some e-business activities).

Amazon's strength is speedy delivery through a network of local fulfillment centers with warehouses where products are stored. There are more than 89 fulfillment centers globally. Amazon invested heavily in warehouses in order to be closer to the customers. It usually takes 2.5 hours from the time an order is placed to the time it is processed. The inventory system uses some robotic features, but still relies extensively on people who use handheld guns for code reading. The recent acquisition of a robotic company may result in the wider use of automation.

For the customer, ordering is easy through the *1-click feature*. Also, customers can Subscribe and Save, which allows for scheduled replenishment of commonly used items. What is considered a bargain is the *Amazon Prime* feature that can be obtained for \$79 a year (increased to \$99 for new customers).^{*} At any rate, Amazon Prime provides for two-day free shipping of many items. It also allows for free *Streaming Video* programs and more than 500,000 free books in the *Kindle's Owners' Lending Library*, which includes more than 100 books on the *New York Times* best-seller list. In all, if one takes full advantage of Amazon Prime, it is a bargain. Bezos is willing to lose some money on shipping and services in exchange for customer loyalty.

The company is also experimenting with *Amazon Fresh*, which is a same-day delivery service of groceries. This experiment started in Seattle in Washington State, where Amazon's headquarters are located, but is spreading to other cities as well. After an assessment of Amazon Fresh, the future of this innovation will be evaluated for further implementation.

In December 2013, during the popular "60 Minutes" TV program, Jeff Bezos introduced the idea of *Amazon Prime Air* which could become a possible delivery service of the future. Drones would be used to deliver small packages. However, this 30-minute delivery service for the future needs the approval of the Federal Aviation Administration.²²



[Amazon.com](http://www.amazon.com) is certainly one of the most exciting companies and more innovations can be expected in the future.

Questions

1. Using the Internet, find out the status of the *Amazon Prime Air* development
2. Using the Internet, search for recent developments at Amazon.com
3. Using the Internet, identify the failures of Amazon's ventures. Why were some of the undertakings not successful?
4. Discuss the advantages and disadvantages of taking risks. What is your inclination for taking risks?

REFERENCES

1. See also Robin Cooper and W. Bruce Chew, "Control Tomorrow's Costs through Today's Design," *Harvard Business Review*, January-February 1996, pp. 88-97; "Budget Types and Uses," <http://able.harvard.edu/fbud>, accessed June 25, 2002.
2. See also Peter F. Drucker, "The Information Executives Truly Need," *Harvard Business Review*, January-February 1995, pp. 54-63; Drucker, "The Next Society," *The Economist*, November 3, 2001, Insert pp. 3-20.
3. "The Same-Only More So?" *The Economist*, December 8, 2001, Insert p. 12.
4. "Management by the Numbers" with book excerpts by Stephen Baker, *Business Week*, September 8, 2008, pp. 32-38; see the cover story "Math Will Rock Your World," *Business Week*, January 23, 2006 and <https://www.google.com/#q=Math%20Will%20Rock%20Your%20World>, accessed May 16, 2014; See various articles in *Business Week*, http://www.businessweek.com/magazine/content/06_04/b3968001.htm; "The Numerati," <http://thenumerati.net/index.cfm?postID=61>, accessed August 30, 2008.
5. "Analytics" and "Business Analytics" in Wikipedia, accessed March 20, 2011; Thomas H. Davenport and Jeanne G. Harris, *Competing on Analytics: The New Science of Winning*. Harvard Business School Press, March 2007; Thomas H. Davenport and Jeanne G. Harris, "Automated Decision Making Comes of Age," *MIT Sloan Management Review*, Summer 2005, and <http://sloanreview.mit.edu/article/automated-decision-making-comes-of-age/>, accessed May 16, 2014.
6. Thomas H. Davenport (2006). "Competing on Analytics," *Harvard Business Review*, January 2006.
7. Stephen H. Wildstrom, "Meet Cisco, the Consumer Company," *Business Week*, May 4, 2009, pp.73-74, and <http://www.businessweek.com/stories/2009-04-21/meet-cisco-the-consumer-company>, accessed May 16, 2014.1
8. See, for example, Debora Spar and Jeffrey J. Bussgang, "Ruling the Net," *Harvard Business Review*, May-June 1996, pp. 125-133.

9. Arthur Armstrong and John Hagel III, "The Real Value of On-line Communities," *Harvard Business Review*, May-June 1996, pp. 134-141; Ruth L. Williams and Joseph Cothrel, "Four Smart Ways to Run Online Communities," *Sloan Management Review*, Summer 2000, pp. 81-91.
10. Chris Anderson, "The Economics of Giving It Away," *The Wall Street Journal*, January 31, 2009, and <http://online.wsj.com/news/articles/SB123335678420235003>, accessed May 16, 2014.
11. Robert Luhn and Scott Spanbauer, "Protect Your PC," *PC World*, July 2002, pp. 92-106; "Cyberspace Invaders," *Consumer Reports*, June 2002, pp. 16-20; see also "Security," <http://www.pcmag.com/category2/0,2806,4829,00.asp>, accessed November 17, 2011; and "Security- PC World," <http://www.pcworld.com/topics/security.html>, accessed November 17, 2011. See also <http://www.pcmag.com/reviews/security-software>, accessed May 16.
12. See also Simon Moore, "Disaster's Future - The Prospect for Corporate Crisis Management and Communication" in *Annual Editions - Management*, Fred H. Maidment, ed. (New York: McGraw-Hill 2009), pp. 106-113, and http://econpapers.repec.org/article/eeebushorZv3a47_3ay_3a2004_3ai_3a1_3ap_3a29-36.htm, accessed November 18, 2011.
13. "Elementary, My Dear Watson," *The Economist*, September 23, 2000, insert pp. 7-9, and <http://www.economist.com/node/375504>, accessed May 15, 2014.
14. Andy Serwer, "Dell Does Domination," *Fortune*, January 21, 2002, pp. 71-75.
15. "A Market for Monopoly?" *The Economist*, June 17, 2000, pp. 59-60.
16. Tyler Maroney, "An Air Battle Comes to the Web," *Fortune*, June 26, 2000, pp. 315-318.
17. "First America, Then the World," *The Economist*, February 26, 2000, insert pp. 49-53.
18. Nicholas Stein, "The World's Most Admired Companies," *Fortune*, October 2, 2000, pp. 183-196.

