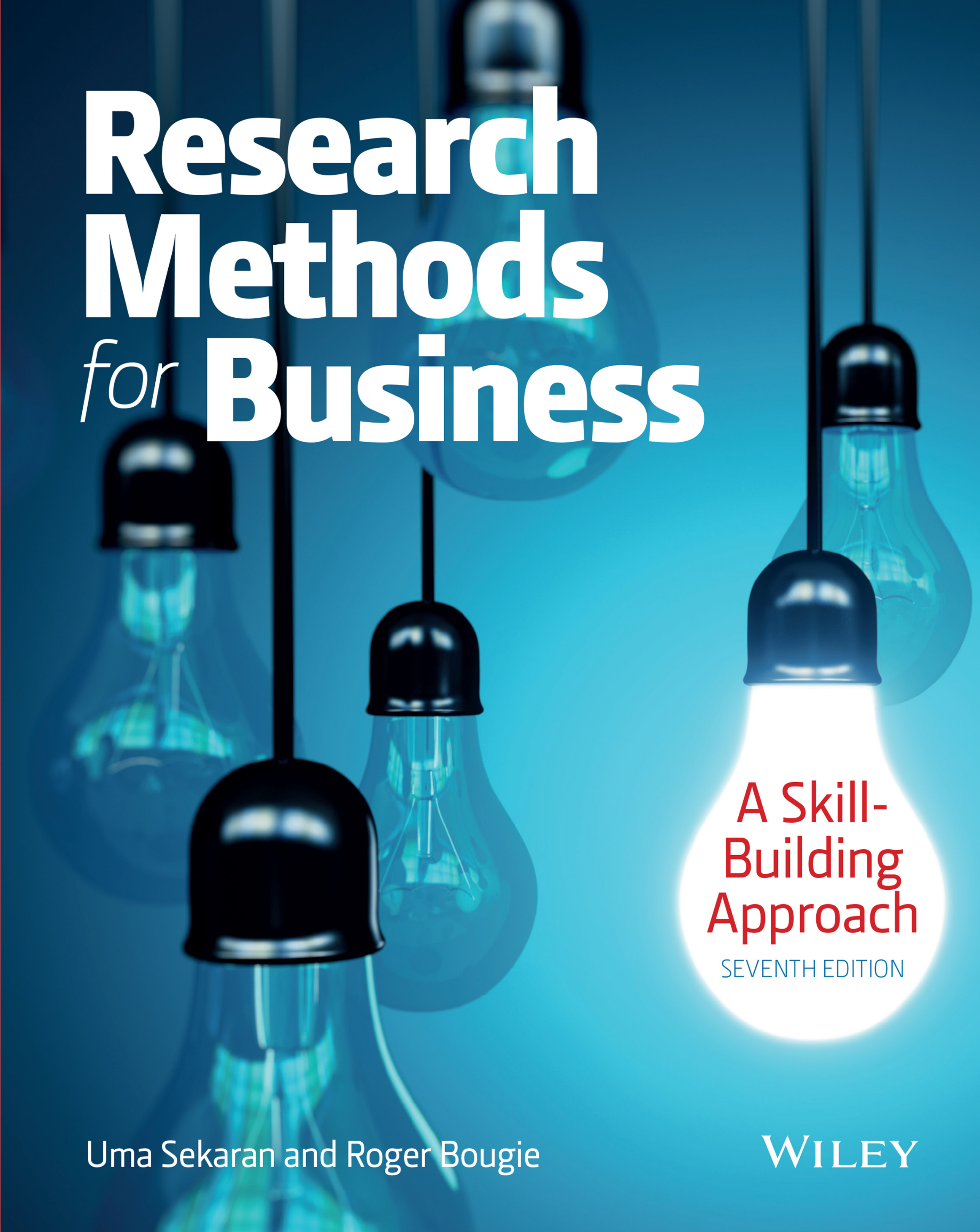

Research Methods *for* Business

A Skill-Building Approach

SEVENTH EDITION

Uma Sekaran and Roger Bougie

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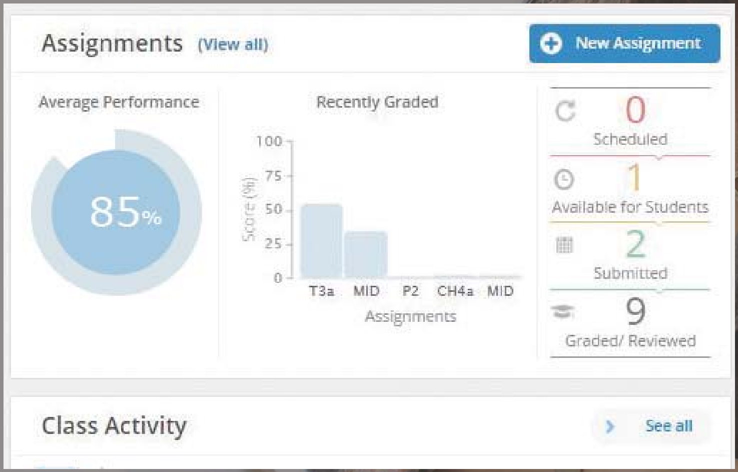
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and
Roger Bougie

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PREFACE

I have used previous editions of this book in various research methods courses with great success. For many years the book has helped thousands of my own students (undergraduate students, graduate students, and executive students), as well as many more around the world, to carry out their research projects. The great strength of *Research Methods for Business* is that students find it clear, informal, easy to use and unintimidating. I have tried to maintain these strengths in this seventh edition.

CHANGES IN THE SEVENTH EDITION

The seventh edition of *Research Methods for Business* has been thoroughly revised.

- Chapter 3 (Defining and Refining the Problem), Chapter 4 (The Critical Literature Review), Chapter 6 (Elements of Research Design), Chapter 7 (Interviews), Chapter 9 (Administering Questionnaires), Chapters 14 and 15 (Quantitative Data Analysis), and Chapter 17 (The Research Report) have been substantially modified and updated in this edition.
- Examples, exercises, and other pedagogical features have been revised and updated in all the chapters.
- The structure of the book has not changed, but the storyline has been greatly improved. As in previous editions, the accessible and informal style of presenting information has been maintained and the focus on practical skill building preserved.
- Chapter 2 introduces and discusses alternative approaches to research. In the new edition, subsequent chapters follow up on this by reviewing a range of topics (such as research questions, research design, and measurement) from various perspectives. This allows users of this book to recognize and develop their *personal ideas* on research and how it should be done, to determine which kinds of research questions are important to them, and what methods for collecting and analyzing data will give them the best answers to their research questions.

The book provides numerous examples to illustrate the concepts and points presented. Users will also note the variety of examples from different areas of the world as well as different areas of business – human resources management, strategic management, operations management, management control, marketing, finance, accounting, and information management.

Most chapters in the book include managerial implications of the contents discussed, emphasizing the need for managers to understand research. The ethical considerations involved in conducting research are also clearly brought out. The dynamics of cross-cultural research in terms of instrument development, surveys, and sampling are discussed, which, in the context of today's global economy, will be useful to students.

We expect that students and instructors alike will enjoy this edition. Students should become effective researchers, helped by the requisite knowledge and skills acquired by the study of this book. Finally, it is hoped that students will find research interesting, unintimidating, and of practical use.

HOW TO USE THIS SEVENTH EDITION

You can read this book in a variety of ways, depending on your reasons for using this book.

If the book is part of a Business Research Methods course, the order in which you read the chapters will be prescribed by your instructor.

If you are reading the book because you are engaged in a project (a consultancy project, a research project, or a dissertation) then the order in which your read the chapters is your own choice. However, we recommend that you follow the structure of the book rather closely. This means that we advise you to start with reading the first three chapters that introduce research, various approaches to what makes good research, and the development of a problem statement and a research proposal. Based on the type of research questions and whether, as a result of your research questions, your study is either qualitative or quantitative in nature you may decide to read the book in the following way.

In the case of qualitative research:

4	The critical literature review
6	Research design
7, 8, and/or 9	Data collection methods
13	Sampling
16	Qualitative data analysis
17	The research report

In the case of quantitative research:

4	The critical literature review
5	Theoretical framework
6	Research design
9	Questionnaires
10	Experimental designs
11 and 12	Measurement and Scaling
13	Sampling
14 and 15	Quantitative data analysis
17	The research report

COMPANION WEBSITES

Lecturers and students have a dedicated companion website available at **www.wiley.com/college/sekaran**.

Lecturers will find a range of bespoke video material, developed by the author to provide extra explanation on difficult topics; videos are signposted in the text. The lecturer website also houses additional case studies related to each chapter, including accompanying cases for the three new chapters. There is also an extensive test bank for lecturers, a comprehensive set of PowerPoint slides to accompany the new edition, and an instructor's manual, which offers an up-to-date and valuable additional teaching aid.

Students will find an online glossary and flashcards, which are useful for self-study and revision. In addition, the student website provides self-test quizzes with over 250 questions for students to use while studying outside the classroom.

ACKNOWLEDGMENTS

Working on the seventh edition of *Research Methods for Business* has been a positive and rewarding experience. Many people have contributed to this in many different ways. Thank you colleagues at Tilburg University and the TIAS School for Business and Society for your feedback on earlier versions of this book. Thank you for providing me with a pleasant, professional and inspiring work environment. Thank you dear students for the lively and inspiring discussions we have had during the past twenty years; I have learned a lot from these discussions. Thanks everybody at John Wiley & Sons, in particular Steve Hardman, for your support, your patience, and your confidence. Thank you reviewers for your constructive and insightful comments on earlier drafts of this book.

Roger Bougie

CHAPTER 1

Introduction to research

LEARNING OBJECTIVES

After completing Chapter 1 you should be able to:

1. Describe and define business research.
2. Distinguish between applied and basic research, giving examples, and discussing why they fall into one or the other of the two categories.
3. Explain why managers should know about research and discuss what managers should and should not do in order to interact effectively with researchers.
4. Identify and fully discuss specific situations in which a manager would be better off using an internal research team, and when an external research team would be more advisable, giving reasons for the decisions.
5. Discuss what research means to you and describe how you, as a manager, might apply the knowledge gained about research.
6. Demonstrate awareness of the role of ethics in business research.

INTRODUCTION

Just close your eyes for a minute and utter the word *research* to yourself. What kinds of images does this word conjure up for you? Do you visualize a lab with scientists at work with Bunsen burners and test tubes, or an Einstein-like character writing a dissertation on some complex subject such as ‘behavioral heterogeneity in economic institutions’, or someone analyzing large amounts of scanner data to assess the impact of a price reduction on sales? Most certainly, all these images do represent different aspects of research. However, research is not necessarily characterized by Bunsen burners, Einstein-like characters or Big Data. **Research**, a somewhat intimidating term for some, is simply the process of finding solutions to a problem after a thorough study and analysis of the situational factors. Along these lines, people (consumers, investors, managers) constantly engage themselves in exploring and examining issues – and hence are involved in some form of research activity- as they want to change mobile phone providers, buy a new car, go to the movies, invest in a business startup, or increase advertising expenditures in their role as a manager.

Research, in some form or another, may help *managers* in organizations to make decisions at the workplace. As we all know, sometimes they make good decisions and the problem gets solved; sometimes they make poor decisions and the problem persists; and on occasions they make such colossal blunders that they get stuck in the mire. The difference between making good decisions and committing blunders often lies in how we go about the decision-making process. In other words, good decision making fetches a "yes" answer to the following questions: Do we identify where exactly the problem lies? Do we correctly recognize the relevant factors in the situation needing investigation? Do we know what types of information are to be gathered and how? Do we know how to make use of the information so collected and draw appropriate conclusions to make the right decisions? And, finally, do we know how to implement the results of this process to solve the problem? This is the essence of research and to be a successful manager it is important to know how to go about making the right decisions by being knowledgeable about the various steps involved in finding solutions to problematic issues of interest to the organization and/or its stakeholders. This is what this book is all about.

Business research

Business research can be described as a systematic and organized effort to investigate a specific problem encountered in the work setting, which needs a solution. It comprises a series of steps that are designed and executed with the goal of finding answers to the issues that are of concern to the manager in the work environment. This means that the first step in research is to know where the problem areas exist in the organization, and to identify as clearly and specifically as possible the problems that need to be studied and resolved. Once the problem is clearly defined, steps can be taken to determine the factors that are associated with the problem, gather information, analyze the data, develop an explanation for the problem at hand and then solve it by taking the necessary corrective measures.

The entire process by which we attempt to solve problems is called research. Thus, research involves a series of well-thought-out and carefully executed activities that enable the manager to know how organizational problems can be solved, or at least considerably minimized. Research encompasses the processes of inquiry, investigation, examination, and experimentation. These processes have to be carried out systematically, diligently, critically, objectively, and logically. The expected end result would be a discovery that helps the manager to deal with the problem situation.

Identifying the critical issues, gathering relevant information, analyzing the data in ways that help decision making, and implementing the right course of action, are all facilitated by understanding business research. After all, decision making is simply a process of choosing from among alternative solutions to resolve a problem and research helps to generate viable alternatives for effective decision making. Knowledge of research thus enables you to undertake research yourself in order to solve the smaller and bigger problems that you will encounter in your (future) job as a treasurer, controller, brand manager, product manager, marketing manager, IT auditor, project manager, business analyst, or consultant. What's more, it will help you to discriminate between good and bad studies published in (professional) journals, to discriminate between good and bad studies conducted by research agencies, to discriminate between good and bad research proposals of research agencies, and to interact more effectively with researchers and consultants.

We can now define business research as an *organized, systematic, data-based, critical, objective, inquiry or investigation into a specific problem*, undertaken with the purpose of finding answers or solutions to it. In essence, research provides the necessary information that guides managers to make *informed* decisions to successfully deal with problems. The information provided could be the result of a careful analysis of *primary* data gathered first-hand or of *secondary* data that are already available (in the company, industry, archives, etc.). These data can be *quantitative* (quantitative data are data in the form of numbers as generally gathered through structured questions) or *qualitative* (qualitative data are data in the form of words) as generated from the broad answers to questions in interviews, or from responses to open-ended questions in a questionnaire, or through observation, or from already available information gathered from various sources such as the Internet.

The role of theory and information in research

We have just explained that research comes in many forms and shapes. There are different types of questions research projects can address and there are many different approaches to collecting and analyzing different types of data. What's more, some research is aimed at building theory, whereas other research is designed to test a theory or to describe what is going on, using an existing framework, instrument, or model. Indeed, in one form or another, both theory and information play an important role in a research project.

The term 'theory' can mean a lot of different things, depending on whom you ask. Many people use the word 'theory' to mean an idea or hunch that someone has, for instance about the optimal formation of a soccer team, investment bankers' salaries, or the Apollo program and the associated moon landings ('the Apollo moon landing didn't happen'). For others, a theory is any concept, instrument, model, or framework that helps them to think about or solve a problem, to describe a phenomenon, or to better understand a topic of interest, such as competitive advantage, portfolio management, or the sociology of Canadian donut shops. To a scientist, a theory explains a certain phenomenon, and the idea is that this explanation will hold in a wide range of settings. For instance, expectancy theory proposes that people will choose how to behave depending on the outcomes they expect as a result of their behavior. In other words, people decide what to do based on what they expect the outcome to be. At work, for example, it might be that people work longer hours because they expect an increase in pay. Like this, a theory may generate testable – and sooner or later, tested – predictions. A theory (in the formal, scientific sense) may thus vary in the extent to which it has been conceptually developed and empirically tested. We will have more to say about the role of information and theory in the research process in subsequent chapters.

Research and the manager

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Research and the manager**.

An experience common to all organizations is that the managers thereof encounter problems, big and small, on a daily basis, which they have to solve by making the right decisions. In business, research is usually primarily conducted to resolve problematic issues in, or interrelated among, the areas of accounting, finance, management, and marketing. In *accounting*, budget control systems, practices, and procedures are frequently examined. Inventory costing methods, accelerated depreciation, time-series behavior of quarterly earnings, transfer pricing, cash recovery rates, and taxation methods are some of the other areas that are researched. In *finance*, the operations of financial institutions, optimum financial ratios, mergers and acquisitions, leveraged buyouts, intercorporate financing, yields on mortgages, the behavior of the stock exchange, the influence of psychology on the behavior of financial practitioners and the subsequent effect on markets, and the like, become the focus of investigation. *Management* research could encompass the study of employee attitudes and behaviors, human resources management, the impact of changing demographics on management practices, production operations management, strategy formulation, information systems, and the like. *Marketing* research could address issues pertaining to consumer decision making, customer satisfaction and loyalty, market segmentation, creating a competitive advantage, product image, advertising, sales promotion, marketing channel management, pricing, new product development, and other marketing aspects.

Exhibit 1 gives an idea of some commonly researched topical areas in business.

EXHIBIT 1

SOME COMMONLY RESEARCHED AREAS IN BUSINESS

1. Employee behaviors such as performance, absenteeism, and turnover.
2. Employee attitudes such as job satisfaction, loyalty, and organizational commitment.
3. Supervisory performance, managerial leadership style, and performance appraisal systems.
4. Employee selection, recruitment, training, and retention.
5. Validation of performance appraisal systems.
6. Human resource management choices and organizational strategy.
7. Evaluation of assessment centers.
8. The dynamics of rating and rating errors in the judgment of human performance.
9. Strategy formulation and implementation.
10. Just-in-time systems, continuous-improvement strategies, and production efficiencies.
11. Updating policies and procedures in keeping with latest government regulations and organizational changes.
12. Organizational outcomes such as increased sales, market share, profits, growth, and effectiveness.
13. Consumer decision making.
14. Customer relationship management.
15. Consumer satisfaction, complaints, customer loyalty, and word-of-mouth communication.
16. Complaint handling.
17. Delivering and performing service.
18. Product life cycle, new product development, and product innovation.
19. Market segmentation, targeting, and positioning.
20. Product image, corporate image.
21. Cost of capital, valuation of firms, dividend policies, and investment decisions.
22. Risk assessment, exchange rate fluctuations, and foreign investment.
23. Tax implications of reorganization of firms or acquisition of companies.
24. Market efficiency.
25. Banking strategies.
26. Behavioral finance: overconfidence, bounded rationality, home-bias.
27. Executive compensation.
28. Mergers and acquisitions.
29. Portfolio and asset management.
30. Financial reporting.
31. Cash flow accounting.
32. Accounting standards.
33. Outsourcing of accounting.
34. Sustainability reporting.

35. The implications of social networks on the capital markets.
36. Corporate governance.
37. Development of effective cost accounting procedures.
38. Installation of effective management information systems.
39. Advanced manufacturing technologies and information systems.
40. Auditor behavior.
41. Approaches and techniques of auditing.
42. The use of technology in auditing.
43. Decision making in auditing.
44. Installation, adaptation, and updating of computer networks and software suitable for creating effective information systems for organizations.
45. Installation of an effective data warehouse and data mining system for the organization.
46. The acceptance of new computer programs.
47. Tax audits.
48. Internal auditing.
49. Accounting fraud and auditor liability.
50. The quality of audit reports.

Not only are the issues within any subarea related to many factors within that particular system, but they must also be investigated in the context of the external environment facing the business. For example, economic, political, demographic, technological, competitive, and other relevant global factors could impinge on some of the dynamics related to the firm. These have to be scrutinized as well to assess their impact, if any, on the problem being researched.

TYPES OF BUSINESS RESEARCH: APPLIED AND BASIC

Research can be undertaken for two different purposes. One is to solve a current problem faced by the manager in the work setting, demanding a timely solution. For example, a particular product may not be selling well and the manager might want to find the reasons for this in order to take corrective action. Such research is called **applied research**. The other is to generate a body of knowledge by trying to comprehend how certain problems that occur in organizations can be solved. This is called **basic, fundamental**, or **pure research**.

It is quite possible that some organizations may, at a later stage, apply the knowledge gained by the findings of basic research to solve their own problems. For instance, a university professor may be interested in investigating the factors that contribute to absenteeism as a matter of mere academic interest. After gathering information on this topic from several institutions and analyzing the data, the professor may identify factors such as inflexible work hours, inadequate training of employees, and low morale as primarily influencing absenteeism. Later on, a manager who encounters absenteeism of employees in his organization may use this information to determine if these factors are relevant to that particular work setting.

In sum, research done with the intention of applying the results of the findings to solve specific problems currently being experienced in an organization is called applied research. Research done chiefly to make a contribution to existing knowledge is called basic, fundamental, or pure research. The findings of such research contribute to the building of knowledge in the various functional areas of business; they teach us something we did not know before. Such knowledge, once generated, is usually later applied in organizational settings for problem solving.

Applied research

The following examples, following two situations cited in *Businessweek* and *The New York Times*, should provide some idea of the scope of business research activities.

EXAMPLE

1. Globally, colas account for more than 50% of all sodas sold. The challenge for the $187 billion soft drink industry is giving consumers in developed markets the sugary taste they want without giving them the mouthful of calories they don't. Concerns about obesity and health have led to nine years of falling U.S. soda consumption. The soda giants can't rely on existing diet versions of their namesake colas, as consumers are shying away from the artificial sweeteners they contain. Critics have blamed the ingredients – rightly or not – for everything from weight gain to cancer. Diet Coke is losing U.S. sales at 7% a year, almost double the rate of decline of American cola sales overall. So Coke and Pepsi are turning to research to save their cola businesses, which take in about two-thirds of the industry's U.S. sales. "If you can crack the perfect sweetener, that would be huge," says Howard Telford, an analyst at researcher Euromonitor International.

Source: Stanford, D. (2015, March 19). *Scientists Are Racing to Build a Better Diet Soda.* Retrieved from http://www.bloomberg.com/news/articles/2015-03-19/coke-pepsi-seek-diet-soda-s-perfect-sweetener

2. In classical mythology, Aquila is the eagle carrying Jupiter's thunderbolts skyward. At Facebook, it is the code name for a high-flying drone, indicative of the social networking company's lofty ambitions. The V-shaped unmanned vehicle, which has about the wingspan of a Boeing 767 but weighs less than a small car, is the centerpiece of Facebook's plans to connect with the 5 billion or so people it has yet to reach. Taking to the skies to beam Internet access down from solar-powered drones may seem like a stretch for a tech company that sells ads to make money. The business model at Facebook, which has 1.4 billion users, has more in common with NBC than Boeing. But in a high-stakes competition for domination of the Internet, in which Google wields high-altitude balloons and high-speed fiber networks, and Amazon has experimental delivery drones and colossal data centers, Facebook is under pressure to show that it, too, can pursue projects that are more speculative than product. One of those offbeat ideas, or so the thinking goes, could turn out to be a winner. "The Amazons, Googles and Facebooks are exploring completely new things that will change the way we live," said Ed Lazowska, who holds the Bill and Melinda Gates Chair in Computer Science and Engineering at the University of Washington.

Source: Hardy, Q. & Goel, V. (2015, March 26). *Drones Beaming Web Access are in the Stars for Facebook*. Retrieved from http://www.nytimes.com/2015/03/26/technology/drones-beaming-web-access-are-in-the-stars-for-facebook.html

The two preceding examples illustrate the benefits of applied research.

Basic or fundamental research

EXAMPLE

Right from her days as a clerical employee in a bank, Sarah had observed that her colleagues, though extremely knowledgeable about the nuances and intricacies of banking, were expending very little effort to improve the efficiency and effectiveness of the bank in the area of customer relations and service. They took on the minimum amount of work, availed themselves of long tea and lunch breaks, and seemed unmotivated in their dealings with the customers and the management. That they were highly knowledgeable about banking policies and practices was clearly evident from their discussions as they processed applications from customers. Sarah herself was very hardworking and enjoyed her work with the customers. She always used to think what a huge waste it was for talented employees to goof off rather than to work hard and enjoy their work. When she left the bank and did the dissertation for her PhD, her topic of investigation was Job Involvement, or the ego investment of people in their jobs. The conclusion of her investigation was that the single most important contributory factor to job involvement is the fit or match between the nature of the job and the personality predispositions of the people engaged in performing it. For example, challenging jobs allowed employees with high capabilities to get job-involved, and people-oriented employees got job-involved with service activities. Sarah then understood why the highly intelligent bank employees could not get job-involved or find job satisfaction in the routine jobs that rarely called for the use of their abilities.

Subsequently, when Sarah joined the Internal Research Team of a Fortune 500 company, she applied this knowledge to solve problems of motivation, job satisfaction, job involvement, and the like, in the organization.

The above is an instance of basic research, where knowledge was generated to understand a phenomenon of interest to the researcher. Most research and development departments in various industries, as well as many professors in colleges and universities, do basic or fundamental research so that more knowledge is generated in particular areas of interest to industries, organizations, and researchers. Though the objective of engaging in basic research is primarily to equip oneself with additional knowledge of certain phenomena and problems that occur in several organizations and industries with a view to finding solutions, the knowledge generated from such research is often applied later for solving organizational problems.

As stated, the primary purpose of conducting basic research is to generate more knowledge and understanding of the phenomena of interest and to build theories based on the research results. Such theories subsequently form the foundation of further studies on many aspects of the phenomena. This process of building on existing knowledge is the genesis for theory building, particularly in the management area.

Several examples of basic research can be provided. For instance, research into the causes and consequences of global warming will offer many solutions to minimize the phenomenon, and lead to further research to determine if and how global warming can be averted. Although research on global warming might primarily be for the purpose of understanding the nuances of the phenomenon, the findings will ultimately be applied and useful to, among others, the agricultural and building industries.

Many large companies, such as Apple, BMW, General Electric, Google, Microsoft, and Shell, also engage in basic research. For instance, fundamental research carried out at the German BMW facilities is aimed at further reducing the fleet's greenhouse gas emissions and promoting electromobility innovations. High-tech companies such as Apple, Microsoft, Google, and Facebook study online behavior and interactions to gain insights into how social and technological forces interact. This allows them to build new forms of online experiences around communities of interest and to increase their understanding of how to bring people together.

University professors engage in basic research in an effort to understand and generate more knowledge about various aspects of businesses, such as how to improve the effectiveness of information systems, integrate technology into the overall strategic objectives of an organization, assess the impact of marketing action, increase the productivity of employees in service industries, monitor sexual harassment incidents at the workplace, increase the effectiveness of small businesses, evaluate alternative inventory valuation methods, change the institutional structure of the financial and capital markets, and the like. These findings later become useful for application in business situations.

As illustrated, the main distinction between applied and basic business research is that the former is specifically aimed at solving a currently experienced problem within a specific organization, whereas the latter has the broader objective of generating knowledge and understanding of phenomena and problems that occur in various organizational settings. Despite this distinction, both types of research may benefit from following the same steps of systematic inquiry to arrive at solutions to problems. For this reason, both basic and applied research are often carried out in a scientific manner (discussed in the next chapter) so that the findings or results generated by them can be relied upon to effectively solve the problem investigated.

MANAGERS AND RESEARCH

Why managers need to know about research

Managers with knowledge of research have an advantage over those without. Though you yourself may not be doing any major research as a manager, you will have to understand, predict, and control events that are dysfunctional within the organization. For example, a newly developed product may not be "taking off," or a financial investment may not be "paying off" as anticipated. Such disturbing phenomena have to be *understood* and explained. Unless this is done, it will not be possible to *predict* the future of that product or the prospects of that investment, and how future catastrophic outcomes can be *controlled*. A grasp of research methods enables managers to understand, predict, and control their environment.

A thought that may cross your mind is that, because you will probably be bringing in researchers to solve problems instead of doing the research yourself, there is no need to bother to study research. The reasons for its importance become clear when one considers the consequences of failing to do so. With the ever-increasing complexity of modern organizations, and the uncertainty of the environment they face, the management of organizational systems now involves constant troubleshooting in the workplace. It would help if managers could sense, spot, and deal with problems *before* they got out of hand. Knowledge of research and problem-solving processes helps managers to identify problem situations before they get out of control. Although minor problems can be fixed by the manager, major problems warrant the hiring of outside researchers or consultants. The manager who is knowledgeable about research can interact effectively with them. Knowledge about research processes, design, and interpretation of data also helps managers to become discriminating recipients of the research findings presented, and to determine whether or not the recommended solutions are appropriate for implementation.

Another reason why professional managers today need to know about research methods is that they will become more discriminating while sifting through the information disseminated in business journals. Some journal articles are more scientific and objective than others. Even among the scientific articles, some are more appropriate for application or adaptation to particular organizations and situations than others. This is a function of the sampling design, the types of organizations studied, and other factors reported in the journal articles. Unless the manager is able to grasp fully what the published empirical research really conveys, she or he is likely to err in incorporating some of the suggestions such publications offer. By the same token, managers can handle with success their own problems at considerable cost savings by studying the results of "good" (discussed in the next chapter) published research that has addressed similar issues.

There are several other reasons why professional managers should be knowledgeable about research and research methods in business. First, such knowledge sharpens the sensitivity of managers to the myriad variables operating in a situation and reminds them frequently of the multicausality and multifinality of phenomena, thus avoiding inappropriate, simplistic notions of one variable "causing" another. Second, when managers understand the research reports about their organizations handed to them by professionals, they are equipped to take intelligent, educated, calculated risks with known probabilities attached to the success or failure of their decisions. Research then becomes a useful decision-making tool rather than generating a mass of incomprehensible statistical information. Third, if managers become knowledgeable about scientific investigations, vested interests inside or outside the organization will not prevail. For instance, an internal research group within the organization will not be able to distort information or manipulate the findings to their advantage if managers are aware of the biases that can creep into research and know how data are analyzed and interpreted. As an example, an internal research team might state that a particular unit to which it is partial (for whatever reason) has shown increased profits and hence should be allocated more resources to buy sophisticated equipment to further enhance its effectiveness. However, the increased profit could have been a one-time windfall phenomenon due to external environmental factors such as market conditions, bearing no relation whatever to the unit's operating efficiency. Thus, awareness of the different ways in which data may be camouflaged will help the manager to make the right decision. Fourth, knowledge about research helps the manager to relate to and share pertinent information with the researcher or consultant hired for problem solving.

In sum, being knowledgeable about research and research methods helps professional managers to:

1. Identify and effectively solve minor problems in the work setting.
2. Know how to discriminate good from bad research.
3. Appreciate and be constantly aware of the multiple influences and multiple effects of factors impinging on a situation.
4. Take calculated risks in decision making, knowing full well the probabilities associated with the different possible outcomes.
5. Prevent possible vested interests from exercising their influence in a situation.
6. Relate to hired researchers and consultants more effectively.
7. Combine experience with scientific knowledge while making decisions.

The manager and the consultant–researcher

Managers often need to engage a consultant to study some of the more complex, time-consuming problems that they encounter, as in the case of Facebook mentioned earlier. It is thus important to be knowledgeable about how to effectively interact with the consultant (the terms researcher and consultant are used interchangeably), what the manager–researcher relationship should be, and the advantages and disadvantages of internal versus external consultants.

During their careers, it often becomes necessary for managers to deal with consultants. In such cases, the manager must not only interact effectively with the research team, but must also explicitly delineate the roles for the researchers and the management. The manager has to inform the researchers what types of information may be provided to them and, more importantly, which of their records will *not* be made available to them. Such records might include the personnel files of the employees, or certain trade secrets. Making these facts explicit at the very beginning can save a lot of frustration for both parties. Managers who are very knowledgeable about research can more easily foresee what information the researchers might require, and if certain documents containing such information cannot be made available, they can inform the research team about this at the outset.

It is vexing for researchers to discover, at a late stage, that the company will not let them have certain information. If they know the constraints right from the beginning, the researchers might be able to identify alternate ways of tackling the problems and to design the research in such a way as to provide the needed answers.

Beyond specifying the roles and constraints, the manager should also make sure that there is congruence in the value systems of management and the consultants. For example, the research team might very strongly believe and recommend that reduction of the workforce and streamlining would be the ideal way to significantly cut down operating costs. Management's consistent philosophy, however, might be *not* to fire employees who are experienced, loyal, and senior. Thus, there might be a clash of ideologies between management and the research team. Research knowledge will help managers to identify and explicitly state, even at the outset, the values that the organization holds dear, so that there are no surprises down the road. Clarification of the issue offers the research team the opportunity to either accept the assignment and find alternative ways of dealing with the problem, or regret its inability to undertake the project. In either case, both the organization and the research team will be better off having discussed their value orientations, thus avoiding potential frustration on both sides.

Exchange of information in a straightforward and forthright manner also helps to increase the rapport and trust levels between the two parties, which in turn motivates the two sides to interact effectively. Under this setup, researchers feel free to approach the management to seek assistance in making the research more purposeful. For instance, the research team is likely to request that management inform the employees of the ensuing research and its broad purpose to allay any fears they might entertain.

To summarize, while hiring researchers or consultants the manager should make sure that:

1. The roles and expectations of both parties are made explicit.
2. Relevant philosophies and value systems of the organization are clearly stated and constraints, if any, are communicated.
3. A good rapport is established with the researchers, and between the researchers and the employees in the organization, enabling the full cooperation of the latter.

INTERNAL VERSUS EXTERNAL CONSULTANTS/RESEARCHERS

Internal consultants/researchers

Some organizations have their own consulting or research department, which might be called the Management Services Department, the Organization and Methods Department, R&D (research and development department), or some other name. This department serves as the **internal consultant** to subunits of the organization that face certain problems and seek help. Such a unit within the organization, if it exists, is useful in several ways, and enlisting its help might be advantageous under some circumstances, but not others. The manager often has to decide whether to use internal or external researchers. To reach a decision, the manager should be aware of the strengths and weaknesses of both, and weigh the advantages and disadvantages of using either, based on the needs of the situation. Some of the advantages and disadvantages of both internal and external teams are now discussed.

Advantages of internal consultants/researchers

There are at least four advantages in engaging an internal team to do the research project:

1. The internal team stands a better chance of being readily accepted by the employees in the subunit of the organization where research needs to be done.

2. The team requires much less time to understand the structure, the philosophy and climate, and the functioning and work systems of the organization.
3. They are available to implement their recommendations after the research findings have been accepted. This is very important because any "bugs" in the implementation of the recommendations may be removed with their help. They are also available to evaluate the effectiveness of the changes, and to consider further changes if and when necessary.
4. The internal team might cost considerably less than an external team for the department enlisting help in problem solving, because they will need less time to understand the system due to their continuous involvement with various units of the organization. For problems of low complexity, the internal team would be ideal.

Disadvantages of internal consultants/researchers

There are also certain disadvantages to engaging internal research teams for the purposes of problem solving. The four most critical ones are:

1. In view of their long tenure as internal consultants, the internal team may quite possibly fall into a stereotyped way of looking at the organization and its problems. This inhibits any fresh ideas and perspectives that might be needed to correct the problem. This is definitely a handicap for situations in which weighty issues and complex problems are to be investigated.
2. There is scope for certain powerful coalitions in the organization to influence the internal team to conceal, distort, or misrepresent certain facts. In other words, certain vested interests could dominate, especially in securing a sizable portion of the available scant resources.
3. There is also a possibility that even the most highly qualified internal research teams are not perceived as "experts" by the staff and management, and hence their recommendations may not get the consideration and attention they deserve.
4. Certain organizational biases of the internal research team might, in some instances, make the findings less objective and consequently less scientific.

External consultants/researchers

The disadvantages of the internal research teams turn out to be the advantages of the external teams, and the former's advantages work out to be the disadvantages of the latter. However, the specific advantages and disadvantages of the external teams may be highlighted.

