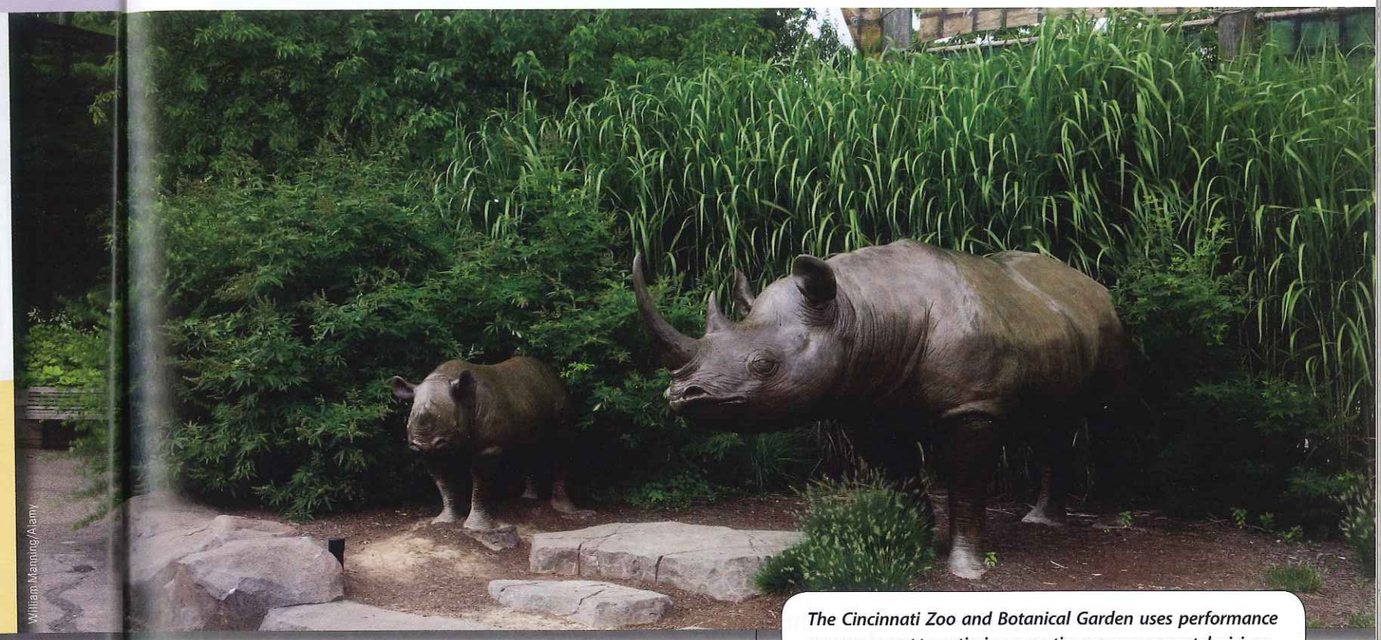
3 Measuring Performance in Operations

LEARNING OUTCOMES

After studying this chapter, you should be able to:

- 3-1 Describe the types of measures used for decision making.
- 3-2 Explain the use of analytics in OM and how internal and external measures are related.
- 3-3 Explain how to design a good performance measurement system.
- 3-4 Describe four models of organizational performance.

After you finish this chapter go to **PAGE 69** for **STUDY TOOLS**



William Manning/Alamy

The Cincinnati Zoo and Botanical Garden uses performance measurement to optimize operations management decisions.

We're sure that most readers have visited a zoo at one time or another. You might not think that operations management is important in running a zoo; but there's a lot more involved in doing so than simply caring for the animals. The Cincinnati Zoo & Botanical Garden has been using performance measurement tools to gain greater insight into visitors' behavior and tailoring operations to their preferences in order to increase visitor attendance and revenues.[1] Using data from ticketing and point-of-sale systems throughout the Zoo with membership information and geographical data gathered from the ZIP codes of all visitors, the Zoo's management created reports and dashboards that help them optimize operations management decisions.

For example, by integrating weather forecast data, the Zoo is able to compare current forecasts with historic attendance and sales data, leading to better labor scheduling and inventory planning. By opening food outlets at specific times of day when demand is highest (e.g., keeping ice cream kiosks open in the final hour before the Zoo closes), the Zoo has been able to increase sales significantly. The initiative paid for itself within three months and delivers, on average, benefits of $738,212 per year. Specifically, the Zoo has seen a 4.2 percent rise in ticket sales by targeting potential visitors who live in specific ZIP codes, and increased food revenues by 25 percent and merchandise sales by 18 percent by optimizing the mix of products and adapting selling practices to match peak purchase times. Because of the Zoo's success, other organizations such as Point Defiance Zoo & Aquarium in Washington state, and History Colorado, a museum in Denver, have embarked on similar initiatives.

WHAT DO YOU THINK?
What measures do you think a company should use to evaluate its goods or services? Provide some examples.

Measurement *is the act of quantifying the performance of organizational units, goods and services, processes, people, and other business activities.* Measurement provides an objective basis for making decisions. By measuring and analyzing customer behavior and a variety of other data, the Cincinnati Zoo is able to better manage operational decisions, leading to more successful outcomes.

Good measures provide a "scorecard" of performance, help identify performance gaps, and make accomplishments visible to the workforce, the stock market, and other stakeholders. For example, the ground-operations area of American Airlines is concerned primarily with the service passengers receive at airports.[2] The ground-operations area routinely measures several factors that customers have noted are important, such as waiting time at the ticket counter, time to opening the cabin door after gate arrival, bag-delivery time, and cabin cleanliness. The popular phrase "How you are measured is how you perform" can lead to improvements. For example, doctors at one hospital tended to rush through colonoscopies, to the detriment of the patients. After an administrator began to measure the length of the procedures and assign a quality rating, doctors' behavior changed and quality improved. However, the wrong kind of performance measure can be dangerous. In one company, engineers were measured on how quickly they could design new products. Unfortunately, those products were not what customers wanted, and revenues and profits quickly fell.

3-1 TYPES OF PERFORMANCE MEASURES

Organizational performance measures can be classified into several important categories:

- Financial
- Customer and market
- Quality
- Time

Measurement is the act of quantifying the performance of organizational units, goods and services, processes, people, and other business activities.

- Flexibility
- Innovation and learning
- Productivity and operational efficiency
- Sustainability

Within each of these categories are organizational-level measures that are of interest primarily to senior managers, as well as more specific measures that are used by operations managers. Some of them are summarized in Exhibit 3.1.

3-1a Financial Measures

Financial measures, such as cost and revenue, often take top priority in for-profit organizations. For example, the banking industry monitors closely the costs associated with checking account transactions. Internet banking is being promoted because it has a distinct cost advantage: the estimated transaction costs typically are 1 percent of branch bank transaction costs. Traditional financial measures that companies use include revenue, return on investment, operating profit, pretax profit margin, asset utilization, growth, revenue from new goods and services, earnings per share, and other liquidity measures. Nonprofit organizations, such as the Red Cross, churches, and government agencies, focus more on minimizing costs and maximizing value to their target markets, customers, and society. Monitoring cost and adherence to budgets are important factors in their operational success.

3-1b Customer and Market Measures

You have probably completed customer satisfaction surveys at a restaurant or after an Internet purchase, or perhaps you have lodged a complaint. Through customer and market feedback, an organization learns how satisfied its

Exhibit 3.1

The Scope of Business and Operations Performance Measurement

Performance Measurement Category	Typical Organizational-Level Performance Measures	Typical Operational-Level Performance Measures
Financial	Revenue and profit Return on assets Earnings per share	Labor and material costs Cost of quality Budget variance
Customer and market	Customer satisfaction Customer retention Market share	Customer claims and complaints Type of warranty failure/upset Sales forecast accuracy
Quality	Customer ratings of goods and services Product recalls	Defects/unit or errors/opportunity Service representative courtesy
Time	Speed Reliability	Flow processing or cycle time Percent of time meeting promised due date
Flexibility	Design flexibility Volume flexibility	Number of engineering changes Assembly-line changeover time
Innovation and learning	New product development rates Employee satisfaction Employee turnover	Number of patent applications Number of improvement suggestions implemented Percent of workers trained on statistical process control
Productivity and operational efficiency	Labor productivity Equipment utilization	Manufacturing yield Order fulfillment time
Sustainability	Environmental and regulatory compliance Product-related litigation Financial audits	Toxic waste discharge rate Workplace safety violations Percent of employees with emergency preparedness training

eBay: If It Moves, Measure It

A saying around eBay's headquarters is, "If it moves, measure it."[3] eBay is just one of many Internet companies that pay close attention to measurements. Web metrics such as how many people visit a web, register to become users, length of time that visitors spend on the site, and how long it takes pages to load are commonly used and tracked closely by most Internet companies. eBay monitors these things, analyzes the data, and uses the results to make timely business decisions, for example, to provide customer incentives such as free listings to stimulate demand during slow periods. But as CEO Meg Whitman noted, "You have to be careful because you can measure too much." One unique measurement that eBay monitors is the "take rate" —the ratio of revenues to the value of goods traded on the site. How might they use this metric to improve customer service and profitability?