19. Fraya Wagner-Marsh, "Customer Relationship Management" in Marilyn Helms, ed. *Encyclopedia of Management*, 5th ed. (Detroit: Gale, 2006), pp. 150-152; "Coffee, Tea, or Mortgage? Banks Are Cozying Up To Customers While Using High-Tech Tools To Identify Prospects," *Business Week*, April 3, 2006, p. 48; "Marriott Uses CRM Application to Boost Sales," <http://www.informationweek.com/news/showArticle.jhtml?articleID=6506964>, accessed May 16, 2014; "Merging Business Cultures to Support Common Goals," <http://www.google.com/search?q=Merging+Business+Cultures+to+Support+Common+Goals&rls=com.microsoft:en-us:IE-SearchBox&ie=UTF-8&oe=UTF-8&sourceid=ie7&rlz=117RNWE>; http://www.cio.com/article/31068/Merging_Business_Cultures_to_Support_Common_Goals, accessed November 17, 2011; "Marriott Hands CRM to Broadsystem," <http://www.brandrepublic.com/News/854476/Marriott-hands-CRM-duties-Broadsystem/>, accessed May 16, 2014; "Battleground CRM: How Are Leading Travel Companies Using CRM to Unlock the Full Revenue Potentials of their Customers?" http://www.hotel-online.com/News/PR2006_4th/Nov06_EyeForTravel.html, accessed May 15, 2014..
20. Gerhard Raab, Riad A. Ajami, Vidhyaranya B. Gargeya, and G. Jason Goddard, *Customer Relationship Management - A Global Perspective*, Burlington VT: Gower Publishing Company, 2008, Chapter 1.
21. J.J. McCorvey, "The Race Has Just Begun," *FastCompany*, September 2013, pp. 66-76; Amazon Prime, <http://www.amazon.com/gp/help/customer/display.html?nodeId=13819211>, accessed February 27, 2014; *Kindle Owner's Lending Library*, <http://www.amazon.com/gp/feature.html?docId=1000739811>, accessed February 27, 2014; "Amazon.com Inc.," *New York Times*, February 27, 2014, http://topics.nytimes.com/top/news/business/companies/amazon_inc/index.html, accessed February 27, 2014.
22. See also Gur Kimchi and Daniel Cuchmueller "For Proving That the Sky is Not the Limit" in *FastCompany*, June 2014, p. 67.

* Primarily because of the negative implications of budgeting in the past, the more positive phrase *profit planning* is sometimes used, and the budget is then known as the *profit plan*.

* The technique was also separately developed as the critical path method by engineers at the Du Pont Company at virtually the same time. Only PERT is discussed here because the critical path method, although different in some respects, utilizes the same principles.

CHAPTER

20

Productivity, Operations Management, and Total Quality Management

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Identify the nature of productivity issues and suggest ways to improve effectiveness and efficiency
2. Describe production and operations management as an applied case of managerial planning and control
3. Understand the operations management system
4. Discuss the tools and techniques for improving productivity
5. Recognize the importance of quality, the nature of a variety of techniques for improving quality, and lean manufacturing
6. Distinguish between supply chain management and value chain management, although the terms are sometimes used interchangeably

In a real sense, this whole book is about the improvement of productivity. But this important topic will receive special attention in

this chapter, with an emphasis on the microlevel of production and operations management.*

PRODUCTIVITY PROBLEMS AND MEASUREMENT

Undoubtedly, productivity is one of the major concerns of managers in the 21st century. This is a concern in many parts of the world. Even Japan, which is admired for productivity improvement, is now concerned about remaining competitive in the world market.

Productivity Problems

Productivity implies measurement, which in turn is an essential step in the control process. Although there is general agreement about the need for improving productivity, there is little consensus about the fundamental causes of the problem and what to do about them. The blame has been assigned to various factors. Some people place it on the greater proportion of less-skilled workers with respect to the total labor force, but others disagree. There are those who see the cutback in research and the emphasis on immediate results as the main culprit. Another reason given for the productivity dilemma is the growing affluence of people, which makes them less ambitious. Still others cite the breakdown in family structure, workers' attitudes, and government policies and regulations. Increasingly, attention shifts to management as the cause of the problem as well as the solution, which is the focus of this book.

Measurement of Productivity of Knowledge Workers

As defined in Chapter 1, **productivity** is the output-input ratio within a time period with due consideration for quality. This definition can be applied to the productivity of organizations, managers, staff personnel, and other workers. Measurement of skilled work is

relatively easy, but it becomes more difficult for knowledge work. The difference between the two kinds of work is the relative use of knowledge and skills. Thus, a person on the production line would be considered a skilled worker, while the assistant to the manager with planning as his or her main function would be a knowledge worker. Managers, engineers, and programmers are knowledge workers, because the relative amount of their work does not consist of utilizing skills as would be the case for bricklayers, mechanics, and butchers. But the job title cannot be the sole guide for making distinctions. The owner of a gas station may schedule the day's tasks, determine priorities, and direct subordinates, but he or she may also change brakes, adjust the carburetor, or realign the front wheels on a car.

Productivity The output-input ratio within a time period with due consideration for quality.

It is clear that, in general, the productivity of the knowledge worker is more difficult to measure than that of the skilled worker. (Note also that worker productivity measurement is somewhat artificial because it often ignores the cost of capital.) One difficulty in measuring the productivity of knowledge workers is that some outputs are really activities that help achieve end results. Thus, the engineer contributes indirectly to the final product. Another difficulty is that knowledge workers often assist other organizational units. The advertising manager's efforts should improve sales, but it is hard to say for sure what the exact contribution is. Still another difficulty is that the quality of knowledge workers' outputs is often hard to measure. The effects of a strategic decision, for example, may not be evident for several years, and even then the success or failure of the new strategic direction may depend on many external forces beyond the control of the manager.

It is evident that productivity improvement is achieved by the good management practices advocated throughout this book. But the discussion will now turn to the specific area of production and operations management, where measurement is relatively easy and which consequently has been the focus of productivity improvement programs in the past.

PRODUCTION AND OPERATIONS MANAGEMENT: MANUFACTURING AND SERVICE

One of the major areas in any kind of enterprise, whether business, government, or others, is production and operations management. It is also the area where managing as a scientifically based art got its start. The contributions of management pioneers like Frederick Taylor, Henry Gantt, and Frank Gilbreth, to mention only a few, indicate that their interest was largely in improving productivity and manufacturing products most efficiently while still recognizing, as they did, the importance of the human factor as an indispensable input.

In the past, **production management** was the term used to refer to those activities necessary to manufacture products. However, in recent years, the area has been generally expanded to include activities such as purchasing, warehousing, transportation, and other operations, from the procurement of raw materials through various activities until a product is available to the buyer. The term **operations management** refers to activities necessary to produce and deliver a service as well as a physical product.

Production management deals with activities necessary to manufacture products.

Operations management deals with activities necessary to produce and deliver a service as well as a physical product.

There are of course other essential activities undertaken by a typical enterprise. These activities often include research and development, engineering, marketing and sales, accounting, and finance. This chapter deals only with what has come to be called operations management or production management or often, production and operations management. It should be pointed out that this is not the same thing as operational management theory. Operational management theory is the study of the practice (managing) which that theory or science is designed to underpin.

Service organizations do not produce a physical output but provide some service as an output. For instance, the input of students with limited knowledge, skills, and attitudes becomes enriched and

transformed through attending lectures, doing case analyses, participating in exercises, and engaging in other activities that will result in the output of educated students, which is documented by a degree. Other examples of service providers are hospitals, doctors, consultants, airlines, restaurants, musicians, and the great variety of retail stores.