Advantages of external consultants/researchers

The advantages of the external team are:

1. The external team can draw on a wealth of experience from having worked with different types of organizations that have had the same or similar types of problems. This wide range of experience enables them to think both divergently and convergently rather than hurry to an instant solution on the basis of the apparent facts in the situation. They are able to ponder over several alternative ways of looking at the problem because of their extensive problem-solving experience in various other organizational setups. Having viewed the situation from several possible angles and perspectives (divergently), they can critically assess each of these, discard the less viable options and alternatives, and focus on specific feasible solutions (think convergently).

2. The external teams, especially those from established research and consulting firms, might have more knowledge of current sophisticated problem-solving models through their periodic training programs, which the teams within the organization may not have access to. Because knowledge obsolescence is a real threat in the consulting area, external research institutions ensure that their members are conversant with the latest innovations through periodic organized training programs. The extent to which internal team members are kept abreast of the latest problem-solving techniques may vary considerably from one organization to another.

Disadvantages of external consultants/researchers

The major disadvantages in hiring an external research team are as follows:

1. The cost of hiring an external research team is usually high and is the main deterrent, unless the problems are critical.
2. In addition to the considerable time the external team takes to understand the organization being researched, they seldom get a warm welcome, nor are readily accepted by employees. Departments and individuals likely to be affected by the research study may perceive the study team as a threat and resist them. Therefore, soliciting employees' help and enlisting their cooperation in the study is a little more difficult and time-consuming for external researchers than for internal teams.
3. The external team also charges additional fees for their assistance in the implementation and evaluation phases.

Keeping in mind these advantages and disadvantages of internal and external research teams, the manager who desires research services has to weigh the pros and cons of engaging either before making a decision. If the problem is a complex one, or if there are likely to be vested interests, or if the very existence of the organization is at stake because of one or more serious problems, it would be advisable to engage external researchers despite the increased costs involved. However, if the problems that arise are fairly simple, if time is of the essence in solving moderately complex problems, or if there is a system-wide need to establish procedures and policies of a fairly routine nature, the internal team would probably be the better option.

Knowledge of research methods and appreciation of the comparative advantages and disadvantages of external and internal teams help managers to make decisions on how to approach problems and determine whether internal or external researchers are the appropriate choice to investigate and solve the problem.

KNOWLEDGE ABOUT RESEARCH AND MANAGERIAL EFFECTIVENESS

As already mentioned, managers are responsible for the final outcome by making the right decisions at work. This is greatly facilitated by research knowledge. Knowledge of research heightens the sensitivity of managers to the innumerable internal and external factors operating in their work and organizational environment. It also helps to facilitate effective interactions with consultants and comprehension of the nuances of the research process.

In today's world, a multitude of instruments and theories, (big) data, and sophisticated technology is available to model and analyze a wide range of issues such as business processes, consumer behavior, investment decisions, and the like. The recommendations of the external consultant who is proficient in research, and urges the application of particular models, instruments, or statistical techniques in a particular situation may make no sense to, and might create some misgivings in, the manager not acquainted with research. Even superficial knowledge of research helps the manager to deal with the consultant/researcher in a mature and confident manner, so that dealing with "experts" does not result in discomfort. As the manager, *you* will be the one to make the final decision on the implementation of the recommendations made by the research team. Remaining objective, focusing on problem solutions, fully understanding the recommendations made, and why and how they have been arrived at, make for good managerial decision making. Although company traditions are to be respected, there may be occasions where today's rapidly changing turbulent environment demands the substitution or re-adaptation of some of these traditions, based on research findings. Thus, knowledge of research greatly enhances the decision-making skills of the manager.

ETHICS AND BUSINESS RESEARCH

Ethics in business research refers to a code of conduct or expected societal norms of behavior while conducting research. Ethical conduct applies to the organization and the members that sponsor the research, the researchers who undertake the research, and the respondents who provide them with the necessary data. The observance of ethics begins with the person instituting the research, who should do so in good faith, pay attention to what the results indicate, and, surrendering the ego, pursue organizational rather than self-interests. Ethical conduct should also be reflected in the behavior of the researchers who conduct the investigation, the participants who provide the data, the analysts who provide the results, and the entire research team that presents the interpretation of the results and suggests alternative solutions.

Thus, ethical behavior pervades each step of the research process – data collection, data analysis, reporting, and dissemination of information on the Internet, if such an activity is undertaken. How the subjects are treated and how confidential information is safeguarded are all guided by business ethics. We will highlight these as they relate to different aspects of research in the relevant chapters of this book.

There are business journals such as the *Journal of Business Ethics* and the *Business Ethics Quarterly* that are mainly devoted to the issue of ethics in business. The American Psychological Association has established certain guidelines for conducting research, to ensure that organizational research is conducted in an ethical manner and the interests of all concerned are safeguarded. As stated, we will discuss the role of ethics in the chapters that follow, insofar as it is relevant to the various steps in the research process.

SUMMARY

- **Learning objective 1: Describe and define business research.**
  Research is the process of finding solutions to a problem after a thorough study and analysis of the situational factors. Business research is an organized, systematic, data-based, critical, objective, inquiry or investigation into a specific problem, undertaken with the purpose of finding answers or solutions to it. In essence, business research provides the necessary information that guides managers to make informed decisions to successfully deal with problems. In one form or another, both theory and information play an important role in research.

- **Learning Objective 2: Distinguish between applied and basic research, giving examples, and discussing why they fall into one or the other of the two categories.**
  Research can be undertaken for different purposes. One is to solve a current problem faced by the manager in the work setting, demanding a timely solution. Such research is called applied research. The other is to generate a body of knowledge by trying to comprehend how certain problems that occur in organizations can be solved. This is called basic, fundamental, or pure research. The findings of such research teach us

something we did not know before. Such knowledge, once generated, is usually later applied in organizational settings for problem solving.

- **Learning Objective 3: Explain why managers should know about research and discuss what managers should and should not do in order to interact effectively with researchers.**
  Managers with knowledge of research have an advantage over those without. A grasp of research methods enables managers to understand, predict, and control their environment and/or to effectively communicate with external researchers or consultants. While hiring external researchers/consultants the manager should ensure that the roles and expectations of both parties are made explicit; relevant philosophies and value systems of the organization are clearly stated and constraints are communicated; and, a good rapport is established with the researchers.

- **Learning Objective 4: Identify and fully discuss specific situations in which a manager would be better off using an internal research team, and when an external research team would be more advisable, giving reasons for the decisions.**
  The manager often has to decide whether to use internal or external researchers. To reach a decision, the manager should be aware of the strengths and weaknesses of both, and weigh the advantages and disadvantages of using either, based on the specific needs of the situation.

- **Learning Objective 5: Discuss what research means to you and describe how you, as a manager, might apply the knowledge gained about research.**
  As the manager, *you* will be the one to make the final decision on the implementation of the recommendations made by the researcher or the research team. Remaining objective, focusing on problem solutions, fully understanding the recommendations made, and why and how they have been arrived at, make for good managerial decision making. Knowledge of research greatly enhances the decision-making skills of the manager.

- **Learning Objective 6: Demonstrate awareness of the role of ethics in business research.**
  Ethics in business research refers to a code of conduct or expected societal norms of behavior while conducting research. Ethical conduct applies to the organization and the members that sponsor the research, the researchers who undertake the research, and the respondents who provide them with the necessary data. Ethical behavior pervades each step of the research process. We will highlight these as they relate to different aspects of research in the relevant chapters of this book.

DISCUSSION QUESTIONS

1. Describe a situation where you used research in order to inform thinking, decisions, and/or actions in relation to a personal issue of interest such as buying a new mobile phone or going to the movies. Provide information about the purpose of your research, the problem, the information you collected, how you collected this information, the role of theory, and the solution to the problem.
2. Why should a manager know about research when the job entails *managing* people, products, events, environments, and the like?

3. For what specific purposes is basic research important?
4. When is applied research, as distinct from basic research, useful?
5. Why is it important to be adept in handling the manager–researcher relationship?
6. Explain, giving reasons, which is more important, applied or basic research.
7. Give two specific instances where an external research team would be useful and two other scenarios when an internal research team would be deployed, with adequate explanations as to why each scenario is justified for an external or internal team.
8. Describe a situation where research will help you as a manager to make a good decision.
9. Given the situations below:
    a. discuss, with reasons, whether they fall into the category of applied or basic research;
    b. for Scenario 1, explain, with reasons, who will conduct the research.

Scenario 1 To acquire or not to acquire: that is the question

Companies are very interested in acquiring other firms, even when the latter operate in totally unrelated realms of business. For example, Coca-Cola has announced that it wants to buy China Huiyuan Juice Group in an effort to expand its activities in one of the world's fastest-growing beverage markets. Such acquisitions are claimed to "work miracles." However, given the volatility of the stock market and the slowing down of business, many companies are not sure whether such acquisitions involve too much risk. At the same time, they also wonder if they are missing out on a great business opportunity if they fail to take such risks. Some research is needed here!

Scenario 2 Reasons for absenteeism

A university professor wanted to analyze in depth the reasons for absenteeism of employees in organizations. Fortunately, a company within 20 miles of the campus employed her as a consultant to study that very issue.

Scenario 3 Effects of service recovery on customer satisfaction

A research scientist wants to investigate the question: What is the most effective way for an organization to recover from a service failure? Her objective is to provide guidelines for establishing the proper "fit" between service failure and service recovery that will generalize across a variety of service industries.

CASE

THE LAROCHE CANDY COMPANY

In 1864 Henricus Laroche started making high-quality chocolate in his kitchen in Ooigem, Belgium. Henricus learned his trade at a famous chocolate shop in Paris, and he and his wife began to make chocolate in bars, wafers, and other shapes soon after Henricus had returned to Belgium to start his own business. The Belgian people loved Laroche's chocolate and the immediate success soon caused him to increase his production facilities. Henricus decided to build a chocolate factory in Kortrijk, a nearby city in the Flemish province West Flanders. With mass-production, the company was able to lower the per-unit costs and to make chocolate, once a luxury item, affordable to everybody. The Laroche Candy Company flourished, expanded its product lines, and acquired related companies during the following decades. Within a century the company had become Belgium's leading candy-manufacturer, employing over 2500 people.

Today, The Laroche Candy Company is one of the biggest manufacturers of chocolate and non-chocolate confectionery products in Europe. Under the present leadership of Luc Laroche the company has become truly innovative. What's more, the company has adopted a very proactive approach to marketing planning and is therefore a fierce competitor in an increasingly global marketplace. The number of products the company produces and markets has increased dramatically; at this moment there are more than 250 Laroche Candy items distributed internationally in bulk, bags, and boxes.

Luc Laroche, born in 1946, is the fifth generation of his family to lead The Laroche Candy Company. He is the great-great-grandson of company founder Henricus Laroche and the current Chairman and CEO of the company. But Luc is nearing retirement. He has planned to stop working in two to three years. Whereas stepping back from power is a very difficult thing to do for a lot of people, it is an easy thing to do for Luc: He is looking forward to spending time with his grandchildren and to driving his Harley-Davidson across Europe. What's more, he has never found the time to play golf, and he is planning to spend "three whole summers learning it" if necessary. And yet, even though "letting go" is not a problem for Luc, he still has his worries about his imminent retirement.

As in most family businesses, Luc's two children spent their share of summers working for the company. Luc's oldest son Davy has repeatedly worked for the accounting department whereas Davy's younger brother Robert has infrequently worked in the field. However, they have never shown a serious interest in the business. Davy, who is 35, currently works as an associate professor of management accounting at a reputable university in Belgium. Robert, aged 32, lives in Paris and has been working as a photographer for the past ten years. About 12 years ago, Robert told his dad, "I know you'd like me to come into the business, but I've got my own path to travel." Luc recalls responding that he respects that and that he does not want Robert to feel constrained; "I just want you to be happy," is what he told Robert on that particular occasion.

Ever since this conversation with Robert, Luc has put his hopes on Davy. A few days ago, Luc invited Davy to have dinner at the famous In de Wulf restaurant in Dranouter, Belgium, to discuss the future of The Laroche Candy Company. He wants to talk about his retirement and a succession plan for the company with Davy, who has serious doubts about taking over the company. Davy knows that for his dad the company is his life and, like his dad, he wants the company to be successful in the future; but he just does not know whether it is a good idea to take over from his father. In an effort to maintain a balanced perspective on the issue, Davy has done some research on it. Hence, he has become very familiar with statistics about the failure rate of family transitions. These statistics have triggered numerous concerns and fears about taking over the company from his father.

Luc and Davy discuss the future of the company during a memorable dinner in Dranouter. Luc tells Davy that he wants his son to take over the company, but Davy explains that he has qualms. He brings up his doubts and fears and alternatives such as going public, selling to a strategic acquirer or investor, or selling to employees through an employee stock ownership plan. Luc hardly listens to Davy's concerns and strikes a blow for family business.

"History is full of examples of spectacular ascents of family business," he said after the waiter has refilled his glass for the fourth time in just over an hour, "the Rothschilds, the Murdochs, the Waltons, and the Vanderbilts, to name only a few. The Rothschilds, for instance, not only accumulated the largest amount of private wealth the Western world has ever seen, they also changed the course of history by financing kings and monarchs. Did you know that they supported Wellington's armies, which ultimately led to the defeat of Napoleon at Waterloo? I bet you didn't."

Davy raised an eyebrow. "I didn't. But what I do know," he replied, "is that only 50 years after the death of Cornelius Vanderbilt, who created a fortune in railroads and shipping, several of his direct descendants were flat broke. Apparently the Vanderbilts had both a talent for acquiring and spending money in unmatched numbers. Seriously, dad, I do believe that strong family values are very important but I also feel that they may place restraints on the development of the company. It is commonly known that familism in Southern Italy is one of the main reasons for the slower economic development of the south relative to the north."

Luc sighed and looked at his son. "So, what does this all mean?"

"Well, I think that the key question is whether family firms evolve as an efficient response to the institutional and market environment, or whether they are an outcome of cultural norms that might be harmful for corporate decisions and economic outcomes," Davy replied with a gentle smile. "Don't you think so?"

"I . . . um . . . I guess I do." Luc smiled back at his son. "I am not sure that I understand what you mean, but it sounds great. Let's throw some money at it and hire a consultant who knows something about this. I'll call McKinsey first thing tomorrow morning. Cheers."

"Cheers dad," Davy echoed lifting his glass.

Two weeks later, Paul Thomas Anderson, a senior McKinsey consultant, put forward the following problem statement in a meeting with Luc Laroche: What are the implications of family control for the governance, financing, and overall performance of The Laroche Candy Company?

CASE QUESTIONS

1. What is business research?
2. Why is the project that Paul Thomas Anderson is doing for The Laroche Candy Company a *research* project?
3. Which steps will Paul take now that he has clearly defined the problem that needs attention?
4. Luc Laroche has decided to hire an external consultant to investigate the problem. Do you think that this is a wise decision or would it have been better to ask his son Davy or an internal consultant to do the research project?
5. What can (or should) Luc do to assist Paul to yield valuable research results?
6. How can basic or fundamental research help Paul to solve the specific problem of The Laroche Candy Company?
7. Try to find relevant books, articles, and research reports relating to this issue. Use, among others, electronic resources of your library and/or the Internet.

CHAPTER 2

The scientific approach and alternative approaches to investigation

LEARNING OBJECTIVES

After completing Chapter 2 you should be able to:

1. Explain what is meant by scientific investigation, giving examples of both scientific and non-scientific investigations.
2. Discuss the seven steps of the hypothetico-deductive method, using an example of your own.
3. Discuss alternative perspectives on what makes good research.

INTRODUCTION

Managers frequently face issues that call for critical decision making. Managerial decisions based on the results of "good" research tend to be effective. In Chapter 1, we defined research as an organized, systematic, data-based, critical, objective inquiry into a specific problem that needs a solution. We also explained that both basic and applied research are often carried out in a *scientific* way. It is therefore important to understand what the term scientific means. Scientific research focuses on solving problems and pursues a step-by-step logical, organized, and rigorous method to identify the problems, gather data, analyze them, and draw valid conclusions from them. Thus, scientific research is not based on hunches, experience, and intuition (though these may play a part in final decision making), but is purposive and rigorous. Because of the rigorous way in which it is done, scientific research enables all those who are interested in researching and knowing about the same or similar issues to come up with comparable findings when the data are analyzed. Scientific research also helps researchers to state their findings with accuracy and confidence. Furthermore, **scientific investigation** tends to be more objective than subjective, and helps managers to highlight the most critical factors at the workplace that need specific attention so as to avoid, minimize, or solve problems. Scientific investigation and managerial decision making are integral aspects of effective problem solving. The term *scientific research* applies, therefore, to both basic and applied research.

Do researchers always take a scientific approach to research? No. Sometimes, researchers have a different perspective on what makes good research and how research should be done. We will have more to say about this later in this chapter. At other times, the problem may be so simple that it does not call for elaborate research, and past experience might offer the necessary solution. Finally, exigencies of time (where quick decisions are called for), unwillingness to expend the resources needed for doing good research, lack of knowledge, and other factors might prompt businesses to try to solve problems based on hunches. However, the probability of making wrong decisions in such cases is high. Even such business "gurus" as Richard Branson and Steve Jobs have confessed to making big mistakes due to errors of judgment. *BusinessWeek*, *Fortune*, and the *Wall Street Journal*, among other business periodicals and newspapers, feature articles from time to time about organizations that face difficulties because of wrong decisions made on the basis of hunches and/or insufficient information. Many implemented plans fail because not enough research has preceded their formulation.

THE HALLMARKS OF SCIENTIFIC RESEARCH

The hallmarks or main distinguishing characteristics of scientific research may be listed as follows:

1. Purposiveness.
2. Rigor.
3. Testability.
4. Replicability.
5. Precision and confidence.
6. Objectivity.
7. Generalizability.
8. Parsimony.

Each of these characteristics can be explained in the context of a concrete example. Let us consider the case of a manager who is interested in investigating how employees' commitment to the organization can be increased. We shall examine how the eight hallmarks of science apply to this investigation so that it may be considered "scientific."

Purposiveness

The manager has started the research with a definite aim or purpose. The focus is on increasing the commitment of employees to the organization, as this will be beneficial in many ways. An increase in employee commitment will translate into lower turnover, less absenteeism, and probably increased performance levels, all of which will definitely benefit the organization. The research thus has a *purposive* focus.

Rigor

A good theoretical base and a sound methodological design add **rigor** to a purposive study. Rigor connotes carefulness, scrupulousness, and the degree of exactitude in research investigations. In the case of our example, let us say the manager of an organization asks 10 to 12 of its employees to indicate what would increase their level of commitment to it. If, solely on the basis of their responses, the manager reaches several conclusions on how employee commitment can be increased, the whole approach to the investigation is unscientific. It lacks rigor for the following reasons:

1. The conclusions are incorrectly drawn because they are based on the responses of just a few employees whose opinions may not be representative of those of the entire workforce.

2. The manner of framing and addressing the questions could have introduced bias or incorrectness in the responses.
3. There might be many other important influences on organizational commitment that this small sample of respondents did not or could not verbalize during the interviews, and the researcher has therefore failed to include them.

Therefore, conclusions drawn from an investigation that lacks a good theoretical foundation, as evidenced by reason 3, and methodological sophistication, as evident from 1 and 2 above, are unscientific. Rigorous research involves a good theoretical base and a carefully thought-out methodology. These factors enable the researcher to collect the right kind of information from an appropriate sample with the minimum degree of bias, and facilitate suitable analysis of the data gathered. The following chapters of this book address these theoretical and methodological issues. Rigor in research design also makes possible the achievement of the other six hallmarks of science that we shall now discuss.

Testability

Testability is a property that applies to the hypotheses of a study. In Chapter 5, we will define a **hypothesis** as a tentative, yet testable, statement, which predicts what you expect to find in your empirical data. Hypotheses are derived from theory, which is based on the logical beliefs of the researcher and on (the results of) previous, scientific research – we will have more to say about these matters in Chapter 5.

A scientific hypothesis must be *testable*. Not all hypotheses can be tested. Non-testable hypotheses are often vague statements, or they put forward something that cannot be tested experimentally. A famous example of a hypothesis that is not testable is the hypothesis that God created the earth.

If, after talking to a random selection of employees of the organization and study of the previous research done in the area of organizational commitment, the manager or researcher develops certain hypotheses on how employee commitment can be enhanced, then these can be tested by applying certain statistical tests to the data collected for the purpose. For instance, the researcher might hypothesize that those employees who perceive greater opportunities for participation in decision making will have a higher level of commitment. This is a hypothesis that can be tested when the data are collected. A correlation analysis will indicate whether the hypothesis is substantiated or not. The use of several other tests, such as the chi-square test and the *t*-test, is discussed in Chapters 14 and 15.

Scientific research thus lends itself to testing logically developed hypotheses to see whether or not the data support the educated conjectures or hypotheses that are developed after a careful study of the problem situation. **Testability** thus becomes another hallmark of scientific research.

Replicability

Let us suppose that the manager/researcher, based on the results of the study, concludes that participation in decision making is one of the most important factors that influences the commitment of employees to the organization. We will place more faith and credence in these findings and conclusion if similar findings emerge on the basis of data collected by others employing the same methods – that is, we have more faith in the findings of a study if the findings are replicated in another study. Replication demonstrates that our hypotheses have not been supported merely by chance, but are reflective of the true state of affairs in the population. The results of the tests of hypotheses should be supported again and yet again when the same type of research is repeated in similar circumstances. To the extent that this does happen (i.e., the results are replicated or repeated), we will gain confidence in the scientific nature of our research.

Replication is made possible by a detailed description of the design details of the study, such as the sampling method and the data collection methods that were used. This information should create the possibility to replicate the research. Replicability is the extent to which a re-study is made possible by the provision of the design details of the study in the research report. **Replicability** is another hallmark of scientific research.

Precision and confidence

In management research, we seldom have the luxury of being able to draw "definitive" conclusions on the basis of the results of data analysis. This is because we are unable to study the universe of items, events, or population we are interested in, and have to base our findings on a sample that we draw from the universe. In all probability, the sample in question may not reflect the exact characteristics of the phenomenon we are trying to study (these difficulties are discussed in greater detail in Chapter 13). Measurement errors and other problems are also bound to introduce an element of bias or error in our findings. However, we would like to design the research in a manner that ensures that our findings are as close to reality (i.e., the true state of affairs in the universe) as possible, so that we can place reliance or confidence in the results.

Precision refers to the closeness of the findings to "reality" based on a sample. In other words, precision reflects the degree of accuracy or exactitude of the results on the basis of the sample, to what really exists in the universe. For example, if I estimated the number of production days lost during the year due to absenteeism at between 30 and 40, as against the actual figure of 35, the precision of my estimation compares more favorably than if I had indicated that the loss of production days was somewhere between 20 and 50. You may recall the term *confidence interval* in statistics, which is what is referred to here as precision.

Confidence refers to the probability that our estimations are correct. That is, it is not merely enough to be precise, but it is also important that we can confidently claim that 95% of the time our results will be true and there is only a 5% chance of our being wrong. This is also known as the *confidence level*.

The narrower the limits within which we can estimate the range of our predictions (i.e., the more precise our findings) and the greater the confidence we have in our research results, the more useful and scientific the findings become. In social science research, a 95% confidence level – which implies that there is only a 5% probability that the findings may *not* be correct – is accepted as conventional, and is usually referred to as a significance level of 0.05 ($p = 0.05$). Thus, precision and confidence are important aspects of research, which are attained through appropriate scientific sampling design. The greater the precision and confidence we aim at in our research, the more scientific is the investigation and the more useful are the results. Both precision and confidence are discussed in detail in Chapter 13 on Sampling.

Objectivity

The conclusions drawn through the interpretation of the results of data analysis should be objective; that is, they should be based on the facts of the findings derived from actual data, and not on our own subjective or emotional values. For instance, if we had a hypothesis that stated that greater participation in decision making would increase organizational commitment, and this was not supported by the results, it would make no sense if the researcher continued to argue that increased opportunities for employee participation would still help! Such an argument would be based not on the factual, data-based research findings, but on the subjective opinion of the researcher. If this was the researcher's conviction all along, then there was no need to do the research in the first place!

Much damage can be sustained by organizations that implement non-data-based or misleading conclusions drawn from research. For example, if the hypothesis relating to organizational commitment in our previous example was not supported, considerable time and effort would be wasted in finding ways to create opportunities for employee participation in decision making. We would only find out later that employees still kept quitting, remained absent, and did not develop any sense of commitment to the organization. Likewise, if research shows that increased pay is not going to increase the job satisfaction of employees, then implementing a revised, increased pay system will only drag down the company financially without attaining the desired objective. Such a futile exercise, then, is based on nonscientific interpretation and implementation of the research results.

The more objective the interpretation of the data, the more scientific the research investigation becomes. Though managers or researchers might start with some initial subjective values and beliefs, their interpretation of the data should be stripped of personal values and bias. If managers attempt to do their own research, they should be particularly sensitive to this aspect. **Objectivity** is thus another hallmark of scientific investigation.

Generalizability

Generalizability refers to the scope of applicability of the research findings in one organizational setting to other settings. Obviously, the wider the range of applicability of the solutions generated by research, the more useful the research is to the users. For instance, if a researcher's findings that participation in decision making enhances organizational commitment are found to be true in a variety of manufacturing, industrial, and service organizations, and not merely in the particular organization studied by the researcher, then the generalizability of the findings to other organizational settings is enhanced. The more generalizable the research, the greater its usefulness and value. However, not many research findings can be generalized to all other settings, situations, or organizations.

For wider generalizability, the research sampling design has to be logically developed and a number of other details in the data-collection methods need to be meticulously followed. However, a more elaborate sampling design, which would doubtless increase the generalizability of the results, would also increase the costs of research. Most applied research is generally confined to research within the particular organization where the problem arises, and the results, at best, are generalizable only to other identical situations and settings. Though such limited applicability does not necessarily decrease its scientific value (subject to proper research), its generalizability is restricted.

Parsimony

Simplicity in explaining the phenomena or problems that occur, and in generating solutions for the problems, is always preferred to complex research frameworks that consider an unmanageable number of factors. For instance, if two or three specific variables in the work situation are identified, which when changed would raise the organizational commitment of the employees by 45%, that would be more useful and valuable to the manager than if it were recommended that he should change ten different variables to increase organizational commitment by 48%. Such an unmanageable number of variables might well be totally beyond the manager's control to change. Therefore, the achievement of a meaningful and parsimonious, rather than an elaborate and cumbersome, model for problem solution becomes a critical issue in research.

Economy in research models is achieved when we can build into our research framework a lesser number of variables that explain the variance far more efficiently than a complex set of variables that only marginally add to the variance explained. **Parsimony** can be introduced with a good understanding of the problem and the important factors that influence it. Such a good conceptual theoretical model can be realized through unstructured and structured interviews with the concerned people, and a thorough literature review of the previous research work in the particular problem area.

In sum, scientific research encompasses the eight criteria just discussed. These are discussed in more detail later in this book.

THE HYPOTHETICO-DEDUCTIVE METHOD

Scientific research pursues a step-by-step, logical, organized, and rigorous method (a scientific method) to find a solution to a problem. The *scientific method* was developed in the context of the natural sciences, where it has been the foundation of many important discoveries. Although there have been numerous objections to this method and to using it in social and business research (we will discuss some of these later in this chapter), it is still the predominant approach for generating knowledge in natural, social, and business sciences. The hypothetico-deductive method, popularized by the Austrian philosopher Karl Popper, is a typical version of the scientific method. The hypothetico-deductive method provides a useful, systematic approach for generating knowledge to solve basic and managerial problems. This systematic approach is discussed next.

The seven-step process in the hypothetico-deductive method

The **hypothetico-deductive method** involves the seven steps listed and discussed next.

1. Identify a broad problem area.
2. Define the problem statement.
3. Develop hypotheses.
4. Determine measures.
5. Data collection.
6. Data analysis.
7. Interpretation of data.

Identify a broad problem area

A drop in sales, frequent production interruptions, incorrect accounting results, low-yielding investments, disinterestedness of employees in their work, customer switching, and the like, could attract the attention of the manager and catalyze the research project.

Define the problem statement

Scientific research starts with a definite aim or purpose. To find solutions for identified problems, a problem statement that includes the general objective and research questions of the research should be developed. Gathering initial information about the factors that are possibly related to the problem will help us to narrow the broad problem area and to define the problem statement. Preliminary information gathering, discussed in greater detail in Chapter 3, involves the seeking of information in depth, of what is observed (for instance, the observation that our company is losing customers). This could be done by a literature review (literature on customer switching) or by talking to several people in the work setting, to clients (why do they switch?), or to other relevant sources, thereby gathering information on what is happening and why. Through any of these methods, we get an idea or a “feel” for what is transpiring in the situation. This allows us to develop a specific problem statement.

Develop hypotheses

In this step, variables are examined to ascertain their contribution or influence in explaining why the problem occurs and how it can be solved. The network of associations identified among the variables is then theoretically woven, together with justification as to why they might influence the problem. From a theorized network of associations among the variables, certain hypotheses or educated conjectures can be generated. For instance, at this point, we might hypothesize that specific factors such as overpricing, competition, inconvenience, and unresponsive employees affect customer switching.

A scientific hypothesis must meet two requirements. The first criterion is that the hypothesis must be *testable*. We have discussed the testability of hypotheses earlier in this chapter. The second criterion, and one of the central tenets of the hypothetico-deductive method, is that a hypothesis must also be *falsifiable*. That is, it must be possible to disprove the hypothesis. According to Karl Popper, this is important because a hypothesis cannot be confirmed; there is always a possibility that future research will show that it is false. Hence, failing to falsify (!) a hypothesis does not prove that hypothesis: it remains provisional until it is disproved. Hence, the requirement of falsifiability emphasizes the tentative nature of research findings: we can only "prove" our hypotheses until they are disproved.

The development of hypotheses and the process of theory formulation are discussed in greater detail in Chapter 5.

Determine measures

Unless the variables in the theoretical framework are measured in some way, we will not be able to test our hypotheses. To test the hypothesis that unresponsive employees affect customer switching, we need to *operationalize* unresponsiveness and customer switching. Measurement of variables is discussed in Chapters 11 and 12.

Data collection

After we have determined how to measure our variables, data with respect to each variable in the hypothesis need to be obtained. These data then form the basis for data analysis. Data collection is extensively discussed in Chapters 7 to 12.

Data analysis

In the data analysis step, the data gathered are statistically analyzed to see if the hypotheses that were generated have been supported. For instance, to see if unresponsiveness of employees affects customer switching, we might want to do a correlational analysis to determine the relationship between these variables.

Hypotheses are tested through appropriate statistical analysis, as discussed in Chapter 15.

Interpretation of data

Now we must decide whether our hypotheses are supported or not by interpreting the meaning of the results of the data analysis. For instance, if it was found from the data analysis that increased responsiveness of employees was negatively related to customer switching (say, 0.3), then we can deduce that if customer retention is to be increased, our employees have to be trained to be more responsive. Another inference from this data analysis is that responsiveness of our employees accounts for (or explains) 9% of the variance in customer switching (0.3^2). Based on these deductions, we are able to make recommendations on how the "customer switching" problem may be solved (at least to some extent); we have to train our employees to be more flexible and communicative.

Note that even if the hypothesis on the effect of unresponsiveness on customer switching is not supported, our research effort has still been worthwhile. Hypotheses that are not supported allow us to refine our theory by thinking about why it is that they were not supported. We can then test our refined theory in future research.

In summary, there are seven steps involved in identifying and resolving a problematic issue. To make sure that the seven steps of the hypothetico-deductive method are properly understood, let us briefly review an example in an organizational setting and the course of action taken in the seven steps.

EXAMPLE

Application of the hypothetico-deductive method in organizations

The CIO Dilemma

Identifying the broad problem area

Sara Foster is the Information Technology Director of a medium-sized firm. She observes that the newly installed Management Information System (MIS) is not being used by middle managers as much as was originally expected. Some middle managers have occasionally approached the ICT helpdesk or some other expert for help, whereas others make decisions without facts. Recognizing there is surely a problem, Sara develops the following broad problem statement: "What should be done to increase the use of the newly installed MIS by our middle managers?"

Defining the problem statement

Talking to some of the middle-level managers, Sara finds that many of them have very little idea as to what the MIS is all about, what kinds of information it can provide, and how to access it and utilize the information. Sara uses Google Scholar to explore further information on the lack of use of management information systems in organizations. The search indicates that many middle-level managers – especially the old-timers – are not open to new ideas or ways of solving problems. Lack of knowledge about what the MIS offers is also found to be another main reason why some managers do not use it. This information helps Sara to narrow the broad problem area and to refine the problem statement: "To what extent do knowledge-related factors and openness to change affect the use of the MIS by middle managers?"

Hypothesizing

Sara develops a theory incorporating all the relevant factors contributing to the use of the MIS by managers in the organization. From such a theory, she generates various hypotheses for testing, one among them being: *Knowledge of the usefulness of the MIS would help managers to put it to greater use.*

Development of measures and data collection

Sara then develops a short questionnaire measuring the various factors theorized to influence the use of the MIS by managers, such as the extent of knowledge of what the MIS is, what kinds of information the MIS provides, how to gain access to the information, and the level of openness to change of managers, and, finally, how often managers have used the MIS in the preceding three months.

Data analysis

Sara then analyzes the data obtained through the questionnaire to see what factors prevent the managers from using the system.

Interpretation

Based on the results, Sara deduces – or concludes – that a lot of managers do not use the MIS because they do not believe that using the system would enhance their job performance. Other managers do not use the system because they do not know how to use it effectively. These deductions help Sara to take necessary action to rectify the situation, which includes, among other things, organizing seminars for training managers on the use of the MIS and illustrating the advantages of using the MIS to the managers.

Review of the hypothetico-deductive method

The hypothetico-deductive method involves the seven steps of identifying a broad problem area, defining the problem statement, hypothesizing, determining measures, data collection, data analysis, and the interpretation of the results. The scientific method uses **deductive reasoning** to *test a theory* (recall that, to a scientist, a theory is an organized set of assumptions that generates testable predictions) about a topic of interest. In deductive reasoning, we work from the more general to the more specific. We start out with a general *theory* and then narrow down that theory into specific hypotheses we can test. We narrow down even further when we collect specific *observations* to test our hypotheses. Analysis of these specific observations ultimately allows us to confirm (or refute) our original theory.

Inductive reasoning works in the opposite direction: it is a process where we observe specific phenomena and on this basis arrive at general conclusions. Hence, in inductive reasoning, we work from the more specific to the more general. The observation of a first, second, and third white swan (this is a very famous example) may lead to the proposition that "all swans are white." In this example, the repeated observation of a white swan has led to the general conclusion that all swans are white. According to Karl Popper it is not possible to "prove" a hypothesis by means of *induction*, because no amount of evidence assures us that contrary evidence will not be found. Observing 3, 10, 100, or even 10 000 white swans does not justify the conclusion that "all swans are white" because there is always a possibility that the next swan we observe will be black. Instead, Popper proposed that (proper) science is accomplished by *deduction*.

However, despite Popper's criticism on induction, both inductive and deductive processes are often used in both fundamental and applied research. Indeed, many researchers have argued that theory generation (induction) *and* theory testing (deduction) are essential parts of the research process.

