

GLOBAL
EDITION



13^e OPERATIONS MANAGEMENT

Sustainability and Supply Chain Management

Jay Heizer • Barry Render • Chuck Munson



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classroom training in areas such as Six Sigma. Over 200 managers have obtained Six Sigma Green Belt certification.

Alaska collects more than 100 quality and performance metrics every day. For example, the accompanying picture tells the crew that it has 6 minutes to close the door and back away from the gate to meet the “time to pushback” target. Operations personnel review each airport hub’s performance scorecard daily and the overall operations scorecard weekly. As Director of System Operations Control, Wayne Newton proclaims, “If it is not measured, it is not managed.” The focus is on identifying problem areas or trends, determining causes, and working on preventive measures.

Within the operations function there are numerous detailed input metrics for station operations (such as the percentage of time that hoses are free of twists, the ground power cord is stowed, and no vehicles are parked in prohibited zones). Management operates under the assumption that if all the detailed input metrics are acceptable, the major key performance indicators, such as Alaska’s on-time performance and 20-minute luggage guarantee, will automatically score well.

The accompanying table displays a sample monthly scorecard for Alaska’s ground crew provider in Seattle. The major evaluation categories include process compliance, staffing (degree that crew members are available when needed), MAP rate (minimum acceptable performance for mishandled bags), delays, time to carousel, safety compliance, and quality compliance. The quality compliance category alone tracks 64 detailed input metrics using approximately 30,000 monthly observations. Each of the major categories on the scorecard has an importance weight, and the provider is assigned a weighted average score at the end of each month. The contract with the supplier provides for up to a 3.7% bonus for outstanding performance and as much as a 5.0% penalty for poor performance. The provider’s line workers receive a portion of the bonus when top scores are achieved.

As a company known for outstanding customer service, service recovery efforts represent a necessary area of emphasis. When things go wrong, employees mobilize to first communicate with, and in many cases compensate, affected customers. “It doesn’t matter if it’s not our fault,” says Minicucci. Front-line

workers are empowered with a “toolkit” of options to offer to inconvenienced customers, including the ability to provide up to 5,000 frequent flyer miles and/or vouchers for meals, hotels, luggage, and tickets. When an Alaska flight had to make an emergency landing in Eugene, Oregon, due to a malfunctioning oven, passengers were immediately texted with information about what happened and why, and they were told that a replacement plane would be arriving within 1 hour. Within that hour, an apology letter along with a \$450 ticket voucher were already in the mail to each passenger’s home. No customer complaints subsequently appeared on Twitter or Facebook. It’s no wonder why Alaska’s customers return again and again.

Discussion Questions*

1. What are some ways that Alaska can ensure that quality and performance metric standards are met when the company outsources its ground operations to a contract provider?
2. Identify several quality metrics, in addition to those identified earlier, that you think Alaska tracks or should be tracking.
3. Think about a previous problem that you had when flying, for example, a late flight, a missed connection, or lost luggage. How, if at all, did the airline respond? Did the airline adequately address your situation? If not, what else should they have done? Did your experience affect your desire (positively or negative) to fly with that airline in the future?
4. See the accompanying table. The contractor received a perfect Time to Carousel score of 10 total points, even though its performance was not “perfect.” How many total points would the contractor have received with the following performance scores: 93.2% of flights scanned, 63.5% of bags scanned, 89.6% of all bags dropped within 20 minutes, and 15 bags arriving longer than 25 minutes?

*You may wish to view the video that accompanies this case before addressing these questions.

Celebrity Cruises: A Premium Experience

Video Case

Twenty years ago, Celebrity Cruises, Inc., decided to make a name for itself in the *premium* market by offering an “upscale experience at an intelligent price.” Evoking images of luxury similar to the Ritz-Carlton brand, this “hotel on the water” treats quality as if it is the heartbeat of the company. Consequently, Celebrity has consistently been awarded the “Best Premium Cruise Line.”

In the cruise and hotel industries, quality can be hard to quantify. Traveling guests are buying an experience—not just a tangible product. So creating the right combination of elements to make the experience stand out is the goal of every employee, from cabin attendants to galley staff to maintenance to entertainers. The captain even has an important social role, often hosting dinners for a dozen guests a night.

“Our target audience consists of savvy, discerning guests who know what they want from this cruise,” says Brian Abel, Associate VP for Hotel Operations. “We meet their needs by being best in the competitive class of modern luxury ships.”