QUALITY MEASUREMENT IN THE INFORMATION AGE¹

In the past, the concepts of quality were mostly applied to products such as cars or refrigerators. With the increase in service companies, quality concepts must also be applied in those firms. This means the measurement of expectations, experiences, and emotions. For example, how do customers feel waiting in line in a restaurant or at Disneyland rides, or waiting on the telephone for help?

Quality in the information age takes on new dimensions. Software package quality does not only include reliability, but also technical support services, compatibility, upgradability of the software, and the integration of the information infrastructure not only with the company, but also with its suppliers and customers. Walmart, for example, gains a competitive edge through supply chain management. Focusing on the quality of the information infrastructure is critical for company success in the new information age.

Entrepreneurial Perspective

Google Brings Quality Measures to the Advertising Industry

For many years, organizations of all types have dedicated major investments in branding and sales with traditional media (newspapers, radio, TV) without clearly knowing the impact of their advertising expenditures. For example, how will the

advertiser know how many people actually read the advertisement it paid for in a local or national newspaper? The functionality of the internet (ability to track users' views and clicks on web advertisements) and Google's effective technology of tracking and placing paid advertisements has enabled organizations to know with much greater assurance the effectiveness and productivity of their advertisement expenditures. In the Google system, advertisers know exactly how many people viewed their advertisement and how many people clicked on an ad and thus visited their website. Additionally, in the Google model, advertisers pay only for the click-through and get the views of their ads for free. This service allows organizations to more productively allocate their limited advertising dollars. Further, it allows small firms establish a global reach with effective and inexpensive Internet media.

THE OPERATIONS MANAGEMENT SYSTEM

Operations management has to be seen as a system. [Figure 20-1](#) gives an overview of the operations function. In the operations management model, the *inputs* include needs of customers, information, technology, management and labor, fixed assets, and variable assets that are relevant to the transformation process. Managers and workers use the information and physical factors to produce outputs. Some physical elements such as land, plant site, buildings, machines, and warehouses are relatively permanent. Other physical elements such as materials and supplies are consumed in the process of producing outputs. The *transformation process* incorporates planning, operating, and controlling the system. There are many tools and techniques available to facilitate the transformation process. The model also reflects a constant concern with *system improvement*. *Outputs* consist of products and services and may even be information, such as that provided by a consulting organization.

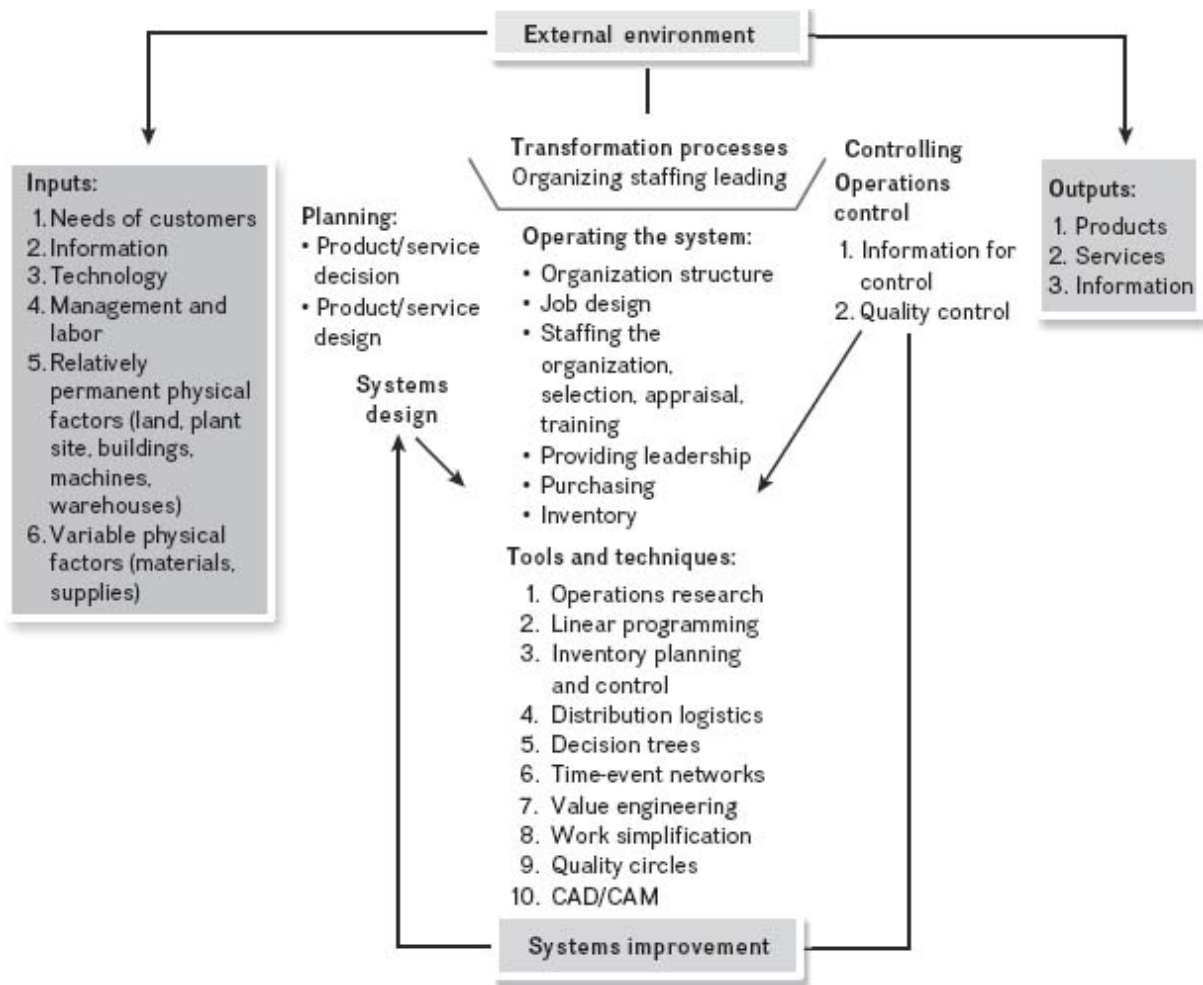


FIGURE 20-1 Operations management system

The last part of the model shows that operations are influenced by *external factors* such as safety regulations or fair labor practices. Since the external environment is discussed elsewhere in this book (especially in Chapter 2 and Part 2), it will not be expanded on here; the important point is that operations management must be an open system interacting with its surroundings.

The operations management model (Figure 20-1) serves as a framework for the discussions that follow. There is a close relationship between this model and the one introduced in Chapter 1 (Figure 1-6), since this operations model may be regarded as a subsystem of a total management system. Examples of operations systems with inputs, transformation (sometimes also called process), and outputs are presented in Table 20-1.