AP Images/PRNewsFoto/eBay, Inc

customers and stakeholders are with its goods and services and performance. Other customer-focused performance measures include customer retention, gains and losses of customers and customer accounts, customer complaints, warranty claims, measures of perceived value, loyalty, positive referral, and customer relationship building.

Measures of customer satisfaction reveal areas that need improvement and show whether changes actually result in improvement. *A* **customer-satisfaction measurement system** *provides a company with customer ratings of specific goods and service features and indicates the relationship between those ratings and the customer's likely future buying behavior.* It tracks trends and reveals patterns of customer behavior from which the company can predict future customer needs and wants. It also tracks and analyzes complaints and other measures of dissatisfaction. At Federal Express, for instance, customers are asked to rate everything from billing to the performance of couriers, package condition, tracking and tracing capabilities, complaint handling, and helpfulness of employees. A restaurant might rate food appearance, taste, temperature, and portions, as well as cleanliness, staff friendliness, attentiveness, and perception of value.

Marketplace performance indicators could include market share, measures of business growth, new product and geographic markets entered, and percentage of new product sales, as appropriate. For example, in a commodity market in which Cargill Kitchen Solutions competes (making various egg products for restaurants and schools from raw eggs), its performance drivers include the U.S. share of market and total pounds of egg products sold. In the highly competitive semiconductor industry, STMicroelectronics looks not only at sales growth but also at differentiated product sales.

3-1c Quality

Quality *measures the degree to which the output of a process meets customer requirements.* Quality applies to both goods and services. **Goods quality** *relates to the physical performance and characteristics of a good.* Goods quality is generally measured using instruments, technology, and data-collection processes. For example, the dimensions and weight of a good such as a laptop computer, its storage capacity, battery life, and actual speed are easy to measure. **Service quality** *is consistently meeting or exceeding customer expectations (external focus) and service-delivery system performance (internal focus) for all service encounters.* Many companies, including Amazon.com, Federal Express, and Nordstrom, have worked hard to provide superior service quality to their customers. Measuring service quality is paramount in such organizations.

A **customer-satisfaction measurement system** provides a company with customer ratings of specific goods and service features and indicates the relationship between those ratings and the customer's likely future buying behavior.

Quality measures the degree to which the output of a process meets customer requirements.

Goods quality relates to the physical performance and characteristics of a good.

Service quality is consistently meeting or exceeding customer expectations (external focus) and service-delivery system performance (internal focus) for all service encounters.

Service-quality measures are based primarily on human perceptions of service collected from customer surveys, focus groups, and interviews. Research has shown that customers use five key dimensions to assess service quality:[4]

1. *Tangibles*—Physical facilities, uniforms, equipment, vehicles, and appearance of employees (i.e., the physical evidence).
2. *Reliability*—Ability to perform the promised service dependably and accurately.
3. *Responsiveness*—Willingness to help customers and provide prompt recovery to service upsets.
4. *Assurance*—Knowledge and courtesy of the service providers and their ability to inspire trust and confidence in customers.
5. *Empathy*—Caring attitude and individualized attention provided to customers.

These five dimensions help form the basis for quality measurement in service organizations. Note that all but the first pertain to behavioral characteristics at the service encounter level, which are more difficult to measure than physical and technical characteristics.

Every service encounter provides an opportunity for error. *Errors in service creation and delivery are sometimes called* **service upsets** *or* **service failures.** Service measures should be linked closely to customer satisfaction so that they form the basis for improvement efforts. For example, a restaurant manager might keep track of the number and type of incorrect orders or measure the time from customer order to delivery.

Errors in service creation and delivery are sometimes called **service upsets** or **service failures.**

Processing time is the time it takes to perform some task.

Queue time is a fancy word for **wait time**—the time spent waiting.

Flexibility is the ability to adapt quickly and effectively to changing requirements.

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3-1d Time

Time relates to two types of performance measures—the *speed* of doing something (such as the time to process a customer's mortgage application) and the *variability* of the process. Speed can lead to a significant competitive advantage. Progressive Insurance, for example, boasts that it settles auto-insurance claims before competitors know there has been an accident![5] Speed is usually measured in clock time, whereas variability is usually measured by quantifying the variance around average performance or targets. A useful measure is **processing time**—*the time it takes to perform some task*. For example, to make a pizza, a worker needs to roll out the dough, spread the sauce, and add the toppings, which might take three minutes. **Queue time** *is a fancy word for* **wait time**—*the time spent waiting*.

An important aspect of measuring time is the variance around the average time, as unanticipated variability is what often leads to an unhappy customer experience. Variability is usually measured by statistics such as the standard deviation or mean absolute deviation. For example, suppose that one company takes 10 days to process a new life insurance application plus or minus 1 day, while another takes 10 days plus or minus 5 days. Which life insurance process will give the best service to its customers? Which firm would you rather do business with?

3-1e Flexibility

Flexibility *is the ability to adapt quickly and effectively to changing requirements*. As new products are being introduced faster and customers expect more customization, operations managers must design value chains that are highly flexible. Flexibility can relate either to adapting to changing customer needs or to the volume of demand. **Goods and service design flexibility** *is the ability to develop a wide range of customized goods or services to meet different or changing customer needs*. Examples of design flexibility include Dell's ability to provide a wide range of customized computer hardware to accommodate home users, small businesses, and large company's server needs, or a health club's ability to customize an individual client's workout or provide cardio rehabilitation classes for heart patients. Such flexibility requires a highly adaptable operations capability. Design flexibility is often evaluated by such measures as the rate of new product development or the percent of a firm's product mix that has been developed over the past three years.

Volume flexibility *is the ability to respond quickly to changes in the volume and type of demand*. This might mean rapid changeover from one product to another as the demand for certain goods increases or decreases, or the ability to produce a wide range of volumes as demand fluctuates. A hospital may have intensive-care nurses on standby in case of a dramatic increase in patient demand because of an accident or be able to borrow specialized diagnostic equipment from other hospitals when needed. Measures of volume flexibility would include

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Goods and service design flexibility is the ability to develop a wide range of customized goods or services to meet different or changing customer needs.

Volume flexibility is the ability to respond quickly to changes in the volume and type of demand.

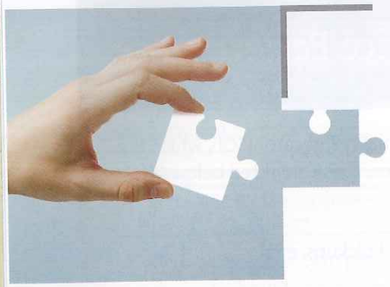
FedEx: Measuring Service Performance

FedEx developed a composite measure of its service performance called the Service Quality Indicator (SQI), which is a weighted sum of 10 factors reflecting customers' expectations of company performance. These are listed below.

Error Type	Description	Weight
1.	*Complaints reopened*—customer complaints (on traces, invoices, missed pickups, etc.) reopened after an unsatisfactory resolution	3
2.	*Damaged packages*—packages with visible or concealed damage or spoilage due to weather or water damage, missed pickup, or late delivery	10
3.	*International*—a composite score of performance measures of international operations	1
4.	*Invoice adjustments*—customer requests for credit or refunds for real or perceived failures	1
5.	*Late pickup stops*—packages that were picked up later than the stated pickup time	3
6.	*Lost packages*—claims for missing packages or with contents missing	10
7.	*Missed proof of delivery*—invoices that lack written proof of delivery information	1
8.	*Right date late*—delivery past promised time on the right day	1
9.	*Traces*—package status and proof of delivery requests not in the COSMOS IIB computer system (the FedEx "real-time" tracking system)	3
10.	*Wrong day late*—delivery on the wrong day	5

Source: Service Quality Indicators at FedEx (internal company document).