Crew-to-guest ratios at Celebrity, and other premium lines, are 1 crew member for every 2 guests. Employees are expected to greet guests with a formal style, to say “good morning” instead

of “hi” and “with pleasure” instead of “no problem.” With crew members from 70 countries, such preferred phrases, dress codes, and many other manners of dealing with customers are detailed in employee training manuals.

Employees sign 4- to 9-month contracts and then typically take 6–8 weeks off. They have difficult jobs, often working 7 days a week, but even with intense schedules, most Celebrity staffers remain on the job for 5 to 7 years.

Food is a very important part of the cruise experience. “Food is the number-one reason people rebook a cruise,” says Abel. So everything served aboard a Celebrity ship is prepared from scratch. About 200 people work in the galley in a structured, well-planned operation, using years of historical data, to forecast demand for each component of each meal.

Guest surveys are provided online at the end of each cruise, and guests complete them at a high rate (about 85%), having been strongly encouraged to do so by their cabin attendants. The surveys serve not only as a measure of overall satisfaction, but two other purposes as well: (1) they are used as a brand marketing tool comparing Celebrity to other cruise lines, hotels, and

Figure 6.9

Celebrity X Cruises®

Welcome to the Celebrity Cruises Feedback Survey. Your opinion is extremely important to us and we'd love to hear feedback.

Very Likely 10 9 8 7 6 5 4 3 2 1 0 Not At All Likely

If asked for your opinion how likely would you be to recommend Celebrity Cruises to a friend family member or colleague?

If you were planning another cruise how likely would you be to choose Celebrity Cruises?

Next

competing entertainment venues, and (2) they provide management with specific feedback, down to the individual employee level in some cases. Abel personally reviews results of each completed cruise within 48 hours and takes action if defects are found in any aspect of the experience. The initial part of the questionnaire appears in Figure 6.9.

Celebrity's main quality feedback tool is called the *net provider score* (NPS), which tallies the guests' answers to a wide series of questions about their experience. The question: "*How likely would you be to recommend Celebrity Cruises to a friend, family member, or colleague?*" is critical and is the measure used to compare ships within Celebrity's fleet as well as with competing cruise lines. Scores of 9–10 on this question label the customers as "advocates." A 7–8 is "neutral," and a score of 6 or below is a "detractor."

The NPS computation is simple: The percentage of detractors is subtracted from the percentage of advocates. For example, if 70% of the guests score the cruise a 9–10, 17% score it a 7–8, and

13% give a 6 or less, the $NPS = 70 - 13 = 57$. An elite line tries to attain a score over 60 on each cruise. Celebrity averages a 65.

Discussion Questions*

1. What unique aspects of the cruise industry make quality service more difficult to attain? What aspects help raise quality?
2. How does the cruise operation differ from that at a land-based hotel?
3. How could control charts, Pareto diagrams, and cause-and-effect diagrams be used to identify quality problems at Celebrity?
4. Suppose that on two successive cruises of the same ship, the cruise line receives NPS scores of: (Trip 1) 78% "advocates," 4% "neutrals," and 18% "detractors" and (Trip 2) 70% "advocates," 20% "neutrals," and 10% "detractors." Which would be preferable and why?
5. List a dozen quality indicators (besides NPS) that Celebrity also measures. (There are 35 on its guest evaluation form.)

*You may wish to view the video that accompanies this case before addressing these questions.

- **Additional Case Studies:** Visit [MyLab Operations Management](#) for these free case studies:

Westover Electrical, Inc.: This electric motor manufacturer must address numerous defects in its wiring process.

Quality at the Ritz-Carlton Hotel Company: How the Ritz treats quality as the heartbeat of the company.

Endnote

1. Philip B. Crosby, *Quality Is Free* (New York: McGraw-Hill, 1979). Further, J. M. Juran states, in his book *Juran on Quality by Design* (The Free Press 1992, p. 119), that costs of poor quality "are huge, but the amounts are not known with

precision. In most companies the accounting system provides only a minority of the information needed to quantify this cost of poor quality. It takes a great deal of time and effort to extend the accounting system so as to provide full coverage."