Induction and deduction are often used in a sequential manner. John Dewey describes this process as "the double movement of reflective thought." Induction takes place when a researcher observes something and asks, "Why does this happen?" In answer to this question, the researcher may develop a provisional explanation – a hypothesis. Deduction is subsequently used to test this hypothesis. The following example illustrates this process.

EXAMPLE

A manager may notice that frequent price promotions of a product have a negative effect on product sales. Based on this observation, the manager may wonder why price promotions have a negative – instead of a positive – effect on sales. Interviews with customers indicate that frequent price promotions have a negative effect on sales because frequent price promotions negatively affect the reputation or image of the product. Based on these interviews, the manager develops a new theory about why price promotions have a negative effect on sales – because frequent price promotions have a negative effect on the reputation of the product! Accordingly, the manager hypothesizes that frequent price promotions negatively affect the reputation of the product and hence product sales. The manager may verify this hypothesis by means of deduction.

This example shows that both inductive and deductive processes are applied in scientific investigations. Although both deductive and inductive processes can be used in quantitative and qualitative research, deductive processes are more often used in causal and quantitative studies, whereas inductive research processes are regularly used in exploratory and qualitative studies.

In sum, theories based on deduction and induction help us to understand, explain, and/or predict business phenomena. When research is designed to test some specific hypothesized outcomes (for instance, to see if controlling aversive noise in the environment increases the performance of individuals in solving mental puzzles), the following steps ensue. The investigator begins with the theory that noise adversely affects mental problem solving. The hypothesis is then generated that if the noise is controlled, mental puzzles can be solved more quickly and correctly. Based on this, a research project is designed to test the hypothesis. The results of the study help the researcher to deduce or conclude that controlling the aversive noise does indeed help the participants to improve their performance on mental puzzles. This method of starting with a theoretical framework, formulating hypotheses, and logically deducing from the results of the study is known as (you probably recognized it already) the hypothetico-deductive method. Here is another example of the hypothetico-deductive research process.

EXAMPLE

A sales manager might observe that customers are perhaps not as pleased as they used to be. The manager may not be certain that this is really the case but may experience uneasiness among consumers and observe that the number of customer complaints has increased recently. This process of observation or sensing of the phenomena around us is what gets most research – whether applied or basic – started. The next step for the manager is to determine whether there is a real problem and, if so, how serious it is. This problem identification calls for some preliminary data gathering. The manager might talk casually to a few customers to find out how they feel about the products and customer service. During the course of these conversations the manager might find that the customers like the products but are upset because many of the items they need are frequently out of stock, and they perceive the salespersons as not being helpful. From discussions with some of the salespersons, the manager might discover that the factory does not supply the goods on time and promises new delivery dates that it fails, on occasion, to keep. Salespersons might also indicate that they try to please and retain the customers by communicating the delivery dates given to them by the factory.

Integration of the information obtained through the informal and formal interviewing process helps the manager to determine that a problem does exist and to define the *central question of the study* as follows: "How do delays affect customer satisfaction?" It also helps the manager to formulate a theoretical framework of all the factors contributing to the problem. In this case, there is a network of connections among the following factors: delays by the factory in delivering goods, the notification of later delivery dates that are not kept, the promises of the salespersons to the customers (in hopes of retaining them) that cannot be fulfilled, all of which contribute to customer dissatisfaction. From the theoretical framework, which is a meaningful integration of all the information gathered, several *hypotheses* can be generated and tested to determine if the data support them. Concepts are then *operationally defined* so that they can be measured. A research design is set up to decide on, among other issues, how to *collect* further data, *analyze* and *interpret* them, and finally, to provide an answer to the problem. The process of drawing from logical analysis an inference that purports to be conclusive is called deduction. Thus, the building blocks of science provide the genesis for the hypothetico-deductive method of scientific research.

Some obstacles to conducting scientific research in the management area

In the management and behavioral areas, it is not always possible to conduct investigations that are 100% scientific, in the sense that, unlike in the physical sciences, the results obtained will not be exact and error-free. This is primarily because of difficulties likely to be encountered in the measurement and collection of data in the subjective areas of feelings, emotions, attitudes, and perceptions. These problems occur whenever we attempt to measure abstract and subjective constructs. Difficulties might also be encountered in obtaining a representative sample, restricting the generalizability of the findings. Thus, it is not always possible to meet all the hallmarks of science in full. Comparability, consistency, and wide generalizability are often difficult to obtain in research. Still, to the extent that the research is designed to ensure purposiveness, rigor, and the maximum possible testability, replicability, generalizability, objectivity, parsimony, and precision and confidence, we would have endeavored to engage in scientific investigation. Several other possible limitations in research studies are discussed in subsequent chapters.

ALTERNATIVE APPROACHES TO RESEARCH

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Following a scientific approach to research should help the researcher to get to the truth about the subject of the research. But is there such a thing as *the* truth? Or is the truth subjective; something that we have only constructed in our minds? All research is based on beliefs about the world around us (the philosophical study of what can be said to exist is called **ontology**) and what we can possibly discover by research. Different researchers have different ideas about these issues.

The disagreement about the nature of knowledge or how we come to know (the appropriate name for these matters is **epistemology**) has a long history and it is not restricted to research in business. Questions such as "What exists?", "What is knowledge?", and "How do we acquire knowledge?" have fascinated philosophers and researchers in many fields for over 2000 years. At this point, we will briefly discuss the most important perspectives for contemporary research in business. We will successively deal with **positivism**, **constructionism**, **critical realism**, and **pragmatism**. Note that in order to make our point we will sometimes exaggerate the descriptions of these research perspectives. For this reason, experts on these matters may sometimes disapprove on what we have to say.

Positivism

In a *positivist* view of the world, science and scientific research is seen as the way to get at *the* truth – indeed, positivists believe that there is an objective truth out there – to understand the world well enough so that we are able to predict and control it. For a positivist, the world operates by laws of cause and effect that we can discern if we use a *scientific approach* to research. Positivists are concerned with the rigor and replicability of their research, the reliability of observations, and the generalizability of findings. They use *deductive reasoning* to put forward theories that they can test by means of a fixed, predetermined research design and objective measures. The key approach of positivist researchers is the experiment, which allows them to test cause-and-effect relationships through manipulation and observation. Some positivists believe that the goal of research is to only describe phenomena that one can directly observe and objectively measure. For them, knowledge of anything beyond that – such as emotions, feelings, and thoughts – is impossible.

Constructionism

A completely different approach to research and how research should be done is constructionism. Constructionism criticizes the positivist belief that there is an objective truth. Constructionists hold the opposite view, namely that the world (as we know it!) is fundamentally mental or mentally constructed. For this reason, constructionists do not search for the objective truth. Instead, they aim to understand the rules people use to make sense of the world by investigating what happens in people's minds. Constructionism thus emphasizes how people construct knowledge; it studies the accounts people give of issues and topics and how people get to these accounts. Constructionists are particularly interested in how people's views of the world result from interactions with others and the context in which they take place. The research methods of constructionist researchers are often qualitative in nature. Focus groups and unstructured interviews allow them to collect rich data, oriented to the contextual uniqueness of the world that is being studied. Indeed, constructionists are often more concerned with understanding a specific case than with the generalization of their findings. This makes sense from the viewpoint of the constructionist; there is no objective reality to generalize about.

Critical realism

Between these two opposed views on research and on how research should be done, there are many intermediary viewpoints. One of these viewpoints is critical realism. Critical realism is a combination of the belief in an external reality (an objective truth) with the rejection of the claim that this external reality can be objectively measured; observations (especially observations on phenomena that we cannot observe and measure directly, such as satisfaction, motivation, culture) will always be subject to interpretation. The critical realist is thus *critical* of our ability to understand the world with certainty. Where a positivist believes that the goal of research is to uncover the truth, the critical realist believes that the goal of research is to progress toward this goal, even though it is impossible to reach it. According to the critical realist viewpoint, measures of phenomena such as emotions, feelings, and attitudes are often subjective in nature and the collection of data is, generally speaking, imperfect and flawed. The critical realist also believes that researchers are inherently biased. They argue that we therefore need to use *triangulation* across multiple flawed and erroneous methods, observations, and researchers to get a better idea of what is happening around us.

Pragmatism

A final viewpoint on research that we will discuss here is pragmatism. Pragmatists do not take on a particular position on what makes good research. They feel that research on both objective, observable phenomena and subjective meanings can produce useful knowledge, depending on the research questions of the study. The focus of pragmatism is on practical, applied research where different viewpoints on research and the subject under study are helpful in solving a (business) problem. Pragmatism describes research as a process where concepts and meanings (theory) are generalizations of our past actions and experiences, and of interactions we have had with our environment. Pragmatists thus emphasize the socially constructed nature of research; different researchers may have different ideas about, and explanations for, what is happening around us. For the pragmatist, these different perspectives, ideas, and theories help us to gain an understanding of the world; pragmatism thus endorses *eclecticism* and *pluralism*. Another important feature of pragmatism is that it views the current truth as *tentative* and changing over time. In other words, research results should always be viewed as provisional truths. Pragmatists stress the relationship between theory and practice. For a pragmatist, theory is derived from practice (as we have just explained) and then applied back to practice to achieve *intelligent* practice. Along these lines, pragmatists see theories and concepts as important tools for finding our way in the world that surrounds us. For a pragmatist, the value of research lies in its practical relevance; the purpose of theory is to inform practice.

Conclusion

You may have asked yourself repeatedly, "Why do I need to know this?" One answer is that we believe that it is important for you to know that there is more than one viewpoint on what makes good research. Knowledge of epistemology may help you to relate to and understand the research of others and the choices that were made in this research. Different researchers have different ideas about the nature of knowledge or on how we come to know (indeed, *the scientific approach* to research is only one – albeit important – view on what "good" research is). These different ideas translate into different approaches that are taken to research, into different research designs, and into different choices regarding the research methods used.

Another answer to the question "Why do I need to know this?" is that you will probably have noticed that *you* prefer one research perspective over the other perspectives. Understanding your personal ideas on research and how it should be done allows you to determine which kinds of research questions are important to you and what methods for collecting and analyzing data will give you the best answer to these questions. It will also help you to make informed decisions during the research process, to have a clear understanding about what the findings of your study (do and do not) mean, and to understand the type of conclusions that your research approach allows you to draw. Like this, it helps you to put your research and research findings in perspective.

In sum, your viewpoint on the nature of knowledge and on how we come to know will have a strong influence on the research questions you ask, your research design, and the research methods you will use. The rest of this book is primarily concerned with the development of research questions, research design, and research methods, and much less with the foregoing philosophical issues. However, it is important that every so often you consider the philosophical underpinnings of your research questions, your research design, and your research methods. This is important since the value of your research findings depends on how well they relate to the methods you have used, the design you have chosen, the questions you have asked, and the research perspective you have taken.

SUMMARY

- **Learning objective 1: Explain what is meant by scientific investigation, giving examples of both scientific and non-scientific investigations.**
  Scientific research focuses on solving problems and pursues a step-by-step, logical, organized and rigorous method to identify the problems, gather data, analyze them, and draw valid conclusions from them. The hallmarks or main distinguishing characteristics of scientific research are purposiveness, rigor, testability, replicability, precision and confidence, objectivity, generalizability, and parsimony.

- **Learning objective 2: Discuss the seven steps of the hypothetico-deductive method, using an example of your own.**
  The hypothetico-deductive method is a typical version of the scientific method. This method provides a useful, systematic approach for generating knowledge to solve basic and managerial problems. The hypothetico-deductive method involves seven steps: (1) identify a broad problem area; (2) define the problem statement; (3) develop hypotheses; (4) determine measures; (5) collect data; (6) analyze data; and (7) interpret data. The scientific method uses deductive reasoning to test a theory about a topic of interest.

- **Learning objective 3: Discuss alternative perspectives on what makes good research.**
  All research is based on beliefs about the world around us and what we can possibly discover by research. Different researchers have different ideas about these issues. *Your* viewpoint on the nature of knowledge and on how we come to know things will have a strong influence on the research questions you ask, your research design, and the research methods you will use.
  In the rest of this book these matters are discussed in more detail.

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DISCUSSION QUESTIONS

1. Describe the hallmarks of scientific research.
2. What are the steps in hypothetico-deductive research? Explain them, using your own example.
3. One hears the word *research* being mentioned by several groups such as research organizations, college and university professors, doctoral students, graduate assistants working for faculty, graduate and undergraduate students doing their term papers, research departments in industries, newspaper reporters, journalists, lawyers, doctors, and many other professionals and nonprofessionals. In the light of what you have learned in this chapter, which among the aforementioned groups of people do you think may be doing "scientific" investigations in the areas of basic or applied research? Why?
4. Explain the processes of deduction and induction, giving an example of each.
5. Discuss the following statement: "Good research is deductive in nature."
6. Discuss the following statement: "The hallmarks of scientific research do not/cannot apply to inductive research."
7. If research in the management area cannot be 100% scientific, why bother to do it at all? Comment on this question.
8. What is epistemology and why is it important to know about different perspectives on research and how it should be done?
9. Discuss the most important differences between positivism and constructionism.
10. Is there a specific perspective on research that appeals to you? Why?
11. Some people think that you should choose a particular research perspective based on the research questions of your study. Others feel that a particular research perspective "chooses" you. That is, they believe that you will have a rather strong preference for one particular research perspective; in turn, this will have an influence on the type of questions you ask. How do you feel about this matter?
12. Critique the following research done in a service industry as to the extent to which it meets the hallmarks of scientific investigation discussed in this chapter.

The Mobile Phone Company

The Mobile Phone Company has been named as the most complained-about mobile phone company, narrowly beating 3G, which has shot to the top of the table as the worst landline provider.

According to the latest figures from the regulator, Ofcom, the Mobile Phone Company was the most complained-about mobile provider – with 0.15 complaints per 1,000 – in the last three months of 2014. It saw its complaint figures rise substantially in the last quarter of 2014. The company wanted to pinpoint the specific problems and take corrective action.

Researchers were called in, and they spoke to a number of customers, noting the nature of the specific problems they faced. Because the problem had to be attended to very quickly, they developed a theoretical base, collected relevant detailed information from a sample of 100 customers, and analyzed the data. The results promise to be fairly accurate with at least an 85% chance of success in problem solving. The researchers will make recommendations to the company based on the results of data analysis.

CHAPTER 3

Defining and refining the problem

LEARNING OBJECTIVES

After completing Chapter 3 you should be able to:

1. Identify problem areas that are likely to be studied in organizations.
2. Narrow down a broad problem into a feasible topic for research using preliminary research.
3. Develop a good problem statement.
4. Develop a research proposal.
5. Be aware of the role of the manager in the early stages of the research process.
6. Be aware of the role of ethics in the early stages of the research process.

INTRODUCTION

Earlier in this book we have described business research as a systematic and organized effort to investigate a specific problem encountered in the work setting. Indeed, managers have to be alert and responsive to what is going on, both within their organization and in its environment in order to take effective decisions and develop effective courses of action. The origin of most research stems from the desire to get a grip on issues, concerns, and conflicts within the company or in its environment. In other words, research typically begins with a problem.

THE BROAD PROBLEM AREA

A "problem" does not necessarily mean that something is seriously wrong with a current situation that needs to be rectified immediately. A problem could also indicate an interest in an issue where finding the right answers might help to improve an existing situation. Thus, it is fruitful to define a problem as *any situation where a gap exists between an actual and a desired ideal state*. Box 3.1 provides examples of problems that the manager may encounter in the work setting.

BOX 3.1

EXAMPLES OF PROBLEMS

1. Long and frequent delays lead to much frustration among airline passengers. These feelings may eventually lead to switching behavior, negative word-of-mouth communication, and customer complaints.
2. Staff turnover is higher than anticipated.
3. The current instrument for the assessment of potential employees for management positions is imperfect.
4. Minority group members in organizations are not advancing in their careers.
5. The newly installed information system is not being used by the managers for whom it was primarily designed.
6. The introduction of flexible work hours has created more problems than it has solved.
7. Young workers in the organization show low levels of commitment to the organization.

The foregoing problems provide us with enough information to embark on our research journey. However, what these problems also have in common is that they still have to be transformed into a *researchable topic* for investigation. Indeed, once we have identified the management problem, it needs to be narrowed down to a researchable topic for study. Very often much work is needed to translate the broad problem into a feasible research topic.

EXAMPLE

Problems versus symptoms of problems

It is very important that symptoms of problems are not defined as the real problem. For instance, a manager might have tried to decrease employee turnover (the best people are leaving the organization) by increasing wages, but with little success. Here the real problem may be something else such as the low motivation of employees who feel they do not have enough control over their work. The high turnover rate may merely be a symptom of the deep-rooted motivational problem. Under these conditions, in the long run, a higher salary will not affect employees' intentions to leave. Thus, finding the "right" answer to the "wrong" problem definition will not help. Hence, it should be recognized that correct problem identification is extremely critical for finding solutions to vexing issues.

Frequently, managers tend to describe the problem in terms of symptoms. Rather than accepting it as such, the researcher needs to identify the problem more accurately. One way of determining that the problem, rather than the symptom, is being addressed is a technique called "5 Whys" or "5 Times Why". 5 Whys is a fairly straightforward approach that will help you to get to the root cause (the most basic cause) of a problem (via preliminary research). Developed by the Japanese industrialist Sakichi Toyada, the idea is to keep asking "Why?" until the most basic cause is arrived at.

Let's go back to our example to illustrate this approach.

My best employees are leaving the organization.

Why?	Because they are not satisfied with their jobs.
Why?	Because they do not find a challenge in their jobs.
Why?	Because they do not have control over their work.
Why?	Because they do not have a lot of influence over planning, executing, and evaluating the work they do.
Why?	Because we have been reluctant to delegate.

Note that the number five is a general guideline for the number of whys needed to get to the root cause level, but asking "Why?" five times versus three, four, or six times is not a strict requirement. What matters is that we investigate recurring problems by addressing true causes and not symptoms of these causes.

"*The introduction of flexible work hours has created more problems than it has solved*" provides a nice starting point for a research project, but it lacks the specificity and focus needed to investigate it. We need to transform the broad problem into a feasible topic for research by a) making it more specific and precise and by b) setting clear boundaries. Finally, we need to select a c) perspective from which we investigate the subject (Machi and McEvoy, 2012).

EXAMPLE

Bringing clarity and focus to the problem

The "secret" to bringing *clarity* and *focus* to your problem is to isolate the key ideas in the first version of the problem statement. A broad, first statement of the problem often includes several words and/or phrases that need definition. Check out the following problem statement:

> ***"Minority group members in organizations are not advancing in their careers."***

To identify the key terms in your problem statement, look for the subjects (careers), verbs (advancing), and objects (minority group members) in your statement. Definitions of key terms must be precise in order to identify the subject of the research and to gain access to relevant academic literature. Precise definitions will allow you to explore the literature. The literature review will help you to refine your research objective(s) and research questions and thus to develop a feasible topic for research.

The selection of a particular (academic) perspective on the problem will allow us to draw upon a rich body of literature to help us to formulate a feasible problem statement, as exemplified by the following example.

EXAMPLE

How the selection of an academic perspective will help us to narrow down our research

Consider the following problem: "*Long and frequent delays lead to much frustration among airline passengers. These feelings may eventually lead to switching behavior, negative word-of-mouth communication, and customer complaints.*" Preliminary research on this issue suggests that service waiting times are typically controlled by two techniques: operations management, to decrease actual, objective waiting times (perspective 1) and management of perceptions, that will help service providers to manage the customers' subjective waiting experience (perspective 2). The selection of a particular academic perspective on the problem (for instance, *management of perceptions* in the foregoing example of long and frequent delays) provides us with a vast body of knowledge that will help us to shape our own thinking and spark valuable insights on the problem under study.

We have just explained that we need to transform (read: narrow down) a broad management problem into a feasible topic for research. *Preliminary information gathering* (or preliminary research) will help us to make the necessary transformations. Figure 3.1 shows the three initial stages of the research process and illustrates how we get from a broad management problem to a feasible topic for research. Note that this process is not linear; in the beginning of our project we will have to move back and forth between preliminary research and (re)defining the problem (see Box 3.2).

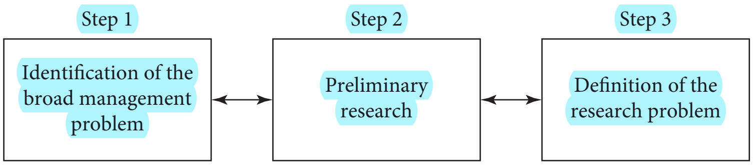
Step 1
Identification of the broad management problem
Step 2
Preliminary research
Step 3
Definition of the research problem

FIGURE 3.1

Three important first steps in the research process

BOX 3.2

DEFINING THE PROBLEM

In the early stages of the research process you will have to spend time *alternating* between preliminary research (e.g., a first review of the literature) and (re)defining the problem statement. Until you have developed a first tentative problem statement you cannot decide what information is useful. However, the awareness and understanding of current work and viewpoints in the subject area may change your perspective on what the problem is and encourage you to refine the problem statement; a more refined problem statement may trigger the need to collect further information which may inspire you to reframe the problem statement . . . and so on.

PRELIMINARY RESEARCH

Once we have identified the broad problem area preliminary research should help the researcher to gain a better understanding of the problem and to narrow the problem down to a researchable topic for study. Preliminary research should help the researcher to find answers to questions such as: "What is the problem?"; "Why does the problem exist?"; "Is the problem important?"; and "What are the benefits of solving the problem?" Although the exact nature of the information needed for this purpose depends on the type of problem one is addressing, it may be broadly classified under two headings:

1. Information on the organization and its environment – that is, the **contextual factors**.
2. Information on the topic of interest.

Nature of information to be gathered

Background information on the organization

Information gathered on relevant contextual factors will be useful in talking knowledgeably with managers and other employees in the company and raising the appropriate issues related to the problem. Along these lines, an understanding of these factors might be helpful in arriving at a precise problem formulation. Background information might include, among other things, the contextual factors listed below, which may be obtained from various sources.

1. The origin and history of the company – when it came into being, business it is in, rate of growth, ownership and control, and so on.
2. Size in terms of employees, assets, or both.
3. Charter – purpose and ideology.
4. Location – regional, national, or other.
5. Resources – human and others.
6. Interdependent relationships with other institutions and the external environment.
7. Financial position during the previous five to ten years, and relevant financial data.
8. Information on structural factors (for instance, roles and positions in the organization and number of employees at each job level, communication channels, control systems, workflow systems).
9. Information on the management philosophy.

Depending on the situation, the type of problem investigated, and the nature of some initial responses received, certain aspects may have to be explored in greater depth than others.

The contextual information mentioned may be obtained through various primary and/or secondary data collection methods, such as interviews and a review of company records and archives. Data gathered through existing sources are called secondary data. **Secondary data** are data that have been collected by others for another purpose than the purpose of the current study. Some secondary sources of data are statistical bulletins, government publications, published or unpublished information available from either within or outside the organization, company websites, and the Internet. The nature and the value of secondary data should be carefully evaluated before it is used. Box 3.3 provides an overview of the key criteria for evaluating secondary data.

BOX 3.3

CRITERIA FOR EVALUATING SECONDARY DATA

Timeliness of the data. *When were the data collected?* It is important that the data are up-to-date. Check the dates on all of your secondary data to make sure that you have the newest information available.

Accuracy of the data. *What was the purpose of (presenting) the data?* Web pages are created with a specific purpose in mind. Commercial organizations often post information online that might favor them in some way or represent their own interests. *Who collected the data? How were the data collected? What are the author's credentials on this subject?* The accuracy of data can be impacted by who collected it and how the data were collected. *Are the data consistent with data from other sources?* If specific information varies from source to source, you need to find out which information is more accurate.

Relevance of the data. Not all of the secondary data you find will be relevant to your particular needs. Data may be accurate and up-to-date but not applicable to your research objective(s) and research questions.

Costs of the data. How much do the data cost? Do the benefits outweigh the costs? Are you better off collecting other data? Are you better off using other (primary?) methods of data collection?

The collection of secondary data is very often quite helpful in the early stages of the research process, but in some cases information is best obtained by other methods such as interviewing people, observation, or by administering questionnaires to individuals. Such data that the researcher gathers first hand for the specific purpose of the study are called **primary data**. Four principal methods of primary data collection (interviews, observation, administering questionnaires, and experiments) are discussed in Chapters 7 to 10.

Note that it is often beneficial to simultaneously gather primary and secondary data in the early stages of the research process. On the one hand, secondary data can help you to focus (further) interviews more meaningfully on relevant aspects pertaining to the problem; on the other hand, interviews may help you to search for relevant information in secondary sources.

Information on the topic or subject area

The literature – the body of knowledge available to you as a researcher – may also help you to think about and/or better understand the problem. A careful review of textbooks, journal articles, conference proceedings, and other published and unpublished materials (see Chapter 4 for a detailed discussion on how to review the literature) ensures that you have a thorough awareness and understanding of current work and viewpoints on the subject area. This helps you to structure your research on work already done and to develop the problem statement with precision and clarity.

A first review of the literature also helps you to make an informed decision about your research approach, as exemplified in Box 3.4. In this example (of *fundamental* research) an *exploratory research* approach is used in order to provide insight into events that typically instigate customer anger in service settings.

BOX 3.4

INSPECTION OF THE LITERATURE ON THE ANTECEDENTS OF CUSTOMER ANGER

Customer anger has been found to lead to negative word-of-mouth communication and switching, above and beyond customer dissatisfaction (Bougie, Pieters & Zeelenberg, 2003; Dubé & Maute, 1996; Nyer, 1997; Taylor, 1994). Since it is also a common emotional response to failed services, it may have strong implications for the performance and profitability of service firms. For these reasons it is critical that service firms try to avoid customer anger.

To be able to avoid customer anger, service providers need to understand what events typically instigate this emotion in customers. Surprisingly, to date, we do not know much about instigations of customer anger. Although we know that core service failures (Dubé and Maute, 1996) and waiting for service (Folkes, Koletsky & Graham, 1987; Taylor, 1994) give rise to anger, systematic research on the precipitating events of this emotion in service settings is absent. Therefore, this exploratory study investigates and categorizes events that typically instigate customer anger to fill this void. Thus it provides a conceptual model of anger instigation in services and guidelines for service firms on how to avoid customer anger.

DEFINING THE PROBLEM STATEMENT

After gathering preliminary information, the researcher is in a position to narrow down the problem from its original broad base and define the issues of concern more clearly. As we have explained earlier, it is critical that the **problem statement** is unambiguous, specific, and focused, and that the problem is addressed from a specific academic perspective. No amount of good research can find solutions to the situation if the critical issue or the problem to be studied is not clearly pinpointed.

What makes a good problem statement?

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A good problem statement includes both a statement of the **research objective(s)** and the **research question(s)**. In chapter 2 we have explained that good research has a purposive focus. Whereas the purpose of fundamental (or basic) research in business is related to expanding knowledge (of processes) of business and management in general, the ultimate aim of applied research is often to *change* something in order to solve a specific problem encountered in the work setting. For instance, a manager might be interested in *determining the factors that increase employee commitment to the organization*, since an increase in employee commitment may translate into lower staff turnover, less absenteeism, and increased performance levels, all of which will benefit the organization. The purpose or objective of the study thus explains *why* the study is being done. The statement of the research objective(s) should be brief, but nonetheless communicate clearly the focus of the project.

EXAMPLE

Examples of research objectives

- To find out what motivates consumers to buy a product online.
- To study the effect of leadership style on employees' job satisfaction.
- To investigate the relationship between capital structure and profitability of the firm.
- To establish success factors regarding the adoption and use of information systems.
- To determine the optimal price for a product.
- To investigate the influence of the in-store shopping environment on impulse buying.
- To establish the determinants of employee involvement.
- To understand the causes of employee absence.

Once the purpose of the study has been identified, one is able to formulate the research question(s) of the study. The inclusion of one or more research questions in the problem statement further clarifies the issue to be resolved. The research question(s) specify *what* you want to learn about the topic. They guide and structure the process of collecting and analyzing information to help you to attain the purpose of your study. In other words, research questions are the translation of the problem of the organization into a specific need for information. Box 3.5 provides an example of a problem statement. Note that both the research objective and the research questions of the study are detailed in this example.

BOX 3.5

EXAMPLE OF A PROBLEM STATEMENT

CAA Airlines carries out charter and regular flights to medium-haul destinations – such as the Mediterranean, North Africa and the Red Sea – and to long-haul destinations such as the Caribbean. Today, CAA's fleet consists of three (new) Boeing 737-800s and four (outdated) Boeing 767-300s. Because the Boeing 767s are rather outdated they need more maintenance than the average airplane. Despite an intensive maintenance program, these planes have a lot of technical problems. Consequently, the long-haul fleet of CAA has needed to deal with a lot of delays recently. New long-haul planes have been ordered, but these planes will not be delivered before 2016. This means that more delays will inevitably occur. This may translate into much frustration among airline passengers, to switching behavior, and to negative word-of-mouth communication. These feelings and behaviors of consumers may eventually have negative effects on the performance and the profitability of the firm.

Prior research has claimed that service waits can be controlled by two techniques: operations management and management of perceptions. For CAA Airlines it is very difficult to obtain "zero defects" (no delays). Hence, this project will focus on managing the perceptions of the wait experience: because CAA Airlines cannot control the actual amount of delays and the duration, the company must focus on managing the customers' perception of the waiting experience. The purpose of this study is twofold: (1) to identify the factors that influence the passengers' waiting experience and (2) to investigate the possible impact of waiting on customer satisfaction and service evaluations.

Therefore, this project focuses on the following research questions:

1. What are the factors that affect the perceived waiting experience of airline passengers and to what extent do these factors affect the perception of waiting times?
2. What are the affective consequences of waiting and how does affect mediate the relationship between waiting and service evaluations?
3. How do situational variables (such as filled time) influence customer reactions to the waiting experience?

Drawing from prior research in the areas of waiting, service evaluations, and mood theory, hypotheses are generated regarding the relationships among a delay, the waiting experience, affect, and service evaluations. The hypothesized relationships are tested in a field setting involving delayed CAA airline passengers.

The foregoing problem statement addresses both the research objectives and the research questions of the study. The research objective and the research questions are strongly related; it would have been impossible to adequately detail the research questions if the research objective had been unclear, unspecified, or ambiguous. What's more, the research questions have been clarified to the extent that it is possible to relate them to existing literature in the areas of waiting, service evaluations, and mood theory. Hence, the broad problem area has been transformed into a researchable topic for study.

Box 3.6 summarizes the problem and the problem statement of the foregoing research project.

BOX 3.6

BUSINESS PROBLEM TRANSLATED INTO PROBLEM STATEMENT

	Problem statement	
Problem	**Research objective**	**Research questions**
Frequent and long delays may translate into much frustration among airline passengers, to switching behavior, and to negative word-of-mouth communication. These feelings and behaviors eventually have negative effects on the performance and the profitability of the firm.	The purpose of this study is twofold: (1) to identify the factors that influence the passengers' waiting experience and (2) to investigate the possible impact of waiting on customer satisfaction and service evaluations.	1. What are the factors that affect the perceived waiting experience of airline passengers and to what extent do these factors affect the perception of waiting times? 2. What are the affective consequences of waiting and how does affect mediate the relationship between waiting and service evaluations? 3. How do situational variables (such as filled time) influence customer reactions to the waiting experience?

By now, it should be clear that a problem statement addresses both the "why" (the specific aim or purpose of the study) and the "what" (the central research question or a set of research questions) of the research. There are three key criteria to assess the quality of a problem statement: it should be relevant, feasible, and interesting.

A problem statement is relevant if it is meaningful from a managerial perspective, an academic perspective, or both. From a *managerial* perspective, research is *relevant* if it relates to (1) a problem that currently exists in an organizational setting or (2) an area that a manager believes needs to be improved in the organization. From an *academic* perspective, research is *relevant* if: (1) nothing is known about a topic, (2) much is known about the topic, but the knowledge is scattered and not integrated, (3) much research on the topic is available, but the results are (partly) contradictory, or (4) established relationships do not hold in certain situations. If you base your research report on the "nothing is known" argument, you will have to prove that your claim is right. The observation that much is known about a topic, but that the knowledge is scattered and not integrated also provides a good basis for a research report. Your task is, however, a difficult one, since it is expected that you will present an integrated overview of the topic. A research project that aims to reconcile contradictory findings or to establish boundary conditions is also a real challenge.

A good problem statement is relevant but also *feasible*. A problem statement is feasible if you are able to answer the research questions within the restrictions of the research project. These restrictions are possibly related to time and money, but also to the availability of respondents, the expertise of the researcher (a problem statement may be too difficult to answer), and the like. A frequent problem in terms of feasibility is that the problem statement is too broad in scope. Indeed, it is important that you develop a narrowly defined research question that can be investigated within a reasonable amount of time, and with a reasonable amount of money and effort. For instance, the problem statement "How do consumers behave?" is far too general to investigate.

A third characteristic of a good problem statement is that it is *interesting* to you. Research is a time-consuming process and you will go through many ups and downs before you present the final version of your research report. It is therefore vital that you are genuinely interested in the problem statement you are trying to answer, so that you can stay motivated throughout the entire research process.

EXAMPLE

Well-defined research questions

1. To what extent do the structure of the organization and type of information systems installed account for the variance in the perceived effectiveness of managerial decision making?
2. To what extent has the new advertising campaign been successful in creating the high-quality, customer-centered corporate image that it was intended to produce?
3. How has the new packaging affected the sales of the product?
4. Has the new advertising message resulted in enhanced recall?
5. How do price and quality rate on consumers' evaluation of products?
6. Is the effect of participative budgeting on performance moderated by control systems?
7. Does better automation lead to greater asset investment per dollar of output?
8. Does expansion of international operations result in an enhancement of the firm's image and value?
9. What are the effects of downsizing on the long-range growth patterns of companies?
10. What are the specific factors to be considered in creating a data warehouse for a manufacturing company?

Basic types of questions: exploratory and descriptive

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Purpose of the study.**

Earlier in this chapter, we explained that a problem statement includes both a statement of the research objective(s) and the research questions. There are three *basic types of questions* that research projects can address: exploratory and descriptive questions. We will now look at each of these in some detail.

Exploratory research questions

Exploratory research questions are typically developed when: a) not much is known about a particular phenomenon; b) existing research results are unclear or suffer from serious limitations; c) the topic is highly complex; or d) there is not enough theory available to guide the development of a *theoretical framework* (discussed in Chapter 5). **Exploratory research** often relies on qualitative approaches to data gathering such as informal discussions (with consumers, employees, managers), interviews, focus groups, and/or case studies (discussed in Chapter 6 and 7). As a rule, exploratory research is flexible in nature. Indeed, the activities of the researcher in exploratory research are quite similar to the activities of Inspector Lewis, Inspector Wallander, Sergeant Hunter, Detective Dee, or the South Florida team of forensic investigators from "CSI Miami", who use old-fashioned police work, cutting-edge scientific methods, or both to solve murder crimes. Whereas the focus of the research is broad at first, it becomes increasingly narrower as the research proceeds. The results of exploratory studies are typically not generalizable to the population.

The following is an example where exploratory research would be necessary.

EXAMPLE

The manager of a multinational corporation is curious to know if the work ethic values of employees working in its subsidiary in Pennathur City are different from those of Americans. There is very little information about Pennathur (except that it is a small city in southern India), and since there is considerable controversy about what work ethic values mean to people in other cultures, the manager's curiosity can be satisfied only by an exploratory study, interviewing the employees in organizations in Pennathur. Religion, political, economic, and social conditions, upbringing, cultural values, and so on play a major role in how people view their work in different parts of the world. Here, since very little is known about work ethic values in India, an exploratory study will have to be undertaken.