The weights reflect the relative importance of each failure. Losing a package, for instance, is more serious than delivering it a few minutes late. The index is reported weekly and summarized on a monthly basis. Continuous improvement goals for the SQI are set each year. SQI is really a measure of process effectiveness. Meeting SQI performance goals also can account for as much as 40 percent of a manager's performance evaluation!



"Microsoft is always two years away from failure."
—Bill Gates

CB2/ZOB WENN Photos/Newscom

the time required to change machine setups or the time required to "ramp up" to an increased production volume in response to surges in sales.

3-1f Innovation and Learning

Innovation *refers to the ability to create new and unique goods and services that delight customers and create competitive advantage.* Many goods and services are innovative when they first appear—think of the iPhone. However, competitors quickly catch up (e.g., Google's Android operating system and the latest Droid phones); thus, innovation needs to be a constant process for many companies and must be measured and assessed. **Learning** *refers to creating, acquiring, and transferring knowledge, and modifying the behavior of employees in response to internal and external change.* For instance, when something goes wrong in one office or division, can the organization ensure that the mistake is not repeated again and does not occur in other offices or divisions? The importance of innovation and learning is well stated by Bill Gates, who said, "Microsoft is always two years away from failure."

Measures of innovation and learning focus on an organization's people and infrastructure. Key measures might include intellectual asset growth, patent applications, the number of "best practices" implemented within the organization, and the percentage of new products developed over the past few years in the product portfolio. Of particular importance are measures associated with an organization's human resource capabilities. These can relate to employee training and skills development, satisfaction, and work-system performance and effectiveness. Examples include absenteeism, turnover, employee satisfaction, training hours per employee, training effectiveness, and measures of improvement in job effectiveness. For instance, The Ritz-Carlton Hotel Company tracks percent turnover very closely, as this measure is a key indicator of employee satisfaction and the effectiveness of its selection and training processes.

Innovation refers to the ability to create new and unique goods and services that delight customers and create competitive advantage.

Learning refers to creating, acquiring, and transferring knowledge, and modifying the behavior of employees in response to internal and external change.

Productivity is the ratio of the output of a process to the input.

3-1g Productivity and Operational Efficiency

Productivity *is the ratio of the output of a process to the input.* As output increases for a constant level of input, or as the amount of input decreases for a constant level of output, productivity increases. Thus, a productivity measure describes how well the resources of an organization are being used to produce output.

$$\text{Productivity} = \frac{\text{Quantity of Output}}{\text{Quantity of Input}} \qquad [3.1]$$

The measures used for the quantity of output and quantity of input in Equation 3.1 need not be expressed in the same units.

Examples of productivity measures include units produced per labor hour, airline revenue per passenger mile, hotel revenue per full-time employee, meals served per labor dollar, and the number of students per

SOLVED PROBLEM

Consider a division of Miller Chemicals that produces water purification crystals for swimming pools. The major inputs used in the production process are labor, raw materials, and energy. For Year 1, labor costs are $180,000; raw materials cost $30,000; and energy costs amount to $5,000. Labor costs for Year 2 are $350,000; raw materials cost $40,000; and energy costs amount to $6,000. Miller Chemicals produced 100,000 pounds of crystals in Year 1 and 150,000 pounds of crystals in Year 2.

Solution:

Using Equation 3.1, we have for Year 1:

$$\text{Productivity} = \frac{\text{Quantity of Output}}{\text{Quantity of Input}} = \frac{100{,}000}{(\$180{,}000 + \$30{,}000 + \$5{,}000)} = 0.465 \text{ lb/dollar}$$

For Year 2 we have:

$$\text{Productivity} = \frac{\text{Quantity of Output}}{\text{Quantity of Input}} = \frac{150{,}000}{(\$350{,}000 + \$40{,}000 + \$6{,}000)} = 0.379 \text{ lb/dollar}$$

We see that productivity has declined in the past year.

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teacher. Productivity measures are often used to track trends over time.

Operational efficiency *is the ability to provide goods and services to customers with minimum waste and maximum utilization of resources.* Some measures of operational efficiency might include the time it takes to fulfill orders, times to set up machinery and equipment, times to change from one product to another on an assembly line, manufacturing yields, and supply-chain performance, to name just a few.

3-1h Sustainability

The **triple bottom line (TBL or 3BL)** *refers to the measurement of environmental, social, and economic sustainability.* Environmental regulations usually require organizations to measure and report compliance, but many companies go beyond what is minimally required. Organizations track numerous environmental measures such as energy consumption, recycling and other resource conservation activities, air emissions, solid and hazardous waste rates, and so on. Social sustainability measures include consumer and workplace safety, community relations, and corporate ethics and governance. Measuring consumer and workplace safety is vital to all organizations, as the well-being of their customers and employees should be a major concern. Federal and state agencies such as the Occupational Safety and Health Administration (OSHA) require organizations to track and report safety indicators, such as reportable accidents. Examples of safety-related performance measures include accident rates, the parts per million of toxic chemicals in a public water supply, or the security in a hotel room. Other social sustainability measures would be the number of ethical violations and community service hours. Finally, economic sustainability measures might include financial audit results, regulatory compliance, legal or governmental sanctions, donations to civic groups, fines for environmental violations, and measures of accomplishment of strategic initiatives, such as the percentage of action plans and project milestones completed on time.

Operational efficiency is the ability to provide goods and services to customers with minimum waste and maximum utilization of resources.

The **triple bottom line (TBL or 3BL)** refers to the measurement of environmental, social, and economic sustainability.

3-2 ANALYTICS IN OPERATIONS MANAGEMENT

As we noted in Chapter 1, business analytics is helping operations managers analyze data more effectively and make better decisions. Typical applications of business

analytics include visualizing data using charts to examine performance trends; calculating basic statistical measures such as means, proportions, and standard deviations; comparing results relative to other business units, competitors, or best-in-class benchmarks; and using correlation and regression analyses to help understand relationships among different measures. For example, Pal's Sudden Service uses an automated data collection, integration, and analysis system, SysDine, to generate store-level and companywide reports on sales, customer count, product mix, ideal food and material cost, and turnover rates, and also has an automated correlation routine available for analyzing key data to support organizational performance reviews and strategic planning. As a result, Pal's is able to identify how changes in one performance area affect all other areas, make accurate performance projections, and understand how to optimize its management system. Understanding the cause-and-effect linkages between key measures of performance is an important application of analytics.

SOLVED PROBLEM

The La Ventana Window Company manufactures original equipment and replacement windows for residential building and remodeling applications. In a cutting process for a certain window model, specifications call for a dimension of 25.50 inches. If the dimension is larger than 25.52 inches, it will be too tight in assembly; and if it is 25.48 inches or less, it will be too loose and will not meet customer requirements. The plant manager collected a sample of 50 parts from this process and measured the dimensions, as shown below. What information do the data provide?

25.51	25.50	25.49	25.50	25.50	25.48	25.50	25.50	25.49	25.52
25.49	25.51	25.51	25.51	25.50	25.50	25.50	25.51	25.50	25.50
25.48	25.50	25.50	25.51	25.50	25.50	25.49	25.50	25.51	25.50
25.49	25.49	25.49	25.51	25.50	25.48	25.48	25.48	25.47	25.49
25.49	25.50	25.50	25.50	25.49	25.48	25.51	25.51	25.50	25.51

Solution:

The OM5 Spreadsheet Templates workbook contains a worksheet titled "Statistical Analysis" that computes basic statistical measures as well as a frequency distribution and histogram for up to 500 data values. Exhibit 3.2 shows the results of these quality measurements. We see that the mean and median values are close to or at the target; however, the frequency distribution and histogram show that no values exceed 25.52, but seven values are 25.48 or less, perhaps suggesting the need for an adjustment to the process. The template is designed such that you can easily change the values from which the frequency distribution and histogram are constructed.

Exhibit 3.2

Statistical Analysis Spreadsheet Template Results for La Ventana Window Company Data

Statistical Analysis

This template is designed to handle up to 500 observations. Enter data only in yellow cells.

