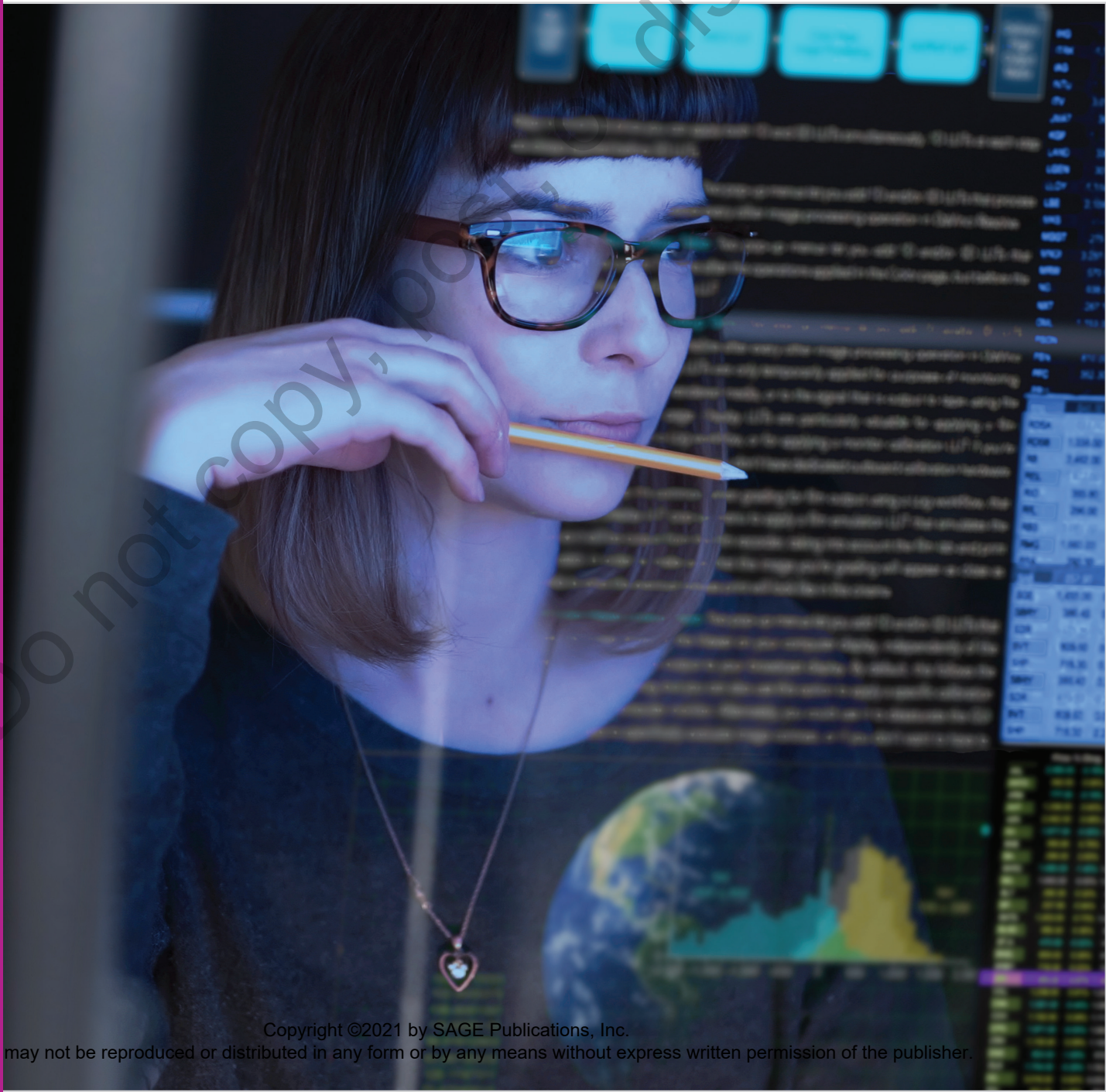# CHAPTER 2

MAKING DECISIONS AND USING ANALYTICS

CHAPTER **LEARNING OBJECTIVES**

After studying this chapter, you should be able to:

2.1 Explain why decision-making is important to a manager's effectiveness.

2.2 Describe the role of intuition in decision-making.

2.3 List and explain major decision traps and how to avoid them.

2.4 Define creativity and discuss the three components of creativity.

2.5 Give an example of business analytics.

2.6 Be familiar with the concept of big data and its use in business decision-making.

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Decisions: The Big Ones

It often seems that a manager's career is an endless succession of decisions. Managers make all kinds of decisions, ranging from routine daily decisions to long-term decisions on strategy. A solid record of good decisions leads an individual to the top of an organization. There are certain decisions a manager has to get right. We have all made decisions we regret. However, there are times when a bad decision can ruin not only a manager's career but the organization's success as well. What are the things a manager must get right? The following list provides examples of critical decisions that may make or break a manager's career. Smart managers pay close attention to these big decisions.

1. *Hiring*. One of the most important decisions a manager makes is who. Who will you choose to run your organization? If you select the right people, with the right skills, they will advance the organization's mission. If you do not have people working for you who are trustworthy, you are in real trouble. When managers fail, it is often due to at least one poor decision regarding whom they hired. For example, suppose a manager hires a brilliant marketing manager from a top school. The marketing manager's big-picture perspective results in large cost overruns on an advertising campaign that fails. It reflects badly on the brand manager, since top management holds her responsible for the expensive and failed campaign.

   Hiring decisions are tough. Managers have to make judgment calls about new employees based on limited résumé information and maybe one interview. Sometimes the process is rushed, and even when it is not, it is hard to assess potential from a résumé or even interviews. Skills are difficult to evaluate, and determining character is even more difficult. Nevertheless, managers know that great organizational performance is due to great people. Managers look everywhere to find the best talent and interview and assess potential employees. Keep this phrase in mind: "Hire slow." Hiring mistakes can be costly, and poor-performing employees can be difficult to terminate.

2. *Firing*. Effective managers remove the toxicity of poor-performing employees from their organization. This is tough. They recognize their responsibility for creating an effective workplace where everyone contributes. A negative employee poisons a working environment, and removing them is often the only choice. The negative employee should receive a lot of feedback, coaching, and opportunities to improve. However, sometimes this does not take, and the employee has to be let go. No one loves firing people, but firing a toxic employee leaves the manager feeling like they did the right thing for the team and the organization. For example, suppose an employee does not pull his weight on a team project. The project is ultimately successful, but the team members feel it was unfair that they had to do his work. Something has to be done about this situation to improve morale, and the employee is fired.

3. *Decisions with ethical implications*. Managers face ethical decisions that sometimes involve a gray area. It is not obvious what is right and what is wrong. However, the best decision-makers transform the gray zone into choices between right and wrong. This is not easy, since reward systems and the drive for short-term results make it tempting to take ethical shortcuts. A manager's reputation is on trial with these decisions. However, results are not worth sacrificing ethics.
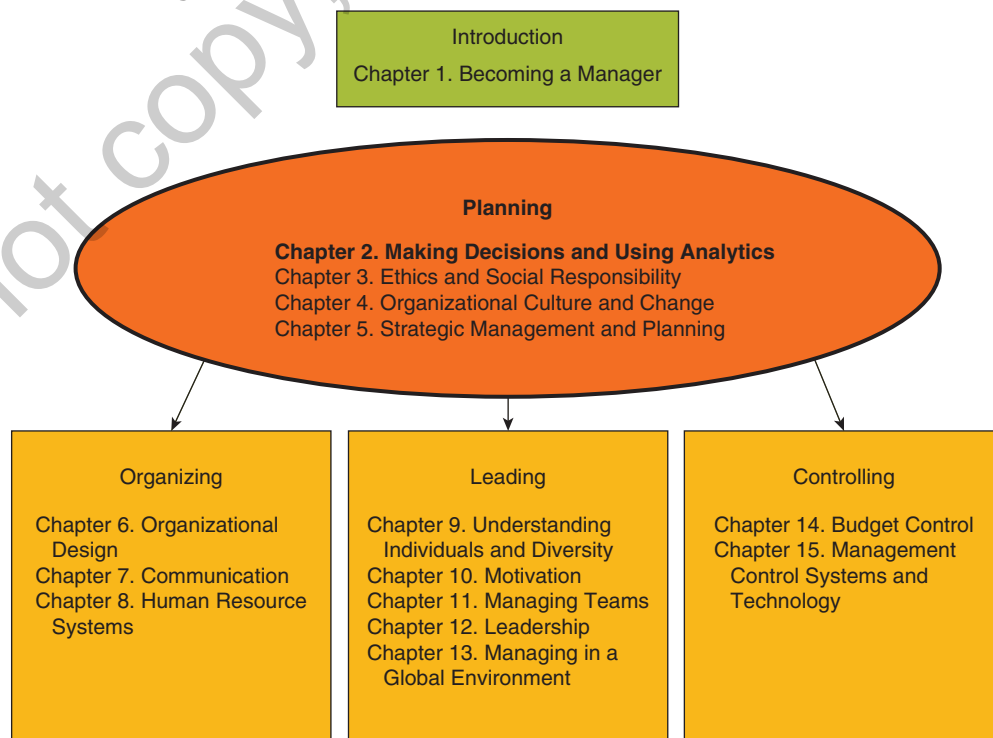
For example, to do business in Latin America, an accounting manager might be asked by their boss to create a "slush fund" for tips to move products ahead when being loaded onto cargo ships. After all, this is a "cultural thing." The manager stands their ground and says no, but has to take responsibility for late shipments.

4. *"Fork-in-the-road" decisions.* There is a famous quote from leadership expert John C. Maxwell: "Every major difficulty you face in life is a fork in the road. You choose which track you will head down, toward breakdown or breakthrough."[1] Managers face challenging "moments of truth" that may result in success or failure. Their decisions will alter the future of the organization—and they know this. For example, a manager might have to choose among software packages to enhance data analytics. Another example is when managers make strategic calls regarding which markets to pursue. Operational decisions affect how efficiently employees can perform their work. The best managers think about these directional decisions carefully by diagnosing the situation and weighing options. They try to maximize success by asking for outside opinions and having others challenge their assumptions. They get the right data to learn the right direction. Then, they are decisive and turn the decision into action.

5. *Responding to mistakes.* Despite the best efforts, sometimes decisions result in unsuccessful outcomes. The competitive landscape may change, resulting in a prior decision not being effective. A manager must recognize this and "own" their decisions. They need to follow up and constantly monitor the results, and be ready to change course if needed. They are comfortable saying, "This was wrong, I was wrong, and we need to go in a different direction." A lack of this level of courage is too common, and perpetuates bad decisions and adversely affects organizations. For example, suppose a manager in a condiment company backs a new low-carb barbecue sauce, since the sales force says customers want lower-carb foods. However, it turns out that it has a regional flavor and will not sell outside the sales area. The manager changes course and limits production of the item.

Sources: Adapted from Azarello, P. (2013). The two most important decisions that an executive can make. Retrieved from https://www.tlnt.com/the-two-most-important-decisions-that-an-executive-can-make/; Myatt, M. (2012). 6 tips for making better decisions. Retrieved from https://www.forbes.com/sites/mikemyatt/2012/03/28/6-tips-for-making-better-decisions/#47294b8e34dc; Petty, A. (2017). 5 critical decisions that will make or break you as a leader. Retrieved from https://www.thebalance.com/decisions-that-make-or-break-you-as-a-leader-2275843.

▼ FIGURE 2.0

Textbook Organization

Introduction
Chapter 1. Becoming a Manager

Planning

Chapter 2. Making Decisions and Using Analytics
Chapter 3. Ethics and Social Responsibility
Chapter 4. Organizational Culture and Change
Chapter 5. Strategic Management and Planning

Organizing

Chapter 6. Organizational Design
Chapter 7. Communication
Chapter 8. Human Resource Systems

Leading

Chapter 9. Understanding Individuals and Diversity
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Controlling

Chapter 14. Budget Control
Chapter 15. Management Control Systems and Technology

These big decisions illustrate the importance of effective decision-making for managers. Decisions and financial success are related. Rather than getting lost in the many decisions you face, pay particular attention to these five important ones. Top-performing managers get more of these decisions right than wrong.

From these examples of the five make-or-break decisions, it is clear that making the right decisions plays a large role in a manager's career success. This chapter will cover both classic and contemporary research on decision-making that every manager must know to make the right decisions, at the right time.

Decision-Making in Organizations

Learning Objective 2.1: Explain why decision-making is important to a manager's effectiveness.