Descriptive research questions

The objective of a **descriptive study** is to obtain data that describes the topic of interest. For instance, if we want to know what percent of the population likes Coca-Cola better than pepsi in a double-blind test, we are interested in describing consumers' taste preferences. Descriptive studies are often designed to collect data that describe characteristics of objects (such as persons, organizations, products, or brands), events, or situations. Descriptive research is either quantitative or qualitative in nature. It may involve the collection of quantitative data such as satisfaction ratings, production figures, sales figures, or demographic data, but it may also entail the collection of qualitative information. For instance, qualitative data might be gathered to describe how consumers go through a decision-making process or to examine how managers resolve conflicts in organizations.

Sometimes the researcher is interested in associations among variables to describe populations, events, or situations. For instance, a researcher might be interested in the relationship between job involvement and job satisfaction, arousal-seeking tendency and risk-taking behavior, self-confidence and the adoption of innovative products, or goal clarity and job performance. Such studies are correlational in nature. **Correlational studies** describe relationships between variables. While correlational studies can suggest that there is a relationship between two variables, finding a correlation does not mean that one variable *causes* a change in another variable.

Descriptive studies may help the researcher to:

1. Understand the characteristics of a group in a given situation (for instance the profile of a specific segment in a market).
2. Think systematically about aspects in a given situation (for instance, factors related to job satisfaction).
3. Offer ideas for further probing and research.
4. Help make certain (simple) decisions (such as decisions related to the use of specific communication channels depending on the customer profile, opening hours, cost reductions, staff employment, and the like).

Below are examples of situations warranting a descriptive study.

EXAMPLE

A bank manager wants to have a profile of the individuals who have loan payments outstanding for six months and more. The profile will include details of their average age, earnings, nature of occupation, full-time/part-time employment status, and the like. This might help him to elicit further information or decide right away on the types of individuals who should be made ineligible for loans in the future.

A CEO may be interested in having a description of how companies in her industry have incorporated corporate social responsibility into the business strategy of the organization. Such information might allow comparison later of the performance levels of specific types of companies.

Causal research questions

Causal studies test whether or not one variable causes another variable to change. In a **causal study**, the researcher is interested in delineating one or more factors that are causing a problem. Typical examples of causal research questions are: "What is the effect of a reward system on productivity?" and "How does perceived value affect consumer purchase intentions?" The intention of the researcher conducting a causal study is to be able to state that variable X causes variable Y. So, when variable X is removed or altered in some way, problem Y is solved (note that quite often, however, it is not just one variable that causes a problem in organizations). In Chapter 5, we will explain that in order to establish a causal relationship, all four of the following conditions should be met:

1. The independent and the dependent variable should covary.
2. The independent variable (the presumed causal factor) should precede the dependent variable.
3. No other factor should be a possible cause of the change in the dependent variable.
4. A logical explanation (a theory) is needed and it must explain why the independent variable affects the dependent variable.

Because of the time sequence condition, experimental designs, discussed in Chapter 6 and in more detail in Chapter 10, are often used to establish causal relationships.

Examples of causal studies are given below.

EXAMPLE

A marketing manager wants to know if the sales of the company will increase if he increases the advertising budget. Here, the manager would like to know the nature of the relationship that may be established between advertising and sales by testing the hypothesis: "If advertising is increased, then sales will also go up."

A prevalent theory is that the diversity of the workforce increases organizational effectiveness. A manager wants to know if this relationship holds for her organization.

A manager wants to test the hypothesis that stress experienced in the job negatively affects the job satisfaction of employees.

A researcher is interested in testing the hypothesis that women are more motivated for their jobs than men.

Researchers often aim to answer different types of research questions in a single project. For this reason it is quite common to conduct exploratory research before moving to descriptive or causal studies in order to develop a thorough understanding of the phenomenon under study. Indeed, the three types of research (exploratory, descriptive, and causal) are often viewed as building blocks, where exploratory research lays the foundation for descriptive research and causal research builds on descriptive research.

BOX 3.6

THE POSITIVIST VIEW

Causal studies are at the heart of the scientific approach. For a positivist, the world operates by laws of cause and effect that can be discerned if a scientific method to research is used. Exploratory research is needed when there is not enough theory available to guide the development of a theoretical framework. In such cases, exploratory research needs to be done to understand what is going on. Based on this preliminary work, we will be able to set up more rigorous (read: causal) designs for further investigation.

After you have defined the problem statement you are ready to start your research. First, however, you need to communicate the problem statement and a number of other important aspects of the study – such as the scope of the study, the procedures to be followed, the time frame, and the budget – to all the parties involved.

THE RESEARCH PROPOSAL

Before any research study is undertaken, there should be an agreement between the person who authorizes the study and the researcher as to the problem to be investigated, the methodology to be used, the duration of the study, and its cost. This ensures that there are no misunderstandings or frustrations later for either party. This is usually accomplished through a research proposal, which the researcher submits and gets approved by the sponsor, who issues a letter of authorization to proceed with the study.

The **research proposal** drawn up by the investigator is the result of a planned, organized, and careful effort, and basically contains the following:

1. A working title.
2. Background of the study.

3. The problem statement:
    a. The purpose of the study
    b. Research questions.
4. The scope of the study.
5. The relevance of the study.
6. The research design, offering details on:
    a. Type of study – exploratory and descriptive
    b. Data collection methods
    c. The sampling design
    d. Data analysis.
7. Time frame of the study, including information on when the written report will be handed over to the sponsors.
8. The budget, detailing the costs with reference to specific items of expenditure.
9. Selected bibliography.

Such a proposal containing the above features is presented to the manager, who might seek clarification on some points, want the proposal to be modified in certain respects, or accept it in toto. A model of a simple research proposal to study the frequent turnover of newly recruited employees is presented below.

MODEL 3.1

Research proposal to study retention of new employees

Purpose of the study

To find a solution to the recurring problem of 40% employee turnover within the first three years of their recruitment, and more specifically to:

1. Draw up a profile of the employees who quit;
2. Assess if there are any special needs of the new recruits that require to be met; and
3. Determine the reasons for employees leaving the organization in the first three years.

Research question

How can small to medium-sized firms increase the organizational commitment of their employees?

Scope of the study

This research analyzes the problem of high turnover of employees within *small to medium-sized firms*.

Relevance of the study

The cost of employee turnover to firms has been estimated to be up to 150% of the employees' remuneration package (Schlesinger & Heskett, 1991). There are both direct and indirect costs involved. Direct costs relate to leaving costs, replacement costs, and transition costs, while indirect costs relate to the loss of production, reduced performance levels, unnecessary overtime, and low morale. The results of this study provide managers with the means to decrease the costs of employee turnover.

The research design (i.e., details of the study)

Survey instruments. First, we will interview a small number of employees who have joined the company in the previous three years. Based on these exploratory findings, we will administer a questionnaire to all of the employees who have joined the company in the past three years.

Data collection. The interviews will be conducted during office hours in the conference hall of the organization at a prearranged time convenient to the interviewees. The questionnaire will be given to the employees to be completed by them in their homes and returned anonymously to the box set up for the purpose by the specified date. They will all be reminded two days before the due date to return their questionnaires, if not already done.

Time frame

The time frame necessary for completion of this research project is approximately five months. During these five months, periodic reports will be provided on the progress being made.

Budget

The budget for this project is in Appendix A.[1]

Selected bibliography

Bateman, T. S. & Strasser, S. (1984) A longitudinal analysis of the antecedents of organizational commitment. *The Academy of Management Journal*, 27(1), 95–112.

Lachman, L. & Aranya, N. (1986) Evaluation of alternative models of commitments and job attitudes of professionals. *Journal of Occupational Behavior*, 7, 227–243.

Meyer, J. & Allen, N. (1997) *Commitment in the Workplace: Theory, research and application*. Thousand Oaks: Sage.

Meyer, J., Stanley, D., Herscovitch, L. & Topolnytsky, L. (2002) Affective, continuance and normative commitment: a meta-analysis of antecedents, correlates and consequences. *Journal of Vocational Behavior*, 63, 20–52.

Schlesinger, L. & Heskett, J. (1991) The service-driven service company. *Harvard Business Review*, 69, 71–81.

Vandenberghe, C., Bentein, K. & Stinglhamber, F. (2002) Affective commitment to the organization, supervisor and work group: antecedents and outcomes. *Journal of Vocational Behavior*, 64, 47–71.

[1] Please note that Appendix A has not been included as Model 3.1 is an example only.

Once the proposal is accepted, the researcher conducts the research, going through the appropriate steps discussed in the research design process.

MANAGERIAL IMPLICATIONS

Managers sometimes look at the symptoms in problematic situations and treat them as if they are the real problems, getting frustrated when their remedies do not work. Understanding the *antecedents–problem–consequences* sequence and gathering the relevant information to get a real grasp of the problem go a long way towards pinpointing it.

Managers' inputs help researchers to define the broad problem area and to narrow down the broad problem into a feasible topic for research. Managers who realize that correct **problem definition** is critical to ultimate problem solution do not begrudge the time spent in working closely with researchers, particularly at this stage.

A well-developed research proposal allows managers to judge the relevance of the proposed study. However, to make sure that the objectives of the study are actually being achieved, managers must stay involved throughout the *entire* research process. Information exchange between the manager and the researcher during all the important stages of the research process will definitely enhance the managerial relevance and the quality of the research effort.

ETHICAL ISSUES IN THE PRELIMINARY STAGES OF INVESTIGATION

Preliminary information is gathered by the researcher to narrow the broad problem area and to define a specific problem statement. In many cases, the researcher interviews decision makers, managers, and other employees to gain knowledge of the situation so as to better understand the problem. Once a problem is specified and a problem statement is defined, the researcher needs to assess his or her research capabilities; if the researcher does not have the skills or resources to carry out the project, he or she should decline the project. If the researcher decides to carry out the project, it is necessary to inform all the employees – particularly those who will be interviewed for preliminary data gathering through structured and unstructured interviews – of the proposed study (though it is not necessary to acquaint them with the actual reasons for the study, because this might bias responses). The element of unpleasant surprise will thus be eliminated for the employees. It is also necessary to assure employees that their responses will be kept confidential by the interviewer/s and that individual responses will not be divulged to anyone in the organization. These two steps make the employees comfortable with the research undertaken and ensure their cooperation. Employees should not be forced to participate in the study. When employees are willing to participate in the study, they have the right to be protected from physical or psychological harm. They also have a right to privacy and confidentiality. Attempts to obtain information through deceptive means should be avoided at all costs.

EXAMPLE

Checklist for dealing with ethical considerations and dilemmas during the first stages of the research process

- Why is this research project worth doing?
- How does the organization benefit from this project?
- What impact, if any, does your research have on the organization?
- Do you have the skills and resources to carry out this research project?
- Have you informed all the employees of the research project? Why not?
- Do you explain the purpose of your research to the participants? Why not?
- Are participants given the opportunity to decline participation?
- Are participants able to withdraw their consent at any point? How?
- Does the research cause you to have access to sensitive information? How will you ensure the confidentiality of this information?
- How will you ensure individual respondents cannot be identified from any research reports or papers that are produced?
- Are there any possible negative effects (long or short term) on your participants (including any physical or psychological harm)?
- How will you report back from the research to your participants?
- Where ethical dilemmas have arisen, what steps have you taken to resolve these?

SUMMARY

- **Learning objective 1: Identify problem areas that are likely to be studied in organizations.**
  Research typically begins with a problem. A problem is any situation where a gap exists between an actual and a desired ideal state. Examples of problems are provided in Box 3.1.

- **Learning objective 2: Narrow down a broad problem into a feasible topic for research using preliminary research.**
  A broad problem area provides researchers with enough information to embark on their research journey. However, a broad problem has to be transformed into a *researchable topic* for investigation by making it more a) specific and precise and by b) setting clear boundaries. Finally, the researcher needs to select a c) perspective

from which the subject is investigated. Preliminary research should help the researcher to arrive at a specific problem statement. Although the exact nature of the information needed for this purpose depends on the type of problem one is addressing, it may be broadly classified under two headings: (1) information on the organization and its environment – that is, the contextual factors, and (2) information on the topic of interest.

- **Learning objective 3: Develop a good problem statement.**
  There are three key criteria to assess the quality of a problem statement: it should be relevant, feasible, and interesting. A good problem statement includes both a statement of the research objective(s) and the research question(s). The research objectives and the research questions are strongly related. There are three *basic types of questions* that research projects can address: exploratory and descriptive questions.

- **Learning objective 4: Develop a research proposal.**
  Before any research study is undertaken, there should be an agreement between the sponsor of the study and the researcher as to the problem to be investigated, the methodology, the duration of the study, and its cost. This is usually accomplished through a research proposal, which the researcher submits and has approved by the sponsor, who issues a letter of authorization to proceed with the study.

- **Learning objective 5: Be aware of the role of the manager in the early stages of the research process.**
  Managers must stay involved in a research project throughout the entire research process. This will enhance the managerial relevance and the quality of the research effort.

- **Learning objective 6: Be aware of the role of ethics in the early stages of the research process.**
  The checklist provided in this chapter will help the researcher to deal with ethical considerations and dilemmas during the first stages of the research process.

In Chapter 4 we will examine the next step in the research process: the critical literature review.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: CAP Airlines**.

DISCUSSION QUESTIONS

1. Define "problem" and provide an example of a problem you have encountered in your daily life. Discuss how you have used research to solve this problem.
2. Why do we still have to transform the following problem statement into a researchable topic for investigation?

"The introduction of flexible work hours has created more problems than it has solved."

3. Use the Internet to find more information about the "Five Times Why" approach. Discuss this approach using an example provided on the Internet.
4. Describe the functions of preliminary data gathering.

5. Why is it important to gather information on the background of the organization? Why is it important to review the literature on your topic?
6. Should a researcher *always* obtain information on the structural aspects and job characteristics from those interviewed? Give reasons for your answer with examples.
7. "The problem definition stage is perhaps more critical in the research process than the problem solution stage." Discuss this statement.
8. "The 'secret' to bringing *clarity* and *focus* to your problem is to isolate the key ideas in the first version of the problem statement." What are the subjects, verbs, and objects in the following statement?

"The newly installed information system is not being used by the managers for whom it was primarily designed."

9. Offer a clearly focused problem statement in the broad area of corporate culture, job satisfaction *or* risk-seeking behaviors of investors.
10. A typical example of a research questions is: "What is the effect of reward system on productivity?"

What is the problem here, according to the researcher?

And what is a possible solution to the problem, according to the same researcher?

11. Below is the gist of an article from *Businessweek*. After reading it:
    a. identify the broad problem area; and
    b. explain how you would proceed further.

Two years ago, Electronic Arts, the second-largest U.S. video game company, ran on promises. Developers pitching a feature for a big game had to produce a cool video to win approval from the bosses. They were then left alone for months, until it was too late to fix any problems, says Ian Milham, one of the company's creative directors. He describes the philosophy as "make a trailer that promises a lot and then don't show anyone until it's perfect."

Often it wasn't. Several of EA's biggest 2013 releases, including entries in its SimCity and Battlefield franchises, were so bug-ridden on release that they crashed game servers and were essentially unplayable for days or weeks before they were fixed. EA's sports games have become Internet punch lines, thanks to videos of glitches trapping digital athletes in anatomically impossible positions.

Burger, D. (2015, March 12) *EA Tries Selling Video Games That Work*. Retrieved from http://www.bloomberg.com/news/articles/2015-03-12/electronic-arts-delays-game-releases-to-fix-bugs-for-a-change

12. Define the problem statement (the *why* and the *what*) in the following situation:

Employee loyalty

Companies benefit through employee loyalty. Crude downsizing in organizations during the recession crushed the loyalty of millions. The economic benefits of loyalty embrace lower recruitment and training costs, higher productivity of workers, customer satisfaction, and the boost to morale of fresh recruits. In order that these benefits are not lost, some companies, while downsizing, try various gimmicks. Flex leave, for instance, is one. This helps employees receive 20% of their salary, plus employer-provided benefits, while they take a 6- to 12-month sabbatical, with a call option on their services. Others try alternatives like more communication, hand holding, and the like.

CHAPTER 4

The critical literature review

LEARNING OBJECTIVES

After completing Chapter 4 you should be able to:

1. Discuss the functions of a literature review.
2. Write a literature review on any given topic, documenting the references in the prescribed manner.
3. Discuss the ethical issues of documenting the literature review.

INTRODUCTION

In Chapter 3, we explained that a first review of the academic literature will help you to narrow down the broad problem and to develop a clear and specific problem statement. But mere definition of the problem does not solve it. How, then, does one proceed further? One answer is by going through the entire process as shown in the research process model in Figure 4.1. This figure illustrates that the next step, after you have developed a research proposal, is the critical literature review. This step is designated step 4 and it is indicated by the shaded portion in the figure.

The aim of this chapter is to introduce you to the process of carrying out a **literature review**. The chapter begins with a definition of the critical literature review, followed by a discussion of its functions. Then it will explain that a critical literature review is a step-by-step process that involves the identification of published and unpublished work from secondary data sources on the topic of interest, the evaluation of this work in relation to the problem, and the documentation of this work. Finally, this chapter will discuss two pitfalls you have to be aware of when you document the literature review: misrepresenting others and plagiarism.

To be able to generate viable alternatives for effective decision making you have to become an expert on your topic. A second review of the literature, or **critical literature review**, is therefore essential in most research projects. A literature review is "the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfill certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed" (Hart, 1998 , p. 13).

In general, a literature review ensures that:

1. The research effort is positioned relative to existing knowledge and builds on this knowledge.
2. You can look at a problem from a specific angle; it shapes your thinking and sparks useful insights on the topic of your research.

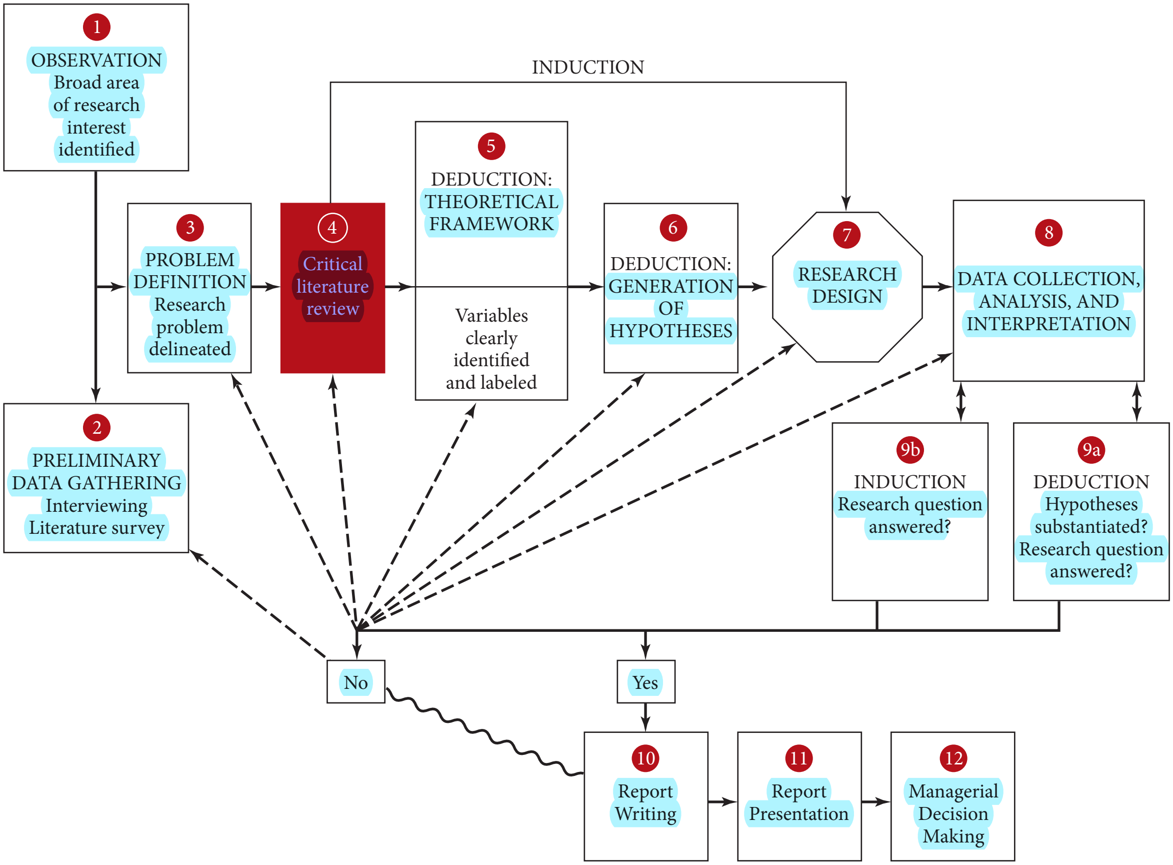
1
OBSERVATION
Broad area of research interest identified
INDUCTION
2
PRELIMINARY DATA GATHERING
Interviewing
Literature survey
3
PROBLEM DEFINITION
Research problem delineated
4
Critical literature review
5
DEDUCTION: THEORETICAL FRAMEWORK
Variables clearly identified and labeled
6
DEDUCTION: GENERATION OF HYPOTHESES
7
RESEARCH DESIGN
8
DATA COLLECTION, ANALYSIS, AND INTERPRETATION
9b
INDUCTION
Research question answered?
9a
DEDUCTION
Hypotheses substantiated?
Research question answered?
No
Yes
10
Report Writing
11
Report Presentation
12
Managerial Decision Making

FIGURE 4.1

The functions of the critical literature review

3. You do not run the risk of "reinventing the wheel", that is, wasting effort on trying to rediscover something that is already known.
4. You are able to introduce relevant terminology and to define key terms used in your writing. This is important because the same term may have different meanings, depending on the context in which it is used. Definitions will also help you to give structure to your essay, article or report (see Box 4.1 for an example).
5. You obtain useful insights of the research methods that others have used to provide an answer to similar research questions. Knowledge of the research methods used by others allows you to replicate existing research, which will help you to relate your research findings to the findings of others.
6. The research effort can be contextualized in a wider academic debate. In other words, it allows you to relate your findings to the findings of others.

A critical review of the literature has helped Emma, George, and Jim (check Box 4.2) to become familiar with relevant knowledge related to the problem that they aim to solve. The examples in Box 4.2 illustrate that a critical review of the literature is vital in nearly all research projects, regardless of the type of study. Indeed,

BOX 4.1

DEFINING WAITING FOR SERVICE

Waiting for service refers to the time between the point a customer is ready to receive a service and the point the service starts (Taylor, 1994). A customer may have to wait before, during, or after a transaction. In other words, there are three kinds of waits: pre-process waits, in-process waits, and post-process waits (Dubé-Rioux, Schmitt & LeClerc 1988; Miller, Kahn & Luce, 2008). To make these different kinds of waits more concrete, imagine you are flying with an airline from point A to B. You may have to wait before you can board the plane (a *pre-process wait*), because the plane cannot land (an *in-process wait*), and because you cannot disembark immediately (a *post-process wait*).

Since the research questions of your study serve as the starting point for your critical review of the literature, some of the functions of a critical literature review depend on the type of study and the specific research approach that is taken, as illustrated by the examples in Box 4.2.

BOX 4.2

SPECIFIC FUNCTIONS OF A LITERATURE REVIEW

Emma is involved in a *descriptive* study that aims to describe how a major player in the pharmaceutical industry delivers valuable products to the market. A critical review of the literature should help her to come up with a comprehensive overview of the relevant perspectives on value, a guiding definition of value and an in-depth overview of frameworks, instruments, and analytical tools (such as Michael Porter's value chain) that will help her to *describe* how the organization can create value and competitive advantage.

George's fundamental research project is *inductive* and *exploratory* in nature. A review of the literature has helped him to develop a theoretical background, which provides an overview of the literature pertinent to the specific topic he is studying. Relevant research findings, methodological issues, and major conclusions of earlier and more recent work are put forward, the logical continuity between earlier and more recent work is clarified, and controversial issues, when relevant, are addressed. George explains that despite the valuable work of others, exploratory research is needed. He argues that although earlier research findings provide a wide variety of potential explanations for the problem under study, they are often conflicting and industry-specific, which limits the generalizability of these findings.

Jim's applied study is *deductive* in nature. A second review of the literature has allowed him to develop a theoretical background. This has helped him to obtain a clear idea as to what *variables* (different types of variables are discussed in Chapter 5) will be important to consider in his theoretical framework, why they are considered important, how they are related to each other, and how they should be measured to solve the problem. A critical review of the literature has also helped him to provide arguments for the relationships between the variables in his conceptual causal model and to develop hypotheses. Along these lines, a second review of the literature provides Jim with a framework for his own work. It ensures that no important variable that has in the past been found (repeatedly) to have an impact on the problem is ignored in the research project. Indeed, if there are variables that are not identified but influence the problem critically, then research done without considering them is an exercise in futility. In such a case, the true reason for the problem will remain unidentified and the research project will not help the manager to solve the problem. To avoid such possibilities Jim has delved into all the important research relating to the problem under study.

familiarity with the literature on your subject area is beneficial in exploratory, descriptive, and in causal research. A literature review is helpful in both an academic (or fundamental) and a non-academic (or applied) context. In both cases, a good theoretical base will add rigor to the study. We have explained earlier that rigorous research allows the researcher to collect the right kind of information with a minimum degree of bias, and facilitates suitable analysis of the data gathered. This is obviously important in both fundamental and applied research.

In sum, a critical review of the literature will spark many useful insights on your research topic; it will allow you to work in an expert manner, to make informed decisions, and to benefit from existing knowledge in many different ways. Let us now turn to how you can approach the literature review.

HOW TO APPROACH THE LITERATURE REVIEW

The first step of a literature review involves the identification of the various published and unpublished materials that are available on the topic of interest, and gaining access to these.

Data sources

The quality of a literature review depends on a cautious selection and reading of books, academic and professional journals, reports, theses, conference proceedings, unpublished manuscripts, and the like. Academic books and journals are, in general, the most useful sources of information. However, other sources such as professional journals, reports, and even newspapers may also be valuable because they can provide you with specific, real-world information about markets, industries, or companies. Therefore, as a rule, you will need to use a combination of information resources. The precise combination of resources depends on the nature and the objectives of your research project.

Textbooks

Textbooks are a useful source of theory in a specific area. An advantage of textbooks is that they can cover a broad range of topics. What's more, textbooks can cover a topic much more thoroughly than articles can. Hence, textbooks offer a good starting point from which to find more detailed sources such as journal articles, theses, and unpublished manuscripts. A downside of textbooks is that they tend to be less up to date than journals.

Journals

Both academic and professional journals are important sources of up-to-date information. Articles in academic journals have generally been peer-reviewed: this means that the articles have been subject to the scrutiny of experts in the same field before being accepted for publication. *Review articles* (that may or may not contain a meta-analysis: a type of data analysis in which the results of several studies are combined and analyzed as if they were the results of one large study) summarize previous research findings to inform the reader of the state of existing research. Review articles are very useful because they provide an overview of all the important research in a specific area. *Research articles* are reports of empirical research, describing one or a few related studies. The conceptual background section of a research article provides a compact overview of relevant literature. Research articles also provide a detailed description of the purpose of the study, the method(s) used, and the results of the study.

Articles in professional journals are a valuable source of recent developments in the field and of facts and figures. What's more, they may provide you with a feel for the practical relevance of a problem.

Theses

PhD theses often contain an exhaustive review of the literature in a specific area. Most PhD theses include several empirical chapters. These chapters often have the same structure and characteristics as academic journal articles. Note that not every empirical chapter of a thesis is eventually published in an academic journal.

Conference proceedings

Conference proceedings can be useful in providing the latest research, or research that has not (yet) been published. Conference proceedings are very up to date, and for this reason this information source is quite valuable if you are working in a relatively new area or domain. Not every manuscript presented at a conference is eventually published in an academic journal; hence you must critically assess the quality of this information source.

Unpublished manuscripts

The APA defines an unpublished manuscript as any information source that is not "officially" released by an individual, publishing house, or other company. Examples of unpublished manuscripts may include papers accepted for publication but still "in press," data from an unpublished study, letters, manuscripts in preparation, and personal communications (including e-mails). Unpublished manuscripts are often very up to date.

Reports

Government departments and corporations commission or carry out a large amount of research. Their published findings provide a useful source of specific market, industry, or company information.

Newspapers

Newspapers provide up-to-date business information. They are a useful source of specific market, industry, or company information. Note that opinions in newspapers are not always unbiased.

The Internet

The amount of information that can be found on the World Wide Web is enormous. You can search for (the details of) books, journals and journal articles, and conference proceedings, as well as for specialized data such as company publications and reports. The number of newspapers, magazines, and journals that is available electronically is enormous.

Note that the Internet is unregulated and unmonitored. Moreover, developing an Internet page is easy and cheap. For this reason, the Internet provides exceptional challenges in determining the usefulness and reliability of information. A source that may help you to assess the quality of online information is Cooke (2001). You can also find useful information on the Internet itself; several universities have developed useful guidelines to assess the quality of information found online (check, for instance, http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html).

Search engines such as Google and Yahoo! can help you to find relevant information. For instance, Google Scholar, which can be accessed from the Google homepage, can help you to identify academic literature, such as peer-reviewed papers, theses, books, abstracts, and articles from academic publishers, universities, and other scholarly organizations.

Searching for literature

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Searching for literature**.

Previously, one had to manually go through several bibliographical indexes that are compiled periodically, listing the journals, books, and other sources in which published work in the area of interest could be found. With modern technology, locating sources where the topics of interest have been published has become much easier. Almost every library today has computer online systems to locate published information. Computerized databases provide a number of advantages. First, they save enormous amounts of time. Second, they are comprehensive in their listing and review of references. Third, gaining access to them is relatively inexpensive. For these reasons the researcher can focus on material most central to the research effort.

You will benefit from spending some time on becoming familiar with the online resources that your library provides. Most libraries have the following electronic resources at their disposal:

- Electronic journals. Your library is probably subscribed to journals that are published or made available online. Discover which journals are provided online by your library.
- Full-text databases. Full-text databases provide the full text of the article. Find out which full-text databases are provided by your library.
- Bibliographic databases. Bibliographic databases display only the bibliographic citations; that is, the name of the author, the title of the article (or book), source of publication, year, volume, and page numbers. These contain the same information as can be found in the Bibliographic Index books in libraries, which are periodically updated, and include articles published in periodicals, newspapers, books, and so on. Some useful indexes are provided in the appendix to this chapter.
- Abstract databases. Abstract databases also provide an abstract or summary of articles. They do not provide the full text of an article or manuscript.

Some of these databases are listed in the appendix at the end of this chapter. Some important research databases available on the World Wide Web are also provided in the appendix. Databases include, among others, listings of journal articles, books in print, census data, dissertation abstracts, conference papers, and newspaper abstracts that are useful for business research.

Evaluating the literature

Accessing the online system and searching for literature in the area of interest will provide a comprehensive bibliography on the subject. Because the search for literature can sometimes provide as many as 100 or more results, you will have to carefully select relevant books and articles.

A glance at the *titles* of the articles or books will indicate which of them may be pertinent and which others are likely to be peripheral to the contemplated study. The *abstract* of an article usually provides an overview of the study purpose, general research strategy, findings, and conclusions. A good abstract thus provides you with enough information to help you to decide whether an article is relevant for your study. An article's *introduction* also provides an overview of the problem addressed by the research and specific research objectives. The introduction often ends with a summary of the research questions that guide the study. The problem statement, research questions, and/or the research objectives give you a feel for what the researcher is studying and thus for the relevance of the article to your study. In a similar fashion, the *table of contents* and the *first chapter of a book* may help you to assess the relevance of the book.

A good literature review needs to include references to the key studies in the field. For this reason, articles and books that are often cited by others must be included in your literature review, even if these articles and books were written 30 or even 40 years ago. Of course, more recent work should also be incorporated in your literature survey, since recent work will build on a broader and more up-to-date stream of literature than older work.

To assess the quality of *recent* research (indeed, in this case you cannot use the number of citations as an indicator of the quality of an article) you could ask the following questions:

- Is the main research question or problem statement presented in a clear and analytical way?
- Is the relevance of the research question made transparent?
- Does this study build directly upon previous research?
- Will the study make a contribution to the field?
- Is there a theory that guides the research?
- Is the theory described relevant and is it explained in an understandable, structured, and convincing manner?
- Are the methods used in the study explained in a clear manner (description of methods)?
- Is the choice of certain methods motivated in a convincing way (justification of methods)?
- Is the sample appropriate?
- Are the research design and/or the questionnaire appropriate for this study?
- Are the measures of the variables valid and reliable?
- Has the author used the appropriate quantitative and/or qualitative techniques?
- Do the conclusions result from the findings of the study?
- Do the conclusions give a clear answer to the main research question?
- Has the author considered the limitations of the study?
- Has the author presented the limitations in the article?

The quality of the journal that published an article can also be used as an indicator of the quality of an article. Important questions in this respect are: "Is the journal peer-reviewed; that is, do all articles have to undergo a review process before they are published?" and "What is the impact factor of the journal?" The impact factor of a journal can be viewed as the average number of citations in a year given to those papers in the journal that were published during a given period (usually the two preceding years). Because important articles are cited more often than articles that are not important, the impact factor of a journal is frequently used as a proxy for the importance of that journal to its field.

In sum, some criteria for assessing the value of articles or books are: the relevance of the issues that are addressed in the article or book, the importance of a book or article in terms of citations, the year of publication of the article or book, and the overall quality of the article or book.

All the articles considered relevant to your study can be listed as references, using the appropriate referencing format, which is discussed in the appendix to this chapter.

Documenting the literature review

As stated earlier, the purpose of the literature review is to help the researcher to build on the work of others and to make informed decisions during the various stages of the research project. A review of the literature identifies and highlights relevant themes and documents significant findings, frameworks, and/or instruments from earlier research that will serve as the foundation for the current project. Documenting the literature review is important to convince the reader that the researcher is knowledgeable about the problem area and has done the preliminary homework that is necessary to conduct the research.

A point to note is that the literature survey should bring together all relevant information in a cogent and logical manner instead of presenting all the studies in chronological order with bits and pieces of uncoordinated information. A literature review is intended to *synthesize* (and not necessarily to summarize) relevant research on your topic. To synthesize is to combine two or more elements to form a new whole. In your literature review, the *elements* are the findings of the literature you select and read; the *new whole* is the conclusion you draw from these findings.

There are several accepted methods of citing references in the literature survey section and using quotations. The *Publication Manual of the American Psychological Association* (2012) offers detailed information regarding citations, quotations, references, and so on, and is one of the accepted styles of referencing in the management area. Other formats include *The Chicago Manual of Style* (2010) and Turabian's *Manual for Writers* (2013). As stated earlier, details of the referencing style and quotations based on the APA *Manual* are offered in the appendix at the end of this chapter.

To conclude, let us take *a portion* of a completed literature review and examine how the activity has helped to (1) introduce the subject of study, (2) identify the problem statement, and (3) build on previous research to offer the basis from which to get to the next steps of the theoretical framework and hypothesis development.