DATA	1	2	3	4	5	6	7	8	9	10
1	25.51	25.50	25.49	25.50	25.50	25.48	25.50	25.50	25.49	25.52
2	25.49	25.51	25.51	25.51	25.50	25.50	25.50	25.51	25.50	25.50
3	25.48	25.50	25.50	25.51	25.50	25.50	25.49	25.50	25.51	25.50
4	25.49	25.49	25.49	25.51	25.50	25.48	25.48	25.48	25.47	25.49
5	25.49	25.50	25.50	25.50	25.49	25.48	25.51	25.51	25.50	25.51
6										

Mean	25.498
Median	25.500
Standard Deviation	0.011
Count	50
Minimum	25.470
Maximum	25.520

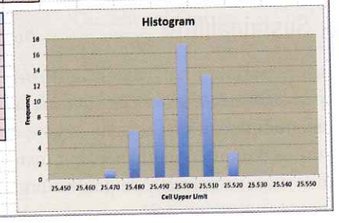
Frequency Distribution and Histogram

Enter smallest and largest limits for the frequency distribution below.
The lower limit should be slightly less than the data minimum.
The upper limit should be slightly larger than the data maximum.

Lower limit	25.450
Upper limit	25.550
Cell width	0.010

Enter number of cells (10 or less): 7

Cell	From	To (inclusive)	Frequency
	-Infinity	25.450	0
1	25.450	25.460	0
2	25.460	25.470	1
3	25.470	25.480	6
4	25.480	25.490	10
5	25.490	25.500	17
6	25.500	25.510	13
7	25.510	25.520	3
8	25.520	25.530	0
9	25.530	25.540	0
10	25.540	25.550	0



3-2a Linking Internal and External Measures

Managers must understand the cause-and-effect linkages between key measures of performance. These relationships often explain the impact of (internal) operational performance on external results, such as profitability, market share, or customer satisfaction. For example, how do goods- and service-quality improvements impact revenue growth? How do improvements in complaint handling affect customer retention? How do increases or decreases in employee satisfaction affect customer satisfaction? How do changes in customer satisfaction affect costs and revenues?

The quantitative modeling of cause-and-effect relationships between external and internal performance criteria is called **interlinking.**[6] Interlinking tries to quantify the performance relationships between all parts of the value chain—the processes ("how"), goods and services outputs ("what"), and customer experiences and outcomes ("why"). With interlinking models, managers can objectively make internal decisions that impact external outcomes, for example, determining the effects of adding resources or changing the operating system to reduce waiting time, and thereby increase customer satisfaction (see Exhibit 3.3).

3-2b The Value of a Loyal Customer

Many organizations lose customers because of poor goods quality or service performance. This is often the result of operations managers failing to consider the economic impact of lost customers when they cut service staff or downgrade product designs. Likewise, many organizations do not understand the economic value of potential new customers when evaluating proposed goods or service improvements on a strict economic basis. Thus, they need an understanding of how customer satisfaction and loyalty affect the bottom line. One way to do this is to compute the economic value that good customers provide.

The **value of a loyal customer (VLC)** *quantifies the total revenue or profit each target market customer generates over the buyer's life cycle.* Understanding the effects of operational decisions on revenue and customer retention can help organizations more appropriately use their resources. Goods-producing and service-providing organizations both benefit from understanding the value of a loyal customer performance relationship. When one considers the fact that it costs three to five times more to acquire a new customer than keep an existing customer, it is clear why customer retention is often the focus of top management improvement initiatives and strategies.

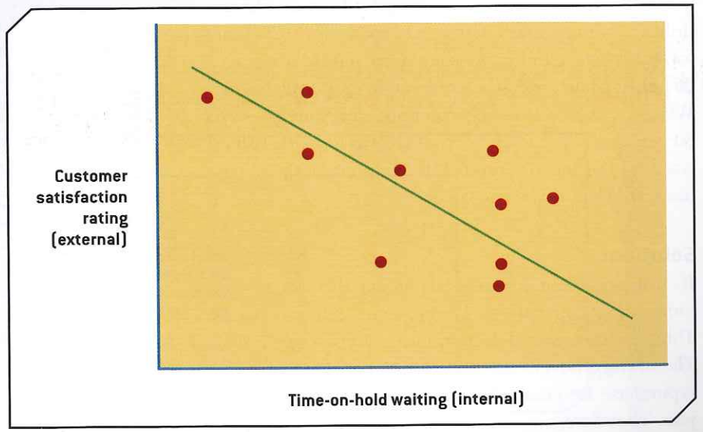
We will walk through an example of computing the average value of a loyal customer. Suppose that a computer manufacturer estimates that its annual customer retention rate is 80 percent, which means that 20 percent of customers who purchase a computer will not buy from it again (we call this the ***customer defection rate*** = 1 − customer retention rate). Assume that fixed costs are 35 percent and the manufacturer makes a before-tax profit margin of 10 percent. Therefore, the incremental contribution to

The quantitative modeling of cause-and-effect relationships between external and internal performance criteria is called **interlinking.**

The **value of a loyal customer (VLC)** quantifies the total revenue or profit each target market customer generates over the buyer's life cycle.

Exhibit 3.3

Interlinking Internal and External Performance Measures



ANALYTICS FOR MANAGING SPORTS TEAMS

Professional and amateur sports are just beginning to take advantage of today's analytical methods and software capabilities in order to evaluate performance and return on investment. In basketball, for example, the "box score" documents traditional performance metrics such as points, field goal percentage, fouls, blocked shots, assists, steals, turnovers, minutes played, and offensive and defensive rebounds. Analytics in the form of shot charts, rebound charts, play-by-play data, and motion-capture video and analysis is used to supplement traditional data. Today, the critical question is how to effectively analyze such data in order to maximize performance and owners' returns for minimal cost.

The popular book and film *Moneyball* has demonstrated the use of analytics in sports management to the average sports fan. The book, published in 2003, before analytics became a buzzword in business, profiles how the Oakland Athletics baseball team used analytics to build a competitive team even with a limited budget, and compete with better-funded teams such as the New York Yankees, which spent nearly three times as much on player personnel. To promote the use of analytics in sports management, the Massachusetts Institute of Technology hosts the annual MIT Sloan Sports Analytics Conference that has been attended by students from over 150 different schools and representatives from over 50 professional sports teams.

profit and overhead is 45 percent. We also assume that customers buy a new computer every two years, or 0.5 times per year, at an average cost of $1,000.

On an annual basis, the average contribution to profit and overhead of a new customer is ($1,000) (0.45) (0.5) = $225 (the multiplier of 0.5 takes into account that customers purchase a new machine every two years). If 20 percent of customers do not return each year, then, on average, the buying life of a customer is five years (1/0.2 = 5). Therefore, the average value of a loyal customer over his or her average buying life is ($225 per year)(5 years) = $1,125.

Now suppose that the customer defection rate can be reduced to 10 percent by improving operations and/or employee service management skills. In this case, the average buying life doubles, and the average value of a loyal customer increases to ($225 per year)(10 years) = $2,250. If goods and service improvements can also lead to a market share increase of 10,000 customers, the total contribution to profit and overhead would be $22,500,000 = ($1,000)(0.45)(0.5)(10)(10,000).

We can summarize the logic of these calculations with the following equation:

$$VLC = (P)(CM)(RF)(BLC) \qquad [3.2]$$

where P = the revenue per unit
CM = contribution margin to profit and overhead expressed as a fraction (i.e., 0.45, 0.5, etc.)
RF = repurchase frequency = number of purchases per year
BLC = buyer's life cycle, computed as 1/defection rate, expressed as a fraction (1/0.2 = 5 years, 1/0.1 = 10 years, etc.)

By multiplying the VLC times the absolute number of customers gained or lost, the total market value can be found.

Exhibit 3.4 shows the calculations for the base case using the Excel VLC template available on the CourseMate Web site. The template can be used to compute the impact of different "what-if?" assumptions in this example.

Operations managers can influence the VLC by increasing the contribution margin through reducing operating costs, increasing repurchase frequency by better customer service, and reducing customer defection rates by creating and delivering consistently excellent system performance. Process managers can use the VLC numbers to help justify improvement initiatives in job and process design, capacity and scheduling, and facility design.