Decision-making affects organizational performance. The right decisions ensure the success of strategies ranging from restructuring to the introduction of new products or processes. Researchers at Bain & Company Consulting surveyed executives worldwide from 760 companies, most with revenues exceeding $1 billion, to understand how effective those companies were at making and executing their critical decisions.[2] Executives were asked to assess their decision quality (whether decisions proved to be right more often than not), speed (whether decisions were made faster or slower than their competitors' were), yield (how well decisions were translated into action), and effort (the time, trouble, and expense required for each key decision). An overall score for each firm was created and then related to each firm's financial performance. The researchers found that decision effectiveness and financial results were highly related for all firms, regardless of the industry or country in which they were located. Firms that were more effective at decision-making and execution generated average total shareholder returns nearly six percentage points higher than those of other firms in the study. The researchers also found that many companies have room to improve their decision-making performance. The typical organization has the potential to double its decision effectiveness.

Managers who collect information and use analytical techniques make decisions that are more effective and profitable. As you learned in Chapter 1, decision-making is central in Mintzberg's classic analysis of the nature of managerial work.[3] Decision-making is a fundamental part of a manager's job. As a manager, you will likely be promoted based on your record of making solid decisions that improve your organization's efficiency and effectiveness. Managers must own the decisions they make, so it is important to know how they are best made. First, the rational approach to decision-making is discussed—this represents best practice in decision-making that every manager should strive to attain.

The Rational Decision-Making Process

The rational decision-making model presents a series of logical steps decision-makers follow to determine the optimal choice.[4] Examples of optimization include maximizing revenue and minimizing cost. The eight-step process for rational decision-making is shown in Figure 2.1. The steps follow.

1. Step 1: The problem (or opportunity) is defined, and then information is gathered and analyzed.
2. Step 2. Decision criteria are established.
3. Step 3. The decision criteria are weighted.
4. Step 4. Based on this information, a broad set of alternatives (or possible courses of action) are identified.
5. Step 5. These alternatives are evaluated in terms of the established decision criteria.

6. Step 6. Based on analysis of the alternative courses of action, a decision is made that is projected to achieve the best possible outcome for the organization. Sometimes the decision-maker has competing objectives and must balance the concerns and choose an optimal solution.
7. Step 7. Decision-makers develop action steps for implementation of the decision.
8. Step 8. The final step is to evaluate the decision, which provides feedback for the further identification of problems.

As you can see, the decision-making process is a cycle that generates new information that is fed back into the problem-solving process.
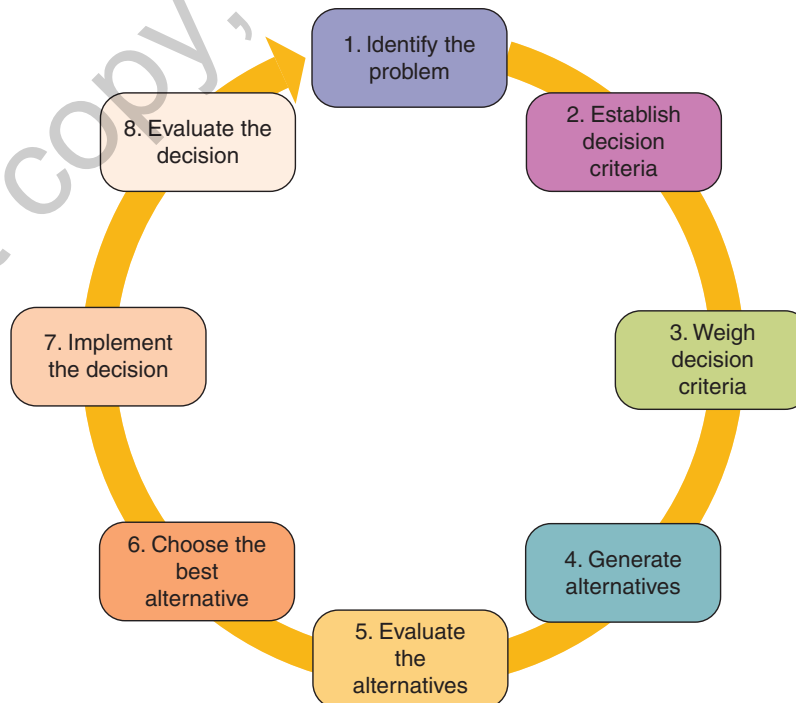
This model includes a number of assumptions. The rational model assumes that decision-makers have complete information, are able to develop an exhaustive list of alternatives, weight them, and then choose a decision with the highest value and/or lowest cost to the organization. At the operational level of management, some problems are routine and a procedure is used to solve them. In reality, however, most problems that managers must solve lack structure, and so it is impossible to program a response.[5] The level of problem structure decreases as one moves from the operational to the senior management level. The top management team faces the most unstructured problems, which have to do with the strategic direction of the organization.

CRITICAL THINKING QUESTIONS

Give an example of a decision you made that did not follow this eight-step rational process. Explain which steps in the model you did not follow and why.

▼ FIGURE 2.1

The Rational Decision-Making Process

1. Identify the problem
2. Establish decision criteria
3. Weigh decision criteria
4. Generate alternatives
5. Evaluate the alternatives
6. Choose the best alternative
7. Implement the decision
8. Evaluate the decision

Source: Adapted from Nutt, P. (1984). Types of organizational decision processes. *Administrative Science Quarterly*, 29, 414–450.

Limits to Rational Decision-Making

Managers sometimes fail to identify the problem correctly at the start of the decision-making process. In addition, some managers consider only a few alternatives rather than a broad set of possible options. They may consider only the most obvious alternatives and not brainstorm creative solutions (creative problem-solving is discussed later in this chapter). Managers may choose a suboptimal course of action (resulting in a lose-lose scenario).[6]

Often, decisions are made without complete information. This happens because of the lack of available information relevant to the problem or time pressure. Sometimes the decision-maker does not have the time to follow the rational process. An experimental study found that under a time constraint, research subjects reverted to a familiar decision-making method rather than attempting to optimize.[7] A review of 89 samples with 17,704 subjects[8] found that time pressure weakens the effects of careful decision-making on performance. For example, a top management team confronted with a product defect might be under time pressure to make a decision on whether or not to recall the product from the market. Such decision constraints combine to jeopardize the ability of the team to implement the rational decision-making process and make a good decision. Decision-makers have limits on their ability to assimilate large amounts of information, and this is called **bounded rationality**.

Bounded Rationality

Decision-makers operate within bounded rationality rather than perfect rationality. What this means is that decision-makers simplify complex problems to limit the amount of information-processing needed.[9] Human beings have a limited capacity to process large amounts of information in the context of decision-making to make optimal decisions. In many instances, managers engage in **satisficing**—they make a decision that is satisfactory but not optimal. However, within the boundaries of this simplified model, they behave rationally.[10]

What do managers do when they satisfice? They limit the information analyzed, and they limit the number of alternatives considered. They choose the first acceptable alternative they see rather than continuing their information search and analysis until they find the best option. Bounded rationality in decision-making is the result of organizational factors (e.g., the top management team presses for their preferred course of action), individual limits on the ability to process information (e.g., limiting creative brainstorming), and perceptions (e.g., errors in interpretation of the data used to make a decision).[11]

Bounded rationality is also the result of two guesses the decision-maker must address: (1) a guess about uncertain future consequences and (2) a guess about uncertain future preferences.[12] This happens because at the time of a decision, managers cannot predict the future. At times, they do not even know what they want to see happen in the future. So the decision-making process may be influenced by other psychological processes, such as the need to justify prior decisions to others.[13] This perspective highlights the importance of uncertainty and risk in the decision-making process. The next section will describe **prospect theory**, which is one of the most important frameworks for explaining decision-making under risk and uncertainty.

Prospect Theory

Daniel Kahneman and Amos Tversky won the Nobel Prize in Economics in 2002, in part for their work on the prospect theory of decision-making.[14] Their work focused on risk perceptions in decisions people make. The authors conducted studies in which they asked research subjects to make decisions when given two monetary options that involved prospective losses and gains. The following set of choices is one they used in their classic studies.

Choosing B indicates that the person is more risk-averse than those choosing A. If you chose B for question 1, and then chose A for question 2, you are like the majority of people

> You have $1,000 and you must pick one of the following choices:
> Choice A: You have a 50% chance of gaining $1,000, and a 50% chance of gaining $0.
> Choice B: You have a 100% chance of gaining $500.

> You have $2,000 and you must pick one of the following choices:
> Choice A: You have a 50% chance of losing $1,000, and a 50% chance of losing $0.
> Choice B: You have a 100% chance of losing $500.

Source: Kahneman, D. & Tversky, A. (1979). Prospect Theory: An analysis of decision under risk. Econometrica, 47(2), 263-291.]

presented with this decision. If people made decisions according to rational decision-making norms, they would pick either A or B in both situations (that is, they should be indifferent because the expected value of both outcomes is the same). However, the results of this study showed that an overwhelming majority of people chose B for question 1 and A for question 2. Why? People are willing to settle for a reasonable gain (even if they have a reasonable chance of earning more), but are willing to engage in risk-seeking behaviors where they can limit their losses. In other words, losses weigh more heavily emotionally in decision-making than equivalent gains. Are you a risk-taker, or are you risk-averse? You will learn more about your attitudes toward risk by completing Self-Assessment 2.1.

Framing

Prospect theory explains that people put more emphasis on gains than losses—they make decisions that increase their gains and avoid loss. People treat the two types of risk (gain versus loss) in a completely different way to maximize their perceived outcome. However, this may result in irrational decisions that are not based on a correct calculation of expected utility. Prospect theory explains why decisions are sometimes irrational. This may be, in part, due to **framing**. Framing refers to whether questions are presented as gains or losses. Leaders must pay attention to how decisions are framed when they are presented. As the examples of monetary choices above illustrate, decisions may be affected by how options are presented (people are more risk-averse when decisions are framed in terms of loss). It is important to consider how information regarding risk and uncertainty is presented.

Risk management is now a part of every manager's job.
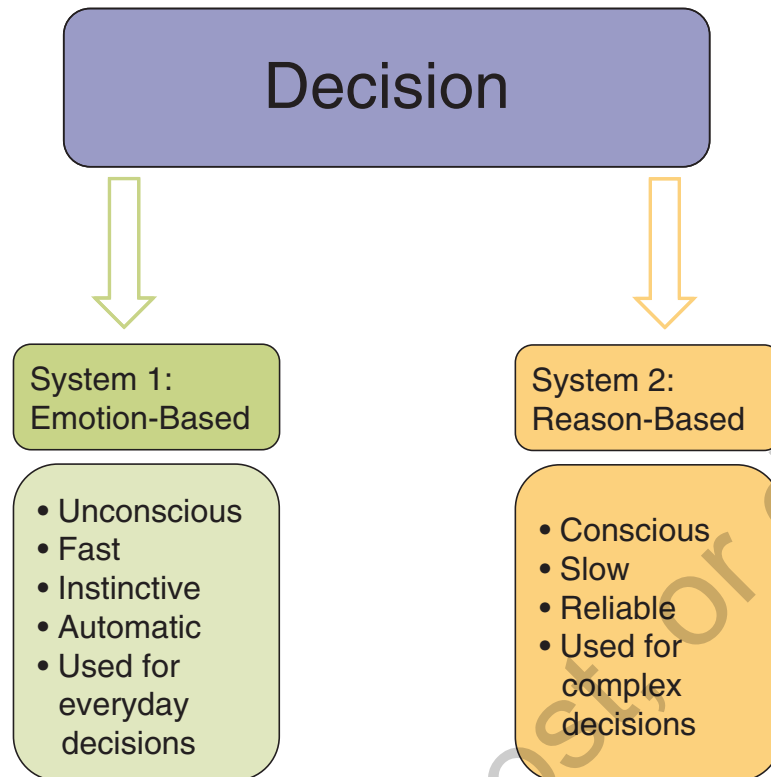
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CRITICAL THINKING QUESTIONS

How could you use prospect theory to get a better deal on a used car you are buying? How could you frame options as gains or losses to get a lower price?

Kahneman's book *Thinking, Fast and Slow*[15] examines two modes of thinking that psychology has labeled System 1 and System 2 thinking (see Figure 2.2).[16] System 1 thinking represents automatic and effortless decision-making that is often involuntary. System 2 thinking is complex thinking that demands mental effort, including complex analytics. You will learn more about such analytics later in this chapter. That said, System 1 thinking represents **intuition**, which has received research attention as well as a great deal of interest in the popular press.