EXAMPLE

Organizational effectiveness

Organization theorists have defined organizational effectiveness (OE) in various ways. OE has been described in terms of objectives (Georgopolous & Tannenbaum, 1957), goals (Etzioni, 1960), efficiency (Katz & Kahn, 1966), resources acquisition (Yuchtman & Seashore, 1967), employee satisfaction (Cummings, 1977), interdependence (Pfeffer, 1977), and organizational vitality (Colt, 1995). As Coulter (2002) remarked, there is little consensus on how to conceptualize, measure, or explain OE. This should, however, not come as a surprise to us since OE models are essentially value-based classifications of the construct (the values being those of the researchers) and the potential number of models that can be generated by researchers is virtually limitless. Researchers are now moving away from a single model and are taking contingency approaches to conceptualizing OE (Cameron, 1996; Wernerfelt, 1998; Yetley, 2001). However, they are still limiting themselves to examining the impact of the dominant constituencies served and the organization's life cycle on OE instead of taking a broader, more dynamic approach (Dahl, 2001, p. 25).

From the above extract, several insights can be gained. The literature review (1) introduces the subject of study (organizational effectiveness), (2) highlights the problem (that we do not have a good conceptual framework for understanding what OE is), and (3) summarizes the work done so far on the topic in a manner that convinces the reader that the researcher has indeed surveyed the work done in the area of OE and wants to contribute to the understanding of the concept, taking off on the earlier contingency approaches in a more creative way. The scholar has carefully paved the way for the next step, which is to develop a more viable and robust model of organizational effectiveness. This model will be logically developed, integrating several streams of research done in other areas (such as cross-cultural management, sociology, etc.), which will be woven further into the literature review. Once the scholar has explicated the framework as to what constitutes OE and what the factors that influence it are, the next step is to develop testable hypotheses to see if the new model is indeed viable.

ETHICAL ISSUES

Earlier in this chapter we have explained that research involves building on the work of others. When you summarize, add to, or challenge the work of others, there are two important pitfalls that you have to beware of:

1. Purposely misrepresenting the work of other authors – that is, their viewpoints, ideas, models, findings, conclusions, interpretations, and so on.
2. Plagiarism – the use of another's original words, arguments, or ideas as though they were your own, even if this is done in good faith, out of carelessness, or out of ignorance.

Both purposely misrepresenting the work of others and plagiarism are considered to be fraud.

In today's information age, copying and pasting information from online sources into your own research paper has become very simple. This may create a temptation to copy (significant) portions of text into your work. Your task is to resist this temptation. Plagiarism is a type of fraud that is taken very seriously in the academic world, mainly because using the work of others as if it were your own does not convey much respect for the efforts that other people have put into their work. Two other reasons to take plagiarism very seriously are provided by IJzermans and Van Schaaijk (2007). They point out that:

1. Plagiarism makes it is difficult for the reader to verify whether your claims about other authors and sources are accurate.
2. You are participating in a scientific debate. You need to make your position in this debate clear by designating the authors whose work you are building on or whose ideas you are challenging.

There are many forms of plagiarism above and beyond copying and pasting text into your own work. Box 4.3 provides an overview of common forms of plagiarism. This overview may help you to avoid the pitfall of plagiarism.

Note that many universities use software such as Turnitin or Ephorus to detect plagiarism. To avoid plagiarism you need to observe the rules for referencing sources, detailed in the appendix of this chapter. You may also benefit from examining the plagiarism guidelines of your own university or from checking out the integrity handbook of the Massachusetts Institute of Technology at the following URL: http://web.mit.edu/academicintegrity/handbook/handbook.pdf

BOX 4.3

COMMON FORMS OF PLAGIARISM

Sources not cited

1. **"The Ghost Writer"**
   The writer turns in another's work, word-for-word, as his or her own.
2. **"The Photocopy"**
   The writer copies significant portions of text straight from a single source, without alteration.
3. **"The Potluck Paper"**
   The writer tries to disguise plagiarism by copying from several different sources, tweaking the sentences to make them fit together while retaining most of the original phrasing.

4. **"The Poor Disguise"**
   Although the writer has retained the essential content of the source, he or she has altered the paper's appearance slightly by changing key words and phrases.
5. **"The Labor of Laziness"**
   The writer takes the time to paraphrase most of the paper from other sources and make it all fit together, instead of spending the same effort on original work.
6. **"The Self-Stealer"**
   The writer "borrows" generously from his or her previous work, violating policies concerning the expectation of originality adopted by most academic institutions.

Sources cited (but still plagiarized)

1. **"The Forgotten Footnote"**
   The writer mentions an author's name for a source, but neglects to include specific information on the location of the material referenced. This often masks other forms of plagiarism by obscuring source locations.
2. **"The Misinformer"**
   The writer provides inaccurate information regarding the sources, making it impossible to find them.
3. **"The Too-Perfect Paraphrase"**
   The writer properly cites a source, but neglects to put in quotation marks text that has been copied word-for-word, or close to it. Although attributing the basic ideas to the source, the writer is falsely claiming original presentation and interpretation of the information.
4. **"The Resourceful Citer"**
   The writer properly cites all sources, paraphrasing and using quotations appropriately. The catch? The paper contains almost no original work! It is sometimes difficult to spot this form of plagiarism because it looks like any other well-researched document.
5. **"The Perfect Crime"**
   Well, we all know it doesn't exist. In this case, the writer properly quotes and cites sources in some places, but goes on to paraphrase other arguments from those sources without citation. This way, the writer tries to pass off the paraphrased material as his or her own analysis of the cited material.

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SUMMARY

- **Learning objective 1: Discuss the functions of a literature review.**
  A literature review is the selection of available documents on a topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfill certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed. A literature review ensures that the research effort is positioned relative to existing knowledge and builds on this knowledge. A literature review has many other functions. Because

the research questions of a study serve as the starting point for the literature review, some of these functions depend on the type of research questions the researcher develops.

- **Learning objective 2: Write a literature review on any given topic, documenting the references in the prescribed manner.**
  The first step of a literature review involves the identification of the materials that are available on the topic of interest, and gaining access to these. Searching for literature in the area of interest will provide a comprehensive bibliography on the subject. That is why the researcher will have to carefully select relevant material. Some criteria for assessing the value of materials are: the relevance of the issues that are addressed, the importance in terms of citations, the year of publication, and overall quality. Documenting the literature review is important to convince the reader that the researcher is knowledgeable about the problem area and has done the preliminary homework that is necessary to conduct the research.

- **Learning objective 3: Discuss the ethical issues of documenting the literature review.**
  When researchers document their literature review, there are two important pitfalls that they have to beware of: (1) purposely misrepresenting the work of other authors; and (2) plagiarism – the use of another's original words, arguments, or ideas as though they were your own, even if this is done in good faith, out of carelessness, or out of ignorance. Both purposely misrepresenting the work of others and plagiarism are considered to be fraud.

The appendix to this chapter offers information on (1) online databases, (2) bibliographical indexes, (3) the APA format for references, and (4) notes on referencing previous studies and quoting original sources in the literature review section.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: The Literature Review.**

DISCUSSION QUESTIONS

1. What is the purpose of a critical literature review?
2. "The exact purpose of a critical literature review depends on the research approach that is taken." Discuss this statement.
3. Provide at least two distinctive definitions of two of the following terms:
   - Leadership
   - Job satisfaction
   - Organizational effectiveness
   - Service quality
   - Auditor liability
   - Cash flow

4. How would you go about doing a literature review in the area of corporate social responsibility?
5. Find two or more sources with contrasting viewpoints on the same issue. Discuss the main differences between these sources.
6. After studying and extracting information from all the relevant work done previously, how does the researcher know which particular references, articles, and information should be given prominence in the literature review?
7. Why is appropriate citation important? What are the consequences of not giving credit to the source from which materials are extracted?

PRACTICE PROJECT

Do the project assigned below, following the step-by-step process outlined:

Compile a bibliography on any one of the following topics, or any other topic of interest to you, from a business perspective: (a) service quality; (b) product development; (c) open-market operations; (d) information systems; (e) manufacturing technology; (f) assessment centers; (g) transfer pricing.

From this bibliography, select five to seven references that include books, academic journals, and professional journals.

Based on these five to seven references, write a literature review using different forms of citation, as described in the appendix.

APPENDIX

SOME ONLINE RESOURCES USEFUL FOR BUSINESS RESEARCH

Online databases

Databases contain raw data stored in a variety of ways. Computerized databases can be purchased that deal with statistical data, financial data, texts, and the like. Computer network links allow the sharing of these databases, which are updated on a regular basis. Most university libraries have computerized databases pertaining to business information that can be readily accessed. Some of the databases useful for business research are listed below:

1. **ABI/INFORM Global** and **ABI/INFORM** provide the capability to search most major business, management, trade and industry, and scholarly journals from 1971 onward. The information search can be made by keying in the name of the author, periodical title, article title, or company name. Full texts from the journals and business periodicals are also available on CD-ROM and electronic services.
2. **The Business Periodicals Index (BPI)** provides an index of business and management periodicals, and is available online and on CD-ROM.
3. **Dow Jones Factiva** products and services provide business news and information. The collection of more than 14000 sources includes the *Wall Street Journal*, *Financial Times*, Dow Jones and Reuters newswires, and the Associated Press, as well as Reuters Fundamentals, and D&B company profiles.
4. **EconLit** is a comprehensive index of journal articles, books, book reviews, collective volume articles, working papers, and dissertations.
5. **The International Bibliography of the Social Sciences (IBSS)** is an online resource for social science and interdisciplinary research. IBSS includes over 2.5 million bibliographic records relating to the four core social science subjects of anthropology, economics, politics, and sociology.
6. **PsycINFO** is an abstract database of psychological literature from the 1800s to the present. PsycINFO contains bibliographic citations, abstracts, cited references, and descriptive information of scholarly publications in the behavioral and social sciences.
7. **RePEc** (**Re**search **P**apers in **Ec**onomics) is a collaborative effort of volunteers in 63 countries to enhance the dissemination of research in economics. The heart of the project is a decentralized database of working papers, journal articles, and software components.
8. **SSRN (Social Science Research Network)** is devoted to the rapid worldwide dissemination of social science research and is composed of a number of specialized research networks in each of the social sciences.
9. **Web of Stories** contains video archive of interviews with today's greatest scientists, writers, filmmakers, and craftspeople about their work. Once-only registration required for a personalized view of the website.
10. **World Development Indicators (World Bank)** is a database, produced by the World Bank, containing statistical data from 1970 onwards on the economic and social development of 223 countries.

The following databases can also be accessed through the Internet: Business and Industry Database, Guide to Dissertation Abstracts, Periodicals Abstract, Social Science Citation Index, STAT-USA.

Note: A cumulated annotated index to articles on accounting and in business periodicals arranged by subject and by author is also available. The Lexis-Nexis Universe provides specific company and industry information including company reports, stock information, industry trends, and the like.

On the Web

Some of the many websites useful for business research are provided below.

General

Bureau of Census: http://www.census.gov/

Business Information on the Internet: http://www.rba.co.uk/sources/. A selection of key business Information Sites on the Internet, compiled by Karen Blakeman.

Business information on the Internet: http://www.crosscut.net/research/business.html. Using the Internet for college research, maintained by Terry Dugas.

Business Researcher's Interests: http://www.brint.com/interest.html

Businessweek Online: http://www.businessweek.com/. The journal *Businessweek* online from 1995 until now.

China & World Economy: http://www.iwep.org.cn/wec/

Company Annual Reports: http://www.annualreports.com

Corporate Information: http://www.corporateinformation.com/. Starting point to find corporate information from around the world.

Economic Journals on the Web: http://www.oswego.edu/~economic/journals.htm

Euromoney Publications: http://www.euromoney.com/. The journal *Euromoney* online from 1995 until now. Registration required.

European Business Directory: http://www.europages.com/home-en.html

Eurostat: http://ec.europa.eu/eurostat. Eurostat is the site of the Statistical Office of the European Community. It provides direct access to the latest and most complete statistical information available on the European Union, the EU members, the euro-zone, and other countries.

Fortune: http://www.fortune.com/. Also contains the Fortune 500 List (500 American companies and 500 global companies with financial data and their home pages).

Forbes Magazine: http://www.forbes.com/forbes/. The journal *Forbes Magazine* online from August 1997 until now.

FT.com. TotalSearch: http://news.ft.com/home/europe. FT.com's TotalSearch gives you access to more than ten million free newspaper and magazine articles alongside results gathered from leading online news sources. TotalSearch also incorporates a definitive web guide in association with Business.com, a leader in business website classification. You can search in the *Financial Times*, the *Guardian*, and *Wall Street Journal* from 1996 until now, or you can refine your search for the *Finanical Times* only.

globalEDGE: http://globaledge.msu.edu/ibrd/ibrd.asp. A directory of international business resources categorized by specific orientation and content. Each resource has been selected and reviewed by the globalEDGE TM Team.

I.O.M.A.: www.ioma.com/ioma/direct.html. This site links to business resources that include financial management, legal resources, small business, human resources, and Internet marketing.

Kompass: http://www.kompass.com/. Addresses and business information of 1.5 million companies worldwide.

List of Economics Journals:

http://en.wikipedia.org/wiki/List_of_economics_journals

NASDAQ Stock Market: http://www.nasdaq.com

New York Stock Exchange: http://www.nyse.com

STAT-USA: http://www.usa.gov/Topics/Reference-Shelf/Data.shtml

Wall Street Executive Library: http://www.executivelibrary.com/. Business sites on newspapers, magazines, government, financial markets, company and industry, law, marketing and advertising, statistics, etc.

Wall Street Journal: http://online.wsj.com/public/us

Accounting

ARN: http://www.ssrn.com/update/arn/. The Accounting Research Network (ARN) was founded to increase communication among scholars and practitioners of accounting worldwide. ARN encourages the early distribution of research results by publishing abstracts of top quality research papers in three journals: *Auditing, Litigation and Tax Abstracts*, *Financial Accounting Abstracts*, and *Managerial Accounting Abstracts*. The journals publish abstracts of articles dealing with empirical, experimental, and theoretical research in financial and managerial accounting, auditing, and tax strategy. ARN is a division of the Social Science Research Network (SSRN).

Accounting terminology guide: http://www.nysscpa.org/glossary

AuditNet: http://www.auditnet.org/. A global resource for auditors.

Internal Auditing World Wide Web (IAWWW): http://www.bitwise.net/iawww/. A warehouse of information and knowledge pertaining to the internal auditing profession and functions across all associations, industries, and countries.

Management

Academy of Management: http://www.aomonline.org

Harvard Business Review: https://hbr.org/

Society for Human Resource Management: www.shrm.org

Sloan Management Review: http://sloanreview.mit.edu/

Financial economics

Behavioral Finance: http://www.behaviouralfinance.net/

CNN financial network: http://money.cnn.com

The Financial Economic Network (FEN) is a division of the Social Science Research Network (SSRN): http://www.ssrn.com/update/fen/

FINWeb: http://finweb.com/. FINWeb is a financial economics website managed by James R. Garven. The primary objective of FINWeb is to list Internet resources providing substantive information concerning economics and finance-related topics.

MFFAIS: http://www.mffais.com/. Mutual Fund Facts About Individual Stocks. A reference site that shows you (among other things) which and how many mutual funds sold shares in a specific company. And the only one that lists more than just the top ten fundholders of a company.

Morningstar, Inc. is a leading provider of independent investment research in North America, Europe, Australia, and Asia: http://www.morningstar.com/

Standard & Poor's Ratings Services provides market intelligence in the form of credit ratings, research: http://www.standardandpoors.com/en_US/web/guest/home

Marketing

The Marketing Science Institute is a nonprofit, membership-based organization dedicated to bridging the gap between academic marketing theory and business practice: http://www.msi.org/

Links to academic marketing journals: http://www.sfu.ca/~mvolker/biz/journal1.htm

KnowThis: http://www.knowthis.com/. Marketing virtual library, offering an objective and unbiased resource for marketing basics, market research, Internet marketing, marketing plans, advertising, and much more.

BIBLIOGRAPHICAL DATABASES

The following indexes help in compiling a comprehensive bibliography on business topics.

1. Bibliographic Index. A cumulative bibliography of bibliographies – an index that lists, by subject, sources of bibliographies.
2. Business Books in Print. This indexes, by author, title, and business subject, the books in print in the areas of finance, business, and economics.
3. Business Periodicals Index. This is a cumulative subject index covering 270 business periodicals.
4. Management Information Guide. This offers bibliographic references in many business areas.
5. Human Resource Management Abstracts. This is an index of articles that deal with the management of people and the subject area of organizational behavior.
6. Psychological Abstracts. This summarizes the literature in psychology, covering several hundred journals, reports, monographs, and other scientific documents.
7. Public Affairs Information Service Bulletin. This has a selective subject index of books, yearbooks, directories, government documents, pamphlets, and over a thousand periodicals relating to national and international economic and public affairs.
8. Work Related Abstracts. This contains abstracts of articles, dissertations, and books relating to labor, personnel, and organizational behavior.

APA FORMAT FOR REFERENCING RELEVANT ARTICLES

A distinction has to be made between a bibliography and references. A **bibliography** is a listing of work that is relevant to the main topic of research interest arranged in alphabetical order of the last names of the authors. A **reference list** is a subset of the bibliography, which includes details of all the citations used in the literature review and elsewhere in the paper, arranged, again, in alphabetical order of the last names of the authors. These citations have the goals of crediting the authors and enabling the reader to find the works cited.

At least three modes of referencing are followed in business research. These are based on the format provided in the *Publication Manual of the American Psychological Association* (APA) (2012), the *Chicago Manual of Style* (2010), and Turabian's *Manual for Writers* (2013). Each of these manuals specifies, with examples, how books, journals, newspapers, dissertations, and other materials are to be referenced in manuscripts. Since the APA format is followed for referencing by many journals in the management area, we will use this below to highlight the distinctions in how books, journals, newspaper articles, dissertations, and so on, are referenced. In the following section we will discuss how these references should be cited in the literature review section. All the citations mentioned in the research report will find a place in the References section at the end of the report.

Specimen format for citing different types of references (APA format)

Book by a single author

Leshin, C.B. (1997). *Management on the World Wide Web*. Englewood Cliffs, NJ: Prentice Hall.

Book by more than one author

Diener, E., Lucas, R., Schimmack, U., & Helliwell, J.F. (2009). *Well-being for public policy*. New York: Oxford University Press.

Book review

Nichols, P. (1998). A new look at Home Services [Review of the book Providing Home Services to the Elderly by Girch, S.]. *Family Review Bulletin*, 45, 12–13.

Chapter in an edited book

Riley, T., & Brecht, M.L. (1998). The success of the mentoring process. In R. Williams (Ed.), *Mentoring and career success*, pp. 129–150. New York: Wilson Press.

Conference proceedings publication

Sanderson, R., Albritton B., Schwemmer R., & Van de Sompel, H. (2011). Shared canvas: A collaborative model for medieval manuscript layout dissemination. Proceedings of the Eleventh ACM/IEEE Joint Conference on Digital Libraries, pp. 175–184. Ottawa, Ontario.

Doctoral dissertation

Hassan, M. (2014). *The Lives of micro-marketers: Why do some differentiate themselves from their competitors more than others?* Unpublished doctoral dissertation, University of Cambridge.

Edited book

Pennathur, A., Leong, F.T., & Schuster, K. (Eds.) (1998). *Style and substance of thinking*. New York: Publishers Paradise.

Edited book, digital, with DOI (Digital Object Identifier)[1]

Christiansen, S. (Ed.). (2007). Offenders' memories of violent crimes. doi: 10.1002/7980470713082.

Journal article

Jeanquart, S., & Peluchette, J. (1997). Diversity in the workforce and management models. *Journal of Social Work Studies*, 43 (3), 72–85.

Deffenbacher, J.L., Oetting, E.R., Lynch, R.S., & Morris, C.D. (1996). The expression of anger and its consequences. *Behavior Research and Therapy*, *34*, 575–590.

Journal article in press

Van Herpen, E., Pieters, R., & Zeelenberg, M. (2009). When demand accelerates demand: Trailing the bandwagon, *Journal of Consumer Psychology*.

Journal article with DOI

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[1] A Digital Object Identifier is a unique alphanumeric string assigned by a registration agency (the International DOI Foundation) to identify an object (such as an electronic document) and provide a persistent link to its location on the Internet. A publisher assigns a DOI when an article is published and made available electronically.

López-Vicente, M., Sunyer, J., Forns, J., Torrent, M., & Júlvez, J. (2014). Continuous Performance Test II outcomes in 11-year-old children with early ADHD symptoms: A longitudinal study. *Neuropsychology*, *28*, 202–211. http://dx.doi.org/10.1037/neu0000048

More than one book by the same author in the same year

Roy, A. (1998a). *Chaos theory*. New York: Macmillan Publishing Enterprises.

Roy, A. (1998b). *Classic chaos*. San Francisco, CA: Jossey-Bass.

Newspaper article, no author

QE faces challenge in Europe's junk bond market (2015, March 27). *Financial Times*, p. 22.

Paper presentation at conference

Bajaj, L.S. (1996, March 13). Practical tips for efficient work management. *Paper presented at the annual meeting of Entrepreneurs*, San Jose, CA.

Unpublished manuscript

Pringle, P.S. (1991). *Training and development in the '90s*. Unpublished manuscript, Southern Illinois University, Diamondale, IL.

Referencing non-print media

App

Skyscape. (2010). Skyscape Medical Resources (Version 1.9.11) [Mobile application software]. Retrieved from http://itunes.apple.com/

Conference proceeding from the Internet

Balakrishnan, R. (2006, March 25–26). *Why aren't we using 3d user interfaces, and will we ever?* Paper presented at the IEEE Symposium on 3D User Interfaces. doi:10.1109/VR.2006.148

Dictionary

Motivation. (n.d.). In Merriam-Webster's online dictionary (12th ed.). Retrieved from http://www.merriam-webster.com/dictionary/motivation

E-book

Diener, E., Lucas, R., Schimmack, U., & Helliwell, J.F. (2009). *Well-being for public policy* (New York: Oxford University Press). Retrieved from http://books.google.com

Electronic journal article

Campbell, A. (2007). Emotional intelligence, coping and psychological distress: A partial least squares approach to developing a predictive model. *E-Journal of Applied Psychology*, *3* (2), 39–54. Retrieved from http://ojs.lib.swin.edu.au/index.php/ejap/article/view/91/117

Message posted to online forum or discussion group

Davitz, J.R. (2009, February 21). How medieval and renaissance nobles were different from each other [Msg 131]. Message posted to http://groups.yahoo.com/group/Medieval_Saints/message/131

Online document

Frier, S. (2015, March 19). *Facebook shares hit record amid optimism for ads business*. Retrieved from http://www.bloomberg.com/news/articles/2015-03-19/facebook-shares-hit-record-amid-optimism-for-ads-business

Online document, no author identified, no date

GVU's 18th WWW customer survey. (n.d.). Retrieved 2009, March 24, from http://www.bb.gotech.edu/gvu/user-surveys/survey-2008-10/

Podcast

Raz, G. (TED Radio Hour Host). (2015, February 27). *Success (R)* [Audio podcast]. Retrieved from http://podbay.fm/show/523121474/e/1425015000?autostart=1

Report from private organization, available on organization's website

Philips UK. (2009, March 23). *U.S. Department of Energy honors Philips for significant advancement in LED lighting*. Retrieved March 2009, 24, from http://www.philips.co.uk/index.page

Streaming video (for instance from YouTube)

How2stats (2011, September 15). Cronbach's Alpha - SPSS (part 1) [Video file]. Retrieved from https://www.youtube.com/watch?v=2gHvHm2SE5s

Tweet

TIAS (@TIASNews). "Cooperative banks make the financial system more stable, says Professor Hans Groeneveld", buff.ly/1BwXNhR. 13 March 2015, 19.24 p.m. Tweet.

Wikipedia

Game theory (n.d.). In *Wikipedia*. Retrieved 2015, November 6, from http://en.wikipedia.org/wiki/Game_theory

REFERENCING AND QUOTATION IN THE LITERATURE REVIEW SECTION

Cite all references in the body of the paper using the author–year method of citation; that is, the surname of the author(s) and the year of publication are given in the appropriate places. Examples of this are as follows:

1. Todd (2015) found the more motivated students are . . .
2. More recent studies of transformational leadership (Hunt, 2014; Osborn, 2013) focus on . . .
3. In a follow-up study from 2013, Green demonstrates . . .

As can be seen from the above, if the name of the author appears as part of the narrative as in the case of 1, the year of publication alone has to be cited in parentheses. Note that in case 2, both the author and the year are cited in parentheses, separated by a comma. If the year and the author are a part of the textual discussion as in 3 above, the use of parentheses is not warranted.

Note also the following:

1. Within the same paragraph, you need not include the year after the first citation so long as the study cannot be confused with other studies cited in the article. An example of this is:
   - Lindgren (2009, p. 24) defines satisfaction as "the customer's fulfillment response. It is the judgment that a . . . service . . . provides a pleasurable level of consumption-related fulfillment." Lindgren finds that . . .
2. When a work is authored by *two* individuals, always cite both names every time the reference occurs in the text, as follows:
   - As Tucker and Snell (2014) pointed out . . .
   - As has been pointed out (Tucker & Snell, 2014), . . .
3. When a work has *more than two* authors but fewer than six authors, cite all authors the first time the reference occurs, and subsequently include only the surname of the first author followed by "*et al.*" as per the example below:
   - Bougie, Pieters, and Zeelenberg (2003) found . . . (first citation) Bougie *et al.* (2003) found . . . (subsequent citations)
4. When a work is authored by *six or more* individuals, cite only the surname of the first author followed by *et al.* and the year for the first and subsequent citations. Join the names in a multiple-author citation in running text by the word *and*. In parenthetical material, in tables, and in the reference list, join the names by an ampersand (&).

5. When a work has no author, cite in text the first two or three words of the article title. Use double quotation marks around the title of the article. For example, while referring to the newspaper article cited earlier, the text might read as follows:
   - There are limits to how risky investors want to get ("QE faces challenge," 2015), . . .
6. When a work's author is designated as "Anonymous," cite in text the word *Anonymous* followed by a comma and the date: (Anonymous, 2014). In the reference list, an anonymous work is alphabetized by the word *Anonymous*.
7. When the same author has several works published in the same year, cite them in the same order as they occur in the reference list, with the in press citations coming last. For example:
   - Research on Corporate Social Responsibility (Long, 1999, 2003, in press) indicates . . .
8. When more than one author has to be cited in the text, these should be in the alphabetical order of the first author's surname, and the citations should be separated by semicolons as per the illustration below:
   - In the job design literature (Aldag & Brief, 2007; Alderfer, 2009; Beatty, 1982; Jeanquart, 1999), . . .
9. Personal communication through letters, memos, telephone conversations, and the like, should be cited in the text only and not included in the reference list since these are not retrievable data. In the text, provide the initials as well as the surname of the communicator together with the date, as in the following example:
   - T. Peters (personal communication, June 15, 2013) feels . . .

In this section we have seen different modes of citation. We will next see how to include quotations from others in the text.

Quotations in text

Quotations should be given exactly as they appear in the source. The original wording, punctuation, spelling, and italics must be preserved even if they are erroneous. The citation of the source of a direct quotation should always include the page number(s) as well as the reference.

Use double quotation marks for quotations in text. Use single quotation marks to identify the material that was enclosed in double quotation marks in the original source. If you want to emphasize certain words in a quotation, underline them and immediately after the underlined words, insert within brackets the words: *italics added*. Use three ellipsis points (. . .) to indicate that you have omitted material from the original source. See the example that follows below.

If the quotation is of more than 40 words, set it in a free-standing style starting on a new line and indenting the left margin a further five spaces. Type the entire quotation double spaced on the new margin, indenting the first line of paragraphs five spaces from the new margin, as shown below.

For instance, Weiner (1998, p. 121) argues that:

> *Following the outcome of an event, there is initially a general positive or negative reaction (a "primitive" emotion) based on the perceived success or failure of that outcome (the "primary" appraisal). (. . .) Following the appraisal of the outcome, a causal ascription will be sought if that outcome was unexpected and/or important. A different set of emotions is then generated by the chosen attributions.*

If you intend publishing an article in which you have quoted extensively from a copyrighted work, it is important that you seek written permission from the owner of the copyright. Make sure that you also footnote the permission obtained with respect to the quoted material. Failure to do so may result in unpleasant consequences, including legal action taken through copyright protection laws.

CHAPTER 5

Theoretical framework and hypothesis development

LEARNING OBJECTIVES

After completing Chapter 5, you should be able to:

1. Discuss the need for a theoretical framework in deductive research.
2. Describe four main types of variables and identify and label variables associated with any given situation.
3. Develop a theoretical framework that includes all the relevant components.
4. Develop a set of hypotheses to be tested.
5. Demonstrate awareness of the role of the manager in the development of a theoretical framework.

INTRODUCTION

After a critical review of the literature you may be ready to develop a theoretical framework. A theoretical framework is the foundation of hypothetico-*deductive* research as it is the basis of the hypotheses that you will develop. Indeed, the development of a theoretical framework is crucial in *deductive, theory-testing, causal* research (but *not* in exploratory or descriptive research where one does not develop a theoretical framework to develop and test hypotheses).

This chapter highlights the importance of theory development in deductive research and explains how theory is developed. The chapter starts with a definition of a theoretical framework followed by a discussion on the need for a theoretical framework. It explains that a theoretical framework involves the identification of a network of relationships among variables considered important to the problem. Different types of variables on hypotheses development are reviewed at the end of this chapter.

As you proceed through this chapter, in various places you are instructed to work through certain exercises. Doing them at that time, before reading further, will help you in becoming adept at formulating theoretical frameworks in a logical manner without getting confused.

THE NEED FOR A THEORETICAL FRAMEWORK

A **theoretical framework** represents your beliefs on *how* certain phenomena (or variables or concepts) are related to each other (a model) and an explanation of *why* you believe that these variables are associated with each other (a theory). Both the model and the theory flow logically from the documentation of previous research in the problem area. Integrating your logical beliefs with published research, taking into consideration the boundaries and constraints governing the situation, is pivotal in developing a scientific basis for investigating the research problem.

The process of building a theoretical framework includes:

1. Introducing definitions of the concepts or variables in your model.
2. Developing a conceptual model that provides a descriptive representation of your theory.
3. Coming up with a theory that provides an explanation for relationships between the variables in your model.

From the theoretical framework, then, testable hypotheses can be developed to examine whether your theory is valid or not. The hypothesized relationships can thereafter be tested through appropriate statistical analyses. Hence, the entire *deductive* research project rests on the basis of the theoretical framework. Even if testable hypotheses are not necessarily generated (as in some applied research projects), developing a good theoretical framework is central to examining the problem under investigation.

Since a theoretical framework involves the identification of the network of relationships among the variables considered important to the study of any given problem situation, it is essential to understand what a variable means and what the different types of variables are.

VARIABLES

A **variable** is anything that can take on differing or varying values. The values can differ at various times for the same object or person, or at the same time for different objects or persons. Examples of variables are production units, absenteeism, and motivation.

EXAMPLE

Production units: One worker in the manufacturing department may produce one widget per minute, a second might produce two per minute, a third might produce five per minute. It is also possible that the same member might produce one widget the first minute and five the next minute. In both cases, the number of widgets produced has taken on different values, and is therefore a variable.

Absenteeism: Today, three members in the sales department may be absent; tomorrow, six members may not show up for work; the day after, there may be no one absent. The value can thus theoretically range from "zero" to "all" being absent, on the absenteeism variable.

Motivation: The levels of motivation of members to learn in the class or in a work team might take on varying values ranging from "very low" to "very high." An individual's motivation to learn from different classes or in different work teams might also take on differing values. Now, how one *measures* the level of motivation is an entirely different matter. The factor called motivation has to be reduced from its level of abstraction and operationalized in such a way that it becomes measurable. We will discuss this in Chapter 11.

Four main types of variables are discussed in this chapter[1]:

1. The dependent variable (also known as the criterion variable).
2. The independent variable (also known as the predictor variable).
3. The moderating variable.
4. The mediating variable.

Each of these variables can be discrete (e.g., male/female) or continuous (e.g., the age of an individual). Associated scale levels of variables are discussed in Chapter 12.

Dependent variable

The **dependent variable** is the variable of primary interest to the researcher. The researcher's goal is to understand and describe the dependent variable, or to explain its variability, or predict it. In other words, it is the main variable that lends itself for investigation as a viable factor. Through the analysis of the dependent variable (i.e., finding what variables influence it), it is possible to find answers or solutions to the problem. For this purpose, the researcher will be interested in quantifying and measuring the dependent variable, as well as the other variables that influence this variable.

EXAMPLE

A manager is concerned that the sales of a new product, introduced after test marketing it, do not meet with his expectations. The dependent variable here is "sales." Since the sales of the product can vary – they can be low, medium, or high – it is a variable; since sales is the main focus of interest to the manager, it is the dependent variable.

A basic researcher is interested in investigating the debt-to-equity ratio of manufacturing companies in southern Germany. Here, the dependent variable is the ratio of debt to equity.

A vice president is concerned that the employees are not loyal to the organization and, in fact, seem to switch their loyalty to other institutions. The dependent variable in this case is "organizational loyalty." Here again, there is variance found in the levels of organizational loyalty of employees. The vice president might want to know what accounts for the variance in the loyalty of organizational members with a view to controlling it. If he finds that increased pay levels would ensure their loyalty and retention, he can then offer inducement to employees by way of pay rises, which will help control the variability in organizational loyalty and keep them in the organization.

It is possible to have more than one dependent variable in a study. For example, there is always a tussle between quality and volume of output, low-cost production and customer satisfaction, and so on. In such cases, the manager is interested to know the factors that influence all the dependent variables of interest and how some of them might differ in regard to different dependent variables. These investigations may call for multivariate statistical analyses.

Now do Exercise 5.1 and Exercise 5.2.

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[1] Extraneous variables that confound cause-and-effect relationships are discussed in Chapter 10 on Experimental Designs.

EXERCISE 5.1

Research in behavioral finance has shown that overconfidence can cause investors to underreact to new information.
What is the dependent variable in this case?

EXERCISE 5.2

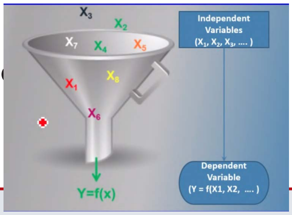
A marketing manager believes that limiting the availability of a product increases product desirability.
What is the dependent variable here?

Independent variable

It is generally conjectured that an **independent variable** is one that influences the dependent variable in either a positive or negative way. That is, when the independent variable is present, the dependent variable is also present, and with each unit of increase in the independent variable, there is an increase or decrease in the dependent variable. In other words, the variance in the dependent variable is accounted for by the independent variable. To establish that a change in the independent variable *causes* a change in the dependent variable, *all four* of the following conditions should be met:

1. The independent and the dependent variable should covary: in other words, a change in the dependent variable should be associated with a change in the independent variable.
2. The independent variable (the presumed causal factor) should precede the dependent variable. In other words, there must be a time sequence in which the two occur: the cause must occur before the effect.
3. No other factor should be a possible cause of the change in the dependent variable. Hence, the researcher should *control for* the effects of other variables.
4. A logical explanation (a theory) is needed and it must explain why the independent variable affects the dependent variable.

Because of the time sequence condition, experimental designs, described in to establish causal relationships.