FIGURE 20-1 Examples of operations systems

Inputs	Transformation	Outputs
<ul style="list-style-type: none">• Plant, factory machines, people, and materials	Assembling bicycles	Completed bicycles
<ul style="list-style-type: none">• Students with limited knowledge, skills, and attitudes	Lectures, cases, experiential exercises, and term papers	Students with enhanced knowledge, skills, and attitudes
<ul style="list-style-type: none">• Client problem	Consulting: data collection and analysis, evaluation of alternatives, selection of an alternative, and recommendation	Consultant's report recommending course of action

Planning Operations

The objectives, premises, and strategies of an enterprise (Part 2) determine the search for and the selection of a product or service as its output. In this discussion, the production of physical products is emphasized, but the concepts can also be applied to the provision of services. After an end product has been selected, the specifications are determined and the technological feasibility of producing it is considered. The design of an operations system requires decisions concerning the location of facilities, the process to be used, the quantity to be produced, and the quality of the product.

Building a Business Case

Before proceeding on an investment or operations decision, managers must often validate that decision by building a business case. A business case provides the reasoning for pursuing a particular course of action. It takes into account the opportunity or problem being addressed, assesses the costs and benefits of various alternative courses of action, and makes a case to pursue one of

those alternatives. For example, the business case may help answer which of three possible software packages to adapt to a firm's operations or which of several potential markets to expand into.

Typically, a business case begins with a clear articulation of the opportunity along with the objectives of the potential course of action. Then, alternative courses of action are identified and data is gathered on each of the likely alternatives that leads to an analysis of these alternatives against the objectives and measures of success. Finally, a choice is made that takes into account relevant risks and a plan is created to implement the chosen course of action. The business case may be communicated in a written document and/or presentation.²

Special interests in a product decision

One of the basic decisions an enterprise makes is selecting a product or products it intends to produce and market. This requires gathering product ideas that will satisfy the needs of customers and contribute to the goals of the enterprise while being consistent with the strategy of the firm. In a product decision, the various interests of functional managers must be considered. The production manager may want a product that can be produced without difficulty, at a reasonable cost, and with long production runs. Engineers may share many of these aims, but they are often looking for engineering sophistication rather than ways of producing the product at a reasonable cost.

The sales or marketing manager's interest is likely to be the needs of customers, and his or her aim is to increase the sales of products through ready availability and competitive prices. Moreover, the sales manager may want to offer a broad product line without considering engineering, production, transportation, and warehousing costs and the problems involved. The finance manager's concerns are likely to be costs and profits, high return on investment, and low financial risks. The divergent interests of these functionally oriented managers and professionals influence what products will be produced and marketed, but it is the general manager who has to integrate the various interests and balance revenues with costs, profits with risks, and long-term with short-term growth.

Product and production design³

The design of a product and its production requires a number of activities. The following steps have often been suggested:

1. Create product ideas by examining consumer needs and screening various alternatives.
2. Select the product on the basis of various considerations, including data from market and economic analyses, and make a general feasibility study.
3. Prepare a preliminary design by evaluating various alternatives, taking into consideration reliability, quality, and maintenance requirements.
4. Reach a final decision by developing, testing, and simulating the processes to see if they work.
5. Decide whether the enterprise's current facilities are adequate or if new or modified facilities are required.
6. Select the process for producing the product and consider the technology and the methods available.
7. After the product is designed, prepare the layout of the facilities to be used, plan the system of production, and schedule the various tasks that must be done.

Systems design

In producing a product, several basic kinds of production layouts can be considered. One alternative is to arrange the layout according to the sequence of *production or assembly* of the product. For example, a truck assembly line may be arranged such that first the preassembled front and rear axles are attached to the frame, followed by the installation of the steering, the engine, and the transmission. Then, the brake lines and electrical cables are connected and other parts are assembled and painted. Finally, the truck is road tested.

A second alternative is to lay out the production system according to the *process* employed. In a hospital, for example, specific steps are likely to be followed: admission of the patient, treatment (which usually involves specific subprocesses), billing for service, and discharge. This may be followed by post-hospitalization treatment.

In a third kind (sometimes called *fixed position* layout), the product stays in one place for assembly. This layout is used for the assembly of extremely large and bulky items such as printing presses, large strip mining machines, and ships.

The fourth kind of layout is determined by the nature of the *project*. Building a bridge or tunnel is normally a one-time project designed to fit specific geographic requirements.

In the fifth kind, the layout is designed to facilitate the *sale* of products. In a supermarket, basic food items such as dairy products are normally located away from the checkout counters. This causes customers to walk through the long aisles and, it is hoped, select other items on the way to the dairy section.

A sixth basic approach is to design the process so that it facilitates *storage or movement* of products. Storage space is costly, and an effective and efficient design can keep storage costs low. Also, to reach an item, it should not be necessary to move many other items.

Operating the System

After a product has been selected and the system for producing it has been designed and built, the next major step is to operate the system. This requires setting up an organization structure, staffing the positions, and training people. Managers are needed to provide the supervision and leadership to carry out activities necessary to produce desired products or provide services. Other activities such as purchasing and maintaining the inventory are also required in operating the system. The aim is to obtain the best productivity ratio within a time period with due consideration for quality.

Controlling Operations with Emphasis on Information Systems

Controlling operations, as in any other case of managerial control, requires setting performance criteria, measuring performance against them, and taking actions to correct undesirable deviations. Thus, one can control production, product quality and reliability levels, inventory

levels, and workforce performance. A number of tools and techniques have been developed to do this, because their application extends beyond operations or production. Some, however, are important to operations; examined here is the role of information systems in operations control.

Information systems, which have been available for several years, integrate information virtually on instantaneous basis, thereby reducing delays that usually impede effective control. With the development of computer hardware and software, it is now possible for virtually any measurable data to be reported as events occur. Systems are available for quickly and systematically collecting data bearing on total operation, for keeping these data readily available, and for reporting without delay the status of any of a large number of projects at any instant. They are, thus, primarily information systems designed to provide effective planning and control.

The growing field of business analytics has focused on using the growing amount of data made available by online systems to provide real-time information to allow managers to better manage supply chains and make key business decisions to help enterprises run more effectively and efficiently.

Innovation Perspective

How an Information System Facilitates Operations

Applied widely now to purchasing, storage, manufacturing, and shipping, information systems may operate through dispatch stations and input centers located throughout a plant. At the dispatch centers, events are recorded as they occur, and the information is dispatched immediately to a computer. For example, when a worker finishes an assigned task on the assembly of a product, the work-order time card is put into a transactor, which electrically transmits to a computer the information that item X has passed through a certain process, has

accumulated y hours of labor, and may or may not be on schedule as well as other pertinent data. The input centers are equipped to originate information needed for a production plan automatically from programmed instructions, purchase orders, shop orders, and other authorizations. These data are fed into a computer and compared against plans, which are used as standards against which actual operations can be compared.