SOLVED PROBLEM

What is the value of a loyal customer (VLC) in the small contractor target market segment who buys an electric drill on average every four years (or every 0.25 year) for $100, when the gross margin on the drill averages 50 percent, and the customer retention rate is 60 percent? What if the customer retention rate increases to 80 percent? What is a 1 percent change in market share worth to the manufacturer if it represents 100,000 customers? What do you conclude?

Solution:

If customer retention rate is 60 percent, the average customer defection rate = (1 − customer retention rate). Thus, the customer defection rate is 40 percent, or 0.4. The average buyer's life cycle is 1/0.4 = 2.5 years. The repurchase frequency is every four years, or 0.25 (1/4) year. Therefore,

$VLC = (P)(RF)(CM)(BLC) = (\$100)(0.25)(0.50)(1/0.4)$
$= \$31.25$

The value of a 1 percent change in market share
= (100,000 customers)($31.25/customer/year)
= $3,125,000

If the customer retention rate is 80 percent, the average customer defection rate is 0.2, and the average buyer's life cycle is 1/0.2 = 5 years. Then,
$VLC = (P)(RF)(CM)(BLC) = (\$100)(0.25)(0.50)(1/.2)$
$= \$62.50$

Thus, the value of a 1 percent change in market share
= (100,000 customers)($62.50/customer/year)
= $6,250,000

The economics are clear. If customer retention can be increased from 60 to 80 percent through better value chain performance, the economic payoff is doubled.

3-3 DESIGNING MEASUREMENT SYSTEMS IN OPERATIONS

What makes a good performance measurement system for operations? Many organizations define specific criteria for selecting and deleting performance measures from the organization's information system. IBM Rochester, for example, asks the following questions:

- Does the measurement support our mission?
- Will the measurement be used to manage change?
- Is it important to our customers?
- Is it effective in measuring performance?
- Is it effective in forecasting results?
- Is it easy to understand/simple?
- Are the data easy/cost-efficient to collect?
- Does the measurement have validity, integrity, and timeliness?
- Does the measurement have an owner?

Good performance measures are actionable. **Actionable measures** *provide the basis for decisions at the level at which they are applied*—the value chain, organization, process, department, workstation, job, and service encounter. They should be meaningful to the user, timely, and reflect how the organization generates value to customers. Performance measures should support, not conflict with, customer requirements. For example, customers expect a timely response when calling a customer support number. A common operational measure is the number of rings until the call is picked up. If a company performs well on this measure, but puts the customer on hold or in a never-ending menu, then a conflict clearly exists.

Actionable measures provide the basis for decisions at the level at which they are applied.

Exhibit 3.4
Excel VLC Template

	A	B	C	D
1	Value of a Loyal Customer			
2	Enter data only in yellow cells.			
3				
4	Revenue per unit	$1,000.00		
5	Percent contribution margin to profit and overhead	45%		
6	Repurchase frequency (purchases/year)	0.5		
7	Defection rate	0.2		
8				
9	Buyer's life cycle	5.00		
10	VLC	$1,125.00		

3-4 MODELS OF ORGANIZATIONAL PERFORMANCE

Four models of organizational performance—the Baldrige Performance Excellence framework, the balanced scorecard, the value chain model, and the Service-Profit Chain—provide popular frameworks for thinking about designing, monitoring, and evaluating performance. The first two models provide more of a "big picture" of organizational performance, whereas the last two provide more detailed frameworks for operations managers. Although OM focuses on execution and delivery of goods and services to customers, it is important to understand these "big-picture" models of organizational performance because operations managers must communicate with all functional areas. In addition, understanding these models helps you better appreciate the interdisciplinary nature of an organization's performance system, the role that operations plays, and why operations managers need interdisciplinary skills.

3-4a Malcolm Baldrige Performance Excellence Framework

The Baldrige Performance Excellence program, formerly known as the Malcolm Baldrige National Quality Award Program, was created to help stimulate American organizations to improve quality, productivity, and overall competitiveness, and to encourage the development of high-performance management practices through innovation, learning, and sharing of best practices. Organizations can receive awards in manufacturing, small business, service, education, health care, and not-for-profit categories. Baldrige recipients show exceptional results that outperform those of their competitors and peers. The program's website at www.nist.gov/baldrige/ provides a wealth of current information about the award, the performance criteria, award recipients, and other aspects of the program.

Although the award itself receives the most attention, the primary purpose of the program is to provide a framework for performance excellence through self-assessment to understand an organization's strengths and weaknesses, thereby setting priorities for improvement. This framework is shown in Exhibit 3.5, and defines the *Criteria for Performance Excellence*. The criteria are

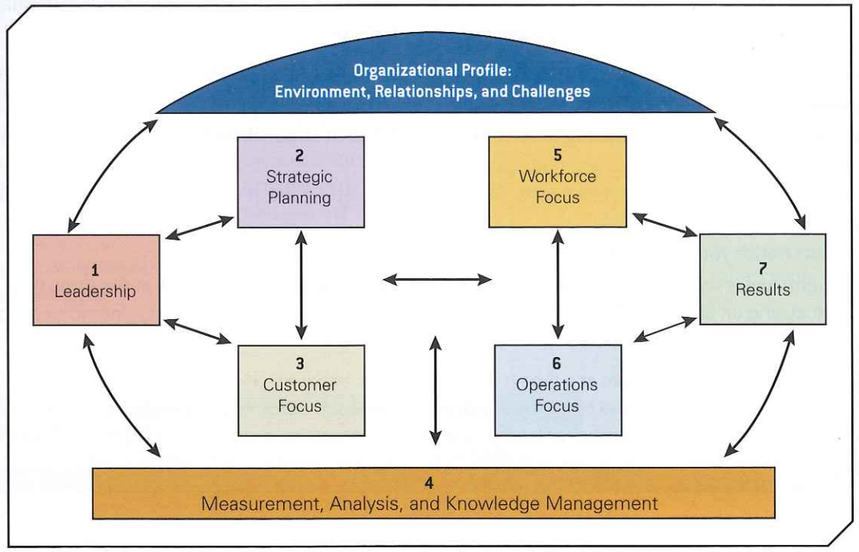
USA.gov

designed to provide a framework for managing an organization to achieve outstanding results. The seven categories are:

1. *Leadership*: This category addresses how senior leaders' personal actions guide and sustain the organization, the organization's governance system, and approaches for fulfilling ethical, legal, and societal responsibilities, as well as supporting key communities.
2. *Strategic Planning*: This category focuses on how an organization develops strategic objectives and action plans, how they are deployed and changed if circumstances require, and how progress is measured.
3. *Customer Focus*: This category addresses how an organization engages its customers for long-term marketplace success, builds a customer-focused culture, listens to the voice of its customers, and uses this information to improve and identify opportunities for innovation.
4. *Measurement, Analysis, and Knowledge Management*: This category focuses on how an organization selects, gathers, analyzes, manages, and improves its data, information, and knowledge assets; how it manages its information technology; and how it reviews data and uses the results to improve its performance.
5. *Workforce Focus*: This category addresses how an organization engages, manages, and develops its workforce to utilize its full potential in alignment with the organization's overall mission, strategy, and action plans; assesses workforce capability and capacity needs; and builds a workforce environment conducive to high performance.
6. *Operations Focus*: This category addresses how an organization designs, manages, and improves its work systems and work processes to deliver customer value, achieve organizational success and sustainability, and prepare for emergencies.
7. *Results*: This category examines an organization's performance and improvement in key business areas—product and process outcomes, customer-focused outcomes, workforce-focused outcomes, leadership and governance outcomes, and financial and market outcomes.

In essence, the criteria framework represents a macro-level interlinking model that relates management practices to business results. For example, if senior managers understand their customers and lead the strategic planning process effectively (Categories 1, 2, and 3), and then translate plans into actions through the workforce and operations (Categories 5 and 6), then positive business results (Category 7) should follow. Category 4 provides the foundation for measuring and assessing results and continual improvements. Some simplify the theory of the Baldrige Award by saying that "leadership drives the system that creates results."

Exhibit 3.5
Baldrige Model of Organizational Performance



Source: 2011–12 Baldrige Criteria for Performance Excellence, U.S. Dept of Commerce.