X_3
X_2
X_7
X_4
X_5
X_8
X_1
X_6
Y=f(x)
Independent Variables (X_1, X_2, X_3, ...)
Dependent Variable (Y = f(X1, X2, ...)

EXAMPLE

Research studies indicate that successful new product development has an influence on the stock market price of the company. That is, the more successful the new product turns out to be, the higher will be the stock market price of that firm. Therefore, the "success of the new product" is the *independent variable*, and "stock market price" the *dependent variable*. The degree of perceived success of the new product developed will explain the variance in the stock market price of the company. This relationship and the labeling of the variables are illustrated in Figure 5.1.

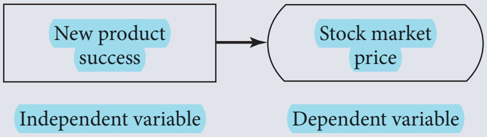


FIGURE 5.1

Diagram of the relationship between the independent variable (new product success) and the dependent variable (stock market price)

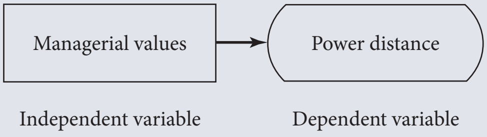


FIGURE 5.2

Diagram of the relationship between the independent variable (managerial values) and the dependent variable (power distance)

Cross-cultural research indicates that managerial values govern the power distance between superiors and subordinates. Here, power distance (i.e., egalitarian interactions between the boss and the employee, versus the high-power superior in limited interaction with the low-power subordinate) is the subject of interest and hence the dependent variable. Managerial values that explain the variance in power distance comprise the independent variable. This relationship is illustrated in Figure 5.2.

Now do Exercise 5.3 and Exercise 5.4. List the variables in these two exercises individually, and label them as dependent or independent, explaining why they are so labeled. Create diagrams to illustrate the relationships.

EXERCISE 5.3

An investor believes that more information increases the accuracy of his forecasts.

EXERCISE 5.4

A marketing manager believes that selecting physically attractive spokespersons and models to endorse their products increases the persuasiveness of a message.

Moderating variable

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: The moderating variable**.

The **moderating variable** is one that has a strong *contingent* effect on the independent variable–dependent variable relationship. That is, the presence of a third variable (the moderating variable) modifies the original relationship between the independent and the dependent variables. This becomes clear through the following examples.

EXAMPLE

It has been found that there is a relationship between the availability of reference manuals that manufacturing employees have access to and the product rejects. That is, when workers follow the procedures laid down in the manual, they are able to manufacture products that are flawless. This relationship is illustrated in Figure 5.3(a). Although this relationship can be said to hold true generally for all workers, it is nevertheless contingent on the inclination or urge of the employees to look in the manual every time a new procedure is to be adopted. In other words, only those who have the interest and urge to refer to the manual every time a new process is adopted will produce flawless products. Others who do not consult the manual will not benefit and will continue to produce defective products. This influence of the attributes of the worker on the relationship between the independent and the dependent variables can be illustrated as shown in Figure 5.3(b).

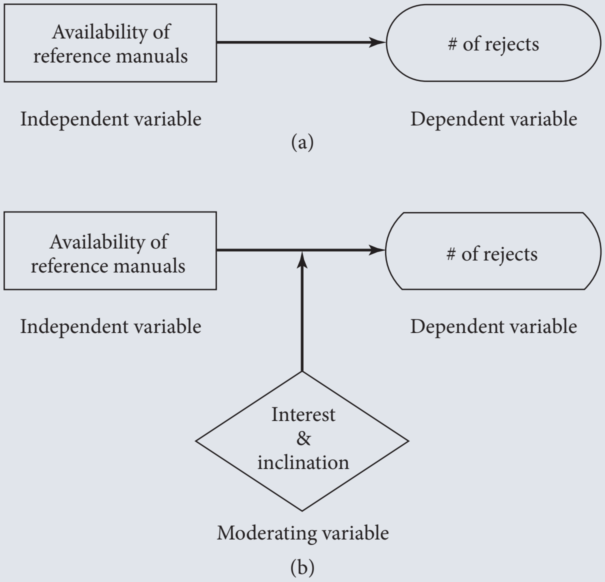

Availability of reference manuals
# of rejects
Independent variable
Dependent variable
(a)
Availability of reference manuals
# of rejects
Independent variable
Dependent variable
Interest & inclination
Moderating variable
(b)

FIGURE 5.3

(a) Diagram of the relationship between the independent variable (availability of reference manuals) and the dependent variable (rejects); (b) diagram of the relationship between the independent variable (availability of reference materials) and the dependent variable (rejects) as moderated by the moderating variable (interest and inclination)

As in the above case, whenever the relationship between the independent variable and the dependent variable becomes contingent or dependent on another variable, we say that the third variable has a moderating effect on the independent variable–dependent variable relationship. The variable that moderates the relationship is known as the moderating variable.

EXAMPLE

Let us take another example of a moderating variable. A prevalent theory is that the diversity of the workforce (comprising people of different ethnic origins, races, and nationalities) contributes more to organizational effectiveness because each group brings its own special expertise and skills to the workplace. This synergy can be exploited, however, only if managers know how to harness the special talents of the diverse work group; otherwise they will remain untapped. In the above scenario, organizational effectiveness is the dependent variable, which is positively influenced by workforce diversity – the independent variable. However, to harness the potential, managers must know how to encourage and coordinate the talents of the various groups to make things work. If not, the synergy will not be tapped. In other words, the effective utilization of different talents, perspectives, and eclectic problem-solving capabilities for enhanced organizational effectiveness is contingent on the skill of the managers in acting as catalysts. This managerial expertise then becomes the moderating variable. These relationships can be depicted as in Figure 5.4.

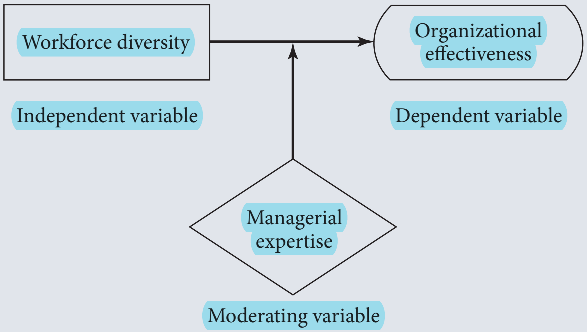


FIGURE 5.4

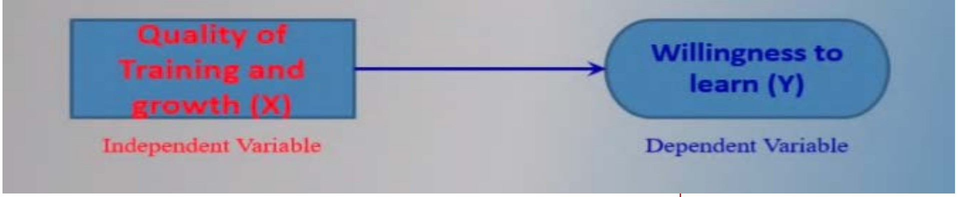
Diagram of the relationship among the three variables: workforce diversity, organizational effectiveness, and managerial expertise

The distinction between an independent variable and a moderating variable

At times, confusion is likely to arise as to when a variable is to be treated as an independent variable and when it becomes a moderating variable. For instance, there may be two situations as follows:

1. A research study indicates that the better the quality of the training programs in an organization and the greater the growth needs of the employees (i.e., where the need to develop and grow on the job is strong), the greater is their willingness to learn new ways of doing things.
2. Another research study indicates that the willingness of the employees to learn new ways of doing things is *not* influenced by the quality of the training programs offered by the organizations to *all* people without any distinction. Only those with high growth needs seem to have the yearning to learn to do new things through specialized training.

In the above two situations, we have the same three variables. In the first case, the training programs and growth need strength are the independent variables that influence employees' willingness to learn, this latter being the dependent variable. In the second case, however, the quality of the training program is the independent variable, and while the dependent variable remains the same, growth need strength becomes a moderating variable. In other words, only those with high growth needs show a greater willingness and adaptability to learn to do new things when the quality of the training program is improved. Thus, the relationship between the independent and dependent variables has now become contingent on the existence of a moderator.


Quality of Training and growth (X)
Independent Variable
Willingness to learn (Y)
Dependent Variable

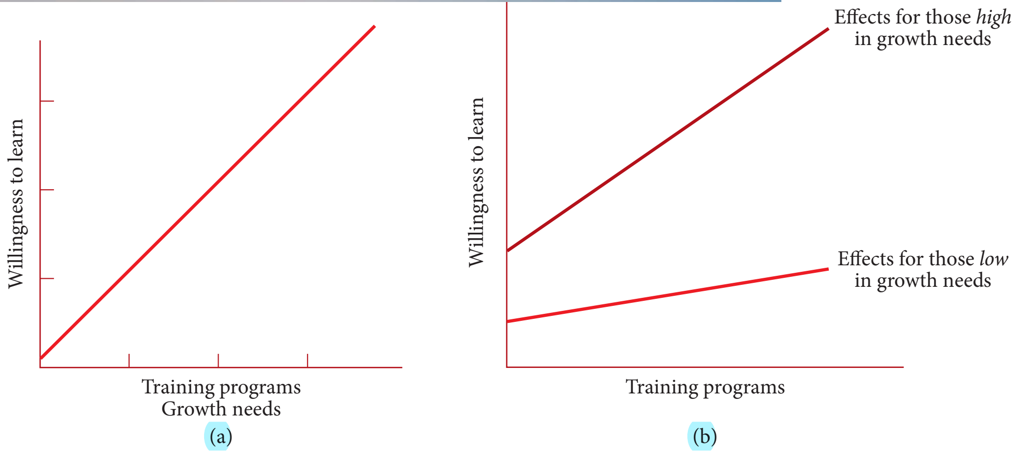
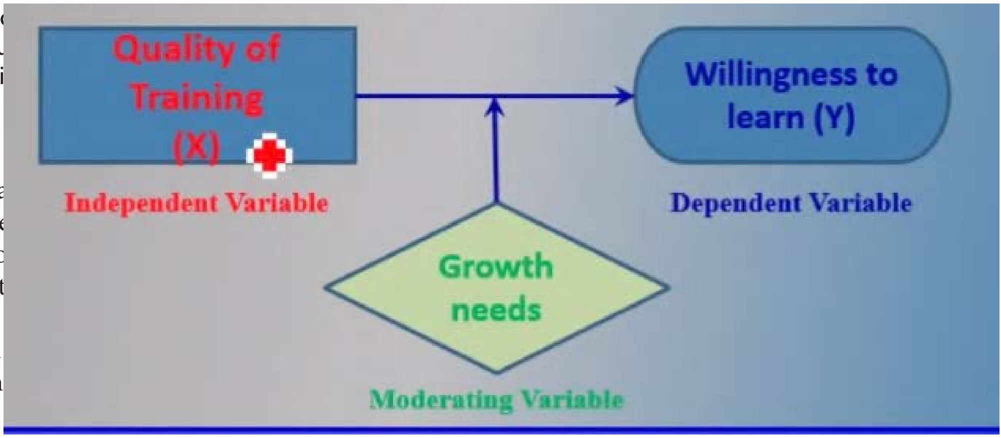


FIGURE 5.5

(a) Illustration of the influence
operates in the situation; (b) illu
a moderating variable is operati


Quality of Training (X)
Independent Variable
Willingness to learn (Y)
Dependent Variable
Growth needs
Moderating Variable

The above illustration ma
whether to label them depende
ferences between the effects c
Figures 5.5(a) and 5.5(b). Not
Figure 5.5(b).

Now do Exercise 5.5 and
illustrate by means of diagram

EXERCISE 5.5

A manager finds that off-the-job classroom training has a great impact on the productivity of the employees in her department. However, she also observes that employees over 60 years of age do not seem to derive much benefit and do not improve with such training.

EXERCISE 5.6

A manager of an insurance company finds that “fear appeals” in commercials are positively associated with consumers’ behavioral intentions to insure their house. This effect is particularly strong for people with a high inherent level of anxiety.

Mediating variable

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: The mediating variable**.

A **mediating variable** (or **intervening variable**) is one that surfaces between the time the independent variables start operating to influence the dependent variable and the time their impact is felt on it. There is thus a temporal quality or time dimension to the mediating variable. In other words, bringing a mediating variable into play helps you to model a *process*. The mediating variable surfaces as a function of the independent variable(s) operating in any situation, and helps to conceptualize and explain the influence of the independent variable(s) on the dependent variable. The following example illustrates this point.

EXAMPLE

In the previous example, where the independent variable (workforce diversity) influences the dependent variable (organizational effectiveness), the mediating variable that surfaces as a function of the diversity in the workforce is "creative synergy." This creative synergy results from a multiethnic, multiracial, and multinational (i.e., diverse) workforce interacting and bringing together their multifaceted expertise in problem solving. This helps us to understand how organizational effectiveness can result from having diversity in the workforce. Note that creative synergy, the mediating variable, surfaces at time t_2, as a function of workforce diversity, which was in place at time t_1, to bring about organizational effectiveness in time t_3. The mediating variable of creative synergy helps us to conceptualize and understand how workforce diversity brings about organizational effectiveness. The dynamics of these relationships are illustrated in Figure 5.6.

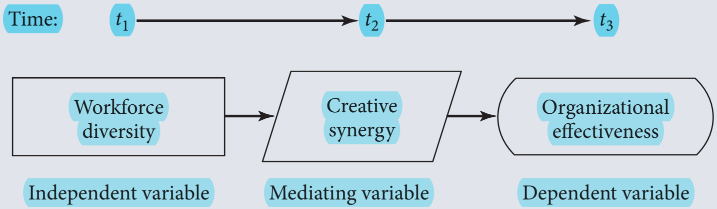


FIGURE 5.6

Diagram of the relationship among the independent, mediating, and dependent variables

It would be interesting to see how the inclusion of the moderating variable, "managerial expertise" in the foregoing example, would change the model or affect the relationships. The new set of relationships that would emerge in the presence of the moderator is depicted in Figure 5.7. As can be seen, managerial expertise moderates the relationship between workforce diversity and creative synergy. In other words, creative synergy will not

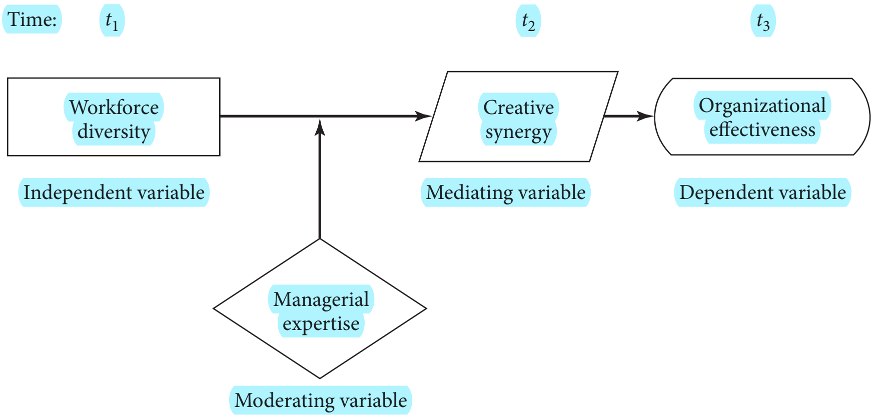


FIGURE 5.7

Diagram of the relationship among the independent, mediating, moderating, and dependent variables

result from the multifaceted problem-solving skills of the diverse workforce unless the manager is capable of harnessing that synergy by creatively coordinating the different skills. If the manager lacks the expertise to perform this role, then no matter how many different problem-solving skills the diverse workforce might have, synergy will just not surface. Instead of functioning effectively, the organization might just remain static, or even deteriorate.

It is now easy to see what the differences are among an independent variable, a mediating variable, and a moderating variable. The **independent variable** helps to *explain* the variance in the dependent variable; the **mediating variable** *surfaces at time* t_2 as a function of the independent variable, which also helps us to conceptualize the relationship between the independent and dependent variables; and the **moderating variable** has a *contingent effect* on the relationship between two variables. To put it differently, while the independent variable explains the variance in the dependent variable, the mediating variable does not add to the variance already explained by the independent variable, whereas the moderating variable has an interaction effect with the independent variable in explaining the variance. That is, unless the moderating variable is present, the theorized relationship between the other two variables considered will not hold.

Whether a variable is an independent variable, a dependent variable, a mediating variable, or a moderating variable should be determined by a careful reading of the dynamics operating in any given situation. For instance, a variable such as motivation to work could be a dependent variable, an independent variable, a mediating variable, or a moderating variable, depending on the theoretical model that is being advanced.

Now do Exercise 5.7, Exercise 5.8, and Exercise 5.9.

EXERCISE 5.7

Make up three different situations in which motivation to work would be an independent variable, a mediating variable, and a moderating variable.

EXERCISE 5.8

Failure to follow accounting principles causes immense confusion, which in turn creates a number of problems for the organization. Those with vast experience in bookkeeping, however, are able to avert the problems by taking timely corrective action. List and label the variables in this situation, explain the relationships among the variables, and illustrate these by means of diagrams.

EXERCISE 5.9

A store manager observes that the morale of employees in her supermarket is low. She thinks that if their working conditions are improved, pay scales raised, and the vacation benefits made more attractive, the morale will be boosted. She doubts, however, if an increase in pay scales would raise the morale of all employees. Her conjecture is that those who have supplemental incomes will just not be "turned on" by higher pay, and only those without side incomes will be happy with increased pay, with a resultant boost in morale. List and label the variables in this situation. Explain the relationships among the variables and illustrate them by means of diagrams. What might be the problem statement or problem definition for the situation?

HOW THEORY IS GENERATED

Having examined the different kinds of variables that can operate in a situation and how the relationships among these can be established, it is now possible to see how we can develop the theoretical framework for our research.

The theoretical framework is the foundation on which the entire deductive research project is based. It is a logically developed, described, and elaborated network of associations among the variables deemed relevant to the problem situation and identified through such processes as interviews, observations, and literature review. Experience and intuition also guide the development of the theoretical framework.

It becomes evident at this stage that, to arrive at good solutions to the problem, one should first correctly identify the problem, and then the variables that contribute to it. The importance of doing a thorough literature review and conducting exploratory and inductive research now becomes clear. After identifying the appropriate variables, the next step is to elaborate the network of associations among the variables, so that relevant hypotheses can be developed and subsequently tested. Based on the results of hypothesis testing (which indicate whether or not the hypotheses have been supported), the extent to which the problem can be solved becomes evident. The theoretical framework is thus an important step in the research process.

The relationship between the literature review and the theoretical framework is that the former provides a solid foundation for developing the latter. That is, the literature review identifies the variables that might be important, as determined by previous research findings. This, in addition to other logical connections that can be conceptualized, forms the basis for the theoretical model. The theoretical framework represents and elaborates the relationships among the variables, explains the theory underlying these relations, and describes the nature and direction of the relationships. Just as the literature review sets the stage for a good theoretical framework, this in turn provides the logical base for developing testable hypotheses.

The components of the theoretical framework

A good theoretical framework identifies and defines the important variables in the situation that are relevant to the problem and subsequently describes and explains the interconnections among these variables. The relationships among the independent variables, the dependent variable(s), and, if applicable, the moderating and mediating variables are elaborated. Should there be any moderating variable(s), it is important to explain how and what specific relationships they moderate. An explanation of why they operate as moderators should also be offered. If there are any mediating variables, a discussion on how or why they are treated as mediating variables is necessary. Any interrelationships among the independent variables themselves, or among the dependent variables themselves (in case there are two or more dependent variables), should also be clearly spelled out and adequately explained. Note that a good theoretical framework is not necessarily a complex framework.

Earlier in this chapter, we have already explained that there are three basic features that should be incorporated in any theoretical framework:

1. The variables considered relevant to the study should be clearly defined.
2. A conceptual model that describes the relationships between the variables in the model should be given.
3. There should be a clear explanation of why we expect these relationships to exist.

It is not always easy to come up with generally agreed-upon *definitions* of the relevant variables. More often than not, there are many definitions available in the literature (for instance, there are literally dozens of definitions of "brand image," "customer satisfaction," and "service quality" available in the marketing literature). Still, well-chosen guiding definitions of concepts are needed, because they will help you to provide an explanation for the relationships between the variables in your model. What's more, they will also serve as a basis for the operationalization or measurement of your concepts in the data collection stage of the research process. Hence, you will have to choose a useful definition from the literature (do not use dictionary definitions, they are usually too general). It is also important that you explain why you have chosen a particular definition as your guiding definition.

A *conceptual model* helps you to structure your discussion of the literature. A conceptual model describes your ideas about how the concepts (variables) in your model are related to each other. A schematic diagram of the conceptual model helps the reader to visualize the theorized relationships between the variables in your model and thus to obtain a quick idea about how you think that the management problem can be solved. Hence, conceptual models are often expressed in this form. However, relationships between variables can also be adequately expressed in words. Both a schematic diagram of the conceptual model and a description of the relationships between the variables in words should be given, so that the reader can see and easily comprehend the theorized relationships. This facilitates and stimulates discussion about the relationships between the variables in your model. It is therefore important that your model is based on a sound theory.

A theory or a clear explanation for the relationships in your model is the last component of the theoretical framework. A theory attempts to explain relationships between the variables in your model: an explanation should be provided for all the important relationships that are theorized to exist among the variables. If the nature and direction of the relationships can be theorized on the basis of the findings of previous research and/or your own ideas on the subject, then there should also be an indication as to whether the relationships should be positive or negative and linear or nonlinear. From the theoretical framework, then, testable hypotheses can be developed to examine whether the theory formulated is valid or not.

Note that you do not necessarily have to "invent" a new theory every time you are undertaking a research project. In an applied research context you apply existing theories to a specific context. This means that arguments can be drawn from previous research. However, in a basic research context you will make some contribution to existing theories and models. In such a case, it is not (always) possible to use existing theories or explanations for relationships between variables. As a result, you will have to rely on your own insights and ideas.

Now do Exercise 5.10.

EXERCISE 5.10

Avatars are virtual characters that can be used as representatives of a company that is using the Internet as a distribution channel. For instance, avatars can be used as shopping assistants, website guides, or as identification figures. A manager of an online company believes that avatar-mediated communication will have a positive effect on satisfaction with her company and on purchase intentions of consumers, because avatars enhance the value of information provided on the website and increase the pleasure of the shopping experience. She also believes that the positive effect of the perceived information value on satisfaction with the company and purchase intentions is stronger when customers are highly involved. Develop a theoretical framework for this situation after stating what the problem definition of the researcher would be in this case.

HYPOTHESIS DEVELOPMENT

Once we have identified the important variables in a situation and established the relationships among them through logical reasoning in the theoretical framework, we are in a position to test whether the relationships that have been theorized do, in fact, hold true. By testing these relationships scientifically through appropriate statistical analyses, or through negative case analysis in qualitative research (described later in the chapter), we are able to obtain reliable information on what kinds of relationships exist among the variables operating in the problem situation. The results of these tests offer us some clues as to what could be changed in the situation to solve the problem. Formulating such testable statements is called *hypothesis development*.

Definition of a hypothesis

A **hypothesis** can be defined as a tentative, yet testable, statement, which predicts what you expect to find in your empirical data. Hypotheses are derived from the theory on which your conceptual model is based and are often relational in nature. Along these lines, hypotheses can be defined as logically conjectured relationships between two or more variables expressed in the form of testable statements. By testing the hypotheses and confirming the conjectured relationships, it is expected that solutions can be found to correct the problem encountered.

EXAMPLE

Several testable statements or hypotheses can be drawn from the example depicted in Figure 5.4. One of them might be:

> ***Workforce diversity has a positive effect on organizational effectiveness.***

The above is a testable statement. By measuring the extent of workforce diversity and organizational effectiveness, we can statistically examine the relationship between these two variables to see if there is a significant (positive) correlation between the two. If we do find this to be the case, then the hypothesis is substantiated. If a significant correlation is not found, then the hypothesis has not been substantiated. By convention in the social sciences, to call a relationship "statistically significant," we should be confident that 95 times out of 100 the observed relationship will hold true. There should be only a 5% chance that the relationship will not be detected.

Statement of hypotheses: formats

If–then statements

As already stated, a hypothesis can be defined as a testable statement of the relationship among variables. A hypothesis can also test whether there are differences between two groups (or among several groups) with respect to any variable or variables. To examine whether or not the conjectured relationships or differences exist, these hypotheses can be set either as propositions or in the form of *if–then statements*. The two formats can be seen in the following two examples.

> ***Young women will be more likely to express dissatisfaction with their body weight, when they are more frequently exposed to images of thin models in advertisements.***

> ***If young women are more frequently exposed to images of thin models in advertisements, then they will be more likely to express dissatisfaction with their body weight.***

Directional and nondirectional hypotheses

If, in stating the relationship between two variables or comparing two groups, terms such as *positive*, *negative*, *more than*, *less than*, and the like are used, then these are **directional hypotheses** because the direction of the relationship between the variables (positive/negative) is indicated, as in the first example below, or the nature of the difference between two groups on a variable (more than/less than) is postulated, as in the second example.

> ***The greater the stress experienced in the job, the lower the job satisfaction of employees.***

> ***Women are more motivated than men.***

On the other hand, **nondirectional hypotheses** are those that do postulate a relationship or difference, but offer no indication of the direction of these relationships or differences. In other words, though it may be conjectured that there is a significant relationship between two variables, we may not be able to say whether the relationship is positive or negative, as in the first example below. Likewise, even if we can conjecture that there will be differences between two groups on a particular variable, we may not be able to say which group will be more and which less on that variable, as in the second example.

> ***There is a relation between arousal-seeking tendency and consumer preferences for complex product designs.***

> ***There is a difference between the work ethic values of American and Asian employees.***

Nondirectional hypotheses are formulated either because the relationships or differences have never been explored, and hence there is no basis for indicating the direction, or because there have been conflicting findings in previous research studies on the variables. In some studies a positive relationship might have been found, while in others a negative relationship might have been traced. Hence, the current researcher might only be able to hypothesize that there is a significant relationship, but the direction may not be clear. In such cases, the hypotheses can be stated nondirectionally. Note that in the first example there is no clue as to whether arousal-seeking tendency and preferences for complex product designs are positively or negatively correlated, and in the second example we do not know whether the work ethic values are stronger in Americans or in Asians. However, it would have been possible to state that arousal-seeking tendency and preferences for complex product designs are positively correlated, since previous research has indicated such a relationship. Whenever the direction of the relationship is known, it is better to develop directional hypotheses for reasons that will become clear in our discussions in a later chapter.

Null and alternate hypotheses

The hypothetico-deductive method requires that hypotheses are falsifiable: they must be written in such a way that other researchers can show them to be false. For this reason, hypotheses are sometimes accompanied by null hypotheses. A **null hypothesis** (H_0) is a hypothesis set up to be rejected in order to support an alternate hypothesis, labeled H_A. When used, the null hypothesis is presumed true until statistical evidence, in the form of a hypothesis test, indicates otherwise. For instance, the null hypothesis may state that advertising does not affect sales, or that women and men buy equal amounts of shoes. In more general terms, the null hypothesis may state that the correlation between two variables is equal to zero or that the difference in the means of two groups in the population is equal to zero (or some other *definite* number). Typically, the null statement is expressed in terms of there being no (*significant*) relationship between two variables or no (*significant*) difference between two groups. The **alternate hypothesis**, which is the opposite of the null, is a statement expressing a relationship between two variables or indicating differences between groups.

To explain further, in setting up the null hypothesis, we are stating that there is no difference between what we might find in the population characteristics (i.e., the total group we are interested in knowing something about) and the sample we are studying (i.e., a limited number representative of the total population or group that we have chosen to study). Since we do not know the true state of affairs in the population, all we can do is to draw inferences based on what we find in our sample. What we imply through the null hypothesis is that any differences found between two sample groups or any relationships found between two variables based on our sample are simply due to random sampling fluctuations and not due to any "true" differences between the two population groups (say, men and women), or relationships between two variables (say, sales and profits). The null hypothesis is thus formulated so that it can be tested for possible rejection. If we reject the null hypothesis, then all permissible alternate hypotheses relating to the particular relationship tested could be supported. It is the theory that allows us to have faith in the alternate hypothesis that is generated in the particular research investigation. This is one more reason why the theoretical framework should be grounded on sound, defendable logic to start with. Otherwise, other researchers are likely to refute and postulate other defensible explanations through different alternate hypotheses.

The *null* hypothesis in respect of group differences stated in the example "*Women are more motivated than men*" would be:

$$H_0: \mu_M = \mu_W$$

or

$$H_0: \mu_M - \mu_W = 0$$

where H_0 represents the null hypothesis, μ_M is the mean motivational level of the men, and μ_W is the mean motivational level of the women.

The *alternate* for the above example would statistically be set as follows:

$$H_A\colon \mu_M < \mu_W$$

which is the same as

$$H_A\colon \mu_W > \mu_M$$

where H_A represents the alternate hypothesis and μ_M and μ_W are the mean motivation levels of men and women, respectively.

For the nondirectional hypothesis of mean group differences in work ethic values in the example "*There is a difference between the work ethic values of American and Asian employees*," the null hypothesis would be:

$$H_0\colon \mu_{AM} = \mu_{AS}$$

or

$$H_0\colon \mu_{AM} - \mu_{AS} = 0$$

where H_0 represents the null hypothesis, μ_{AM} is the mean work ethic value of Americans and μ_{AS} is the mean work ethic value of Asians.

The alternate hypothesis for the above example would statistically be set as:

$$H_A\colon \mu_{AM} \neq \mu_{AS}$$

where H_A represents the alternate hypothesis and μ_{AM} and μ_{AS} are the mean work ethic values of Americans and Asians, respectively.

The null hypothesis for the relationship between the two variables in the example "*The greater the stress experienced in the job, the lower the job satisfaction of employees*," would be H_0: There is no relationship between stress experienced on the job and the job satisfaction of employees. This would be statistically expressed by:

$$H_0\colon \rho = 0$$

where ρ represents the correlation between stress and job satisfaction, which in this case is equal to 0 (i.e., no correlation).

The alternate hypothesis for the above null, which has been expressed directionally, can be statistically expressed as:

$$H_A\colon \rho < 0 \left(\text{The correlation is negative.}\right)$$

For the example "*There is a relationship between age and job satisfaction*," which has been stated nondirectionally, the null hypothesis would be statistically expressed as:

$$H_0\colon \rho = 0$$

whereas the alternate hypothesis would be expressed as:

$$H_A: \rho \neq 0$$

Having formulated the null and alternate hypotheses, the appropriate statistical tests (*t*-tests, *F*-tests) can then be applied, which indicate whether or not support has been found for the alternate hypothesis – that is, that there is a significant difference between groups or that there is a significant relationship between variables, as hypothesized.

The steps to be followed in hypothesis testing are:

1. State the null and the alternate hypotheses.
2. Choose the appropriate statistical test depending on whether the data collected are parametric or nonparametric.
3. Determine the level of significance desired ($p = 0.05$, or more, or less).
4. See if the output results from computer analysis indicate that the significance level is met. If, as in the case of Pearson correlation analysis in Excel software, the significance level is not indicated in the printout, look up the critical values that define the regions of acceptance on the appropriate table (i.e., (t, F, χ^2) – see the statistical tables at the end of this book). This critical value demarcates the region of rejection from that of acceptance of the null hypothesis. When the resultant value is larger than the critical value, the null hypothesis is rejected, and the alternate accepted. If the calculated value is less than the critical value, the null is accepted and the alternate rejected.

Note that null hypotheses are rarely presented in research reports or journal articles.

Now do Exercise 5.11, Exercise 5.12, and Exercise 5.13.

EXERCISE 5.11

Create a diagram to illustrate the relationships between the relevant variables in Exercise 5.9 and develop five different hypotheses.

EXERCISE 5.12

A production manager is concerned about the low output levels of his employees. The articles that he has read on job performance frequently mention four variables as being important to job performance: (1) skills required for the job, (2) rewards, (3) motivation, and (4) satisfaction. In several of the articles it was also indicated that only if the rewards were (attractive) to the recipients did motivation, satisfaction, and job performance increase, not otherwise. Given this situation:

1. Define the problem.
2. Create a diagram.
3. Develop at least six hypotheses.

EXERCISE 5.13

A recent study has investigated the effect of corporate social responsibility (CSR) on the market value of the firm. This study developed and tested a conceptual framework, which posits that (1) customer satisfaction mediates the relationship between CSR and the market value of the firm, and (2) two firm factors ("innovativeness capability" and "product quality") moderate the relationship between CSR and customer satisfaction. For this situation, define the problem, draw a schematic diagram, and formulate the hypotheses.

Hypothesis testing is strongly associated with designing experiments and the collection of quantitative data. However, as exemplified by Box 5.1, hypotheses can also be tested with qualitative data.

BOX 5.1

HYPOTHESIS TESTING WITH QUALITATIVE RESEARCH: NEGATIVE CASE ANALYSIS

Hypotheses can also be tested with qualitative data. For example, let us say that, after extensive interviews, a researcher has developed the theoretical framework that unethical practices by employees are a function of their inability to discriminate between right and wrong, or due to a dire need for more money, or the organization's indifference to such practices. To test the hypothesis that these three factors are the primary ones that influence unethical practices, the researcher should look for data to refute the hypothesis. When even a single case does not support the hypothesis, the theory needs revision. Let us say that the researcher finds one case where an individual is deliberately engaged in the unethical practice of accepting kickbacks (despite the fact that he is knowledgeable enough to discriminate right from wrong, is not in need of money, and knows that the organization will not be indifferent to his behavior), simply because he wants to "get back" at the system, which "will not listen to his advice." This new discovery, through disconfirmation of the original hypothesis, known as *the negative case method*, enables the researcher to revise the theory and the hypothesis until such time as the theory becomes robust.

We have thus far seen how a critical literature review is done, theoretical frameworks are formulated, and hypotheses developed. Let us now illustrate this logical sequence through a small example where a researcher wants to examine the organizational factors influencing women's progress to top management positions. The literature review and the number of variables are deliberately kept small, since the purpose is merely to illustrate how a theoretical framework is developed from the literature review, and how hypotheses are developed based on the theoretical framework.

EXAMPLE

Literature review, theoretical framework, and hypothesis development

Introduction

"Fewer large companies are run by women than by men named John, a sure indicator that the glass ceiling remains firmly in place in corporate America" (Wolfers, 2015). Despite the spectacular increase in the number of managerial women during the last decades, the number of women in top management positions continues to be very small and static, suggesting a glass-ceiling effect that women still face (Lückerath-Rovers, 2013; Morrison, White & Vura, 1999; O'Neil, Hopkins & Bilimoria, 2008; Van Velsor, 2000). Given the demographics of the workplace, which projects that more and more women will enter the workforce in the future, it becomes important to examine the factors that might facilitate the advancement of women to top executive positions. This study is an effort to identify the factors that currently impede women's advancement to the top in organizations.

A brief literature review

It is often declared that since women have only recently embarked on careers and entered the managerial ranks, it will take more time for them to rise to top executive positions. However, many women in higher middle-management positions feel that there are at least two major stumbling blocks to their advancement: gender role stereotypes and inadequate access to critical information (Daniel, 1998; Koenig *et al.*, 2011; Schein, 2007; Welch, 2001).