In addition to providing fast entry, comparison, and retrieval of information, such an integrated operations control system furnishes needed information for planning programs in areas such as purchasing, production, and inventory control. Moreover, it permits almost instantaneous comparison of results with plans, pinpointing where they differ and providing a regular (daily or more often, if needed) system of reports on deviations from plans such as items that are behind schedule or costs that are running above budget.

Other planning, control, and information systems have been developed to reflect the interaction between production and distribution operations and such key financial measures as cost, profit, and cash flow. Companies with real-time computer models can give operating managers virtually instant analysis of what-if questions as the effects of reducing or raising output, the impact of a decline in demand, and the sensitivity of the system to labor-cost increases, price changes, and new equipment additions. To be sure, system models, simulating actual operations and their impact on financial factors, are primarily planning tools, but so are most control techniques. By making possible exceptionally quick responses to the many what-if questions of operating managers, system models can greatly reduce the time elapsed in correcting for deviations from plans and can materially improve control.

These and other systems that use the technology of fast computation clearly promise to hasten the day when planning of all the areas of production can be more precise and controlling more effective. The drawback is not cost; rather, it is the failure of managers to spend time and mental effort conceptualizing the system and its

relationships or to see that someone else in the organization does so. Nevertheless, as pointed out in Chapter 18, fast information availability can never provide true real-time control of the time delay in any feedback system. Only a feedforward approach can overcome these delays.

TOOLS AND TECHNIQUES FOR IMPROVING PRODUCTIVITY

There are many tools and techniques available for improving manufacturing and service operations. They include inventory planning and control, the just-in-time (JIT) inventory system, outsourcing, operations research, value engineering, work simplification, quality circles, total quality management (TQM), lean manufacturing, computer-aided design (CAD), and computer-aided manufacturing (CAM).

Inventory Planning and Control

In the history of operations research, perhaps more attention has been directed to inventory control than to any other practical area of operations. The essential systems relationships can be seen as a little “black box” ([Figure 20-2](#)).

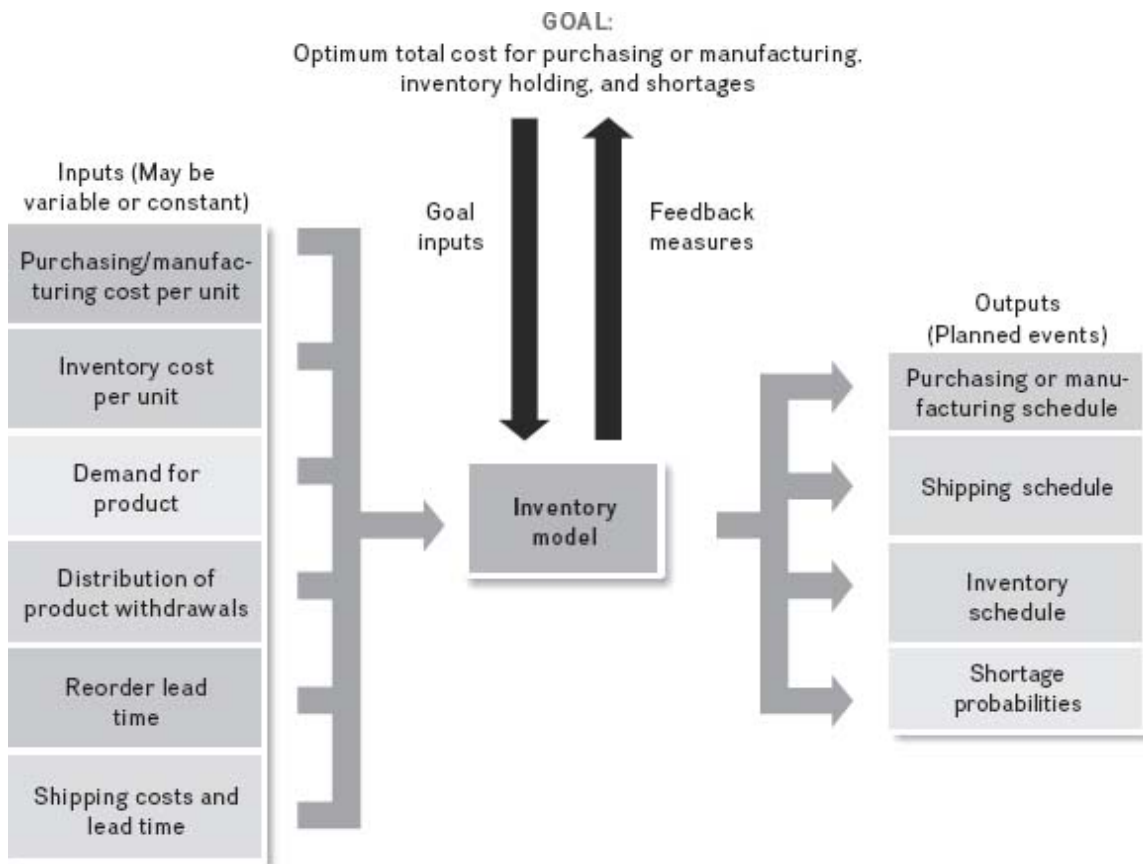


FIGURE 20-2 Inventory control model

In mathematical form, these conceptual relationships are expressed by the equation

$$Q_e = \sqrt{\frac{2DS}{H}}$$

where Q_e = economic order quantity

D = demand per year

S = setup costs

H = inventory-holding (carrying) cost per item per year

The model in [Figure 20-2](#) illustrates several things. It forces consideration of the goals desired and of the need for placing values on outputs and inputs. It also furnishes a manager with the basis for plans and with standards by which to measure performance. However, with all its advantages, this is a subsystem and does not

incorporate other subsystems such as production planning, distribution planning, and sales planning.

The **economic order quantity (EOQ) approach** to determining inventory levels has been used by firms for many years. It works reasonably well for finding order quantities when demand is predictable and fairly constant throughout the year (i.e., there are no seasonable patterns). However, for determining the inventory levels of parts and materials used for some production processes, it does not work well. For example, poor quality of parts may increase the demand for these production inputs. Thus, demand is likely to be intermittent, resulting in inventory shortages some times and excesses at other times. Firms determining inventory levels in these manufacturing settings have found that inventory control approaches such as material requirement planning and *kanban* (JIT) systems perform better than EOQ.

Just-in-Time Inventory System

One reason for Japan's high manufacturing productivity is the cost reduction it achieves through its **JIT inventory method**. In this system, the supplier delivers the components and parts to the production line only when needed and JIT to be assembled. Other names for this or very similar methods are **zero inventory** and **stockless production**.

Just-in-time inventory system The supplier delivers the components and parts to the production line only when needed and JIT to be assembled.

For this method to work, a number of requirements must be fulfilled. First, the quality of the parts must be very high—a defective part could hold up the assembly line; second, there must be dependable relationships and smooth cooperation with suppliers; and third, the suppliers ideally should be located near the company, with dependable transportation available.