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Chapter 6 *Rapid Review*

Main Heading	Review Material	MyLab Operations Management
QUALITY AND STRATEGY (pp. 248–249)	<p>Managing quality helps build successful strategies of differentiation, low cost, and <i>response</i>.</p> <p>Two ways that quality improves profitability are:</p> <ul style="list-style-type: none"> ■ <i>Sales gains</i> via improved response, price flexibility, increased market share, and/or improved reputation ■ <i>Reduced costs</i> via increased productivity, lower rework and scrap costs, and/or lower warranty costs 	<p>Concept Questions: 1.1–1.5</p> <p>VIDEO 6.1 The Culture and Quality at Arnold Palmer Hospital</p>
DEFINING QUALITY (pp. 249–251)	<p>An operations manager's objective is to build a total quality management system that identifies and satisfies customer needs.</p> <ul style="list-style-type: none"> ■ Quality—The ability of a product or service to meet customer needs. <p>The American Society for Quality (ASQ) defines quality as “the totality of features and characteristics of a product or service that bears on its ability to satisfy stated or implied needs.”</p> <p>The two most well-known quality awards are:</p> <ul style="list-style-type: none"> ■ <i>U.S.</i>: Malcolm Baldrige National Quality Award, named after a former secretary of commerce ■ <i>Japan</i>: Deming Prize, named after an American, Dr. W. Edwards Deming <ul style="list-style-type: none"> ■ ISO 9000—A set of quality standards developed by the International Organization for Standardization (ISO). <p>ISO 9000 is the only quality standard with international recognition. To do business globally, being listed in the ISO directory is critical.</p> <ul style="list-style-type: none"> ■ Cost of quality (COQ)—The cost of doing things wrong; that is, the price of nonconformance. <p>The four major categories of costs associated with quality are <i>prevention costs</i>, <i>appraisal costs</i>, <i>internal failure costs</i>, and <i>external failure costs</i>.</p> <p>Four leaders in the field of quality management are W. Edwards Deming, Joseph M. Juran, Armand Feigenbaum, and Philip B. Crosby.</p>	<p>Concept Questions: 2.1–2.6</p>
TOTAL QUALITY MANAGEMENT (pp. 251–256)	<ul style="list-style-type: none"> ■ Total quality management (TQM)—Management of an entire organization so that it excels in all aspects of products and services that are important to the customer. <p>Seven concepts for an effective TQM program are (1) continuous improvement, (2) Six Sigma, (3) employee empowerment, (4) benchmarking, (5) just-in-time (JIT), (6) Taguchi concepts, and (7) knowledge of TQM tools.</p> <ul style="list-style-type: none"> ■ PDCA—A continuous improvement model that involves four stages: plan, do, check, and act. <p>The Japanese use the word <i>kaizen</i> to describe the ongoing process of unending improvement—the setting and achieving of ever-higher goals.</p> <ul style="list-style-type: none"> ■ Six Sigma—A program to save time, improve quality, and lower costs. <p>In a statistical sense, Six Sigma describes a process, product, or service with an extremely high capability—99.9997% accuracy, or 3.4 defects per million.</p> <ul style="list-style-type: none"> ■ Employee empowerment—Enlarging employee jobs so that the added responsibility and authority are moved to the lowest level possible in the organization. <p>Business literature suggests that some 85% of quality problems have to do with materials and processes, not with employee performance.</p> <ul style="list-style-type: none"> ■ Quality circle—A group of employees meeting regularly with a facilitator to solve work-related problems in their work area. ■ Benchmarking—Selecting a demonstrated standard of performance that represents the very best performance for a process or an activity. <p>The philosophy behind just-in-time (JIT) involves continuing improvement and enforced problem solving. JIT systems are designed to produce or deliver goods just as they are needed.</p> <ul style="list-style-type: none"> ■ Quality robust—Products that are consistently built to meet customer needs, despite adverse conditions in the production process. ■ Target-oriented quality—A philosophy of continuous improvement to bring the product exactly on target. ■ Quality loss function (QLF)—A mathematical function that identifies all costs connected with poor quality and shows how these costs increase as output moves away from the target value. 	<p>Concept Questions: 3.1–3.6</p>