Two Decision-Making Routes

Decision

System 1: Emotion-Based

- Unconscious
- Fast
- Instinctive
- Automatic
- Used for everyday decisions

System 2: Reason-Based

- Conscious
- Slow
- Reliable
- Used for complex decisions

Source: Adapted from WebMarketingHub. (2018). B2B decision making process: The role of emotions. Retrieved from https://www.the-b2b-webmarketing-hub.com/index.php/2018/03/27/b2b-decision-making-process-the-role-of-emotions/.

Intuition

Learning Objective 2.2: Describe the role of intuition in decision-making.

"The essence of intuition or intuitive responses is that they are reached with little apparent effort, and typically without conscious awareness. They involve little or no conscious delibera-tion."[17] Four characteristics comprise intuition:

- a nonconscious process
- involving holistic associations
- that are produced rapidly,
- which result in affectively charged judgments.[18]

Intuition helps managers make fast and accurate decisions. While research on such uncon-scious thought processes is somewhat new, available evidence supports the idea that intuitive processes should be considered part of a manager's decision-making.

Malcom Gladwell's book *Blink: The Power of Thinking Without Thinking*[19] popularized the idea that intuition may play an important role in decision-making. Gladwell notes that people learn by their experiences and that they may not know why they know things but are certain they know them. He explains the influences of the unconscious mind on decisions and puts forth the premise that there can be value in a decision made in the "blink of an eye" rather than after months of analysis. Gladwell introduces the idea of "thin-slicing," in which the

Small business owners often rely on their intuition to predict which foods their customers will buy.

©iStockphoto.com/monkeybusinessimages

unconscious mind finds patterns in situations based on very brief experiences. However, he cautions that errors are made when thin-slicing is used to make decisions, due to the decision traps discussed later in this chapter.

Intuition is not the same thing as common sense. Intuition is perception without conscious thinking and can seem like common sense. However, intuition varies greatly, from basic gut feelings to complicated judgments like a physician's quick diagnosis. According to Simon, "intuition and judgment—at least good judgment—are simply analyses frozen into habit and into the capacity for rapid response through recognition."[20] In other words, intuition is the unconscious operation in the brain formed by freezing sensing and judgment. By contrast, common sense is not typically repetitive; it is a more simplified thought process. Another major difference is that intuition is individual and common sense is often social (i.e., what the majority of people think as a consensus).[21] A comparison of intuition and common sense is shown in Table 2.1.

Benefits of Intuition

Most managers acknowledge that intuition plays a role in their decisions. They often rely on "gut feelings" or instincts in making important decisions, particularly related to innovation.[22] In-depth interviews with 60 professionals across a variety of industries and occupations found that intuition has benefits:[23]

- *Expedited decision-making.* Intuition results in quicker decisions that get the job done, adapting to a changing environment.
- *Improvement of the decision.* Intuition provides a check and balance, allows for fairness, avoids having to rework the decision, and causes managers to pay more attention.
- *Facilitation of personal development.* Intuition gives a manager more power, develops instincts, helps the manager apply their experiences, and allows positive risk-taking.
- *Promotion of decisions compatible with company culture.* Intuition helps managers make decisions that correspond with the organization's values.

CRITICAL THINKING QUESTIONS

Give an example of when you made a decision based on your intuition. Why did you think you knew the right thing to do without analysis? Discuss the success or failure of this decision. Would you rely on your intuition for a similar decision in the future? Explain.

Another decision tool that is often used in organizations when decisions are routine is a heuristic. These useful decision rules are applied widely in organizations, and are discussed next.

▼ TABLE 2.1

Intuition Versus Common Sense

Intuition	Common Sense
• Perception without conscious thinking	• Perception with conscious thinking
• Gut feelings	• Simplified thought process
• Individual (what an individual thinks)	• Social (what the majority agrees)

Heuristics

The use of **heuristics** or decision rules is an effective way to manage information and make improved decisions. Heuristics rely on one or more of the following methods to reduce effort:[24]

1. Examining fewer cues—for example, by limiting information to only what's important.
2. Reducing the difficulty associated with retrieving and storing cue values—for example, by using *less than*, *equal to*, or *greater than* instead of actual values.
3. Simplifying the weighting principles for cues—for example, by weighing each piece of information equally.
4. Integrating less information—for example, by selecting threshold values and accepting what is "good enough."
5. Examining fewer alternatives—for example, by using pairwise comparisons and then selecting one alternative from each set.

Heuristics underlie both intuitive and deliberate decision-making.[25] The selection of decision rules is a two-step process in which the task and the individual's memory constrain the set of applicable rules. The individual's ability to process information and perception of what is rational guide the final decision. Deliberate judgments are less accurate than intuitive judgments. In both cases, accuracy depends on the match between the rule employed and the characteristics of the situation. For example, the use of a financial criterion to decide whether to enter an international market may miss opportunities that might only be realized if the national culture is considered. Table 2.2 shows 10 commonly used heuristics. For example, the **recognition heuristic** is commonly used in business decisions in which decision-makers select one of two alternatives because one has the higher value on a given criterion (such as return on investment, or ROI). Another possible heuristic is **fluency**, in which the quickest decision is selected (e.g., when there is a pressing need to bring a new product to market before competition enters). The **equality heuristic** prescribes that resources are allocated equally (e.g., through budgets allocated for entertainment expenses across sales units). **Imitating the majority** involves doing what most people do (e.g., creating an Instagram account because most others in your industry have one). **Imitating the successful** is what is commonly referred to as "best practices," in which successful practices are imitated. For example, college football teams may imitate the successful "turnover chain" implemented by Coach Manny Diaz at the University of Miami.[26] Whether decisions are based on intuition or analysis, using one of these 10 heuristics should reduce the effort expended in making decisions by simplifying them.

Imitating the successful: Defensive back Sheldrick Redwine (22) celebrates his interception with the University of Miami Turnover Chain during a game.

©Icon Sportswire/Getty Images

CRITICAL THINKING QUESTIONS

> Provide an example of how heuristics are used in college admission decisions based on minimum SAT scores and grade point average. What specific cutoff scores are used to make college admission decisions? What are the limitations of using heuristics in this way?

Heuristics are useful because they aid in simplifying challenging problems so that the problem is then rapidly solved. However, there is a danger in simplification in that it may lead to biases and decision traps. Managers need to be mindful of these decision traps and know how to avoid them. The next sections review common decision errors.

Ten Heuristics for Managers

Heuristic	Definition
Recognition Heuristic	If one of two alternatives is recognized, infer that it has the higher value on the criterion
Fluency Heuristic	If both alternatives are recognized but one is recognized faster, infer that it has the higher value on the criterion
Take-the-Best	To infer which of two alternatives has the higher value, (a) search through cues in order of vality, (b) stop search as soon as a cue discriminates, and (c) choose the alternative this cue favors
Tallying: Unit-Weight	To estimate a criterion, do not estimate weights, but simply count
Linear Model	The number of positive cues
Satisficing	Search through alternatives, and choose the one that exceeds your aspiration level
Equality Heuristic: 1/N	Allocate resources equally to each of N alternatives
Default Heuristic	If there is a default, do nothing
Tit-for-tat	Cooperate first, and them imitate your partner's last behavior
Imitate the Majority	Consider the majority of people, and imitate their behavior
Imitate the Successful	Consider the most successful person/organization, and imitate the behavior

Source: Adapted from Kruglanski, A. W. & Gigerenzer, G. (2011). Intuitive and deliberate judgments are based on common principles. *Psychological Review,* 118(1), 97–109.

Decision Traps

Learning Objective 2.3: List and explain major decision traps and how to avoid them.

Hindsight Bias

Hindsight bias, also commonly referred to as the **I-knew-it-all-along effect**,[27] is well established as having far-reaching effects. Hindsight bias is defined as "the tendency for individuals with outcome knowledge (hindsight) to claim they would have estimated a probability of occurrence for the reported outcome that is higher than they would have estimated in foresight (without the outcome information)."[28]

Four processes underlie this belief.

- First, the person recalls the old event and responds consistently with the memory of it.
- Second, the person focuses on the outcome and adjusts their belief, pretending they did not know the outcome.
- Third, the belief is reconstructed based on what the person's judgment would have been prior to the outcome. Research shows people do this by first sampling evidence related to the judgment from their long-term memories and the external world. Once an outcome is known, people look for and retain evidence that fits the outcome rather than evidence that contradicts it.
- The fourth process is based on a person's motivation to present themselves favorably to others. People want to be seen as accurate, and they claim when something happens that they "knew it all along."

A review of 90 studies[29] of hindsight bias showed support for the existence of this bias in decision-making. Hindsight bias may influence how outcomes of decisions are interpreted after the fact and lead to poor decision-making, since a manager may ignore important information in the present and then reconstruct the past as if they had the knowledge. Thus, a manager's ability to learn from past mistakes is compromised by hindsight bias. This may be compounded if the manager is also overconfident in their decision-making ability and this is another decision trap.

CRITICAL THINKING QUESTIONS

Provide an example of a time when someone said "I knew it all along." Did you believe them? Why or why not?

Overconfidence

Overconfidence bias (sometimes referred to as **hubris**) is an inflated level of confidence in how accurate a person's knowledge or predictions are.[30] Hubris is foolish overconfidence. This implies a level of ignorance or arrogance that is likely to cause failures. The term *hubris* originates with ancient Greek mythology, where it was used to describe arrogance before the gods. The goddess Nemesis often doomed mortals with their own foolish overconfidence as punishment.[31]

The bankruptcy of the Schwinn bicycle company under the leadership of the fourth-generation CEO, Edward R. Schwinn Jr., offers a cautionary tale. The company was founded in 1895 by Schwinn's great-grandfather, a German-born bicycle maker. By the 1950s, Schwinn held 28% of the market and dominated the industry due to innovation. Schwinn was the best-recognized brand for low-cost, functional transportation for children and adults. However, when they were at the top, Schwinn began to take it easy. It lost the innovation edge. Schwinn dismissed three important new ideas: lighter bikes, sleeker bikes, and mountain bikes. They soon found they could not meet the challenges created by their competition.[32] Schwinn eventually declared bankruptcy and became part of a multinational conglomerate.[33]

Why does hubris occur? Due to bounded rationality, the ability to estimate probable outcomes is critical to a manager's ability to make sound decisions in organizations. Research has shown that accurate forecasting improves a manager's ability to create an effective vision for their organization.[34] To avoid overconfidence bias, managers may keep it in check by assigning a trusted follower to critique the decisions (i.e., play the "devil's advocate" role), by being open to different opinions, and by placing limits on their power by having someone else approve decisions (a peer, for example). Reminding oneself of past decision-making errors may also be an effective way to keep overconfidence in check.[35]

A bicycle zone sign sits outside the Schwinn/GT Corporation headquarters on July 17, 2001 in Boulder, CO, when it filed for bankruptcy protection for the second time.

©Michael Smith/Staff/Getty Images

Escalation of Commitment

Escalation of commitment occurs when individuals continue a failing course of action after receiving feedback that shows it is not working. In effect, they try to turn the situation

around by increasing investment after a setback.[36] People continue to invest in failing courses of action to recoup their losses and to show that they have made the right decision all along. This is sometimes called the **sunk-costs fallacy**, as the continued commitment is made because a person has already invested in this course of action and does not recognize that what they invested initially is sunk (or gone).

An experimental study [37] found that decision-makers continued to invest in research and development (R&D) of a failing company when they had personal responsibility for the negative outcomes. The reason for this is self-justification, or the need to demonstrate to other people that one's actions are rational. In addition to self-justification, escalation may be caused by risk perceptions (recall prospect theory), group decision-making failures, or an organization's tendency to avoid change.[38]

Figure 2.3 shows the reasons why leaders may engage in escalation of commitment. It happens for a variety of organizational, social, and psychological reasons. Organizations may be rigid and resistant to change—decision-makers may be unable to change course. Instead of viewing the money already spent as sunk costs, decision-makers may focus on how much they have already spent.[39] Managers may let pride in their own decision-making ability (or the need to "save face") get in the way. The culture in the organization may reward decision-makers for being persistent, and this puts social pressure on them to continue to support a losing course of action. Managers hate to lose, and they want to be able to turn things around—they have the need to finish what they have started, and this may contribute to escalation.[40] Finally, continuing to invest in a decision justifies prior investments in the decision, even though it is "throwing good money after bad."