Outsourcing⁴

One recent trend in the United States and Europe is **outsourcing**. This means that production and operations are contracted to outside vendors that have expertise in specific areas. The aim may be to reduce costs by saving on personnel benefits, to reduce personnel, or to be able to reassign employees to other tasks that are more important. Thus, outsourcing is an important tool for expanding a company and for maintaining a competitive position. It enables a firm to focus on its core competencies and let outside companies do what they can do best. For example, Nike, Inc., the large supplier of athletic shoes, uses outsourcing for all of its shoe production, keeping only the production of the sophisticated Nike Air system. It also outsources advertising. By focusing on what it can do best, Nike has accomplished an extraordinary growth rate.

Outsourcing The contracting of production and operations to outside vendors that have expertise in specific areas.

www.nike.com

Other reasons for outsourcing include gaining access to the best sources available worldwide, sharing of risks between the firm and its suppliers, allocating capital to key success factors, outsourcing functions that are difficult to manage, or lacking the capability to carry out certain tasks.

Outsourcing may also serve as a strategic weapon. General Motors produces almost two-thirds of its parts in-house compared to Chrysler, which “insources” only about one-third of its parts. This gives Chrysler a competitive advantage because General Motors’ in-house labor costs are substantially higher than the suppliers’. Kodak found it more effective to outsource the day-to-day operation of its fleet of 10,000 vehicles. Similarly, Procter & Gamble benefited from outsourcing its fleet operation, thus lowering its costs and improving the productivity of its sales force. Another function that may be outsourced is property management. Johnson Controls, for example, provides operation and maintenance services of buildings. The Presbyterian Medical Center in Philadelphia selected a single source for managing various tasks, including its food service, security,

environmental services, central processing, transportation, maintenance, and engineering functions. Even Apple Computer has outsourced its system and network engineering as well as its telecommunication and help desk services to a Canadian company. Outsourcing parts of the retailers' information system helped Britain's Woolworth's department store to reduce costs and gain skills.

The potential advantages of outsourcing are that it may lower the cost, it allows the firm to concentrate on its mission and focus on its core competencies. The company may also learn from the other firm. However, outsourcing can also have disadvantages such as losing some control and skills, impacting on the work culture if a lower-cost provider is chosen. The out-sourced firm may also become a competitor.

It has been suggested that, before deciding on outsourcing, a business practice reengineering* study should be conducted. The findings of this analysis may indicate which tasks are best suited for being continued within the company and which should be contracted out.

Innovation Perspective

GE's Contribution to India's Outsourcing Boom⁶

In 1989, few companies realized the outsourcing potential of India. When Jack Welch, then CEO of GE, visited India, he was told of India's need for developing the high-tech sector. But it was after 1991, when the Indian government began reducing tariff barriers and export controls that India's economy started taking off. Mr. Welch's emphasis of cost-cutting made India's companies aware of their potential competitive strengths. GE's confidence in India's advantage encouraged other investments. GE itself opened the Technology Center in Bangalore providing thousands of employees to work on many projects, including developing new refrigerators, jet engines, and many software projects. GE and

other companies contributed to India's economic growth of about 7 percent in 2005.

www.ge.com

India's competitive strength becomes clear when comparing its labor rates with that in the United States. For example, software programmers with two- to four-year experience earn approximately \$10,000 annually in India, while a U.S. counterpart makes some \$62,000. Similarly, workers at India's call centers earn some \$3,000 a year while a similar job in the United States pays \$27,000. While today many companies have located their service centers to India, only few people realize GE's contribution to India's outsourcing boom.

Operations Research

There are almost as many definitions of operations research as there are writers on the subject. For the purposes of this discussion, the most acceptable definition is that **operations research** is the application of scientific methods to the study of alternatives in a problem situation, with a view to obtaining a quantitative basis for arriving at a best solution. Thus, the emphasis is on scientific method, on the use of quantitative data, on goals, and on the determination of the best means of reaching the goals. In other words, operations research might be called "quantitative common sense."

Operations research The application of scientific methods to the study of alternatives in a problem situation with a view to obtaining a quantitative basis for arriving at a best solution.

Value Engineering

A product can be improved and its costs lowered through **value engineering**, which consists of analyzing the operations of the product or service, estimating the value of each operation, and attempting to improve that operation by trying to keep costs low at each step or part. The following specific steps are suggested:

Value engineering The process of analyzing the operations of the product or service, estimating the value of each operation, and attempting to improve that operation by trying to keep costs low at each step or part.

1. Divide the product into parts and operations.
2. Identify the costs for each part and operation.
3. Identify the relative value of the contribution of each part to the final unit or product.
4. Find a new approach for those items that appear to have a high cost and low value.

Work Simplification

Work methods can also be improved through **work simplification**, which is the process of obtaining the participation of workers in simplifying their work. Training sessions are conducted to teach concepts and principles of techniques such as time and motion studies, workflow analyses, and the layout of the work situation.

Work simplification The process of obtaining workers' participation in simplifying their work.

Quality Circles

A quality control circle or **quality circle** (QC) is a group of people from the same organizational area who meet regularly to solve problems they experience at work. Members are trained in solving problems, in applying statistical quality control, and in working in groups. Usually a facilitator works with each group, which normally consists of 6-12 members. The QCs may meet four hours a month.

Although QC members may receive recognition, they usually do not receive monetary rewards.

Quality circle A group of people from the same organizational area who meet regularly to solve problems they experience at work.
International

International Perspective

Quality Circles in Japan

For some time now, Japanese products have been well received. To a great extent, this has been due to the quality of the products; but this has not always been the case. In fact, in the 1950s and 1960s, many products made in Japan had the image of poor quality.

In order to compete in the world market, Japanese firms had to improve the quality of their products. The campaign to improve quality was initiated by regulatory action taken by the Japanese government. Shortly after World War II, the Japanese, realizing that their economic success depended on increasing exports, encouraged their government to set up a system of regulations mandating that all exporters submit to a government agency a sample of each product to be exported and that they meet demanding requirements for quality before receiving a permit to export.

The legislative drive for quality was supported by various management techniques encouraging or requiring product quality. One of the techniques is QC, now in widespread use in Japan. At first, the focus was on the analysis of quality problems, but now other problems are also dealt with such as cost reduction, workshop facilities improvement, safety, employee morale, pollution control, and employee education.

QCs evolved from suggestion programs. In both approaches, workers participate in solving work-related problems. Although the problems are usually quite specific, those dealt with by QCs are often more complex and require the involvement of several team members. The team consists primarily of rank and file workers and sometimes supervisors, too. So-called efficiency experts are usually excluded from the team.

It is interesting to note that while the concept of quality control originated in the United States, the Japanese appear to have perfected it. More recently, American firms have “rediscovered” the importance of quality, as shown by advertisements for Chrysler and Ford automobiles. At any rate, there is no reason to doubt that QCs can be used by companies in the United States and other countries, which are now faced with a competitive situation in a world market that demands quality products.