Gender stereotypes, or sex-role stereotypes as they are also known, are societal beliefs that men are better suited for taking on leadership roles and positions of authority and power, whereas women are more suited for taking on nurturing and helping roles (DeArmond *et al.*, 2006; Eagly, 1989; Kahn & Crosby, 1998; Smith, 1999). These beliefs influence the positions that are assigned to organizational members. Whereas capable men are given line positions and developed to take on higher responsibilities and executive roles in the course of time, capable women are assigned to staff positions and dead-end jobs. With little exposure to management of budgets and opportunities for significant decision making, women are seldom groomed for top-level positions.

Women are also excluded from the "old boys" network because of their gender. Information exchange, development of career strategies, clues regarding access to resources, and such important information vital to upward mobility are thus lost to women (*The Chronicle*, 2000). While many other factors impinge on women's upward mobility, the two variables of gender-role stereotypes and exclusion from critical information are particularly detrimental to women's advancement to senior level positions.

Theoretical framework

The dependent variable of advancement of women to top management positions is influenced by gender-role stereotyping and access to critical information. These two variables are also interrelated as explained below.

Gender-role stereotypes adversely impact on women's career progress. Since women are perceived as ineffective leaders but good nurturers, they are not assigned line positions in their early careers but offered staff responsibilities. It is only in line positions that managers make significant decisions, control budgets, and interact with top-level executives who have an impact on their future careers. These opportunities to learn, grow and develop on the job, and gain visibility in the system help managers to advance to top-level positions. However, since women in staff positions do not gain these experiences or have the visibility to be identified as key people in the organization with the potential to be successful top managers, their advancement to top-level positions is never considered by the system and they are always overlooked. Thus, gender-role stereotypes hinder the progress of women to the top.

Gender-role stereotypes also hinder *access to information*. If women are not considered to be decision makers and leaders, but are perceived merely as support personnel, they will not be apprised of critical information essential for organizational advancement, since this is not seen as relevant for them. Exclusion from the networks where men informally interact with one another (golf courses, bars, and so on) precludes women from gaining access to crucial information and resources vital for their advancement. For example, many of the significant organizational changes and current events are discussed informally among men outside the work setting. Women are generally unaware of the most recent developments since they are not a part of the informal group that interacts and exchanges information away from the workplace. This definitely is a handicap. For example, knowledge of an impending vacancy for an executive position enables one to strategize to occupy that position. One can become a key contender by procuring critical information relevant to the position, get prepared to present the appropriate credentials to the right people at the right time, and thus pave the way for success. Thus, access to critical information is important for the progress of all, including women. When women do not have the critical information that is shared in informal networks, their chances of advancement to top positions also get severely restricted.

The foregoing relationships are shown schematically in Figure 5.8.

Hypotheses

1. *The greater the extent of gender-role stereotyping in organizations, the fewer will be the number of women at the top.*

2. *The effect of gender-role stereotyping on advancement of women to the top is partially mediated by access to information.*

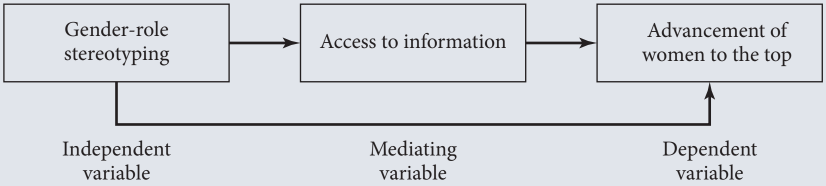


FIGURE 5.8

Schematic diagram of the example relating to women in managerial positions

MANAGERIAL IMPLICATIONS

Knowledge of how and for what purpose the theoretical framework is developed, and the hypotheses are generated, enables the manager to be an intelligent judge of the research report submitted by the consultant. At this juncture, it becomes clear that once the problem is defined, a good grasp of the concepts "independent variable" and "dependent variable" broadens the understanding of managers as to how multiple factors (the independent variables in the model) may provide possible solutions to the problem (the dependent variable in the model). An understanding of the concept "moderating variable" may allow the manager to understand that some of the proposed solutions may not solve the problem for everybody or in every situation. Likewise, knowledge of what significance means, and why a given hypothesis is either accepted or rejected, helps the manager to persist in or desist from following hunches, which, while making good sense, do not work. If such knowledge is absent, many of the findings through research will not make much sense to the manager and decision making will bristle with confusion.

SUMMARY

- **Learning objective 1: Discuss the need for a theoretical framework in deductive research.**
  A theoretical framework represents a researcher's beliefs on how certain phenomena (or variables or concepts) are related to each other (a model) and an explanation of why he or she believes that these variables are associated with each other (a theory). From a theoretical framework, testable hypotheses can be developed to examine whether a theory is valid or not. The entire deductive research project rests on the basis of the theoretical framework.

- **Learning objective 2: Describe four main types of variables and identify and label variables associated with any given situation.**
  Since a theoretical framework involves the identification of a network of relationships among the variables considered important to the study of any given problem situation, it is essential to understand what a variable means and what the different types of variables are. A variable is anything that can take on differing or varying values. Four main types of variables discussed in this chapter are: (1) the dependent variable; (2) the independent variable; (3) the moderating variable; and (4) the mediating variable.

- **Learning objective 3: Develop a theoretical framework that includes all the relevant components.**
  Three basic features that should be incorporated in any theoretical framework:

  - The variables considered relevant to the study should be clearly defined.
  - A conceptual model that describes the relationships between the variables in the model should be given.
  - There should be a clear explanation of why we expect these relationships to exist.

Just as the literature review sets the stage for a good theoretical framework, this in turn provides the logical base for developing testable hypotheses.

- **Learning objective 4: Develop a set of hypotheses to be tested.**
  Hypotheses are derived from the theory on which a conceptual model is based. They are often relational in nature. Along these lines, hypotheses can be defined as logically conjectured relationships between two or more variables expressed in the form of testable statements. By testing the hypotheses and confirming the conjectured relationships, it is expected that solutions can be found to correct the problem encountered.

- **Learning objective 5: Demonstrate awareness of the role of the manager in the development of a theoretical framework.**
  Knowledge of how and for what purpose the theoretical framework is developed and the hypotheses are generated enables the manager to be an intelligent judge of the research report submitted by the researcher.

In the next chapter we will examine a number of basic research design issues.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: The Social Network**.

DISCUSSION QUESTIONS

1. "Because literature review is a time-consuming exercise, a good, in-depth interview should suffice to develop a theoretical framework." Discuss this statement.
2. "Good models are complex. What's more, a good model should include both moderating and mediating variables." Discuss this statement.
3. "Academic researchers usually develop more complex and elaborate models than applied researchers." Discuss this statement.
4. "In an applied research context you do not need to explain the relationships between the variables in your conceptual model." Discuss this statement.
5. There is an advantage in stating the hypothesis both in the null and in the alternate; it adds clarity to our thinking of what we are testing. Explain.
6. It is advantageous to develop a directional hypothesis whenever we are sure of the predicted direction. How will you justify this statement?
7. In recent decades, many service markets have been liberalized. For this reason, incumbent service firms are facing new competitors and must address customer switching. You are discussing the determinants of customer switching with a service firm manager. She believes that product quality, relationship quality, and switching costs are important determinants of customer switching. You agree with the contention that product quality and relationship quality are important determinants of switching. However, you believe that switching costs *moderate* the relationships between product quality, relationship quality, and customer switching. Provide arguments for this contention.

8. For the following case:
   a. Identify the problem.
   b. Develop a diagram representing the conceptual model.
   c. Develop the hypotheses.

   Concerned about her current customer base, manager Andersen started to think of factors that might affect the attractiveness of an auditing firm. Of course, the service quality provided and the fees charged by the auditor seem two important factors. Next, she decides that the reputation of the auditing firm also needs to be included in the framework as an independent variable. As illustrated by the dramatic effects of recent auditing scandals, reputation seems especially important for large auditors (i.e., auditing firms that are large in size). Finally, manager Andersen also thinks that the proximity of the auditing firm to the customer is another variable to be included as an independent variable. Proximity very likely affects the possibility for the client to personally meet with the auditors on a regular basis and she knows from her own contact with customers that they perceive personal interactions as quite important.

9. Develop a conceptual model for the scenario below.

   Incidence of smoking in movies has started to increase again, after having declined for several decades. According to the National Cancer Institute, smoking is seen in at least three out of four contemporary box-office hits. What's more, identifiable cigarette brands appeared in about one-third of all movies in 2008. Exposure to smoking in movies is an important predictor of adolescent smoking initiation: smoking in movies has been shown to affect adolescents' intentions to start smoking. In turn, the intentions to start smoking are determined by a more positive attitude toward smoking after seeing a film character smoke. Recent research has revealed that the relationship between seeing a film character smoke and the attitude toward smoking is stronger when a person's identification with a film character increases. These findings are consistent with social learning theory, which predicts that attitudes and behaviors are modeled by observing the behaviors of others.

10. Develop a conceptual model for the following case.

    Once given, bonuses are extraordinarily hard to take away without undermining employee morale. The adverse effects of these cuts far outweigh the anticipated savings in dollars. Research has shown that when the reason behind the cuts is explained to employees, morale does not drop.

11. Product placement is a form of advertising in which a company's products and name are intentionally positioned in motion pictures, television programs, radio broadcasts, and the like. Product placement can take many forms: verbal mentions in dialogue; actual use by a character; or visual displays (for instance, a company logo on a vehicle or billboard). Develop a theoretical framework on this issue, based on a review of the current literature. This framework should include:
    a. a specification and definition of an appropriate dependent variable;
    b. a conceptual model that describes the relationships between the dependent variable, at least one independent variable, and either a moderating or a mediating variable;
    c. a theory on why you would expect these relationships to exist;
    d. an appropriate number of testable hypotheses.

PRACTICE PROJECT

For the topic you chose to work on for the project in Chapter 4, do the following:

- Go through the computer-generated bibliography again.
- Define a problem statement that, in your opinion, would be most useful for researchers to investigate.
- Carry out a literature review that would seem to offer the greatest potential for developing a good theoretical framework, using about five to seven references.
- Develop the theoretical framework incorporating its three basic features, as discussed in the chapter.
- Generate a set of testable hypotheses based on the theoretical framework.

CHAPTER 6

Elements of research design

LEARNING OBJECTIVES

After completing Chapter 6 you should be able to:

1. Explain what is meant by a research design.
2. Develop an appropriate research design for any given study.
3. Explain why a researcher might be constrained to settle for less than the "ideal" research design.
4. Demonstrate awareness of the role of the manager in the area of research design.

INTRODUCTION

Up to now you have made a great effort to:

- develop a problem statement;
- develop a research proposal;
- conduct a critical review of the literature;
- document your literature review; and
- (in deductive research) develop a theoretical framework and hypotheses.

The next step is to design the research in such a way that the requisite data can be gathered and analyzed to answer your research questions to be able to arrive at a solution for the problem that catalyzed the research project.

THE RESEARCH DESIGN

A **research design** is a blueprint or plan for the collection, measurement, and analysis of data, created to answer your research questions.

The various issues involved in the research design and discussed in this chapter are shown comprehensively in Figure 6.1. As may be seen, issues relating to decisions regarding the research strategy (for instance, experiments, surveys, case studies), the extent to which the study is manipulated and controlled by the researcher (extent of researcher interference), location (i.e., the study setting), the level at which the data will be analyzed (unit of analysis), and temporal aspects (the time horizon) are integral to research design. These issues are discussed in this chapter.

As shown in Figure 6.1, each component of the research design offers several critical choice points. Obviously, there is no single design that is superior in all circumstances. Instead, you will have to make choices and create a design that is suitable for the job at hand. The quality of a research design depends on how carefully you choose the appropriate design alternatives, taking into consideration the specific objectives, research questions, and constraints of the project, such as access to data, time, and/or money.

In addition to the decisions above regarding the research design, choices have to be made as to the data collection method to be used, the type of sample (sampling design), how variables will be measured (measurement), and how they will be analyzed to test the hypotheses (data analysis). These issues are discussed in subsequent chapters.

ELEMENTS OF RESEARCH DESIGN

Research strategies

A strategy is a plan for achieving a certain goal. A *research strategy* will help you to meet your research objective(s) and to answer the research questions of your study. The choice for a particular research strategy will therefore depend on the research objective(s) and (the type of) research questions of your study, but also on your viewpoint on what makes good research and on practical aspects such as access to data sources and time constraints.

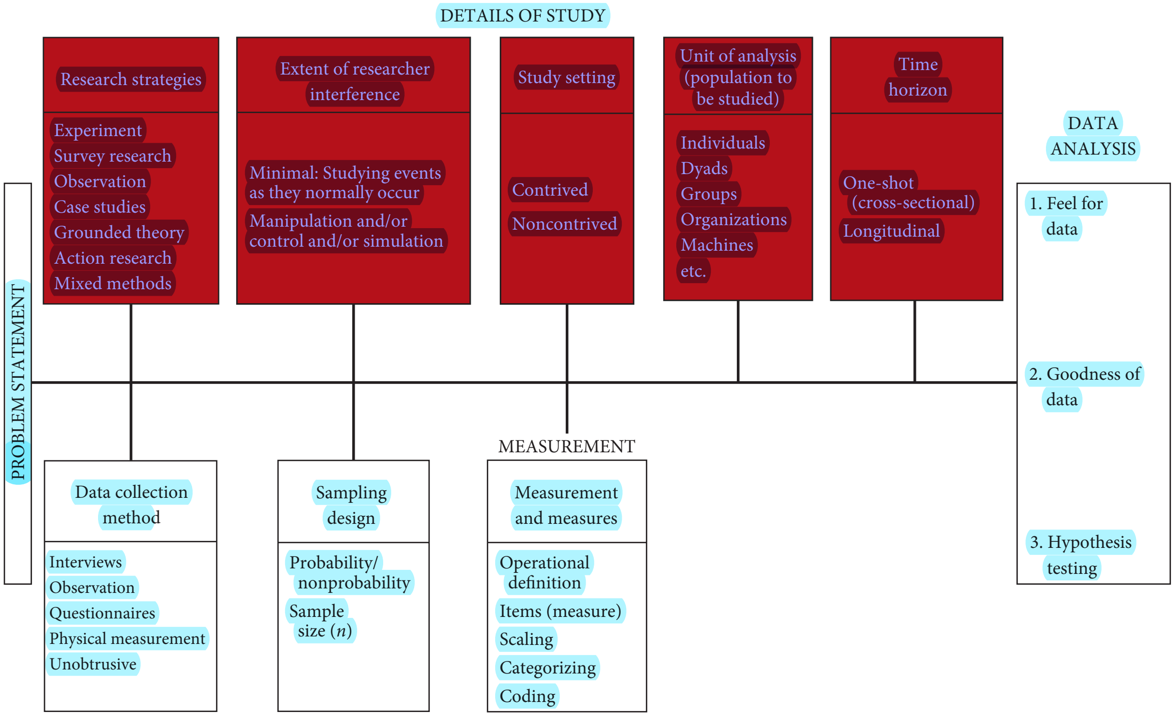

DETAILS OF STUDY
Research strategies
Experiment
Survey research
Observation
Case studies
Grounded theory
Action research
Mixed methods
Extent of researcher interference
Minimal: Studying events as they normally occur
Manipulation and/or control and/or simulation
Study setting
Contrived
Noncontrived
Unit of analysis (population to be studied)
Individuals
Dyads
Groups
Organizations
Machines
etc.
Time horizon
One-shot (cross-sectional)
Longitudinal
DATA ANALYSIS
1. Feel for data
2. Goodness of data
3. Hypothesis testing
PROBLEM STATEMENT
MEASUREMENT
Data collection method
Interviews
Observation
Questionnaires
Physical measurement
Unobtrusive
Sampling design
Probability/ nonprobability
Sample size (n)
Measurement and measures
Operational definition
Items (measure)
Scaling
Categorizing
Coding

FIGURE 6.1

The research design

In this section we will discuss the following research strategies: experiments, surveys, ethnography, case studies, grounded theory, and action research.

Experiments

Experiments are usually associated with a hypothetico-deductive approach to research. The purpose of an experiment is to study causal relationships between variables. Experimental designs are less useful or appropriate for answering exploratory and descriptive research questions.

In an experiment, the researcher *manipulates* the independent variable to study the effect of this manipulation on the dependent variable. In other words, the researcher deliberately changes a certain variable (or certain variables), for instance "reward system", to establish whether (and to what extent) this change will produce a change in another variable, in this example "productivity". The simplest experimental design is a two-group, post-test-only, randomized experiment, where one group gets a treatment, for instance "piece wages". The other group (the comparison group, in this example the "hourly wages" group) does not get the treatment. Subjects (workers) are randomly assigned to the groups and hence the researcher is able to determine whether the productivity of the two groups is different after the treatment. Later on in this chapter, we will have more to say about the extent of researcher interference with the study and the study setting. This will help us to make a distinction among field experiments and lab experiments. Chapter 10 discusses lab experiments and field experiments, manipulation, controlling "nuisance" variables, factors affecting the validity of experiments, and various types of experiments in considerable detail.

Under the right circumstances, an experimental design is a very strong design to use. However, experimental designs are not always feasible in an applied research context where the researcher tries to solve a management problem. For instance, we do not want (for obvious reasons) to assign customers to a low service quality treatment to study the effect of service quality on customer retention or assign workers to highly stressful situations to investigate the effect of work-related stress on personal and professional relations. In such cases, we may opt for an alternative research strategy to answer the research questions of their study.

Survey research

A **survey** is a *system* for collecting information from or about people to describe, compare, or explain their knowledge, attitudes, and behavior (Fink, 2003). The survey strategy is very popular in business research, because it allows the researcher to collect quantitative and qualitative data on many types of research questions. Indeed, surveys are commonly used in exploratory and descriptive research to collect data about people, events, or situations. For instance, in a business context, surveys are often taken on the subject of consumer decision making, customer satisfaction, job satisfaction, the use of health services, management information systems, and the like. A large number of such surveys are one-time surveys. Other surveys are continuing, allowing the researcher to observe changes over time. The questions in survey instruments are typically arranged into self-administered questionnaires that a respondent completes on his or her own, either on paper or via the computer. Other survey instruments are interviews and structured observation. Interviews, observation, and self-administered questionnaires are discussed in subsequent chapters. Interviews are discussed in Chapter 7, structured observation in Chapter 8, and self-administered questionnaires in Chapter 9.

Ethnography

Ethnography is a research strategy that has its roots in anthropology. It is a strategy in which the researcher "closely observes, records, and engages in the daily life of another culture [. . .] and then writes accounts of this culture, emphasizing descriptive detail" (Markus & Fischer, 1986, p. 18). Ethnography involves immersion in the particular culture of the social group that is being studied (such as, for instance, bankers in the City of London), observing behavior, listening to what is said in conversations, and asking questions. It thus aims to generate an understanding of the culture and behavior of a social group from an "insider's point of view."

Participant observation is closely related to **ethnography**. However, different people have different ideas about the exact relationship between the two. Ethnography and participant observation are sometimes used interchangeably in the literature. For some, both ethnography and participant observation are research strategies that involve spending long periods watching people and talking to them about what they are doing, thinking, and saying, with the objective of generating an understanding of the social group under study (Delamont, 2004). For others, ethnography is a more inclusive term, whereas participant observation is more specific and related to a particular method of data collection. From this perspective, participant observation is a primary source of ethnographic data. However, it is just one of a number of methods, and rarely the only method, used by a researcher to generate an understanding of a culture or a social group. Along these lines, observation – observing behavior through a long-term engagement in the field setting where ethnography takes place – is regarded as one of several methods for ethnographic research. Other methods, such as interviews and questionnaires, may also be used to collect data in ethnographic research. We will have more to say about these various approaches to observation in Chapter 8.

Case studies

Case studies focus on collecting information about a specific object, event or activity, such as a particular business unit or organization. In case studies, the case is the individual, the group, the organization, the event, or the situation the researcher is interested in. The idea behind a case study is that in order to obtain a clear picture of a problem one must examine the real-life situation from various angles and perspectives using multiple methods of data collection. Along these lines, one may define a case study as a research strategy that involves an empirical investigation of a particular contemporary phenomenon within its real-life context using multiple methods of data collection (Yin, 2009). It should be noted that case studies may provide both qualitative and quantitative data for analysis and interpretation. As in experimental research, hypotheses can be developed in case studies as well. However, if a particular hypothesis has not been substantiated in even a single other case study, no support can be established for the alternate hypothesis developed.

Grounded theory

Grounded theory is a systematic set of procedures to develop an inductively derived theory from the data (Strauss & Corbin, 1990). Important tools of grounded theory are theoretical sampling, coding, and constant comparison. Theoretical sampling is "the process of data collection for generating theory whereby the analyst jointly collects, codes, and analyzes the data and decides what data to collect next and where to find them, in order to develop his theory as it emerges" (Glaser & Strauss, 1967, p. 45). In constant comparison you compare data (for instance, an interview) to other data (for instance, another interview). After a theory has emerged from this process you compare new data with your theory. If there is a bad fit between data (interviews), or between the data and your theory, then the categories and theories have to be modified until your categories and your theory fit the data. In constant comparison, discrepant and disconfirming cases play an important role in rendering categories and (grounded) theory.

Action research

Action research is sometimes undertaken by consultants who want to initiate change processes in organizations. In other words, **action research** is a research strategy aimed at effecting planned changes. Here, the researcher begins with a problem that is already identified, and gathers relevant data to provide a tentative problem solution. This solution is then implemented, with the knowledge that there may be unintended consequences following such implementation. The effects are then evaluated, defined, and diagnosed, and the research continues on an ongoing basis until the problem is fully resolved. Thus, action research is a constantly evolving project with interplay among problem, solution, effects or consequences, and new solution. A sensible and realistic problem definition and creative ways of collecting data are critical to action research.

Extent of researcher interference with the study

The extent of **interference** by the researcher has a direct bearing on whether the study undertaken is correlational or causal. A correlational study (recall that a correlational study is descriptive in nature, see Chapter 3) is conducted in a natural environment (for instance, a supermarket or the factory floor) with minimal interference by the researcher with the normal flow of events. For example, if a researcher wants to study the factors influencing training effectiveness (a correlational study), all that the individual has to do is delineate the relevant variables, collect the relevant data, and analyze them to come up with the findings. Though there is some disruption to the normal flow of work in the system as the researcher interviews employees and administers questionnaires in the workplace, the researcher's interference in the routine functioning of the system is minimal as compared to that caused during causal studies and experimental designs.

In studies conducted to establish cause-and-effect relationships, the researcher tries to manipulate certain variables so as to study the effects of such manipulation on the dependent variable of interest. In other words, the researcher deliberately changes certain variables in the setting and interferes with the events as they normally occur. As an example, a researcher might want to study the influence of lighting on worker performance; hence he manipulates the lighting in the work situation to varying intensities. Here, there is considerable researcher interference with the natural and normal setting. In other cases the researcher might even want to create an altogether new artificial setting where the cause-and-effect relationships can be studied by manipulating certain variables and tightly controlling certain others, as in a laboratory. Thus, there could be varying degrees of interference by the researcher in the manipulation and control of variables in the research study, either in the natural setting or in an artificial lab setting.

Let us give examples of research with varying degrees of interference – minimal, moderate, and excessive.

EXAMPLE

Minimal interference

A hospital administrator wants to examine the relationship between the perceived emotional support in the system and the stresses experienced by the nursing staff. In other words, she wants to do a correlational study. Here, the administrator/researcher will collect data from the nurses (perhaps through a questionnaire) to indicate how much emotional support they get in the hospital and to what extent they experience stress. (We will learn in a later chapter how to measure these variables.) By correlating the two variables, the answer that is being sought can be found. In this case, beyond administering a questionnaire to the nurses, the researcher has not interfered with the normal activities in the hospital. In other words, researcher interference has been minimal.

Moderate interference

The same researcher is now no longer content with finding a correlation, but wants to firmly establish a causal connection. That is, the researcher wants to demonstrate that if the nurses had emotional support, this indeed would cause them to experience less stress. If this can be established, then the nurses' stress can definitely be reduced by offering them emotional support. To test the cause-and-effect relationship, the researcher will measure the stress currently experienced by the nurses in three wards in the hospital, and then deliberately manipulate the extent of emotional support given to the three groups of nurses in the three wards for, perhaps, a week, and measure the amount of stress at the end of that period. For one group, the researcher will ensure that a number of lab technicians and doctors help and comfort the nurses when they face stressful events – for example, when they care for patients suffering excruciating pain and distress in the ward. Under a similar setup, for a second group of nurses in another ward, the researcher might arrange only a moderate amount of emotional support, employing only the lab technicians and excluding doctors. The third ward might operate without any emotional support. If the experimenter's theory is correct, then the reduction in the stress levels before and after the one-week period should be greatest for the nurses in the first ward, moderate for those in the second ward, and nil for the nurses in the third ward. Here we find that not only does the researcher collect data from nurses on their experienced stress at two different points in time, but she also "plays with" or manipulates the normal course of events by deliberately changing the amount of emotional support received by the nurses in two wards, while leaving things in the third ward unchanged. Here, the researcher has interfered more than minimally.

Excessive interference

The above researcher, after conducting the previous experiments, feels that the results may or may not be valid since other external factors might have influenced the stress levels experienced by the nurses. For example, during that particular experimental week, the nurses in one or more wards may not have experienced high levels of stress because there were no serious illnesses or deaths in the ward. Hence, the emotional support received might not be related to the level of stress experienced. The researcher might now want to make sure that such extraneous factors as might affect the cause-and-effect relationship are controlled. So she might take three groups of medical students, put them in different rooms, and confront all of them with the same stressful task. For example, she might ask them to describe in the minutest detail, the procedures in performing surgery on a patient who has not responded to chemotherapy and keep bombarding them with more and more questions even as they respond. Although all are exposed to the same intensive questioning, one group might get help from a doctor who voluntarily offers clarification and help when students stumble. In the second group, a doctor might be nearby, but might offer clarification and help only if the group seeks it. In the third group, there is no doctor present and no help is available. In this case, not only is the support manipulated, but even the setting in which this experiment is conducted is artificial inasmuch as the researcher has taken the subjects away from their normal environment and put them in a totally different setting. Here, the researcher has intervened maximally with the normal setting, the participants, and their duties. In Chapter 10 we will see why such manipulations are necessary to establish cause-and-effect relationships beyond any doubt.

In summary, the extent of researcher interference is related to whether the research questions are correlational or causal in nature and to the importance of establishing a causal relationship beyond any doubt what so ever.

Study setting: contrived and noncontrived

As we have just seen, business research can be done in the natural environment where events proceed normally (i.e., in **noncontrived settings**) or in artificial, **contrived settings**. Exploratory and descriptive (correlational) studies are invariably conducted in noncontrived settings, whereas most causal studies are done in contrived lab settings.

Studies done in noncontrived settings are called **field studies.** Studies conducted to establish cause-and-effect relationships using the same natural environment in which the subjects under study (employees, consumers, managers, and the like) normally function are called **field experiments**. Here, as we have seen earlier, the researcher does interfere with the natural occurrence of events inasmuch as the independent variable is manipulated. For example, a manager wanting to know the effects of pay on performance should raise the salary of employees in one unit, decrease the pay of employees in another unit, and leave the pay of the employees in a third unit untouched. Here there is a tampering with, or manipulating of, the pay system to establish a cause-and-effect relationship between pay and performance, but the study is still conducted in the natural setting and hence is called a field experiment.

Experiments done to establish a cause-and-effect relationship beyond the possibility of the least doubt require the creation of an artificial, contrived environment in which all the extraneous factors are strictly controlled. Similar subjects are chosen carefully to respond to certain manipulated stimuli. These studies are referred to as **lab experiments**. Let us give some further examples to understand the differences among a field study (a noncontrived setting with minimal researcher interference), a field experiment (noncontrived setting but with researcher interference to a moderate extent), and a lab experiment (a contrived setting with researcher interference to an excessive degree).

EXAMPLE

Field study

A bank manager wants to analyze the relationship between interest rates and bank deposit patterns of clients. She tries to correlate the two by looking at deposits into different kinds of accounts (such as savings, certificates of deposit, golden passbooks, and interest-bearing checking accounts) as interest rates change. This is a field study where the bank manager has merely taken the balances in various types of account and correlated them to the changes in interest rates. Research here is done in a noncontrived setting with no interference with the normal work routine.

Field experiment

The bank manager now wants to determine the cause-and-effect relationship between the interest rate and the inducement it offers to clients to save and deposit money in the bank. She selects four branches within a 60-mile radius for the experiment. For one week only, she advertises the annual rate for new certificates of deposit received during that week in the following manner: the interest rate will be 9% in one branch, 8% in another, and 10% in the third. In the fourth branch, the interest rate remains unchanged at 5%. Within the week, she will be able to determine the effects, if any, of interest rates on deposit mobilization.

The above is a field experiment since nothing but the interest rate is manipulated, with all activities occurring in the normal and natural work environment. Hopefully, all four branches chosen will be more or less compatible in size, number of depositors, deposit patterns, and the like, so that the interest–savings relationships are not influenced by some third factor. But it is possible that some other factors might affect the findings. For example, one of the areas may have more retirees who may not have additional disposable income to deposit, despite the attraction of a good interest rate. The banker may not have been aware of this fact while setting up the experiment.

Lab experiment

The banker in the previous example may now want to establish the causal connection between interest rates and savings, beyond a doubt. Because of this, she wants to create an artificial environment and trace the true cause-and-effect relationship. She recruits 40 students who are all business majors in their final year of study and are more or less of the same age. She splits them into four groups and gives each one of them chips that count for $1000, which they are told they might utilize to buy their needs, or save for the future, or both. She offers them, by way of incentive, interest on what they save but manipulates the interest rates by offering a 6% interest rate on savings for group 1, 8% for group 2, 9% for group 3, and keeps the interest at the low rate of 1% for group 4.

Here, the manager has created an artificial laboratory environment and has manipulated the interest rates for savings. She has also chosen subjects with similar backgrounds and exposure to financial matters (business students). If the banker finds that the savings by the four groups increase progressively, keeping in step with the increasing rates of interest, she will be able to establish a cause-and-effect relationship between interest rates and the disposition to save.

In this lab experiment with the contrived setting, the researcher interference has been maximal, inasmuch as the setting is different, the independent variable has been manipulated, and most external nuisance factors such as age and experience have been controlled.

Experimental designs are discussed more fully in Chapter 10. However, the above examples show us that it is important to decide the various design details before conducting the research study, since one decision criterion might have an impact on others. For example, if one wants to conduct an exploratory or a descriptive study, then the necessity for the researcher to interfere with the normal course of events will be minimal. However, if causal connections are to be established, experimental designs need to be set up either within a setting where the events normally occur (a field experiment) or in an artificially created laboratory setting (a lab experiment).

In summary, we have thus far made a distinction among (1) field studies, where various factors are examined in the natural setting in which daily activities go on as normal with minimal researcher interference, (2) field experiments, where cause-and-effect relationships are studied with some amount of researcher interference, but still in the natural setting where events continue in the normal fashion, and (3) lab experiments, where the researcher explores cause-and-effect relationships, not only exercising a high degree of control but also in an artificial and deliberately created setting. In Chapter 10 we will see the advantages and disadvantages of using contrived and noncontrived settings for establishing cause-and-effect relationships.

Unit of analysis: individuals, dyads, groups, organizations, cultures

The **unit of analysis** refers to the level of aggregation of the data collected during the subsequent data analysis stage. If, for instance, the problem statement focuses on how to raise the motivational levels of employees in general, then we are interested in individual employees in the organization and have to find out what we can do to raise their motivation. Here the unit of analysis is the individual. We will be looking at the data gathered from each individual and treating each employee's response as an individual data source. If the researcher is interested in studying two-person interactions, then several two-person groups, also known as *dyads*, will become the unit of analysis. Analysis of husband–wife interactions in families and supervisor–subordinate relationships in the workplace are good examples of dyads as the unit of analysis. However, if the problem statement is related to group effectiveness, then the unit of analysis will be at the group level. In other words, even though we may gather relevant data from all individuals comprising, say, six groups, we aggregate the individual data into group data so as to see the differences among the six groups. If we are comparing different departments in the organization, then the data analysis will be done at the departmental level – that is, the individuals in the department will be treated as one unit – and comparisons made by treating the department as the unit of analysis.

Our research question determines the appropriate unit of analysis. For example, if we wish to study group decision-making patterns, we will probably be examining such aspects as group size, group structure, cohesiveness, and the like, in trying to explain the variance in group decision making. Here, our main interest is not in studying individual decision making but *group* decision making, and we will be studying the dynamics that operate in several different groups and the factors that influence group decision making. In such a case, the unit of analysis will be groups.

As our research question addresses issues that move away from the individual to dyads, and to groups, organizations, and even nations, so also does the unit of analysis shift from individuals to dyads, groups, organizations, and nations. The characteristic of these "levels of analysis" is that the lower levels are subsumed within the higher levels. Thus, if we study buying behavior, we have to collect data from, say, 60 individuals, and analyze the data. If we want to study group dynamics, we may need to study, say, six or more groups, and then analyze the data gathered by examining the patterns in each of the groups. If we want to study cultural differences among nations, we will have to collect data from different countries and study the underlying patterns of culture in each country. Some critical issues in cross-cultural research are discussed in later chapters.

Individuals do not have the same characteristics as groups (e.g., structure, cohesiveness), and groups do not have the same characteristics as individuals (e.g., IQ, stamina). There are variations in the perceptions, attitudes, and behaviors of people in different cultures. Hence, the nature of the information gathered, as well as the level at which data are aggregated for analysis, are integral to decisions made on the choice of the unit of analysis.

It is necessary to decide on the unit of analysis even as we formulate the research question, since the data collection methods, sample size, and even the variables included in the framework may sometimes be determined or guided by the level at which data are aggregated for analysis.

Let us examine some research scenarios that would call for different units of analysis.

EXAMPLE

Individuals as the unit of analysis

The Chief Financial Officer of a manufacturing company wants to know how many of the staff would be interested in attending a three-day seminar on making appropriate investment decisions. For this purpose, data will have to be collected from each individual staff member and the unit of analysis is the individual.

Dyads as the unit of analysis

Having read about the benefits of mentoring, a human resources manager wants to first identify the number of employees in three departments of the organization who are in mentoring relationships, and then find out what the jointly perceived benefits (i.e., by both the mentor and the one mentored) of such a relationship are. Here, once the mentor and the mentored pairs are identified, their joint perceptions can be obtained by treating each pair as one unit. Hence, if the manager wants data from a sample of 10 pairs, he will have to deal with 20 individuals, a pair at a time. The information obtained from each pair will be a data point for subsequent analysis. Thus, the unit of analysis here is the dyad.

Groups as the unit of analysis

A manager wants to see the patterns of usage of the newly installed information system (IS) by the production, sales, and operations personnel. Here, three groups of personnel are involved and information on the number of times the IS is used by each member in each of the three groups, as well as other relevant issues, will be collected and analyzed. The final results will indicate the mean usage of the system per day or month for each group. Here, the unit of analysis is the group.

Divisions as the unit of analysis

Procter & Gamble wants to see which of its various divisions (soap, paper, oil, etc.) have made profits of over 12% during the current year. Here, the profits of each of the divisions will be examined and the information aggregated across the various geographical units of the division. Hence, the unit of analysis will be the division, at which level the data will be aggregated.