3-4b The Balanced Scorecard

Robert Kaplan and David Norton of the Harvard Business School, in response to the limitations of traditional accounting measures, popularized the notion of the *balanced scorecard*, which was first developed at Analog Devices. Its purpose is "to translate strategy into measures that uniquely communicate your vision to the organization." Their version of the balanced scorecard, as shown in Exhibit 3.6, consists of four performance perspectives:

- *Financial Perspective:* Measures the ultimate value that the business provides to its shareholders. This includes profitability, revenue growth, stock price, cash flows, return on investment, economic value added (EVA), and shareholder value.

Would You Fly on This Airline?

Imagine entering the cockpit of a modern jet airplane and seeing only a single instrument there. How would you feel about boarding the plane after the following conversation with the pilot?

Passenger: I'm surprised to see you operating the plane with only a single instrument. What does it measure?

Pilot: Airspeed. I'm really working on airspeed this flight.

Passenger: That's good. Airspeed certainly seems important. But what about altitude? Wouldn't an altimeter be helpful?

Pilot: I worked on altitude for the last few flights, and I've gotten pretty good at it. Now I have to concentrate on proper airspeed.

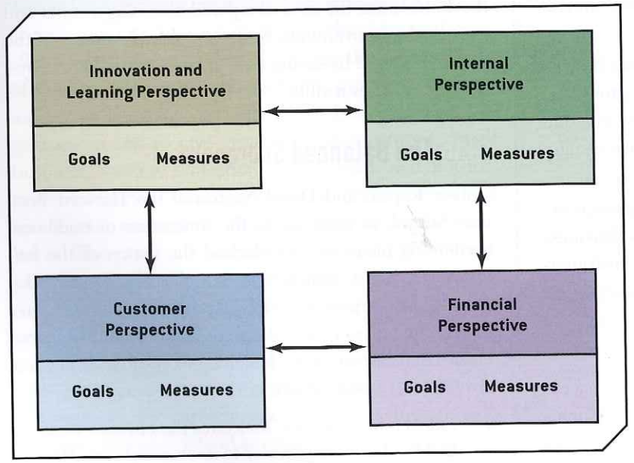
Passenger: But I notice you don't even have a fuel gauge. Wouldn't that be useful?

Pilot: You're right; fuel is significant, but I can't concentrate on doing too many things well at the same time. So on this flight I'm focusing on airspeed. Once I get to be excellent at airspeed, as well as altitude, I intend to concentrate on fuel consumption on the next set of flights.[7]

Concentrating on only one measure at a time is not a good idea, either for pilots or for modern organizations. World-class organizations normally use between 3 and 10 performance measures per process, depending on the complexity of goods and services, number of market segments, competitive pressures, and opportunities for failure.

Exhibit 3.6

The Balanced Scorecard Performance Categories and Linkages



Source: Adapted from R. S. Kaplan and D. P. Norton, "The Balanced Scorecard—Measures That Drive Performance," Harvard Business Review, January–February 1992, p. 72.

- *Customer Perspective:* Focuses on customer wants and needs and satisfaction as well as market share and growth in market share. This includes safety, service levels, satisfaction ratings, delivery reliability, number of cooperative customer–company design initiatives, value of a loyal customer, customer retention, percent of sale from new goods and services, and frequency of repeat business.
- *Innovation and Learning Perspective:* Directs attention to the basis of a future success—the organization's people and infrastructure. Key measures might include intellectual and research assets, time to develop new goods and services, number of improvement suggestions per employee, employee satisfaction, market innovation, training hours per employee, hiring process effectiveness, revenue per employee, and skills development.
- *Internal Perspective:* Focuses attention on the performance of the key internal processes that drive the business. This includes such measures as goods- and service- quality levels, productivity, flow time, design and demand flexibility, asset utilization, safety, environmental quality, rework, and cost.

The internal perspective is most meaningful to operations managers, as they deal with the day-to-day decisions that revolve around creating and delivering goods and services. As noted in Chapter 1, the internal perspective includes all types of internal processes: value-creation processes, support processes, and general management or business processes.

The balanced scorecard is designed to be linked to an organization's strategy. The linkages between corporate and operations strategy and associated performance measures (called *competitive priorities*) are discussed in Chapter 4. Top management's job is to guide the organization, make trade-offs among these four performance categories, and set future directions.

PRO-TEC Coating Company: Keeping Performance in Balance

PRO-TEC Coating Company, a joint venture between United States Steel Corporation and Kobe Steel Ltd. of Japan, is the industry leader in advanced high-strength steel coating and ultra-high-strength steel coating. PRO-TEC uses a balanced-scorecard (BSC) approach to help align the company's six key success factors (KSFs)—associate quality of life, customer service, technical innovation and product development, system reliability, good citizenship, and long-term viability—with its mission, vision, and values; its quality, safety, and environmental policies; company policy manuals; and procedure and work instruction manuals for its integrated Quality and Environmental System. The BSC provides senior leaders with a systematic way to review performance and take action as needed.

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The BSC uses a stoplight color-coded designation (green, yellow, red) that reflects the actual performance (good, marginal, or at-risk) against short-term targets. The at-risk BSC measures require action, and are reviewed at monthly plant management meetings. The BSC is also used for managing daily operations. For example, measures for safety and health, such as completion of housekeeping and quarterly safety audit items, mobile equipment inspections, and the weekly safety binder sign-off, are reviewed each Monday.[8]

3-4c The Value Chain Model

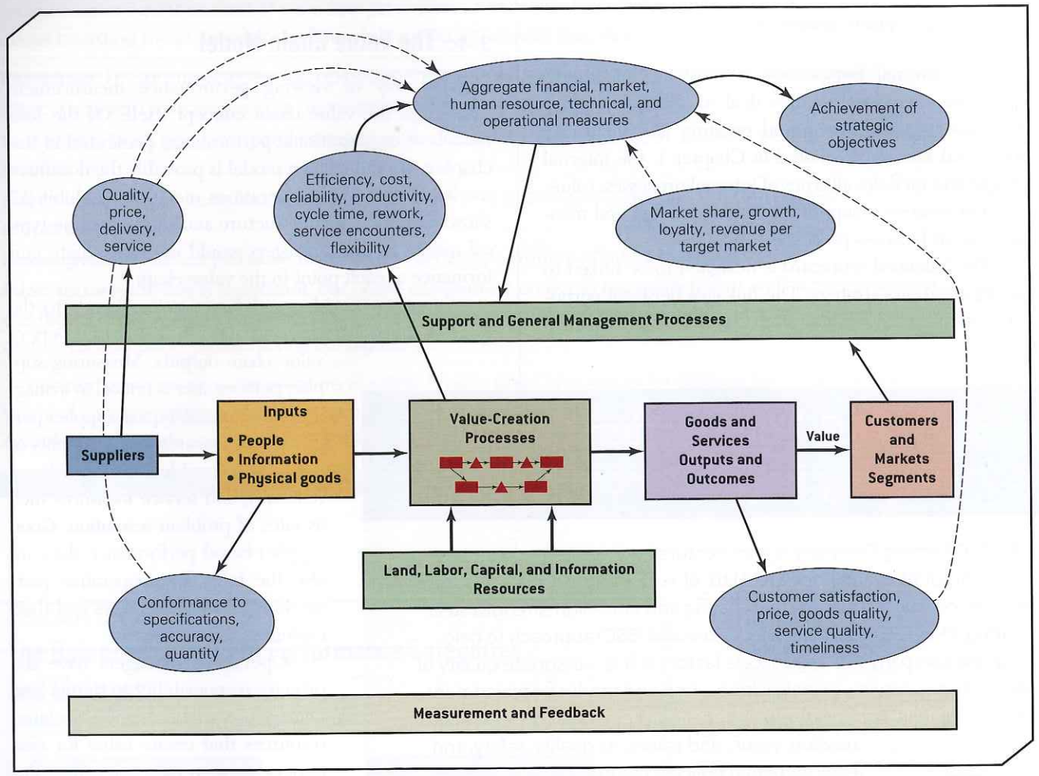
A third way of viewing performance measurement is through the value chain concept itself. Of the four models of organizational performance presented in this chapter, the value chain model is probably the dominant model, especially for operations managers. Exhibit 3.7 shows the value chain structure and suggests some typical measures that managers would use to evaluate performance at each point in the value chain.