Total Quality Management⁷

One popular approach to improving quality is called **TQM**. However, this term has various meanings. In general, TQM involves the organization’s long-term commitment to the continuous improvement of quality, throughout the organization and with the active participation of all members at all levels, to meet and exceed customer expectations. This top management-driven philosophy is considered a way of organizational life. In a sense, TQM is simply effective management.

Total quality management Long-term commitment to continuous quality improvement, throughout the organization and with the active participation of all members at all levels, to meet and exceed customer expectations.

Although the specific programs may vary, they usually require a careful analysis of customer needs, an assessment of the degree to which these needs are currently met, and a plan to fill the possible gap between the current and the desired situation. The success of this quality improvement approach often needs the cooperation of

suppliers. Furthermore, to make the TQM program effective, top managers must be involved. They must provide a vision, reinforce values emphasizing quality, set quality goals, and deploy resources for the quality program. It is obvious that TQM demands a free flow of information—vertically, horizontally, and diagonally.

Training and development is very important for developing skills and for learning how to use tools and techniques such as statistical quality control. This continual effort for improving quality requires an environment that can be called a learning organization (Chapter 13). Any quality improvement effort needs not only the support, but also the involvement of management, from the top to the bottom as well as nonmanagerial employees. People need to be empowered to initiate and implement the necessary changes. In the modern, interlocking organization, teamwork often becomes a prerequisite for an effective and efficient operation.

The quality improvement efforts need to be continuously monitored through ongoing data collection, evaluation, feedback, and improvement programs. TQM is not a one-time effort; instead, it is a continual, long-term endeavor that needs to be recognized, reinforced, and rewarded.

When done effectively, TQM should result in greater customer satisfaction, fewer defects and less waste, increased total productivity, reduced costs and improved profitability, and an environment in which quality has high priority.

A concern for quality should not be restricted to business. Principles of quality improvement also apply to government. The mayor of Madison, Wisconsin, demonstrated how quality programs can be implemented in the city government. The first test came in the motor equipment division. After the initial success, a formal quality program was started citywide. What is surprising is that resistance to the program came not from unions or from the city council but from middle-level bureaucrats, who saw their power being eroded by the reduction in departmental barriers and by greater teamwork.

Quality management is of global concern. Therefore, the topics of the contributions by quality gurus, the Malcolm Baldrige National Quality Award, ISO 9000, and the European model for TQM are discussed in Chapter 3 on global management.

Lean Manufacturing⁸

A study at the Massachusetts Institute of Technology that compared American, Japanese, and European car manufacturers showed that the Japanese gained a competitive advantage from the use of fewer workers, a shorter development time, lower inventories, fewer suppliers, less production space, and less investment to produce more models. The Japanese also had much shorter delivery time and were more productive than the Americans and Europeans.

Some of the differences between traditional mass production and lean production managerial practices are listed in [Table 20-2](#).

TABLE 20-2 Mass production versus lean production managerial practices

Mass production	Lean production
<ul style="list-style-type: none">• Sporadic and inconsistent improvements	<ul style="list-style-type: none">• Continuous improvements (<i>kaizen</i>) with strategic breakthroughs
<ul style="list-style-type: none">• Satisfied with “good enough”	<ul style="list-style-type: none">• Aiming at zero defects
<ul style="list-style-type: none">• High inventory acceptable	<ul style="list-style-type: none">• Just-in-time inventory system
<ul style="list-style-type: none">• “Me” management with emphasis on individual performance	<ul style="list-style-type: none">• “We” or team management
<ul style="list-style-type: none">• Attitude that workers are the cause of poor quality	<ul style="list-style-type: none">• Responsibility for problems rests on everyone, especially management

It should be pointed out that, since the study was conducted, U.S. and European automobile manufacturers have adopted many of the lean production concepts and have become more productive. Lean thinking has even spread to nonautomotive companies. Walmart, a U.S. retail store, installed a JIT delivery system that works by letting suppliers connect to its computerized ordering system. Thus, suppliers can anticipate demands for their products. Pratt & Whitney, a U.S. aerospace firm, rearranged its work flow and thereby reduced its stock level by 70 percent and its unit costs by 20 percent.

Computer-Aided Techniques

Product design and manufacturing have been changing in recent years, largely because of the application of computer technology. CAD and CAM are part of the cornerstones of the factory of the future.

CAD/CAM help engineers design products much more quickly than they could with the traditional paper-and-pencil approach. This will become increasingly important, since product life cycles are getting shorter. Capturing the market quickly is crucial in the competitive environment. Moreover, firms can respond rapidly to the requests of customers with specific requirements. The ultimate aim of many companies is computer-integrated manufacturing.

SUPPLY CHAIN AND VALUE CHAIN MANAGEMENT ⁹

The terms supply chain and value chain management are sometimes used interchangeably. However, *Industry Week* points out that **supply chain management** focuses on the sequence of getting raw materials and subassemblies through the manufacturing process in an economical manner. **Value chain management**, on the other hand, has a broader meaning and involves analyzing every step in the process, ranging from the handling of raw materials to servicing end users, providing them with the greatest value at the lowest cost. Therefore, some suggest that supply chain management focuses more on the internal process with an emphasis on efficient flow of resources such as materials, while value chain management has similar aims with an additional concern for the external environment such as the customer.

Supply chain management focuses on the sequence of getting raw materials and subassemblies through the manufacturing process economically.

Value chain management involves analyzing every step in the process, ranging from the handling of raw materials to servicing end users, providing them with the greatest value at the lowest cost.

Professor Michael Porter popularized the **value chain process model**, which includes the primary activities of inbound logistics, operations, outbound logistics, marketing/sales, and service. The process is supported by the enterprise infrastructure, the management of human resources, technology, and procurement. Porter's model illustrates that value chain analysis has a broader orientation than supply chain management.

The **value chain process model** includes the primary activities of inbound logistics, operations, outbound logistics, marketing/sales, and service, with the process supported by the enterprise infrastructure, human resource management, technology, and procurement.

The goal of value chain management is to create a seamless chain of activities from the supplier, through the manufacturer, and to the customer to meet and exceed his or her expectations. The process requires that all managerial functions of planning, organizing, staffing, leading, and controlling be carried out effectively and efficiently in a collaborative manner. In addition, technology is used to facilitate the entire process. The previous chapter, on the various aspects of information technology, discussed how this can be done. Value chain management may require a thorough analysis of the organizational process using reengineering concepts (Chapter 7). Still another way of improving the value chain (especially for manufacturing) is to study and apply the operations management model ([Figure 20-1](#)).

International Perspective

The Interconnected Global Supply Chain Management

Thomas Friedman in his book *The World is Flat* called the new supply chaining in the global market a “flattener.”¹⁰ For example, this means that a company uses the lowest priced products wherever they may be obtained, being China, India, or elsewhere. Robin Meredith used the term “disassembly line.” I like to call this trend as the *interconnected global supply chain*. For example, clothing sold by J. C. Penney in America may include yarn produced in Korea, buttons from China, and finished in Thailand.¹¹ Similarly, Apple’s iPod may be produced in China, but containing chips that were invented in India. For many years, car companies have been using parts often produced in various countries. The aim is to obtain quality products at a low price. While the transportation costs partly offset the labor cost savings, the oil crisis, especially after 2008, will have a dramatic impact on the management of the supply chain. This is particularly true for heavier goods.