There are other examples of poor decisions due to escalation. Venture capitalists sometimes continue to invest in start-up companies even after results indicate the ideas are not working out in the marketplace.[41] Senior bank managers escalated commitment to loans they initiated

▼ FIGURE 2.3

Causes of Escalation of Commitment
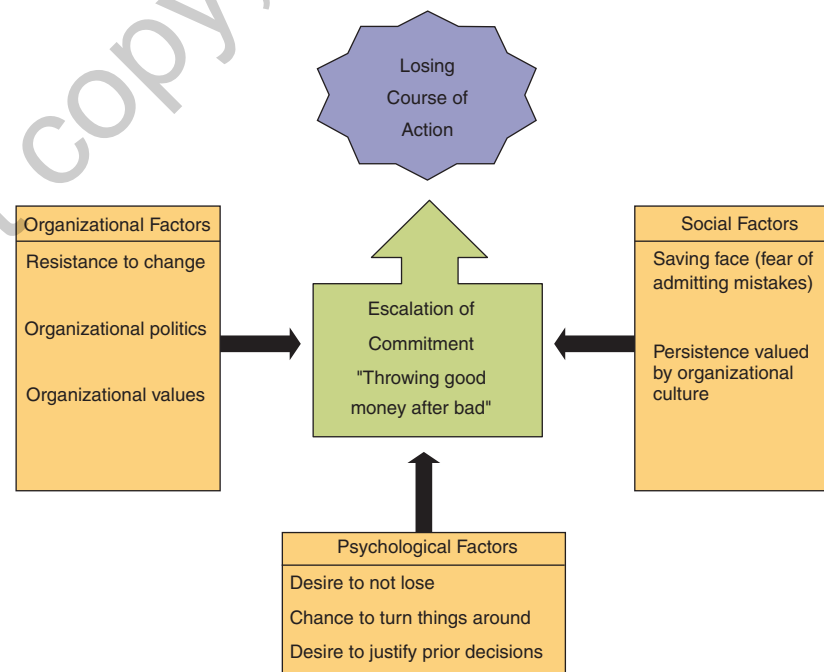
Source: Adapted from Staw, B. M. & Ross, J. (1989). Understanding behavior in escalation situations. *Science, 246,* 216–220.

by retaining them even after the loans were not being paid on time.[42] These examples illustrate that escalation is a serious decision trap leaders may fall into because they want to avoid regretting a bad decision.[43] Is it possible for a manager to avoid escalation of commitment? The following four antidotes to escalation have been proposed:[44]

1. Separate the initial decision-maker from the decision evaluator. In other words, remove the ego of the decision-maker from the evaluation of it.
2. Create accountability for decision processes only, not outcomes. Ask employees to explain or justify their decision processes (i.e., how they made the decision in the first place).
3. Shift attention away from the self. Make a balance assessment by considering the impact of the decision on other people.
4. Be careful about compliments. Try not to inflate the decision-maker's ego. Research has shown that positive feedback increases the risk of becoming overconfident about one's decisions.

Another important way that mangers can avoid falling into decision traps is through careful planning. As noted in Chapter 1, planning is the first step in the management process. Next, we will discuss how to avoid derailment of decisions by planning.

Avoiding Derailment Through Planning

Francesca Gino, in her book *Sidetracked: Why Our Decisions Get Derailed, and How We Can Stick to the Plan*,[45] describes how decision-makers often don't reach their goals due to their own decision-making traps, relationships with other people, and aspects of the situation. Her analysis suggests that things that may seem unimportant or even irrelevant to the decision may have a significant influence on sidetracking the decision-maker into following a different course of action than intended. She points out that acknowledgment of decision biases may not be enough to avoid being sidetracked into making the wrong decision. Her remedy is to start with a plan. In so doing, the leader is more prepared and better able to track progress toward goals. In the preparation of the plan, the following nine principles should be followed:

1. Raise your awareness. Become aware of your biases and keep them in check.
2. Take your emotional temperature. Examine how your emotions may cloud your decisions.
3. Zoom out. Keep the big picture in mind and other people's roles in your plan.
4. Take the other party's point of view. Analyze the decision from another person's viewpoint.
5. Question your bonds. Reflect on ties to the others and how they may affect your plan.
6. Check your reference points. Uncover the real motives behind your decisions, and whether or not you are trying to impress others.
7. Consider the source. Carefully examine the information, and consider the motives of the source as well as the situation.
8. Investigate and question the frame. Frame aspects of the decision in various ways—check whether you are too optimistic or pessimistic.
9. Make your standards shine. Reference your moral compass in making plans to be sure you do not get off course.

Managers can avoid decision traps through careful planning and analysis. Applying critical thinking (which you learned about in Chapter 1) can go a long way toward raising questions

that will help avoid decision errors. Considering alternative possibilities will also help avoid decision errors such as escalation of commitment. It is important to ask "what if" during the course of the decision-making process. As you learned earlier in the description of the rational decision-making model, generating a broad set of alternative scenarios is one of the keys to decision-making. To do this, managers need to be creative. Next, the creative problem-solving process is described, as well as how a manager can become more creative in brainstorming solutions.

Creative Problem-Solving

Learning Objective 2.4: Define creativity and discuss the three components of creativity.

Creativity is defined as a process and/or a product, generally thought of as a useful solution to a problem, or novel and effective ideas.[46] However, an idea that is unique, but lacks usefulness to others, is not considered "creative."[47] This definition makes a lot of sense in the business context. For example, a team could brainstorm wild ideas for new products, and while this may be fun, they are not realistic or useful to the company in furthering its goals.

Three-Component Model of Creativity
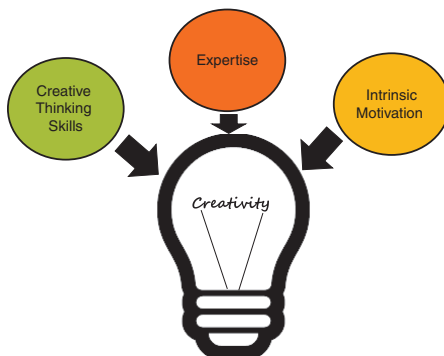
Source: Adapted from Amabile, T. M. (1998, September/October). How to kill creativity. *Harvard Business Review*, pp. 77–87.

Three-Component Model of Creativity

One of the most important models of creativity in organizations is the three-component model of creativity[48] developed by Teresa Amabile from Harvard University. As shown in Figure 2.4, creativity is a function of three contributing components: **expertise**, **creative-thinking skills**, and **intrinsic motivation**.

- *Expertise* refers to knowledge (technical, processes, and academic).
- *Creative-thinking skills* refers to how adaptable and imaginative individuals in the organization are.
- *Intrinsic motivation* refers to the urgent need to solve the problem faced, regardless of the monetary rewards expected.

Can creativity be learned? If a person has the expertise related to the problem, their creative-thinking skills can be enhanced through training.[49] In addition, managers can create the right procedures and workplace climates to enhance creativity. For example, managers can give followers challenging problems to work on and allow them the freedom to innovate. Support from the organization also matters. For creativity to thrive, Amabile believes people need resources, a positive work group climate, and encouragement.[50]

There are widespread myths about creativity. For example, some people believe that creativity is the result of a "lone genius" working in a laboratory. Quite the opposite is true; most innovative breakthroughs happen through teams that brainstorm new ideas. David Burkus's book *The Myths of Creativity: The Truth About How Innovative Companies and People Generate Ideas*[51] challenges commonly held "myths" about creative people and innovation processes. These myths and the reality demonstrated by Burkus's research are shown in Table 2.3.

CRITICAL THINKING QUESTIONS

Give an example of a time when you were creative. What was your motivation, your expertise, your creative thinking skill? How can you develop your creativity?

To implement creative ideas, managers must find the useful ones that have the best chance to be implemented. Such decisions must be based on good information. Fortunately, there is a field called business analytics that analyzes data to help mangers make good decisions.

Making Decisions Using Business Analytics

Learning Objective 2.5: Give an example of business analytics.

Business analytics is defined as "the use of data, information technology, statistical analysis, quantitative methods, and mathematical or computer-based models to help managers gain improved insight about their business operations and make better, fact-based decisions."[52]

Companies of all sizes increasingly value business analytics. According to an article in *Business Horizons*, "at its core, business analytics is about leveraging value from data."[53] Analytics is the number-one technology priority for top executives. Organizations get $10.66 of value for every $1 invested in analytics, and growth forecasts are stronger than expected, outpacing the growth in general information technology investment. Research has demonstrated that the use of analytics predicts corporate performance in terms of profitability, revenue, and shareholder return. Top-performing organizations (those that outperform their competitors) are three times as likely to be more sophisticated in their use of analytics than lower performers.[54]

Figure 2.5 depicts the relationships that are currently defining business analytics. Business analytics is considered a part of business intelligence. Statistics are the foundation for business analytics. Data mining is focused on better understanding patterns among variables in large databases using statistical and analytical tools. **Risk analysis** relies on spreadsheet models and statistical analysis to examine the impacts of uncertainty and is often supported with simulations. What-if analysis is facilitated by systematic approaches that optimize alternate scenarios through modeling. At the core of these techniques is visualization, which involves clearly communicating data at all levels of an organization, revealing patterns that aid management decision-making.

▼ TABLE 2.3

The Myths of Creativity

Myth	Reality (Evidence-Based Research Findings)
1. Eureka myth: New ideas are a flash of insight	New ideas are the result of hard work on a problem over time; the solution may come quickly after working on it
2. Breed myth: Creativity is genetic; some people are born more creative than others	Creative potential is in everyone; confidence and hard work lead to creative solutions
3. Originality myth: A new idea is one person's "intellectual property	New ideas are actually combinations of old ideas; sharing ideas leads to more innovation
4. Expert myth: An expert or small team of experts come up with creative ideas in a company	An outsider may be better able to innovate because they are not limited by considering why something won't work
5. Incentive myth: Monetary incentives increase creativity and innovation	Incentives may help but may do more harm than good
6. Lone creator myth: Creative works come from one person working alone	Creativity is often a team effort; leadership makes a difference
7. Brainstorming myth: Generating "crazy" ideas produces creative ones	Just "throwing ideas around" alone does not result in innovation; there's a larger process
8. Cohesive myth: Everyone working on a problem should have fun together and like one another	The most creative organizations build constructive controversy and conflict into their innovation process
9. Constraints myth: Limitations hinder the process	Creativity thrives under constraints
10. Mousetrap myth: Once a new idea emerges, the creative process is finished	Great ideas are often rejected at first; finding the right marketing and the right customers is essential—new ideas must be communicated

Source: Burkus, D. (2013). *The myths of creativity: The truth about how innovative companies and people generate great ideas.* San Francisco, CA: Jossey Bass.
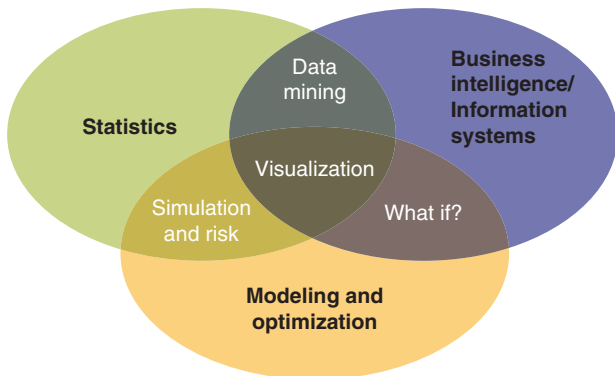
Managers rely on data to make business decisions.

©mrmohock/Shutterstock

Another useful way that managers think about analytics is to define it not as a concept but as a practice. Analytics comprises three distinct aspects:

- Descriptive analytics: statistical methods designed to explore "What happened?"
- Predictive analytics: machine-learning methods designed to predict "What will happen next?"
- Prescriptive analytics: uses optimization methods to identify best alternatives, and is designed to answer "What should the business do next?"[55]

Analytics are used throughout organizations for a variety of purposes. Some examples of business analytics are provided in Table 2.4.

Management Analytics

The term **management analytics** encompasses **behavioral analytics** and **operational analytics**. Behavioral analytics describes the collection and analysis of data on human behavior, its predictors, and its outcomes. One example of the application of behavioral analytics is the analysis of consumer behavior. Have you ever noticed that when you search for a product on Google, it begins showing up in your social media newsfeeds? E-commerce data analysis is now regarded as a "killer app" for the field of data mining. Large data sets are created by integrating click-stream records generated by searches and website activity with demographic

▼ FIGURE 2.5

Business Analytics

Source: Evans, J. R. (2012). Business analytics: The next frontier for decision sciences. *Decision Line, 43*(2), 4–6, p. 5.