Suppliers provide goods and services inputs to the value chain that are used in the creation and delivery of value chain outputs. Measuring supplier performance is critical to managing a value chain. Typical supplier performance measures include quality of the inputs provided, price, delivery reliability, and service measures such as rates of problem resolution. Good supplier-based performance data are also the basis for cooperative partnerships between suppliers and their customers.

Operations managers have the primary responsibility to design and manage the processes and associated resources that create value for customers. Process data can reflect defect and error rates of intermediate operations, and also efficiency measures such as cost, flow time, delivery variability, productivity, schedule performance, equipment downtime, preventive maintenance activity, rates of problem resolution, energy and equipment efficiency, and raw material usage. For example, Motorola measures nearly every process in the company, including engineering-design, order entry, manufacturing, human resources, purchasing, accounting, and marketing, for improvements in error rates and flow times. One of its key business objectives is to reduce total organizational

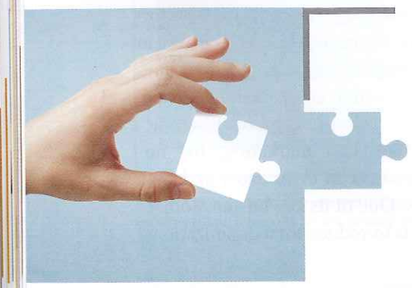
Exhibit 3.7

Examples of Value Chain Performance Measurements



flow time—the time from the point a customer expresses a need until the customer pays the company for the good or service.

Measuring goods and service outputs and outcomes tell a company whether its processes are providing the levels of quality and service that customers expect. Organizations measure outputs and outcomes using measures such as unit cost, defects per million opportunities, and lead time. Through customer and market information, an organization learns how satisfied its customers and stakeholders are with its goods and services and performance and how best to configure the goods and services (i.e., customer benefit packages). Measures of customer satisfaction and retention reveal areas that need improvement and show whether changes actually result in improvement.



Measuring goods and service outputs and outcomes tell a company whether its processes are providing the levels of quality and service that customers expect.

Measurement and feedback provide the means of coordinating the value chain's physical and information flows and for assessing whether the organization is

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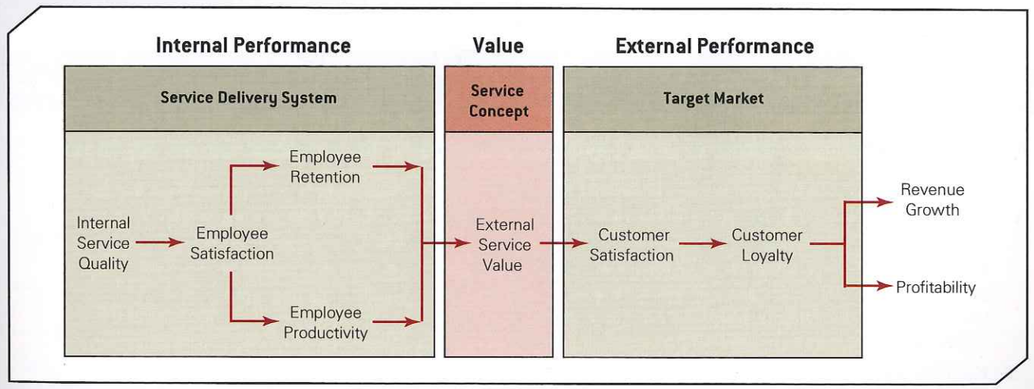
achieving its strategic objectives. This is similar to the role of Category 4 (Measurement, Analysis, and Knowledge Management) in the Malcolm Baldrige framework. One objective of timely information sharing is to reduce or replace assets (employees, inventory, trucks, buildings, etc.) with smart and timely performance information. For example, General Electric sells lightbulbs in Walmart stores; these sales are recorded immediately at General Electric factories and production is scheduled to real-time sales data. Fewer resources are needed to achieve performance goals when "information replaces assets." That is, inventories are reduced, flow times are shorter, quality is better, and costs are lower.

3-4d The Service-Profit Chain

The Service-Profit Chain (SPC) was first proposed in a 1994 *Harvard Business Review* article and is most applicable to service environments.[9] Exhibit 3.8 is one representation of the SPC, and many variations of this model

Exhibit 3.8

The Service-Profit Chain Model



Adapted from J. L. Heskett, T. O. Jones, G. W. Loveman, W. E. Sasser, Jr., and L. A. Schlesinger, "Putting the Service-Profit Chain to Work," Harvard Business Review, March–April 1994, pp. 164–174.

have been proposed in academic and practitioner articles. Many companies, such as Citibank, General Electric, Intuit, Southwest Airlines, Taco Bell, Harrah's Entertainment, and Xerox, have used this model of organizational performance. The theory of the Service-Profit Chain is that employees, through the service-delivery system, create customer value and drive profitability. As J. W. Marriott, the founder of Marriott Hotels, said long ago, "Happy employees create happy customers."

The model is based on a set of cause-and-effect linkages between internal and external performance, and in this fashion, defines the key performance measurements on which service-based firms should focus. Because much of the value created in service processes is at the service-encounter level, the Service-Profit Chain focuses on employees or service providers. Healthy, motivated, well-trained, and loyal employees demonstrate higher levels of satisfaction that result in higher retention and productivity. This leads to higher levels of external service value to customers. External service value is created by service providers mainly at the service-encounter level. Buyers of services focus on outcomes, results, and experiences. Ultimately, good value creates higher customer satisfaction and loyalty, which in turn leads to higher revenue growth and profitability.

Discussion Questions

1. What types of performance measurements might be used to evaluate a fraternity or student organization?
2. What information would you need to fully answer the questions that IBM Rochester uses for selecting measures and indicators that are listed in Section 3 of this chapter? Where would you get this information?
3. Discuss some analytical or graphical approaches that organizations can use for analyzing performance data based on your experience and previous coursework.
4. Under which perspective of the balanced scorecard would you classify each of the following measurements?
   a. On-time delivery to customers
   b. Time to develop the next generation of products
   c. Manufacturing yield
   d. Engineering efficiency
   e. Quarterly sales growth
   f. Percentage of products that equal 70 percent of sales
   g. Cash flow
   h. Number of customer partnerships
   i. Increase in market share
   j. Unit cost of products
5. When the value of a loyal customer (VLC) market segment is high, should these customers be given premium goods and services for premium prices? If the VLC is low, should they be given less service? Explain.

Problems and Activities

Note: An asterisk denotes problems for which a spreadsheet template on the CourseMate Web site may be used.

1. Interview managers at a local company to identify the key business measures (financial, market, supplier, employee, process, information, innovation, etc.) for that company. What quality indicators does that company measure? What cause-and-effect (interlinking) performance relationships would be of interest to the organization?
2. Each day, a FedEx competitor processes approximately 85,000 shipments. Suppose that they use the same Service Quality Index as FedEx and identified the following numbers of errors during a five-day week (see the "FedEx: Measuring Service Performance" box): These values are hypothetical and do not reflect any real company's actual performance.

   Complaints reopened: 125

   Damaged packages: 18

   International: 102

   Invoice adjustments: 282

   Late pickup stops: 209

   Lost packages: 2

   Missed proof of delivery: 26

   Right date late: 751

   Traces: 115

   Wrong day late: 15

   Compute the Service Quality Indicator by finding the weighted sum of errors as a percentage of total shipments. How might such an index be used in other organizations, such as a hotel or automobile service facility?
3. Research and write a short paper on how some organization (you choose the organization) applies the five dimensions of service quality.
4. A major airline is attempting to evaluate the effect of recent changes it has made in scheduling flights between New York City and Los Angeles. Data available are as follows:

	Number of Flights	Number of Passengers
Month prior to schedule change	16	8,795
Month after schedule change	25	15,653