As we pointed out earlier, management is one of the most important human activities. We introduced the systems approach to managing in which key managerial activities are grouped into the managerial functions of planning, organizing, staffing, leading, and controlling. These functions are essential for any organization. However, the application of the key managerial activities and the time spent for each function varies for each organizational level and the kind of enterprise— those aiming for profit and those not for profit. Management is an art that uses the underlying sciences. The goal of all managers is the same: to create a surplus that benefits not only people and the organization, but also the nation and the society.

SUMMARY

Productivity is a major concern of managers. It implies measurement, an essential step in the control process. The productivity measurement of skilled workers is generally easier than that of knowledge workers such as managers. Yet, managerial productivity is very important, especially for organizations operating in a competitive environment.

Production management refers to those activities necessary to manufacture products; it may also include purchasing, warehousing, transportation, and other operations. Operations management has a similar meaning, referring to activities necessary to produce and deliver a service as well as a physical product. Quality measurement in the information age requires factors other than reliability, such as the information infrastructure and the services of software suppliers.

The operations management system model includes inputs, the transformation process, outputs, and the feedback system. Selecting a product or service to produce requires consideration of customer needs, organizational goals, and the various interests of the functional managers of the enterprise. Planning and designing a product and its production involves several activities. Companies can choose from at least six kinds of production layouts catering for different production or operation needs. In order to operate the system, the managerial functions of organizing, staffing, and leading must be carried out effectively. Controlling operations requires an information system often supported by computers.

A variety of tools and techniques are available for making operations more productive, including inventory planning and control, the JIT inventory system, outsourcing, operations research, value engineering, work simplification, quality circles, TQM, lean manufacturing, and a variety of computer-aided approaches. The concepts of supply chain management and value chain management are similar. However, the latter is more comprehensive and emphasizes the end user of the product or service.

KEY IDEAS AND CONCEPTS FOR REVIEW

- Productivity problems and measurement
- Production management
- Operations management
- Quality in the information age
- Operations management system
- Steps in product and production design
- Production layouts
- Inventory planning and control
- Just-in-time inventory system
- Outsourcing
- Operations research
- Value engineering
- Work simplification
- Quality circle
- Total quality management
- Lean manufacturing
- Computer-aided design
- Computer-aided manufacturing
- Supply chain management
- Value chain management
- Value chain process model

FOR DISCUSSION

1. How would you measure the productivity of managers and other knowledge workers? Explain in detail.
2. Why is the field of production and operations management good to use as a case example of planning and control techniques? Why do you think this area was favored for analysis and productivity improvement by the pioneers in the field of management?

3. Distinguish between the planning and control techniques that are usually found only in production and operations management and those that are found useful in all areas of management. Why is there a distinction?
4. Explain the nature of and reasons for each step usually found in the development of a production and operations management program.
5. There are many typical layouts used in the design of a production program. Which one is ordinarily used for the manufacture of automobiles? Why?
6. Real-time information can be widely used in the area of production, but this does not solve the problem of control. Why?
7. What tools generally found in operations research have been widely used in production and operations management? Do they have anything in common? If so, what is it?
8. Why do you believe that quality control circles have been used so much in Japan?

EXERCISES/ACTION STEPS

1. Draw the layout of your apartment or house and indicate the pathways you take while doing your typical daily chores. Show any rearrangements you could make that would increase your effectiveness and personal productivity.
2. Interview several managers in a local company and ask how they measure the quality of their operations.

INTERNET RESEARCH

1. Toyota was the first to adopt the JIT system. Dell applied the virtual network to JIT. Search the Internet for the term “just-in-time.” Find out how JIT is used by enterprises.
2. Search the Internet for the term “total quality management.” How is the approach used by organizations? Present your findings to the class.

Innovation Case

What Future Car Do You Want?¹²

Cars are changing continuously. Customers want safer, more fuel-efficient cars, and cars that “think” for the driver. To some extent, the futuristic car is already here, but many new features evolve rather quickly. Demand for gas-electric hybrids from Toyota and Honda is great as gas prices have soured. Hybrids from Toyota (Prius), Lexus (RX 40), Honda (Civic and Accord models), and Ford’s SUV (Escape) are now more often seen on U.S. highways. Companies such as DaimlerChrysler and other carmakers investing in hydrogen and fuel research. But it appears that this technology is still far away to be used in large numbers on passenger cars. The higher cost is only one factor in slowing the use of hydrogen-powered cars; safety and the need for a network of fuel stations are other considerations.

But the most dramatic advances can be expected in the use of electronic devices such as “active steering” using computer-controlled small electric motors in the BMW, cruise control that can identify when the driver gets too close to another vehicle. Increasingly, 2006 vehicles are equipped with satellite radios.

The traditional haggling over price at dealerships is also changing. Consumers now can find information not only about the technical details of cars, but also price information on the Internet.

Questions

1. What features would you be looking for in a new car?
2. List and prioritize the features important to you?
3. How important is safety, fuel economy, reliability, looks, entertainment, and others? Give the reason for your choices.

REFERENCES

1. Richard B. Chase and Nicholas J. Aquilano, *Production and Operations Management: A Life Cycle Approach*, 8th ed. (Homewood, IL: Irwin, 1997); C. K. Prahalad and M. S. Krishnan, "The New Meaning of Quality in the Information Age," *Harvard Business Review*, September-October 1999, pp. 109-18 and <http://hbr.org/1999/09/the-new-meaning-of-quality-in-the-information-age/ar/1> accessed May 17, 2014.
2. Discussion of developing a business case is based on several sources, including Harvard Business Press' "Developing a Business Case." 2011.
3. See also Erwin Danneels, "BPS: The Dynamics of Product Innovation and Firm Competences," *Academy of Management Proceedings*, 2000.
4. John S. Pearce II and Richard B. Robinson, *Strategic Management* (New York: McGraw- Hill, Irwin, 2011), Chapter 11.
5. Henry Mintzberg and James Brian Quinn, *The Strategy Process*, 3rd ed. (Upper Saddle River, NJ: Prentice Hall, 1996), p. 64.
6. "In India's Outsourcing Boom, GE Played a Starring Role," *The Wall Street Journal*, March 23, 2005.
7. For a discussion of the integration of leadership and TQM, see Sheila M. Puffer and Daniel J. McCarthy, "A Framework for Leadership in a TQM Context," *Journal of Quality Management*, vol. 1, no. 1 (1996), pp. 109-130. See also the relationship between quality and performance by Barbara B. Flynn, "The Relationship between Quality and Other Dimensions of Competitive Performance: Tradeoff or Compatibility?" *Academy of Management Proceedings*, 2000.