▼ TABLE 2.4

Examples of Business Analytics

Function	Description	Exemplars
Supply chain	Simulate and optimize supply chain flows; reduce inventory and stock-outs.	Dell, Wal-Mart, Amazon
Customer selection, loyalty, and service	Identify customers with the greatest profit potential; increase likelihood that they will want the product or service offering; retain their loyalty.	Harrah's, Capital One, Barclays
Pricing	Identify the price that will maximize yield, or profit.	Progressive, Marriott
Human capital	Select the best employees for particular tasks or jobs, at particular compensation levels.	New England Patriots, Oakland A's, Boston Red Sox
Product and service quality	Detect quality problems early and minimize them.	Honda, Intel
Financial performance	Better understand the drivers of financial performance and the effects of nonfinancial factors.	MCI, Verizon
Research and development	Improve quality, efficacy, and, where applicable, safety of products and services.	Novartis, Amazon, Yahoo

Source: Davenport, T. H. (2006). Competing on analytics. *Harvard Business Review, 84*(1), 98–108, p. 103.

FACT OR FICTION?

Do Companies Know Your Secrets?

Andrew Pole was an analyst at Target. Two managers from the marketing department asked him if he had the ability to use statistics to figure out if a customer was pregnant—even if she did not want anyone to know. What a strange question! However, it turns out that new parents spend a lot of money in retail stores. Target sells a wide range of products, from housewares to clothing, and yes—items for a new baby. It is very difficult to change shopping habits, and marketers know this. People tend to visit the same stores for the same items, which they can find in the same places. The marketers knew that if a woman was pregnant and went to target for cleaning supplies, she would also start looking at baby items if she had received specialized mailings and coupons for baby items.

Research has shown that there are some short periods in a person's life where shopping habits are malleable. The biggest moment is just before the birth of a child. Expecting parents experience a lot of different emotions, and their loyalties for brands and stores are open as they anticipate buying for the new addition to their family. However, timing is important. Birth records are used to identify new parents, but usually, by the time they receive advertisements for baby products, they've already purchased most of them during pregnancy. The Target managers wanted to get to new parents before everyone else did—so could the analyst figure out when customers were expecting a child? Specifically in the first or second trimester of pregnancy, which corresponds with an explosion in spending on many new items such as lotions and maternity clothes. The marketers wanted a list of pregnant women, with their addresses.

This was important, because if women started shopping for a variety of items at Target during pregnancy, they would continue to be loyal to the store in the future due to changed shopping habits. New mothers are busy, and the idea that they can go to one store for diapers as well as groceries has a lot of appeal. In addition, they might see a nice pressure cooker and buy that as well to make meal preparation easier and faster for the family.

Retailers know what you buy based on ID numbers that are linked to your credit card number, and they save all the data on what you buy and when. The analyst went to work using data collected on the buying habits of women and built an analytical model by identifying women who had signed up for the baby registry—a solid indicator of pregnancy. He next compared the items bought by these women with those of all Target customers. There were 25 products that separated these women from the rest of the customers, such as unscented lotions, vitamins, scent-free soaps, large bags of cotton balls, hand sanitizers, and washcloths. Using the data on such purchases, the analyst was able to predict the chances that a woman was pregnant, and even her delivery date! For example, pregnant women buy hand sanitizers as they get close to their delivery date. Target used these predictions to identify which women should receive specific mailings with coupons. The 25 products were analyzed together to create a "pregnancy prediction" score

for each shopper who visited a Target. He found that he could also estimate her due date to within a few days, so Target marketers would know exactly when to send coupons related to the stages of a pregnancy. Consider the following example:

> Take a fictional Target shopper named Jenny Ward, who is 23, lives in Atlanta and in March bought cocoa-butter lotion, a purse large enough to double as a diaper bag, zinc and magnesium supplements and a bright blue rug. There's, say, an 87 percent chance that she's pregnant and that her delivery date is sometime in late August.[57]

This all sounds like brilliant marketing, right?

Well, it turns out it was. Until the fallout hit the media.

A teenager in Minneapolis was one of the pregnant women identified by the analyst at Target, and she received coupons related to pregnancy (imagine her receiving a coupon for morning-sickness herbal-supplement pills). Her concerned father complained to a Target store manager that his daughter had been mailed pregnancy-related coupons. He felt that the coupons encouraged teens to become pregnant and were not acceptable. He later found out his daughter was pregnant and realized there were things going on under his roof he did not know about. Awkward. The *New York Times* wrote an article exposing how companies are learning our secrets. The story was picked up by Fox News and other major news programs. The public was shocked by Target's actions to delve into the private lives of their customers. Target learned that while this was legal, people were disturbed that the company knew about their pregnancies in advance. The company still uses analytics to determine if a woman is pregnant, but mixes other coupons with pregnancy-related ones so it's less obvious.

Discussion Questions

1. Explain the business reasons for Target wanting to be able to identify which of its customers were pregnant.

2. Why didn't marketers at Target anticipate the backlash that might occur if parents learned of their daughters' pregnancies through ads sent to the home? What could have been done to avoid this?

3. Do you feel that companies learning your secrets through your Google searches or purchase patterns is an invasion of privacy? Evaluate the ethics of this form of marketing.

Sources: Adapted from Duhigg, C. (2012). "How Companies Learn Your Secrets," *New York Times.* Retrieved from http://www.nytimes.com/2012/02/19/magazine/shopping-habits.html? pagewanted=all&_r=0; Hill, K. (2014). How Target figured out a teen girl was pregnant before her father did. *Forbes.* Retrieved from https://www.forbes.com/sites/kashmirhill/2012/02/16/how-target-figured-out-a-teen-girl-was-pregnant-before-her-father-did/#3622196a6668.

and other behavioral data. The result is massive databases requiring a mix of automated analysis techniques and human effort that give marketing managers strategic insight about their customers.[56]

Another important application of behavioral analytics in management is employees. This has various names, including **people analytics**, **workforce analytics**, and **talent management**. These behavioral analytics help companies and managers improve employee selection, retention, motivation, training, and employee performance. People analytics applies the analysis of human behavior to such workforce challenges as:

- hiring the best employees
- assessing employees' training needs and the effectiveness of training programs
- learning the effectiveness of reward systems for motivating employees
- analyzing the reasons for employee turnover

Specific examples of people analytics described by organizations include:

- Performance analytics, which is a new class of business intelligence that ties human capital management to financial performance (Deloitte Consulting).
- Talent analytics, to gain understanding of staffing processes in order to analyze and optimize the whole system or improve individual aspects (Stepstone and Hire.com).
- Metrics and dashboards for various users, including recruiters, business executives, hiring managers, human resources, and more (Kenexa).[58]

As illustrated by the above three definitions, analytics is either an analytical technique, a process for gaining talent insights, or a set of measures. Allan Schweyer, a human resources and information technology consultant, points out that people analytics supports management decisions in important ways:

> If you do proper workforce analytics and planning, then you know who to recruit, who to develop, who to redeploy and where to redeploy them, whether you should hire someone externally or promote someone from within, and whether you should look for a contingent worker, contractor, or full-time worker. Workforce-planning analytics can help you make the best talent-management decisions and align those with your corporate objectives.[59]

Operational analytics has been defined as "the application of advanced analytical methods to make better decisions."[60] Colin White, the founder of BI Research and president of DataBase Associates Inc., explains that analytics produced by traditional business intelligence applications and their underlying data warehouses help businesses understand what has happened in the past. There are three types of traditional analytics: strategic, tactical, and operational. Managers use strategic and tactical analytics for both long-term and short-term business decision-making and action-taking. A data warehouse can also be used in conjunction with advanced analytical and data-mining technologies to look for business trends and

CRITICAL THINKING QUESTIONS

Give examples of information (data) for selecting the best employees (list at least five different criteria that you believe relate to job performance). Next, rank your list in terms of the most important to the least important.

CAREERS IN MANAGEMENT

Careers in Business Analytics

Given this chapter's focus on business analytics, it seems fitting to look at statistical indicators regarding prospects for a career in business analytics. The U.S. Bureau of Labor Statistics (BLS; https://www.bls.gov/jobs/) provides a great deal of information on business analytics careers. Table 2.5 provides data on job types, salaries, and predicted employment growth.

▼ TABLE 2.5

Business Analytics Career Data

Job Type	Average Salary	Predicted Employment Growth
Management Analytics	$91,910	12.1%
Operational Analytics	$84,340	27.4%
Systems Analytics	$92,960	11.6%
Marketing Analytics	$70,620	22.8%
Financial Analytics	$97,604	10.8%

Source: U.S. Department of Labor, Bureau of Labor Statistics. (2016). *Occupational outlook handbook, 2015–16.* Retrieved from http://www.bls.gov/ooh.

Business analytics is a promising field for future graduates. The demand for expertise in analytics is strong, based on the following facts:

- In a 2017 interview, the executive chairman of Google's parent company, Alphabet, had some unambiguous things to say: "I think a basic understanding of data analytics is incredibly important for this next generation of young people. By data analytics, I mean a basic knowledge of how statistics work, and a basic knowledge of how people make conclusions over big data."

- A quick Google search will turn up a number of reports from the Big Four consulting firms aimed at helping companies solve their top business analytics challenge: finding enough people trained in business analytics to hire. John Lucker of

Deloitte Consulting recommends a recruiting strategy many university students would likely enjoy: "Companies need to recognize that they need to really develop close relationships with these [business analytics] degree programs. Creating a true courtship between companies and universities is becoming more and more important."

- Another consulting firm, PricewaterhouseCoopers, identified several important skills students should acquire in its report "Data Driven: What Students Need to Succeed in a Rapidly Changing Business World." Among others, these skills included:
  - regression analysis
  - exploratory data analysis, including descriptive statistics
  - statistical inference
  - core skills in basic spreadsheet and statistical analysis programs

So if you are interested in a career in business analytics, it's time to take some courses on statistics.

Discussion Questions

1. Which of the job types shown in Table 2.5 are you most interested in? Explain why you are drawn to that type of analytics work.

2. Operational analytics focuses on improving existing operations. Why do you think operational analytics has the highest predicted growth rate?

3. Do some research to locate an undergraduate major or master's degree in business analytics. Examine the courses you would need to take. Would you be interested in pursuing analytics as a field of study? Why or why not?

Sources: Adapted from Deloitte Consulting. (2017). Analytics trends 2016: The next evolution. Retrieved from https://www2.deloitte.com/us/en/pages/deloitte-analytics/articles/analytics-trends.html; PricewaterhouseCoopers. (2015). Data driven: What students need to succeed in a rapidly changing business world. Retrieved from https://www.pwc.com/us/en/faculty-resource/assets/pwc-data-driven-paper-feb2015.pdf; Ward, M. (2017). Google billionaire Eric Schmidt says this is the skill employers will look for in the future. Retrieved from https://www.cnbc.com/2017/03/31/google-execs-agree-on-the-skill-employers-will-look-for-in-the-future.html.

patterns in historical data, and the resulting predictive analytics are used to forecast what could happen in the future.[61] For example, spending patterns of credit-card holders detect fraud. If a cardholder typically uses their card to purchase groceries and gasoline, and then a charge comes through for an expensive hotel in France, the credit-card company flags it and sends an email to the cardholder to confirm the charge.

▼ FIGURE 2.6

Executives Struggle With Data Analytics
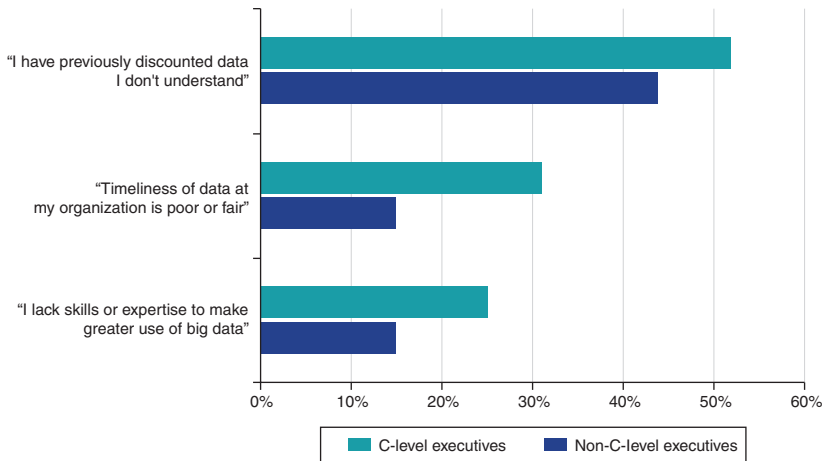
Source: PricewaterHouseCoopers. (2014). Gut & gigabytes. *SAGE Business Researcher.* Retrieved from http://businessresearcher
.sagepub.com/sbr-1645-94783-2641913/20150209/big-data, p. 33.