Chapter 6 **Rapid Review** *continued*

Main Heading	Review Material	MyLab Operations Management
TOOLS OF TQM (pp. 257–261)	<p>TQM tools that generate ideas include the <i>check sheet</i> (organized method of recording data), <i>scatter diagram</i> (graph of the value of one variable vs. another variable), and <i>cause-and-effect diagram</i>. Tools for organizing the data are the <i>Pareto chart</i> and <i>flowchart</i>. Tools for identifying problems are the <i>histogram</i> (distribution showing the frequency of occurrences of a variable) and <i>statistical process control chart</i>.</p> <ul style="list-style-type: none"> ■ Cause-and-effect diagram—A schematic technique used to discover possible locations of quality problems. (Also called an Ishikawa diagram or a fish-bone chart.) <p>The 4 Ms (material, machinery/equipment, manpower, and methods) may be broad “causes.”</p> <ul style="list-style-type: none"> ■ Pareto chart—A graphic that identifies the few critical items as opposed to many less important ones. ■ Flowchart—A block diagram that graphically describes a process or system. ■ Statistical process control (SPC)—A process used to monitor standards, make measurements, and take corrective action as a product or service is being produced. ■ Control chart—A graphic presentation of process data over time, with predetermined control limits. 	<p>Concept Questions: 4.1–4.6</p> <p>Problems: 6.1, 6.3, 6.5, 6.8–6.14, 6.16–6.19</p> <p>ACTIVE MODEL 6.1</p> <p>Virtual Office Hours for Solved Problem: 6.1</p>
THE ROLE OF INSPECTION (pp. 261–264)	<ul style="list-style-type: none"> ■ Inspection—A means of ensuring that an operation is producing at the quality level expected. ■ Source inspection—Controlling or monitoring at the point of production or purchase: at the source. ■ Poka-yoke—Literally translated, “mistake proofing”; it has come to mean a device or technique that ensures the production of a good unit every time. ■ Checklist—A type of poka-yoke that lists the steps needed to ensure consistency and completeness in a task. ■ Attribute inspection—An inspection that classifies items as being either good or defective. ■ Variable inspection—Classifications of inspected items as falling on a continuum scale, such as dimension, size, or strength. 	<p>Concept Questions: 5.1–5.6</p> <p>Problems: 6.20–6.21</p> <p>VIDEO 6.2</p> <p>Quality Counts at Alaska Airlines</p>
TQM IN SERVICES (pp. 264–266)	<p>Determinants of service quality: reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding/knowing the customer, and tangibles.</p> <ul style="list-style-type: none"> ■ Service recovery—Training and empowering frontline workers to solve a problem immediately. ■ SERVQUAL—A popular measurement scale for service quality that compares service expectations with service performance. 	<p>Concept Questions: 6.1–6.6</p> <p>VIDEO 6.3</p> <p>Celebrity Cruises: A Premium Experience</p>

Self Test

■ **Before taking the self-test**, refer to the learning objectives listed at the beginning of the chapter and the key terms listed at the end of the chapter.

LO 6.1 In this chapter, *quality* is defined as:

- the degree of excellence at an acceptable price and the control of variability at an acceptable cost.
- how well a product fits patterns of consumer preferences.
- the totality of features and characteristics of a product or service that bears on its ability to satisfy stated or implied needs.
- being impossible to define, but you know what it is.

LO 6.2 ISO 9000 is an international standard that addresses ____.

LO 6.3 If 1 million passengers pass through the Jacksonville Airport with checked baggage each year, a successful Six Sigma program for baggage handling would result in how many passengers with misplaced luggage?

- 3.4
- 6.0
- 34
- 2,700
- 6 times the monthly standard deviation of passengers

LO 6.4 The process of identifying other organizations that are best at some facet of your operations and then modeling your organization after them is known as:

- continuous improvement.
- employee empowerment.
- benchmarking.
- copycatting.
- patent infringement.

LO 6.5 The Taguchi method includes all except which of the following major concepts?

- Employee involvement
- Remove the effects of adverse conditions
- Quality loss function
- Target specifications

LO 6.6 The seven tools of total quality management are ____, ____, ____, ____, ____, ____, and ____.

Answers: LO 6.1. c; LO 6.2. quality management systems; LO 6.3. a; LO 6.4. c; LO 6.5. a; LO 6.6. check sheets, scatter diagrams, cause-and-effect diagrams, Pareto charts, flowcharts, histograms, SPC charts.

Statistical Process Control

SUPPLEMENT OUTLINE

LEARNING OBJECTIVES

LO S6.1

LO S6.2

LO S6.3

LO S6.4

LO S6.5

LO S6.6

LO S6.7

◆ Statistical Process Control (SPC) 278

◆ Process Capability 291

◆ Acceptance Sampling 293

Explain the purpose of a control chart 279

Explain the role of the central limit theorem in SPC 280

Build \bar{x} -charts and R -charts 281

List the five steps involved in building control charts 285

Build p -charts and c -charts 287

Explain process capability and compute C_p and C_{pk} 291

Explain acceptance sampling 294

As part of its statistical process control system, Flowers Bakery, in Georgia, uses a digital camera to inspect just-baked sandwich buns as they move along the production line. Items that don't measure up in terms of color, shape, seed distribution, or size are identified and removed automatically from the conveyor.



Courtesy of Georgia Institute of Technology