   Using passengers per flight as a productivity indicator, comment on the apparent effect of the schedule change.
5. Revenue or costs per passenger mile are two key performance measures in the airline industry. Research their use in this industry and prepare a one-page paper summarizing how they are used and why they are so important.
6. A hamburger factory produces 60,000 hamburgers each week. The equipment used costs $10,000 and will remain productive for four years. The labor cost per year is $13,500.
   a. What is the productivity measure of "units of output per dollar of input" averaged over the four-year period?
   b. The company has the option of purchasing equipment for $13,000, with an operating life of five years. It would reduce labor costs to $11,000 per year. Should it consider purchasing this equipment (using productivity arguments alone)?
7. A fast-food restaurant has a drive-through window and during peak lunch times can handle a maximum of 50 cars per hour with one person taking orders, assembling them, and acting as cashier. The average sale per order is $9.00. A proposal has been made to add two workers and divide the tasks among the three. One will take orders, the second will assemble them, and the third will act as cashier. With this system, it is estimated that 80 cars per hour can be serviced. Use productivity arguments to recommend whether or not to change the current system.
8. A key hospital outcome measure of clinical performance is length of stay (LOS)—that is, the number of days a patient is hospitalized. For patients at one hospital with acute myocardial infarction (heart attack), the length of stay over the past four years has consistently decreased. The hospital also has data for various treatment options, such as the percentage of patients who received aspirin upon arrival and cardiac medication for left ventricular systolic dysfunction (LVSD). The data are as follows:

Year	Average LOS	Aspirin on Arrival	LVSD Medication
2007	4.55 days	95%	89%
2008	4.33 days	98%	93%
2009	4.12 days	99%	96%
2010	4.02 days	100%	98%

   Illustrate the interlinking relationships by constructing scatter charts, using Excel, showing the LOS as a function of each of the other variables. What do these models tell you?
9. Customers call a call center to make room reservations for a small chain of 42 motels located throughout the southwestern part of the United States. Business analytics is used to determine how and if the following performance metrics are related: time by quarter, average time on hold (seconds) before a customer reaches a company customer service representative, percent of time the customer inquiry is solved the first time (called first-pass quality), and customer satisfaction with the overall call center experience. The company has collected the following data:

Quarter	Average Hold Time	Percent Solved First Time	Overall Customer Satisfaction
Q1	22 seconds	89%	96%
Q2	34 seconds	80%	92%
Q3	44 seconds	78%	82%
Q5	67 seconds	85%	84%
Q6	38 seconds	87%	90%
Q7	70 seconds	76%	80%
Q8	86 seconds	67%	74%

   Develop a graphical interlinking model by constructing scatter charts showing the relationships between each pair of variables. What do your two models tell you?

10.* What is the average value of a loyal customer (VLC) in a target market segment if the average purchase price is $75 per visit, the frequency of repurchase is six times per year, the contribution margin is 10 percent, and the average customer defection rate is 25 percent?

11.* Using the base case data in question 10, analyze how the value of a loyal customer (VLC) will change if the average customer defection rate varies between 15 and 40 percent (in increments of 5 percent) and the frequency of repurchase varies between three and nine times per year (in increments of one year). Sketch graphs (or use Excel charts) to illustrate the impact of these assumptions on the VLC.

12.* What is the average defection rate for grocery store shoppers in a local area of a large city if customers spend $45 per visit, customers shop 52 weeks per year, the grocery store has an 8 percent gross margin, and the value of a loyal customer is estimated at $2,750 per year?

13. Research and write a short paper on how sports analytics is used by some professional team (you select the team).

14. Go to the Baldrige website and find the links to the most recent award recipients. Review one of the application summaries and describe the types of performance measures that these companies use.

15. The balanced scorecard was originally developed by Arthur M. Schneiderman at Analog Devices. Visit his website, www.schneiderman.com, and read the articles to answer the following questions:
    a. How was the first balanced scorecard developed?
    b. What steps should an organization follow to build a good balanced scorecard?
    c. Why do balanced scorecards sometimes fail?

BankUSA: Credit Card Division Case Study

BankUSA operates in 20 states and provides a full range of financial services for individuals and business. The credit card division is a profit center that has experienced a 20 percent annual growth rate over the last five years. The credit card division processes two types of credit cards. One type is for traditional card issuers such as savings and loan banks, credit unions, small banks without credit card processing capability, selected private-label firms such as a retail chain, and BankUSA's own credit cards. This "individual customer" market segment involves about 15 million cardholders. These credit card services include producing and mailing the plastic credit cards to customers, preparing and distributing monthly statements to customers via the Internet or by mail, handling all customer requests such as billing information, address changes, stop payments, and so on, and preparing and distributing summary reports to all internal and external customers.

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BankUSA's individual customer market segment involves about 15 million cardholders.

Recently, the bank has been receiving numerous complaints about excessive wait times in their customer support call center. In an executive staff meeting, Ms. Juanita Sutherland, the president of BankUSA's credit card division, was told point-blank by the firm's CEO: "Our customers are unhappy, and we're beginning to see account closures and transfers to other credit cards. So, what's going on here? I want a full report at our next meeting."

Ms. Sutherland was perplexed, as her call center manager, John Jackson, told her that he believed that wait times averaged less than two minutes. "Well, I believe in the motto 'In God we trust; all others bring data,'" she told John. "Show me the data." Over the next two weeks, John sampled 500 customer calls during peak times (the call center runs seven days a week). The data were recorded in an Excel file shown in Exhibit 3.9 (also available in the OM5 Data Workbook in the worksheet "BankUSA Call Center Wait Times"). However, John knew little about what to do with the data...

CASE QUESTIONS FOR DISCUSSION

1. You have been called in to assist Mr. Jackson in analyzing the data he collected. Using basic statistical analysis tools, what can you tell him about the wait times?
2. How should Mr. Jackson respond to Ms. Sutherland at their next meeting? What should he tell her, and what steps might you suggest he do next?

STUDY TOOLS 3

LOCATED AT THE BACK OF THE TEXTBOOK

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- ☐ Key Term Flash Cards
- ☐ Practice Quizzes to prepare for tests
- ☐ "Beat the Clock" and "Quizbowl" to master concepts
- ☐ "Crossword Puzzle" to review key terms
- ☐ Spreadsheet Templates
- ☐ Videos of real-company OM examples

Exhibit 3.9

Sample Internal and External Credit Card Division Performance Data (This spreadsheet is available in the OM5 Data Workbook on the CourseMate Web site.)

BankUSA Credit Card Division									
Wait times for 500 Customers									
26	137	415	68	66	87	67	174	108	35
358	30	325	195	63	54	72	280	65	216
218	43	58	61	265	119	135	118	667	68
71	70	68	253	159	97	9	16	28	40
190	233	62	557	78	186	76	138	23	70
36	185	303	94	66	143	166	61	52	128
45	128	314	66	94	147	333	89	69	138
68	113	40	10	69	187	80	23	406	44
45	79	9	149	109	155	114	78	23	89
66	182	18	89	61	91	79	61	77	118
132	83	30	253	162	68	392	53	81	292
372	81	95	189	190	317	429	234	62	475
125	87	315	20	35	79	109	111	93	215
16	61	141	75	53	47	66	37	201	149
37	105	26	102	68	245	67	38	39	224
116	66	189	46	98	82	174	70	134	61
145	46	43	60	38	55	112	112	69	62
160	139	132	277	202	70	118	52	201	65
276	141	19	65	15	65	83	350	316	62
132	78	29	169	65	64	203	295	18	108
124	265	273	122	86	67	147	78	46	289
180	66	167	186	876	450	614	69	71	35
111	194	98	87	127	323	128	21	51	72
119	93	98	24	139	249	88	84	33	86
75	82	92	197	87	173	122	116	144	94
164	156	36	59	66	90	200	134	139	134
39	115	64	203	146	208	30	54	54	45
698	50	81	86	66	77	376	82	83	55
46	262	67	132	197	41	153	70	70	29
172	130	52	311	156	148	227	57	48	268
151	73	47	175	49	272	233	211	158	31
83	82	163	69	46	76	106	124	77	232
166	107	61	191	66	371	129	44	33	64
78	83	88	248	75	55	461	88	260	205
68	64	182	67	117	31	315	117	45	137
502	156	149	357	47	69	164	250	237	16
83	81	83	136	65	193	142	89	87	425
139	204	17	49	189	136	73	57	72	158
19	76	85	315	268	143	96	98	40	159
44	148	466	41	40	72	25	182	24	74
117	426	139	141	88	143	87	125	195	61
38	102	87	96	70	255	305	128	191	379
176	65	116	12	67	79	53	295	99	147
128	131	97	111	133	100	60	88	118	60
18	518	98	30	85	51	62	60	80	62
427	329	15	118	268	72	74	84	236	40
72	714	77	57	37	391	82	209	106	248
145	203	97	66	49	27	83	43	48	145
185	14	204	74	74	63	206	31	209	176
74	131	19	79	223	143	220	108	320	141