Using big data requires
summaries called dash-
boards.

©NicoElNino/Alamy Stock Photo

Overcoming the Fear of Data and Statistics

Many adults, especially in the United States think of themselves as being "bad at math" and, consequently, go out of their way to avoid it.[62] This belief often stems from memories of math and statistics courses being full of abstract symbols and formulas that had to be memorized. Some students are bored with math because they failed to see the usefulness of learning the formulas. However, math provides the foundations for statistical analyses, which managers rely on to make good decisions.

This discussion of analytics in a management course may come as a bit of a surprise to you. Despite its beginnings as a highly quantitative science (recall Taylorism discussed in Chapter 1), some managers overlook the value of statistical analysis. Managers are consumers of analytics. Yet some managers have not embraced the power of business analytics. As Figure 2.6 shows, many modern executives admit to being uncomfortable with quantitative data ("big data" in particular, which you will learn about next).

The situation is particularly troublesome for "C-level" executives (e.g., chief executive officer, chief financial officer) who represent leadership positions in corporations. A *SAGE Business Researcher* report sheds some interesting light on the issue. According to an individual quoted in the report, "the key is not actually understanding computing technologies so much as it is understanding how to interpret and evaluate the results of the analyses. This is really a problem dealing with mathematical and statistical sophistication."[63]

Do you fear mathematics and statistics used for analytics? Find out by completing Self-Assessment 2.2.

The Era of "Big Data"

Learning Objective 2.6: Be familiar with the concept of big data and its use in business decision-making.

Over the past few decades, the rapid development of computer hardware and software has resulted in the creation of mountains of data. In addition, advancements in sensor technology, the Internet, wireless sensor networks, and low-cost memory (e.g., "cloud storage") have resulted in the exponential growth of data in recent years.[64] You may feel intimidated by the daunting task of sorting through all the information now at your disposal. Organizations today hire analysts to create reports that interpret large amounts of data so that managers can make better decisions. You have probably heard the term **big data**. Big data involves collections of large amounts of data and has been defined in terms of high volume, high velocity, and high variety—the three Vs:

- High volume—the amount or quantity of data
- High velocity—the rate at which data is created
- High variety—the different types of data[65]

Big data is used by organizations to analyze patterns that improve decisions. Using publicly available data from Google and other websites combined with basic statistical analysis, author Seth Stephens-Davidowitz reached some interesting conclusions about human behavior. For example, data is being used to predict who will default on loans applied for in a peer-to-peer lending site. Applicants who mentioned the word *hospital* or *thank you* in their application were significantly more likely to default on that loan than borrowers who did not. Applicants who used words like *college graduate* or *lower interest rate* in their application were found to be safer-than-average borrowers.[66]

Recall the discussion of critical thinking from Chapter 1 of this textbook. Analytics are a powerful tool, but managers must use critical thinking to interpret data. When managers rely on analysis of big data, it is possible to draw the wrong conclusions. The aforementioned peer-to-peer lending example concluded that polite people (those who say *thank you*) are financially irresponsible. Even though this conclusion was supported by the analysis, many polite people will not default on loans. Thus, it is important to apply logic and critical thinking to the power of big-data analysis. Analytics are an aid in critical thinking, not a replacement for it.

Despite the caveat regarding the need for critical thinking, big data holds amazing potential for improving our business decisions. Analytics help solve the types of real-world problems that managers face every day. Not surprisingly, many corporations have increased their investment in big-data projects, as shown in Figure 2.7.

Examples of Big-Data Analytics

Hugh Watson, professor of management information systems at the University of Georgia, provides the following examples of applications of big data.[67]

A Starbucks Product Launch Goes Better With Big Data

Before companies had access to big data from social media platforms, obtaining consumer feedback was a lengthy and costly undertaking. Big data makes the process instant. For example, when Starbucks launched a new coffee flavor, they worried that customers would think it was too strong. The morning of the launch, they kept a close watch on social media to see what customers had to say about the product. Via blogs, Twitter, and discussion boards, they discovered something unexpected: customers enjoyed the new coffee, but they thought it was overpriced. Starbucks immediately adjusted the price point, and by the end of the day, the negative feedback had stopped.

Traditional methods like assessing sales figures and bringing in focus groups could have taken weeks, or even months, to yield results. Thanks to social media, Starbucks was able to respond to the market in a single day.

▼ FIGURE 2.7

Business Plans to Invest in or Deploy Big Data Projects
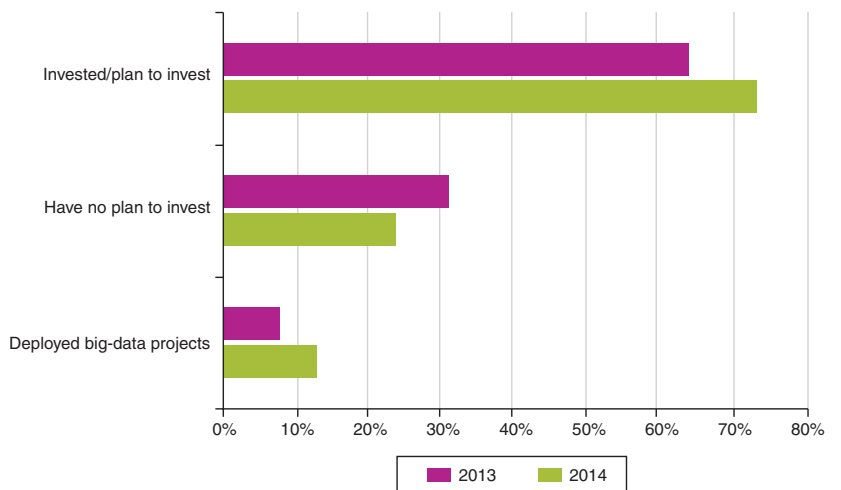
Source: Gartner Research. (2014). Press release, "Gartner Survey Reveals That 73 Percent of Organizations Have Invested or Plan to Invest in Big Data in the Next Two Years," Gartner Research, Sept. 17, 2014.

Starbucks monitors big data from social medium to set prices.

©iStockphoto.com/RichieChan

Analytics Helps Chevron Avoid Costly Drill Misses

Oil drilling is a risky business, and failure is expensive. Continuous improvement of data analysis capabilities helps Chevron avoid drill misses in the Gulf of Mexico. When the federal government suspended drilling after the BP Gulf spill in 2010, Chevron used the downtime to enhance its already advanced seismic data analysis. The company improved the odds of successful drilling by 13%. At first glance, that figure may not seem dramatic, but keep in mind, each drill miss can cost Chevron upwards of $100 million dollars.[68]

Monitoring Cab Data at U.S. Xpress Saves Times, Money, and Trouble

U.S. Xpress, a transportation company, is a prime example of how continuous data streaming increases efficiency. U.S. Express cabs stream more than 900 pieces of data to the cloud so it can be analyzed and delivered to users, from drivers to senior execs.[69] By keeping constant tabs on its vehicles' condition and location, the company can avoid common industry pitfalls. For instance, if a cab is low on fuel, a driver can be instantly directed to the nearest gas station with the lowest prices. Data streaming helps eliminate everything from running out of gas to breakdowns and traffic jams.

Managerial Implications

This chapter covered the important role that managers have in making decisions for their organizations. You should understand the following key takeaways:

- Decision-making is essential to managerial effectiveness. Making the right business decisions ensures the organization's success. Also, becoming an effective decision-maker will enhance your management career.
- The rational decision-making model represents best practice in decision-making. It is a cyclical process comprising eight steps: (1) define the problem (or opportunity), (2) establish decision criteria, (3) weight decision criteria, (4) generate alternatives, (5) evaluate alternatives, (6) make a decision, (7) develop action steps for implementation, and (8) evaluate the decision.
- Prospect theory provides insight into why managers sometimes are not rational in making decisions. The way decisions are framed will affect how a person will react in terms of the decisions they make. People are more likely to take risks when the decision is framed as a loss situation.
- Intuition plays a role in decision-making, and managers often rely on it. Intuition has both positive and negative effects on decisions that managers should be aware of. Heuristics support intuitive decision-making by setting forth decision rules that can be followed in advance of the decision.
- Managers fall into decision traps in decision-making: hindsight, hubris (overconfidence), and escalation of commitment. These traps can be avoided.
- Creativity is important to problem-solving, and three components must be present: expertise, creativity skills, and intrinsic task motivation.
- Business analytics are an essential part of critical thinking and effective decision-making.
- Whether your career takes you to small, traditional companies, big-data hubs, or anything in between, there are almost no management scenarios where analytic skills won't improve your decision-making skills and marketability.

- Management analytics include analysis of consumer behavior and people management. No matter what your interests, there is a high demand for analytic skills.
- You do not need to be a gifted mathematician to learn and apply analytical skills. You can begin by taking courses in statistics.

This chapter highlights the important process of decision-making, and it is clear that to make decisions effectively, managers need to be able to collect good data, analyze it, and summarize it. As you can see, the ability to interpret data is essential in making evidence-based management decisions that are successful.

KEY TERMS

behavioral analytics   50

big data   54

bounded rationality   39

business analytics   49

creative-thinking skills   48

creativity   48

equality heuristic   43

escalation of commitment   45

expertise   48

fluency   43

framing   40

heuristics   43

hindsight bias *or* I-knew-it-all-along effect   44

imitating the majority   43

imitating the successful   43

intrinsic motivation   48

intuition   40

management analytics   50

operational analytics   50

overconfidence bias *or* hubris   45

people analytics *or* workforce analytics *or* talent management   52

prospect theory   39

recognition heuristic   43

risk analysis   49

satisficing   39

sunk-costs fallacy   46

TOOLKIT

Activity 2.1

Exxel's New Product Development Decision

As a product development manager, you have the option of developing one of two potential new products. One product is an airbag sensor, and the other product is an antilock brake sensor. Both of the products are described below. You have already spent $3.175 million on preliminary marketing and technical assessment. To take either product to the next stage of development and testing, it would cost another $12 million. You have recently been promoted to your current position at Exxel Corporation, and you want to make a good impression on your new boss.

Product 1: Airbag sensor. The proposed new airbag sensor is highly innovative and will offer substantial advantages over the existing one. Unlike the current sensor, which is silicon based, the new sensor will incorporate a radically new diamond sensor technology that will make it resistant to all corrosive materials, elements, and weather conditions. While current sensors are reliable, the new sensor will be a vast improvement and will continue to work properly for decades. This is extremely important, since an airbag sensor must work perfectly; it cannot deploy an airbag in the absence of a collision, nor can it fail to deploy in a collision. Automakers face potentially huge lawsuits if an airbag system fails. In addition, with advances in industrial diamond fabrication, the new sensor will be substantially smaller (i.e., 75%).

Product 2: Antilock brake sensor. The proposed new antilock brake sensor will offer incremental advantages over the existing one, since it will be identical in form and function to Exxel's existing sensor. However, this new sensor is slightly more durable and will cost a little less to produce (i.e., 1.5%).

Discussion Questions

1. Which product did you decide to make the investment for further development? Explain why you chose this product.
2. Did you feel personally responsible for the decision you made? Explain the role personal responsibility played in your decision to invest. Did you consider the personal risks to your career? What were the risks?
3. What role did the innovativeness of the product play in your decision to invest? Did you consider the risks that the product would fail? What were the risks?

Source: Adapted from Schmidt, J. B., & Calantone, R. J. (2002). Escalation of commitment during new product development. *Journal of the Academy of Marketing Science, 30*(2), 103–118.

A New Mission Statement for the MBC Corporation

The October 2011 board meeting of the MBC Corporation was two weeks away, and new CEO Dave Williams needed to decide whether to proceed with his plan to discuss changing the mission statement with the board. MBC's current mission statement read as follows:

> Our collective purpose is to achieve long-term profitable growth as a global supplier of high-quality metal-based chemicals. MBC is committed to excellence in customer service.

Williams found the current mission statement lacking; he thought it should articulate MBC's core values and inspire employees. When Williams raised the idea of changing the mission statement with the company's senior executives, however, he was met with disinterest at best. One vice president said, "I thought we were here to talk about important things." Williams was not sure if they were actually opposed to his idea or if he had failed to effectively communicate its importance. Although he was disappointed with his senior team's response, he had gotten support from one trusted board member, Larry Deer, and was still considering taking the idea to the full board.

MBC Corporation

Founded in 1946, the MBC Corporation was a manufacturer and marketer of metal-based chemicals with headquarters in Denver, Colorado, and plants in Colorado and Louisiana. Following a recent acquisition, MBC employed 200 people and generated $250 million in annual revenues. MBC's primary product, which helped reduce greenhouse gas emissions and strengthen building products, accounted for 80% of its sales. MBC was a family-owned company; the Williams and Giles families owned 98% of the company's stock. Dave Williams's grandfather had been a cofounder, and his father, Steve, had served as president and CEO for 34 years until his retirement in 2010. Steve Williams had guided the company through some rough spots and had grown annual revenue from $10 million to $250 million. He had also favored an "old-school" approach to management, creating a hierarchical structure and culture in which seniority and position were rewarded more than performance.

Dave Williams

Although MBC was his family's company, Dave Williams did not begin his career with the firm. After graduating from college, he first worked as an institutional broker for a large financial company and then in business development and trade execution for Harris Futures and Options. In 1998, Williams's father told him that if he wanted to come into the family business, "you need to do so sooner rather than later." Williams joined MBC later that year. Although he had not started his career with MBC, Williams had "paid his

dues"; despite his work experience, he started at MBC in a clerical position so he could learn everything about the business. Later he assumed responsibility for developing markets for new products and selling existing products. In February 2010 he was promoted to executive vice president, and he was elected by the board as president and CEO five months later. Williams's election to the CEO role was not without controversy. The other two candidates for the job, brothers John and Jerry Giles, had been with the company longer than Williams, held senior leadership positions, and between them owned 49% of the shares in the company. Williams's father held his family's 49% ownership stake.

Approaching the Board

When he became CEO, Williams proceeded cautiously. He thought the company needed to create a culture that could attract top talent and adapt to impending changes in the market and regulatory environment, but he waited to turn his focus toward those strategic issues until he had succeeded in mending fences and gaining the support of the Giles brothers. Changing the mission statement would require approval from the board of directors. Two-day board meetings were held in March and October each year, one in Denver and the other in Montana or Louisiana. Of the nine board members, only four owned shares in MBC: chairman of the board Steve Williams, chair emeritus Larry Deer, and John and Jerry Giles. Before the full board acted on any issue, the four owners discussed it first; only if they could not reach consensus would the remaining directors be asked to make a decision. Williams was closer to Larry Deer than to any other board member except his father. Deer had formerly served as board chairman, was the son of one of the cofounders, and was the retired president of a regional automotive supply company. Over the years, he had been a mentor to Williams, and the two were good friends. When Williams discussed his proposal to change the mission statement, Deer supported the idea. The next day he sent Williams an email in which he suggested that the new mission statement should state that MBC "values results over effort" and that the goal of the company is "to maximize profits through sustained growth and continuous improvement."

Decision

Williams had just two weeks left to decide if he should discuss creating a new mission statement with the board, and if so, how to proceed. More immediately, he needed to respond to Deer and his suggestions.

Discussion Questions

1. What are the key concerns that Williams should consider in his decision to change the mission statement of MBC Corporation? Who are the key stakeholders in this decision?

2. Williams wants consensus from the board. What other decision-making approaches could he use?
3. What should Williams do if the board cannot reach a decision on the new mission statement?

Source: Feddersen, T. J. & Edwards, S. (2017). A new mission statement for the MBC Corporation. *SAGE Business Cases.* Thousand Oaks, CA: SAGE Publishing.

Case Study 2.2

"Effective . . . but Creepy" Employee Tracking and Data Collection

In Sara's past roles as managerial analyst and systems analyst, she had gotten used to thinking about the potentially far-reaching implications of her decisions. In her new job as a consultant, however, she was starting to realize that she had failed to appreciate just how much of the modern world was intertwined with the data corporations collected.

Controversy over companies collecting data—knowingly, unknowingly, and many places in between—from customers was nothing new. She had made those types of decisions in the past. When was it acceptable to collect customer data and when did it cross a line; how much responsibility did she and her employer have to keep the data private; were they allowed to sell it? All of this was old hat for Sara.

Somehow, she had never considered these decisions in the context of a company's own employees, though. Part of her felt that "what's good for the goose is good for the gander." If employees like her were willing to collect data from customers (who might or might not love the idea of her doing it), why couldn't the same logic be applied to employees? Heck, those people were paid to be there. If they could track the people who were paying the company (directly or indirectly, through advertising revenue and the like), why not the people doing the tracking? Even if it did involve things like tracking their Internet usage and . . . keystrokes. Was it that? Was it the invasiveness of her new client's proposal that made her feel queasy?

Even before she knew that literally everything employees typed would be logged (including work emails, reports, casual browsing, personal email, banking passwords—everything), she had some misgivings. Why did it seem so wrong? Companies had always tracked things like hours worked, efficiency and production levels, and sick days. That these forms of monitoring had evolved along with technology seemed like it should not be a surprise. It was certainly common enough. According to a 2014 research report Sara had recently read:

- 45% of companies tracked employees' keystrokes and time spent at the keyboard
- 43% of companies stored and reviewed computer files
- 43% of companies monitored employees' email

- 12% of companies monitored the blogosphere for comments about the company
- 10% of companies monitored social networking sites

Quite a bit of the proposed tracking could actually help employees. That guy who sat at his desk for 10 hours a day, 5 days a week, always complaining about how busy he was even though no one could put a finger on what exactly he did—he would be in big trouble, but everyone who had been picking up his slack might finally get recognition for their extra effort.

But still, she was having a hard time signing off on her client's proposal, even though her analyses left no doubt as to the financial benefits of expanded employee monitoring. It was some consolation that she wasn't the only one feeling this way. She recalled a recent incident that had benefited an employee, yet still evoked a sour response from the public:

> The *New York Times* (NYT) last year highlighted a situation involving Jim Sullivan, a waiter at a Dallas restaurant whose actions came under scrutiny "not by the prying eyes of a human boss, but by intelligent software. The digital sentinel, he was told, tracked every waiter, every ticket, and every dish and drink, looking for patterns that might suggest employee theft. But that torrent of detailed information, parsed another way, cast a computer-generated spotlight on the most productive workers."
>
> The monitoring worked out well for Sullivan, who was recognized as a stellar employee and promoted to manager. Although the surveillance was legal, the article provoked angry comments on the *NYT*'s website from readers complaining that it was overly intrusive.
>
> The program monitoring Sullivan's workday was NCR's Restaurant Guard, a system that tracks restaurant transactions in real time, using artificial intelligence to detect patterns of fraud and to spot performance bottlenecks. Using software that detects specified keywords, many employers monitor telephone calls and network traffic, including even emails sent from an employee's private email account. Some companies also employ video cameras to watch employees and geolocation tools to track employees with company cars or cellphones.

Reflecting on the Restaurant Guard case, the phrase "effective . . . but creepy" came to mind, as it often did when she thought about these things.

The CEO who hired Sara was also worried by a rash of high-profile instances where employees had done an odd thing: using technology, they had broken laws in service of the company's goals. The CEO cited a report that summarized Volkswagen's notorious experience with this type of behavior in the summer of 2015:

Months after Volkswagen publicly admitted in August 2015 that it had installed software in 11 million diesel automobiles designed to deceive emissions tests, the public remains in the dark about just who was responsible.

Michael Horn, head of Volkswagen's American division, told Congress on Oct. 8 that neither Volkswagen's supervisory board nor its top executives ordered the installation of devices that could sense when they were being tested and then change the vehicles' performance to improve results. "This was not a corporate decision," Horn said. "This was something individuals did."

"Assuming their executives are telling the truth," the company president remarked, "we could be seeing a paradoxical situation where employees will break the law to do what they think they need to do to help the company succeed. We don't want that."

Sara reflected on the bigger picture. The same report went on to explain that because technology can make some deviant behaviors very easy and hard to detect, bending the rules has become more tempting for more people.

> These situations illustrate how technology allows unethical and illegal actions to occur almost invisibly and "with comparatively few people being in the accountability line," says Ken Goodman, director of the University of Miami's Miller School of Medicine Institute for Bioethics and Health Policy and co-director of the University of Miami Ethics Programs. The situation puts an extra burden on companies—rather than lawmakers or regulators—to follow ethical practices in implementing new technologies, says Arthur Schwartz, general counsel of the National Society of Professional Engineers. "I don't think the laws and regulations ever keep up," Schwartz says.

That last sentence was the reason Sara had been hired, and she knew it. Because traditional behavioral controls had been losing ground in the battle to discourage unethical and illegal technology-assisted behaviors, companies were (somewhat ironically) turning to technology as a solution. More specifically, the use of high-tech employee monitoring and tracking technology had become an increasingly common technique for keeping employee behavior in check. This, of course, had sparked further debate. As someone familiar with both behavioral and systems analytics, Sara could see both sides. As her report stated:

> "Sophisticated monitoring software and hardware allow businesses to conduct basic business transactions, avoid liability, conduct investigations and, ultimately, achieve success in a competitive global environment," according to Corey Ciocchetti, professor of business ethics at the University of Denver. At the same time, Ciocchetti wrote, "This trend is problematic because excessive and unreasonable monitoring can:

> (1) invade an employee's reasonable expectation of privacy, (2) lead employees to sneak around to conduct personal activities on work time, (3) lower morale, (4) cause employees to complain and, potentially, quit and (5) cause employees to fear using equipment even for benign work purposes."

To be sure, there were plenty of well-informed people who believed the good outweighed the bad. Returning to her write-up of the Restaurant Guard case, Sara recalled a few strong arguments in favor of such monitoring tools:

> The public's suspicions about Restaurant Guard's intrusiveness led Andrew McAfee, co-director of the Initiative on the Digital Economy at the Massachusetts Institute of Technology's Sloan School of Management, to write a *Harvard Business Review* column in defense of the software. He argued that it "doesn't engage in surveillance of employees' personal electronic communications, or any other activity they might reasonably consider private. Instead, it monitors their on-the-job performance, which is exactly one of the things that managers are supposed to do" to monitor employees.

> "Most of this monitoring is perfectly legal and even prudent in today's employment arena," wrote Ciocchetti of the University of Denver. "While employee monitoring remains a contentious issue, employers have good reasons for checking in on their employees' activities. Sexual or pornographic e-mails and Web pages, containing pictures or merely sexually explicit language, can form the basis for a harassment lawsuit. Excessive personal use of company broadband capacity or e-mail accounts will lead to decreased productivity, storage shortages and slower network operations. Failing to monitor is also likely to allow rogue employees to steal trade secrets or send out confidential information in violation of various federal and state laws."

There was certainly some merit to the argument that these systems didn't seem to do much that managers weren't supposed to be doing anyway. But then, Sara thought, managers were people, just like employees. Computers had really changed that dynamic. This called to mind a final passage from her report that had stuck with her:

> "Most employees know that their employer has the ability to conduct surveillance but they have no idea how much surveillance is really happening or the circumstances under which it happens," says Lewis Maltby, president of the National Workrights Institute, a worker advocacy group based in Princeton, N.J. For example, Maltby notes that many employees think that their boss looks at their email or Internet traffic only when there's a reason to do so. "But that's not how it works," he says. "It's an open secret that IT techs read other employees' emails for fun. And many employers don't even have a policy against this."

Decision

Sara was fairly certain that if she chose not to endorse this employee-monitoring proposal, she would likely be replaced by another consultant who would. By giving it her approval, however, she knew she would bear some responsibility for changing the employer–employee relationship at this company forever.

Discussion Questions

1. What benefits and drawbacks for employees might result from the sharp increase in employee monitoring and data collection being proposed here? What benefits and drawbacks might the company and its management experience?

2. From an ethical perspective, what arguments can be made in favor of the types of employee behavior and performance tracking discussed in this case? What arguments can be made against it?

3. If you were in Sara's position, would you endorse the tracking proposal or decline it, knowing it would likely cost you your current position?

4. If you were the CEO of this company and knew the pros and cons associated with employing these new forms of employee monitoring, do you think you would use it?

Source: Adapted from Marshall, P. (2016). Technology and business ethics. *SAGE Business Researcher.* Thousand Oaks, CA: SAGE.

Self-Assessment 2.1

What Is Your Attitude Toward Risk?

This self-assessment exercise identifies your attitudes toward taking risks as determined by research. The goal of this assessment is for you to learn about your propensity to take risks and how it may affect your decision-making. There are no right or wrong answers, and this is not a test. You don't have to share your results with others unless you wish to do so.

Part I. Taking the Assessment

Instructions: Circle the response that best describes your attitudes. How likely is it that you would engage in the behaviors shown in the questions?

Statement	Very Unlikely	Unlikely	Not Sure	Likely	Very Likely
1. Admitting your tastes are different than those of your friends.	1	2	3	4	5
2. Going camping in the wilderness, beyond the civilization of a campground.	1	2	3	4	5
3. Chasing a tornado or hurricane by car to take dramatic photos.	1	2	3	4	5
4. Disagreeing with your father on a major issue.	1	2	3	4	5
5. Going on a vacation in a developing country without prearranged travel and hotel accommodations.	1	2	3	4	5
6. Going down a ski run that is beyond your ability or closed.	1	2	3	4	5
7. Approaching your boss to ask for a raise.	1	2	3	4	5
8. Going whitewater rafting during rapid water flows in the spring.	1	2	3	4	5
9. Telling a friend their significant other made a pass at you.	1	2	3	4	5
10. Wearing provocative or unconventional clothing on occasion.	1	2	3	4	5
11. Periodically engaging in a dangerous sport (e.g., mountain climbing or skydiving).	1	2	3	4	5
12. Taking a job you enjoy over one that is prestigious but less enjoyable.	1	2	3	4	5
13. Defending an unpopular issue that you believe in at a social occasion.	1	2	3	4	5
14. Trying out bungee jumping at least once.	1	2	3	4	5

Part II. Scoring Instructions

In Part I, you rated yourself on 14 questions. Research has shown that risk depends on the situation. This assessment measured your attitudes toward risk in social and recreational settings. Add the numbers you circled in each of the columns to derive your score for social risk and recreational risk.

Social Risk	Recreational Risk
1. _____	2. _____
4. _____	3. _____
7. _____	5. _____
9. _____	6. _____
10. _____	8. _____
12. _____	11. _____
13. _____	14. _____
Total _____	Total _____

Scores can range from 7 (very low) to 35 (very high). In general, if your score is above 15, you have a propensity toward taking that type of risk (social or recreational).

Source: Adapted from Weber, E. U., Blais, A. R., & Betz, N. E. (2002). A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviors. *Journal of Behavioral Decision Making, 15*(4), 263–290.

Discussion Questions

1. Add your two scores together (social plus recreational risk). Is your score above 30? Do you feel you are a risk-taker in general?
2. Compare your scores for social and recreational risk. Is one higher than the other? Describe a situation in which you took a social or recreational risk. How did it turn out?

3. How will your attitudes toward risk affect your management career choice? How you will make decisions as a manager? Provide an example for each.

Self-Assessment 2.2

Are You Afraid of Statistics?

This chapter discussed the fact that many people reach adulthood with a firm belief that they are bad at math—many of those being convinced that they were "born that way." This sentiment is so common that researchers have actually investigated whether it is possible to inherit weak quantitative aptitude at birth.

An important step in overcoming the self-imposed barrier anxiety can cause is to recognize that it is there in the first place. Several math anxiety measures have been developed. This self-assessment uses one specifically designed to assess anxiety regarding the types of statistical analyses you will learn in this chapter.

We invite you to test your comfort level before you begin, and, as always, you do not need to share your score with others unless you choose to do so. The survey is a bit long (51 items), and some items may not seem applicable to you. Try to answer them all, even if you have to speculate about your response for some. After the assessment, we will provide descriptive statistics you can use to compare yourself to others who have completed all 51 items.

Part I. Taking the Assessment

Instructions: Circle the response that best describes your reactions to each of the following situations.

Statements	No Anxiety	Little Anxiety	Mild Anxiety	Moderate Anxiety	Strong Anxiety
1. Studying for an examination in a statistics course.	1	2	3	4	5
2. Interpreting the meaning of a table in a journal article.	1	2	3	4	5
3. Going to ask my statistics teacher for individual help with material I am having difficulty understanding.	1	2	3	4	5
4. Doing the coursework for a statistics course.	1	2	3	4	5
5. Making an objective decision based on empirical data.	1	2	3	4	5

	1	2	3	4	5
6. Reading a journal article that includes some statistical analyses.	1	2	3	4	5
7. Trying to decide which analysis is appropriate for my research project.	1	2	3	4	5
8. Doing an examination in a statistics course.	1	2	3	4	5
9. Reading an advertisement for a car which includes figures on miles per gallon, depreciation, etc.	1	2	3	4	5
10. Walking into the room to take a statistics test.	1	2	3	4	5
11. Interpreting the meaning of a probability value once I have found it.	1	2	3	4	5
12. Arranging to have a body of data put into the computer.	1	2	3	4	5
13. Finding that another student in class got a different answer than I did to a statistical problem.	1	2	3	4	5
14. Determining whether to reject or retain the null hypothesis.	1	2	3	4	5
15. Waking up in the morning on the day of a statistics test.	1	2	3	4	5
16. Asking one of my teachers for help in understanding a printout.	1	2	3	4	5
17. Trying to understand the odds in a lottery.	1	2	3	4	5
18. Watching a student search through loads of computer printouts from his/her research.	1	2	3	4	5
19. Asking someone in the computer lab for help in understanding a printout.	1	2	3	4	5

(*Continued*)

(Continued)

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
20.	Trying to understand the statistical analyses described in the abstract of a journal article.	1	2	3	4	5
21.	Enrolling in a statistics course.	1	2	3	4	5
22.	Going over a final examination in statistics after it has been marked.	1	2	3	4	5
23.	Asking a fellow student for help in understanding a printout.	1	2	3	4	5

Instructions: Circle the response that best describes your reactions to each of the following situations.

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
24. I am a subjective person, so the objectivity of statistics is inappropriate for me.	1	2	3	4	5
25. I have not done math for a long time. I know I'll have problems getting through statistics.	1	2	3	4	5
26. I wonder why I have to do all these things in statistics when in actual life I'll never use them.	1	2	3	4	5
27. Statistics is worthless to me, since it's empirical and my area of specialization is abstract.	1	2	3	4	5
28. Statistics takes more time than it's worth.	1	2	3	4	5
29. I feel statistics is a waste.	1	2	3	4	5
30. Statistics teachers are so abstract they seem inhuman.	1	2	3	4	5
31. I can't even understand secondary school math; how can I possibly do statistics?	1	2	3	4	5
32. Most statistics teachers are not human.	1	2	3	4	5
33. I lived this long without knowing statistics; why should I learn it now?	1	2	3	4	5

34. Since I've never enjoyed math, I don't see how I can enjoy statistics.	1	2	3	4	5
35. I don't want to learn to like statistics.	1	2	3	4	5
36. Statistics is for people who have a natural leaning toward math.	1	2	3	4	5
37. Statistics is a pain I could do without.	1	2	3	4	5
38. I don't have enough brains to get through statistics.	1	2	3	4	5
39. I could enjoy statistics if it weren't so mathematical.	1	2	3	4	5
40. I wish the statistics requirement were removed from my academic program.	1	2	3	4	5
41. I don't understand why someone in my field needs statistics.	1	2	3	4	5
42. I don't see why I have to fill my head with statistics. It will have no use in my career.	1	2	3	4	5
43. Statistics teachers speak a different language.	1	2	3	4	5
44. Statisticians are more number oriented than they are people oriented.	1	2	3	4	5
45. I can't tell you why, but I just don't like statistics.	1	2	3	4	5
46. Statistics teachers talk so fast you cannot logically follow them.	1	2	3	4	5
47. Statistical figures are not fit for human consumption.	1	2	3	4	5
48. Statistics isn't really bad. It's just too mathematical.	1	2	3	4	5
49. Affective skills are so important in my (future) profession that I don't want to clutter my thinking with something as cognitive as statistics.	1	2	3	4	5
50. I'm never going to use statistics, so why should I have to take it?	1	2	3	4	5
51. I'm too slow in my thinking to get through statistics.	1	2	3	4	5

Part II. Scoring Instructions

Let's see what your responses tell you about your statistics anxiety level. Part of the reason this measure is so long is that it actually assesses six different dimensions of statistical anxiety. Use the table below to see your score for each. To compute the average for each dimension, total your ratings in each column and then divide by the number of items (for example, for the Testing dimension, divide by 8).

Testing	Interpretation	Asking for Help	Worth	Teacher	Self-Concept
1. _____	2. _____	3. _____	24. _____	30. _____	25. _____
4. _____	5. _____	16. _____	26. _____	32. _____	31. _____
8. _____	6. _____	19. _____	27. _____	43. _____	34. _____
10. _____	7. _____	23. _____	28. _____	44. _____	38. _____
13. _____	9. _____		29. _____	46. _____	39. _____
15. _____	11. _____		33. _____		48. _____
21. _____	12. _____		35. _____		51. _____
22. _____	14. _____		36. _____		
	17. _____		37. _____		
	18. _____		40. _____		
	20. _____		41. _____		
			42. _____		
			45. _____		
			47. _____		
			49. _____		
			50. _____		
Average _____	Average _____	Average _____	Average _____	Average _____	Average _____

Part III. Interpretation

As you may have deduced from the items in the survey, the first three dimensions in the scoring table assess specific types of anxiety: testing anxiety, interpretation anxiety, and anxiety related to seeking help. The next three dimensions assess your perceptions of the value (or "worth") of statistics, your fear of statistics teachers (yes, that is what they called it), and your "computation self-concept" (your belief in your ability to handle mathematical computations related to statistics).

A more detailed description is provided by a group of researchers who examined the effectiveness of this measure:

Higher scores on an item or subscale indicate higher levels of that attitude or anxiety except for the "fear of statistics teachers" subscale where higher scores indicate lower levels of anxiety or more positive attitudes. The "worth of statistics" subscale attempts to measure the perceived usefulness of statistics. The

"interpretation anxiety" subscale attempts to measure anxiety when interpreting statistical results. "Test and class anxiety" is designed to assess the anxiety experienced when taking a statistics test or attending a statistics class. The "computation self-concept" subscale is related to a person's self-belief in their ability to cope with the calculations and mathematics related to statistics. The "ask for help" subscale attempts to assess the anxiety experienced when an individual intends to ask for help on a statistical problem . . . "fear of statistics teachers" [measures] students' perceptions of their statistic teachers.

Because each dimension has a different number of items, there is no set "high" or "low" range. If you add your averages for all six dimensions, you should have a score somewhere between 51 and 306.

As promised, here are descriptive statistics for a group of 650 British college students who completed this same questionnaire.

	Testing	Interpretation	Asking for Help	Worth	Teacher	Self-Concept
Mean Score	27.07	30.26	10.39	56.98	18.20	23.91
Standard Deviation	6.69	8.42	3.87	14.13	4.72	6.60
Range of Scores	8–40	11–53	4–20	17–80	5–25	9–35

Age: Mean = 22, Standard Deviation = 5.44, Range = 18–56

Gender: 79% female, 21% male

Discussion Questions

1. How does your mean (average) score for each dimension of the statistical anxiety measure (Testing, Interpretation, Asking for Help, Worth, Teacher, and Self-Concept) compare to the average scores shown in the top line of the table above? What does this comparison tell you about yourself?

2. What do the results of this measure tell you about your overall statistical anxiety? For which of the six facets do you have the highest anxiety levels? What can you do to alleviate those types of anxiety?

3. Next, add to your interpretation of these descriptive statistics using the following steps:

   a. Calculate the total possible variation for each dimension by subtracting the lowest score from the highest score shown in the Range of Scores row.

   b. Now look at the Mean and Standard Deviation for each dimension.

   c. What do these three statistics tell you about the average person in this sample?

For example, the total possible variation for Self-Concept is 24 (35–39), the mean is 23.91, and the standard deviation is 6.60. This tells us that the 650 British students in this sample had very high confidence in their mathematical abilities (23.91/24), on average, but that there was some considerable variation. Since the maximum score is only 0.09 higher than the average, the standard deviation tells us that roughly 68% (see descriptive statistics table) of students scored between 24.00 and 17.40 and 95% scored between 24.00 and 10.89. (Can you see how the standard deviation was used to calculate those ranges?) Try this yourself with the Testing, Interpretation, or Asking for Help categories.

Source: Hanna, D., Shevlin, M., & Dempster, M. (2008). The structure of the statistics anxiety rating scale: A confirmatory factor analysis using UK psychology students. *Personality and Individual Differences, 45*, 68–74.

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