Industry as the unit of analysis

An employment survey specialist wants to see the proportion of the workforce employed by the health care, utilities, transportation, and manufacturing industries. In this case, the researcher has to aggregate the data relating to each of the subunits comprised in each of the industries and report the proportions of the workforce employed at the industry level. The health care industry, for instance, includes hospitals, nursing homes, mobile units, small and large clinics, and other health care providing facilities. The data from these subunits will have to be aggregated to see how many employees are employed by the health care industry. This will need to be done for each of the other industries.

Countries as the unit of analysis

The Chief Financial Officer (CFO) of a multinational corporation wants to know the profits made during the past five years by each of the subsidiaries in England, Germany, France, and Spain. It is possible that there are many regional offices of these subsidiaries in each of these countries. The profits of the various regional centers for each country have to be aggregated and the profits for each country for the past five years provided to the CFO. In other words, the data will now have to be aggregated at the country level. As can be easily seen, the data collection and sampling processes become more cumbersome at higher levels of units of analysis (industry, country) than at the lower levels (individuals and dyads). It is obvious that the unit of analysis has to be clearly identified as dictated by the research question. Sampling plan decisions will also be governed by the unit of analysis. For example, if I compare two cultures, for instance those of India and the United States –where my unit of analysis is the country – my sample size will be only two, despite the fact that I shall have to gather data from several hundred individuals from a variety of organizations in the different regions of each country, incurring huge costs. However, if my unit of analysis is individuals (as when studying the buying patterns of customers in the southern part of the United States), I may perhaps limit the collection of data to a representative sample of a hundred individuals in that region and conduct my study at a low cost!

It is now even easier to see why the unit of analysis should be given serious consideration even as the research question is being formulated and the research design planned.

Time horizon: cross-sectional versus longitudinal studies

Cross-sectional studies

A study can be undertaken in which data are gathered just once, perhaps over a period of days or weeks or months, in order to answer a research question. Such studies are called **one-shot** or **cross-sectional studies** (see the following example).

The purpose of the studies in the two following examples was to collect data that would be pertinent to finding the answer to a research question. Data collection at one point in time was sufficient. Both were cross-sectional designs.

EXAMPLE

E.1 Data were collected from stock brokers between April and June of last year to study their concerns in a turbulent stock market. Data with respect to this particular research had not been collected before, nor will they be collected again for this research.

E.2 A drug company wanting to invest in research for a new obesity (reduction) pill conducted a survey among obese people to see how many of them would be interested in trying the new pill. This is a one-shot or cross-sectional study to assess the likely demand for the new product.

Longitudinal studies

In some cases, however, the researcher might want to study people or phenomena at more than one point in time in order to answer the research question. For instance, the researcher might want to study employees' behavior before and after a change in the top management, so as to know what effects the change accomplished. Here, because data are gathered at two different points in time, the study is not cross-sectional or of the one-shot kind, but is carried longitudinally across a period of time. Such studies, as when data on the dependent variable are gathered at two or more points in time to answer the research question, are called **longitudinal studies**.

EXAMPLE

E.1 A marketing manager is interested in tracing the pattern of sales of a particular product in four different regions of the country on a quarterly basis for the next two years. Since data will be collected several times to answer the same issue (tracing pattern of sales), the study falls into the longitudinal category.

E.2 In 2002, Sturges, Guest, Conway and Davey published the results of a two-wave longitudinal study investigating the relationship between career management and organizational commitment among graduates in the first ten years at work. Data were collected at two points in time 12 months apart. The results of this study showed that high organizational commitment predicts the practice of career management activities by graduates to further their career within the organization. On the other hand, low commitment was closely associated with behavior aimed at furthering their career outside the organization. The results also pointed out that graduates who manage their own careers receive more career management help from their employer. This suggests that there may be the potential for employers to create a "virtuous circle" of career management in which individual and organizational activities complement each other.

Longitudinal studies take more time and effort and cost more than cross-sectional studies. However, well-planned longitudinal studies can, among other things, help to identify cause-and-effect relationships. For example, one could study the sales volume of a product before and after an advertisement, and provided other environmental changes have not impacted on the results, one could attribute the increase in the sales volume, if any, to the advertisement. If there is no increase in sales, one could conclude that either the advertisement is ineffective or it will take a longer time to take effect.

Experimental designs invariably are longitudinal studies, since data are collected both before and after a manipulation. Field studies may also be longitudinal. For example, a study of the comparison data pertaining to the reactions of managers in a company toward working women now and ten years later will be a longitudinal field study. Most field studies conducted, however, are cross-sectional in nature often because of the time, effort, and costs involved in collecting data over several time periods. Longitudinal studies will certainly be necessary if a manager wants to keep track of certain factors (e.g., sales, advertising effectiveness, etc.) over a period of time to assess improvements, or to detect possible causal connections (sales promotions and actual sales data; frequency of drug testing and reduction in drug usage, etc.). Though more expensive, longitudinal studies offer some good insights.

MIXED METHODS

Earlier (in Chapter 3) we explained that qualitative studies are often carried out to better understand the nature of a problem. Extensive interviews with many people might have to be undertaken to get a handle on the situation and understand the phenomenon. When the data reveal some pattern regarding the phenomenon of interest, theories are developed and hypotheses formulated. Other methods, such as an experimental method, for instance, are subsequently used to test these hypotheses. Along these lines, combinations of qualitative and quantitative methods are used in many studies.

Mixed methods research aims to answer research questions that cannot be answered by “qualitative” or “quantitative” approaches alone. Mixed methods research focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. A mixed methods approach is increasingly advocated within business research. The attractiveness of this approach is that it allows researchers to combine inductive and deductive thinking, to use more than one research method to address the research problem, and to solve this problem using different types of data. On the other hand, a mixed methods approach complicates the research design and therefore requires clear presentation to allow the reader to sort out its different components.

EXAMPLE

Henry Mintzberg interviewed managers to explore the nature of managerial work. Based on the analysis of his interview data, he formulated theories of managerial roles, the nature and types of managerial activities, and so on. These have been tested in different settings through both interviews and questionnaire surveys.

Triangulation is a technique that is also often associated with using mixed methods. The idea behind triangulation is that one can be more confident in a result if the use of different methods or sources leads to the same results. Triangulation requires that research is addressed from multiple perspectives. Several kinds of triangulation are possible:

- Method triangulation: using multiple methods of data collection and analysis.
- Data triangulation: collecting data from several sources and/or at different time periods.
- Researcher triangulation: multiple researchers collect and/or analyze the data.
- Theory triangulation: multiple theories and/or perspectives are used to interpret and explain the data.

TRADE-OFFS AND COMPROMISES

This concludes the discussions on the basic design issues regarding the research strategy, extent of researcher interference, study setting, unit of analysis, and the time horizon. The researcher determines the appropriate decisions to be made in the study design based on the research perspective of the investigator, the research objective(s), research questions, the extent of rigor desired, and practical considerations. Sometimes, because of the time and costs involved, a researcher might be constrained to settle for less than the "ideal" research design. For instance, the researcher might have to conduct a cross-sectional instead of a longitudinal study, do a field study rather than an experimental design, choose a smaller rather than a larger sample size, and so on, thus suboptimizing the research design decisions and settling for a lower level of scientific rigor because of resource constraints. This trade-off between rigor and practical considerations will be a deliberate and conscious decision made by the manager/researcher, and will have to be explicitly stated in the research report. Compromises so made also account for why management studies are not entirely scientific, as discussed in Chapter 2. Mixed methods research focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. As stated above, a mixed methods approach complicates the research design and therefore requires clear presentation to allow the reader to sort out its different components. Regardless of the complexity of the design, the researcher always has to be very clear about each aspect discussed in this chapter before embarking on data collection.

Now do Exercises 6.1, 6.2, 6.3, and 6.4.

EXERCISE 6.1

A foreman thinks that the low efficiency of the machine tool operators is directly linked to the high level of fumes emitted in the workshop. He would like to prove this to his supervisor through a research study.

1. Would this be a causal or a correlational study? Why?
2. Is this an exploratory, a descriptive, or a causal study? Why?
3. What kind of a study would this be: field study, lab experiment, or field experiment? Why?
4. What would be the unit of analysis? Why?
5. Would this be a cross-sectional or a longitudinal study? Why?

EXERCISE 6.2

You want to examine how exposure to thin or heavy models in advertisements influences a person's self-esteem. You believe that the effect of exposure to models in advertisements depends on the extremity of the model's thinness or heaviness. Discuss the design decisions that you as a researcher will make to investigate this issue, giving reasons for your choices.

EXERCISE 6.3

You want to investigate the specific effects of specific emotions on customers' behavioral responses to failed service encounters across industries. Discuss the design decisions that you as a researcher will make to investigate this issue, giving reasons for your choices.

EXERCISE 6.4

You are interested in how person–organization fit relates to employees' affective commitment and intention to stay with an organization during the early stages of a strategic organizational change.

MANAGERIAL IMPLICATIONS

Knowledge about research design issues helps the manager to understand what the researcher is attempting to do. The manager also understands why the reports sometimes indicate data analytic results based on small sample sizes, when a lot of time has been spent in collecting data from several scores of individuals, as in the case of studies involving groups, departments, or branch offices.

One of the important decisions a manager has to make before starting a study pertains to how rigorous the study ought to be. Knowing that more rigorous research designs consume more resources, the manager is in a position to weigh the gravity of the problem experienced and decide what kind of design will yield acceptable results in an efficient manner. For example, the manager might decide that knowledge of which variables are associated with employee performance is good enough to enhance performance results and there is no need to ferret out the cause. Such a decision would result not only in economy in resources, but also cause the least disruption to the smooth flow of work for employees and preclude the need for collecting data longitudinally. Knowledge of interconnections among various aspects of the research design helps managers to call for the most effective study, after weighing the nature and magnitude of the problem encountered, and the type of solution desired.

One of the main advantages in fully understanding the difference between causal and correlational studies is that managers do not fall into the trap of making implicit causal assumptions when two variables are only associated with each other. They realize that *A* could cause *B*, or *B* could cause *A*, or both *A* and *B* could covary because of some third variable.

Knowledge of research design details also helps managers to study and intelligently comment on research proposals and on research reports.

SUMMARY

- **Learning objective 1: Explain what is meant by a research design.**
  A research design is a blueprint or plan for the collection, measurement, and analysis of data, created to answer your research questions. Issues relating to decisions regarding the research strategy (for instance, experiments, surveys, case studies), the extent of researcher interference, location (i.e., the study setting), the level at which the data will be analyzed (unit of analysis), and temporal aspects (the time horizon) are integral to research design.

- **Learning objective 2: Develop an appropriate research design for any given study.**
  Each component of the research design offers several critical choice points. There is no single design that is superior in all circumstances. Instead, the researcher will have to make choices and create a design that is suitable for the job at hand. The researcher determines the appropriate decisions to be made in the study design based on the research perspective of the investigator, the research objective(s), research questions, the extent of rigor desired, and practical considerations.

- **Learning objective 3: Explain why a researcher might be constrained to settle for less than the "ideal" research design.**
  Sometimes, because of the time and costs involved, a researcher might be constrained to settle for less than the "ideal" research design. For instance, the researcher might have to conduct a field study rather than an experimental design or choose a smaller rather than a larger sample size thus sub-optimizing the research design decisions and settling for a lower level of scientific rigor because of resource constraints. This trade-off between rigor and practical considerations should be a deliberate and conscious decision made by the researcher.

- **Learning objective 4: Demonstrate awareness of the role of the manager in the area of research design.**
  Knowledge about research design issues helps the manager to understand what the researcher is attempting to do and to study and intelligently comment on research proposals and on research reports.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: The effect of calorie information on food consumption**.

DISCUSSION QUESTIONS

1. What are the basic research design issues? Describe them in some detail.
2. Why is it important to consider basic design issues before conducting the study and even as early as at the time of formulating the research question?
3. Is a field study totally out of the question if one is trying to establish cause-and-effect relationships?
4. "A field study is often more useful than a lab experiment." Discuss this statement.
5. Why is the unit of analysis an integral part of the research design?
6. Discuss the interrelationships among the research questions of a study (exploratory, descriptive, causal), study setting (noncontrived or contrived), researcher interference, research strategy, and time horizon of study.
7. Below are three scenarios. Indicate how the researcher should proceed in each case; that is, determine the following, giving reasons:
   a. Type of research question (exploratory, descriptive, or causal).
   b. The extent of researcher interference.

c. The study setting.
d. The research strategy.
e. The time horizon for the study.
f. The unit of analysis.

Scenario 1

A specific department within an organization has a high turnover rate; employees of this department have a shorter average tenure than those of other departments in the company. Skilled workers are leaving and the worker population contains a high percentage of novice workers. Ms Joyce Lynn has no idea what is going on and wants to know more about what is happening.

Scenario 2

Mr Paul Hodge, the owner of several restaurants on the East Coast, is concerned about the wide differences in their profit margins. He would like to try some incentive plans for increasing the efficiency levels of those restaurants that lag behind. But before he actually does this, he would like to be assured that the idea will work. He asks a researcher to help him on this issue.

Scenario 3

A manager is intrigued as to why some people seem to derive joy from work and get energized by it, while others find it troublesome and frustrating.

CHAPTER 7

INTERVIEWS

LEARNING OBJECTIVES

After completing Chapter 7, you should be able to:

1. Differentiate primary from secondary data collection methods.
2. Plan, design, and carry out a personal interview.
3. Plan, design, and carry out a group interview.
4. Discuss the advantages and disadvantages of interviewing.

INTRODUCTION

Having discussed a number of basic issues in research design in the previous chapter, we will now turn to *primary data collection methods* – or ways in which data collected from original sources for the specific purpose of this study can be gathered. Data collection methods are an integral part of research design, as shown in the shaded portion of Figure 7.1.

The aim of this chapter is to introduce a commonly used method of primary data collection: interviewing. Different types of interviews are discussed and ways in which to structure and carry out interviews are explained. The chapter starts with an introduction to primary data collection methods.

PRIMARY DATA COLLECTION METHODS

Since business is largely a social phenomenon, much of the information needed to make decisions in the work setting has to come from people – for instance from employees, consumers, managers, investors, and/or suppliers. For this reason, interviews, observation, and questionnaires are very popular in business research; these methods allow the researcher to collect a wide variety of different sorts of data from human respondents. We discuss these methods in, respectively, Chapter 7, Chapter 8, and Chapter 9. After we have discussed these non-experimental approaches to the collection of primary data, we discuss *experimental designs* in Chapter 10. In this way, our discussion on primary data collection methods is organized around four principal methods of primary data collection.

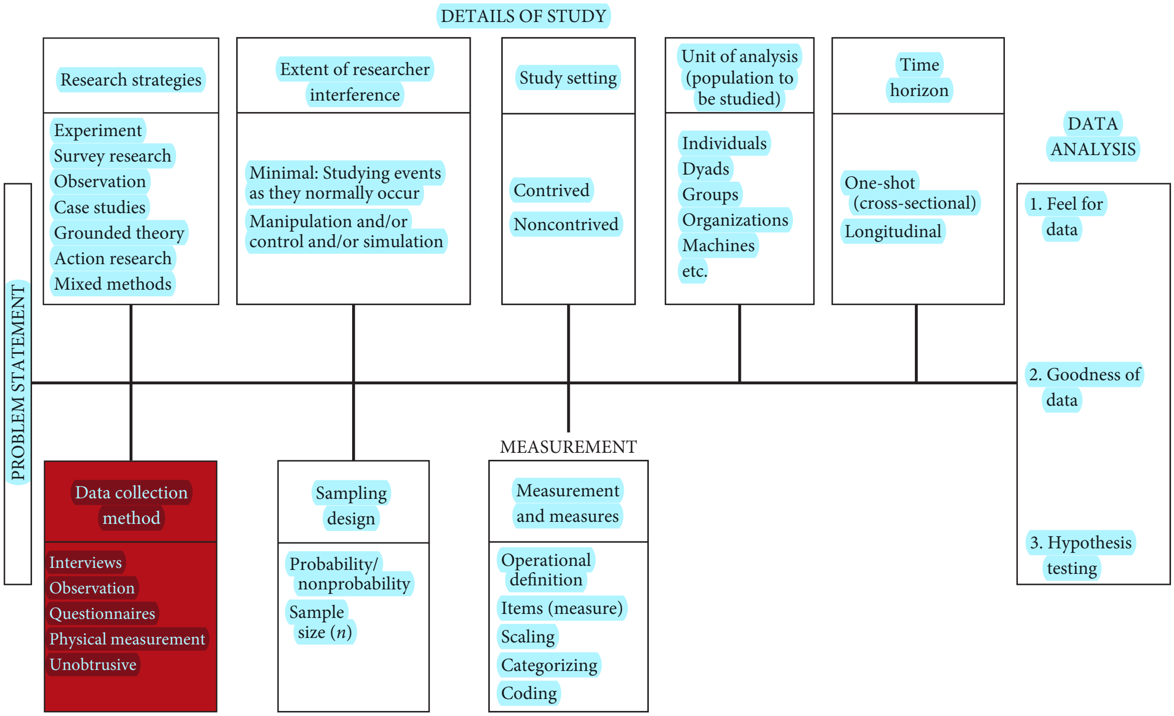

DETAILS OF STUDY
Research strategies
Experiment
Survey research
Observation
Case studies
Grounded theory
Action research
Mixed methods
Extent of researcher interference
Minimal: Studying events as they normally occur
Manipulation and/or control and/or simulation
Study setting
Contrived
Noncontrived
Unit of analysis (population to be studied)
Individuals
Dyads
Groups
Organizations
Machines
etc.
Time horizon
One-shot (cross-sectional)
Longitudinal
DATA ANALYSIS
1. Feel for data
2. Goodness of data
3. Hypothesis testing
PROBLEM STATEMENT
Data collection method
Interviews
Observation
Questionnaires
Physical measurement
Unobtrusive
Sampling design
Probability/ nonprobability
Sample size (n)
MEASUREMENT
Measurement and measures
Operational definition
Items (measure)
Scaling
Categorizing
Coding

FIGURE 7.1

Research design and how data collection methods fit in

A thorough knowledge of the most important methods will help you to evaluate alternative approaches to primary data collection (check Box 7.1 for a further example). As you will understand, the primary data collection decision – which involves the selection of the method(s) of obtaining the information needed – is interrelated with the other steps in the research process. That is why your choice of method(s) will depend on the objective(s) of the study, the research questions, and the research strategy. Facilities available, the degree of accuracy required, the type of data required, the time span of the study, the expertise of the reviewer, and other costs and resources associated with and available for data gathering will also affect the choice of method(s). Problems researched with the use of *appropriate* methods greatly enhance the value of the study.

BOX 7.1

UNOBTRUSIVE METHODS

Unobtrusive methods do not require the researcher to interact with the people he or she is studying. Unobtrusive methods are sometimes used by researchers who seek to understand what people actually *do*, instead of what they say they do (as in interviews or in questionnaires). *Internet clickstream data* exemplify unobtrusive data. Nowadays, virtually every commercial website monitors traffic to its site to collect data on its visitors. Based on the observed behavior of these visitors, it is possible to develop a thorough understanding of the website's customer base. This helps managers to predict likely future behavioral patterns but also to anticipate customers' responses to (future) marketing activities. Like this, clickstream data provide managers with a valuable tool to shape their marketing efforts (cf. Park and Fader, 2004). *Scanner data* (data on sales of consumer goods obtained by scanning bar codes of products in retail outlets) also provide managers with detailed information about the effects of marketing activities (such as price promotions) on sales (cf. Van Heerde, Gupta and Wittink, 2003). Other examples of unobtrusive methods are the wear and tear of books in a library, which offers a good indication of their popularity, frequency of use, or both; the number of different brands of soft drink cans found in trash bags, which offers a measure of their consumption levels; signatures on checks exposed to ultraviolet rays, which can indicate forgery and fraud; and actuarial records, which are good sources for collecting data on the births, marriages, and deaths in a community. These unobtrusive sources of data and their use are important in research aimed at understanding behavior.

INTERVIEWS

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Interviewing**.

A widely used method of collecting data in business research is to interview respondents to obtain information on an issue of interest. An **interview** is a guided, purposeful conversation between two or more people. There are many different types of interviews. Individual or group interviews may be unstructured or structured, and conducted face to face, by telephone, or online.

Unstructured and structured interviews will be discussed first. Some important factors to be borne in mind while interviewing will then be detailed. Next, the advantages and disadvantages of face-to-face interviewing and telephone interviews are considered and then, computer-assisted interviews are described. A discussion on group interviews concludes this chapter. Managerial implications and ethics in interviews and other types of survey research are discussed in Chapter 9 after we have discussed interviews, observation, and administering questionnaires in greater detail.

Unstructured and structured interviews

Unstructured interviews

Unstructured interviews are so labeled because the interviewer does not enter the interview setting with a planned sequence of questions to be asked of the respondent. A possible objective of an unstructured interview is to bring some preliminary issues to the surface so that the researcher can determine what factors need further in-depth investigation. In Chapter 3, in the discussion of the "broad problem area," we saw several situations where the manager might entertain a vague idea of certain changes taking place in the situation without knowing what exactly they are. Such situations call for unstructured interviews with the people concerned.

Suppose that a manager is interested in solving a problem in the work setting. In order to understand the situation in its totality, the researcher may interview employees at several levels. In the initial stages, only broad, open-ended questions should be asked, and the replies to them should inform the researcher of the perceptions of the individuals. The type and nature of the questions asked of the individuals might vary according to the job level and type of work done by them. For instance, top and middle-level managers might be asked more direct questions about their perceptions of the problem and the situation. Employees at lower levels may have to be approached differently.

Clerical and other employees at lower hierarchical levels may be asked broad, open-ended questions about their jobs and the work environment during unstructured interviews. Supervisors may be asked broad questions relating to their department, the employees under their supervision, and the organization. The following question, for instance, may be put to them during the unstructured interview stage:

> ***Tell me something about your unit and department, and perhaps even the organization as a whole, in terms of work, employees, and whatever else you think is important.***

Such a question might elicit an elaborate response from some people; others may just say that everything is fine. Following the leads from the more vocal persons is easy, especially when the interviewer listens carefully to the important messages that they might convey in a very casual manner while responding to a general, global question. As managers and researchers, we should train ourselves to develop these listening skills and identify the critical topics that are touched on. However, when some respondents give a monosyllabic, crisp, short reply that is not informative, the interviewer will have to ask questions that call for details and cannot be answered in one or two words. Such questions might be phrased like the one below:

> ***I would like to know something about your job. Please describe to me in detail the things you do in your job on a typical day, from eight in the morning to four in the afternoon.***

Several questions might then be asked as a follow-up to the answer. Some examples of such follow-up questions include:

> ***Compared to other units in this organization, what are the strengths and weaknesses of your unit?***

> ***If you could have a problem solved in your unit, or a bottleneck eliminated, or something attended to that blocks your effectiveness, what would that be?***

If the respondent answers that everything is fine and she has no problems, the interviewer could say: "*That is great! Tell me what contributes to this effectiveness of your unit, because most other organizations usually experience several difficulties.*" Such a questioning technique usually brings the respondent's defenses down and makes him or her more amenable to sharing information. Typical of the revised responses to the original question would be something like, "*Well, it is not that we never have a problem; sometimes there is delay in getting the jobs done, crash jobs have some defective items, . . .*" Encouraging the respondent to talk about both the good things and those not-so-good in the unit can elicit a lot of information. Whereas some respondents do not need much encouragement to speak, others do, and they have to be questioned broadly. Some respondents may show reluctance to be interviewed, and subtly or overtly refuse to cooperate. The wishes of such people must be respected and the interviewer should pleasantly terminate such interviews.

Employees at the shop-floor level, and other nonmanagerial and nonsupervisory employees, might be asked very broad questions relating to their jobs, work environment, satisfactions and dissatisfactions at the workplace, and the like – for example:

What do you like about working here?

If you were to tell me which aspects of your job you like and which you do not, what would they be?

Tell me something about the reward systems in this place.

If you were offered a similar job elsewhere, how willing would you be to take it and why?

If I were to seek employment here and request you to describe your unit to me as a newcomer, what would you say?

After conducting a sufficient number of such unstructured interviews with employees at several levels and studying the data obtained, the researcher would know the variables that needed greater focus and called for more in-depth information.

This sets the stage for the interviewer to conduct further structured interviews, for which the variables will have been identified.

Structured interviews

Structured interviews are those conducted when it is known at the outset what information is needed. The content of a structured interview can be prepared in advance, and usually consists of:

- an introduction: the interviewer introduces him- or herself, the purpose of the interview, assures confidentiality, asks permission to record the interview;
- a set of topics (usually questions) in a logical order: first "warm-up" questions (which are easy to answer and non-threatening) and then the main questions covering the purpose of the interview;
- suggestions for probing questions (Box 7.2): follow-up questions that are used when the first answer is unclear or incomplete, the interviewer does not fully understand the answer, or in any other case where the interviewer requires more specific or in-depth information.

BOX 7.2

PROBING TACTICS

- Silence.
- Repeating the answer.
- "So what I hear you saying is . . ."
- "I'm not quite sure I understood . . . Could you . . ."
- "Could you please tell me more about . . ."
- "Could you give an example?"
- "Could you go over that again?"
- "Anything else?"

As the respondents express their views, the researcher notes them down. The same questions will be asked of everybody in the same manner. Sometimes, however, based on the exigencies of the situation, the experienced researcher might take a lead from a respondent's answer and ask other relevant questions not on the interview protocol. Through this process, new factors might be identified, resulting in a deeper understanding. However, to be able to recognize a probable response, the interviewer must comprehend the purpose and goal of each question. This is particularly important when a team of trained interviewers conducts the survey.

Visual aids such as pictures, line drawings, cards, and other materials are also sometimes used in conducting interviews. The appropriate visuals are shown to the interviewees, who then indicate their responses to the questions posed. Marketing research, for example, benefits from such techniques in order to capture the likes and dislikes of customers with regard to different types of packaging, forms of advertising, and so on. Visual aids, including painting and drawing, are particularly useful when children are the focus of marketing research. Visual aids also come in handy while endeavoring to elicit certain thoughts and ideas that are difficult to express or awkward to articulate.

When a sufficient number of structured interviews has been conducted and adequate information obtained to understand and describe the important factors operating in the situation, the researcher stops the interviews. The information is then tabulated and the data analyzed. This helps the researcher to accomplish the task he set out to achieve, such as describing the phenomena, or quantifying them, or identifying the specific problem and evolving a theory of the factors that influence the problem, or finding answers to the research question. Much qualitative research is done in this manner.

Review of unstructured and structured interviews

The main purpose of the unstructured interview is to explore and probe into the several factors in the situation that might be central to the broad problem area. During this process it might become evident that the problem, as identified by the client, is but a symptom of a more serious and deep-rooted problem. Conducting unstructured interviews with many people could result in the identification of several critical factors in the situation. These would then be pursued further during structured interviews for eliciting more in-depth information on them. This helps identify the critical problem as well as ways of solving it. In applied research, a tentative theory of the factors contributing to the problem is often conceptualized on the basis of the information obtained from unstructured and structured interviews.

Training interviewers

When several long interviews are to be conducted, it is often not feasible for one individual to conduct all the interviews. A team of trained interviewers then becomes necessary. Interviewers have to be thoroughly briefed about the research and trained in how to start an interview, how to proceed with the questions, how to motivate respondents to answer, what to look for in the answers, and how to close an interview. They also need to be instructed about taking notes and coding the interview responses. The tips for interviewing, discussed later, should become a part of their repertoire for interviewing.

Good planning, proper training, offering clear guidelines to interviewers, and supervising their work all help in profitably utilizing the interviewing technique as a viable data collection mechanism. Personal interviews provide rich data when respondents spontaneously offer information, in the sense that their answers do not typically fall within a constricted range of responses, as in a questionnaire. However, personal interviews are expensive in terms of time, training costs, and resource consumption.

Some tips to follow when interviewing

The information obtained during the interviews should be as free as possible of bias. **Bias** refers to errors or inaccuracies in the data collected. Bias could be introduced by the interviewer, the interviewee, or the situation. The interviewer could bias the data if proper trust and rapport are not established with the interviewee, or when the responses are either misinterpreted or distorted, or when the interviewer unintentionally encourages or discourages certain types of response through gestures and facial expressions.

Listening attentively to the interviewee, evincing keen interest in what the respondent has to say, exercising tact in questioning, repeating and/or clarifying the questions posed, and paraphrasing some of the answers to ensure their thorough understanding go a long way in keeping alive the interest of the respondent throughout the interview. Recording the responses accurately is equally important.

Interviewees can bias the data when they do not come out with their true opinions but provide information that they think is what the interviewer expects of them or would like to hear. Also, if they do not understand the questions, they may feel diffident or hesitant to seek clarification. They may then answer questions without knowing their importance, and thus introduce bias.

Some interviewees may be turned off because of personal likes and dislikes, or the dress of the interviewer, or the manner in which the questions are put. They may, therefore, not provide truthful answers, but instead, deliberately offer incorrect responses. Some respondents may also answer questions in a socially acceptable manner rather than indicating their true sentiments.

Biases could be situational as well, in terms of (1) nonparticipants, (2) trust levels and rapport established, and (3) the physical setting of the interview. Nonparticipation, either because of unwillingness or the inability of the interviewee to participate in the study, can bias data inasmuch as the responses of the participants may be different from those of the nonparticipants (which implies that a biased, rather than a representative, set of responses is likely to result). Bias also occurs when different interviewers establish different levels of trust and rapport with their interviewees, thus eliciting answers of varying degrees of openness. The actual setting in which the interview is conducted might sometimes introduce bias. Some individuals, for instance, may not feel quite at ease when interviewed at the workplace and therefore may not respond frankly and honestly.

In door-to-door or telephone interviews, when the respondent cannot be reached due to unavailability at that time, callbacks and further contacts should be attempted so that the sample does not become biased (discussed in Chapter 13 on Sampling). The interviewer can also reduce bias by being consistent with the questioning mode as each person is interviewed, by not distorting or falsifying the information received, and by not influencing the responses of the subjects in any manner.

The above biases can be minimized in several ways. The following strategies will be useful for the purpose.

Establishing credibility and rapport, and motivating individuals to respond

The projection of professionalism, enthusiasm, and confidence is important for the interviewer. For instance, a manager hiring outside researchers to deal with a problem within an organization would be interested in assessing their abilities and personality predispositions. Researchers must establish rapport with, and gain the confidence and approval of, the hiring client before they can even start their work in the organization. Knowledge, skills, ability, confidence, articulateness, and enthusiasm are therefore qualities a researcher must demonstrate in order to establish credibility with the hiring organization and its members.

To obtain honest information from the respondents, the researcher/interviewer should be able to establish rapport and trust with them. In other words, the researcher should be able to make the respondent sufficiently at ease to give informative and truthful answers without fear of adverse consequences. To this end, the researcher should state the purpose of the interview and assure complete confidentiality about the source of the responses. Establishing rapport with the respondents may not be easy, especially when interviewing employees at lower levels. They are likely to be suspicious of the intentions of the researchers; they may believe that the researchers are on the management's "side," and therefore likely to propose a reduction in the labor force, an increase in the workload, and so on. Thus, it is important to ensure that everyone concerned is aware of the researchers' purpose as being one of merely understanding the true state of affairs in the organization. The respondents must be tactfully made to understand that the researchers do not intend to take sides; they are not there to harm the staff, and will provide the results of research to the organization only in aggregates, without disclosing the identity of the individuals. This should encourage the respondents to feel secure about responding.

The researcher can establish rapport by being pleasant, sincere, sensitive, and nonevaluative. Evincing a genuine interest in the responses and allaying any anxieties, fears, suspicions, and tensions sensed in the situation will help respondents to feel more comfortable with the researchers. If the respondent is told about the purpose of the study and how he or she was chosen to be one of those interviewed, there should be better communication between the parties. Researchers can motivate respondents to offer honest and truthful answers by explaining to them that their contribution will indeed help, and that they themselves may stand to gain from such a survey, in the sense that the quality of life at work for most of them may improve significantly.

Certain other strategies in how questions are posed also help participants to offer less biased responses. These are discussed below.

The questioning technique

Funneling At the beginning of an unstructured interview, it is advisable to ask open-ended questions to get a broad idea and form some impressions about the situation. For example a question that could be asked would be:

What are some of your feelings about working for this organization?

From the responses to this broad question, further questions that are progressively more focused may be asked as the researcher processes the interviewees' responses and notes some possible key issues relevant to the situation. This transition from broad to narrow themes is called the **funneling technique**.

Unbiased questions It is important to ask **unbiased questions** to ensure that you minimize bias in the responses. For example, "*Tell me how you experience your job*" is a better question than, "*Boy, the work you do must be really boring; let me hear how you experience it.*" The latter question is "loaded" in terms of the interviewer's own perceptions of the job. A loaded question might influence the types of answers received from the respondent. Bias could also be introduced by emphasizing certain words, by tone and voice inflections, and through inappropriate suggestions.

Clarifying issues To make sure that the researcher understands issues as the respondent intends to represent them, it is advisable to restate or rephrase important information given by the respondent. For instance, if the interviewee says, "*There is an unfair promotion policy in this organization; seniority does not count at all – it is the juniors who always get promoted,*" the researcher might interject, "*So you are saying that juniors always get promoted over the heads of even capable seniors.*" Rephrasing in this way clarifies the issue of whether or not the respondent considers ability important. If certain things that are being said are not clear, the researcher should seek clarification. For example, if the respondent happens to say, "*The facilities here are really poor; we often have to continue working even when we are dying of thirst,*" the researcher might ask if there is no water fountain or drinking water available in the building. The respondent's reply to this might well indicate that there is a water fountain across the hall, but the respondent would like one on his side of the work area as well.

Helping the respondent to think through issues If the respondent is not able to verbalize her perceptions, or replies, "*I don't know*," the researcher should ask the question in a simpler way or rephrase it. For instance, if a respondent is unable to specify what aspects of the job he dislikes, the researcher might ask the question in a simpler way. For example, the respondent might be asked which task he would prefer to do: serve a customer or do some filing work. If the answer is "*serve the customer*," the researcher might use another aspect of the respondent's job and ask the paired-choice question again. In this way, the respondent can sort out which aspects of the job he likes better than others.

Taking notes When conducting interviews, it is important that the researcher makes written notes as the interviews are taking place, or as soon as the interview is terminated. The interviewer should not rely on memory, because information recalled from memory is imprecise and often likely to be incorrect. Furthermore, if more than one interview is scheduled for the day, the amount of information received increases, as do possible sources of error in recalling from memory who said what. Information based solely on recall introduces bias into the research.

The interviews can be recorded on tape if the respondent has no objection. However, taped interviews might bias the respondents' answers because they know that their voices are being recorded, and their anonymity is not preserved in full. Hence, even if the respondents do not object to being taped, there could be some bias in their responses. Before recording or videotaping interviews, one should be reasonably certain that such a method of obtaining data is not likely to bias the information received. Any audio or videotaping should always be done only after obtaining the respondent's permission.

Review of tips to follow when interviewing

Establishing credibility as able researchers is important for the success of the research project. Researchers need to establish rapport with the respondents and motivate them to give responses relatively free from bias by allaying whatever suspicions, fears, anxieties, and concerns they may have about the research and its consequences. This can be accomplished by being sincere, pleasant, and nonevaluative. While interviewing, the researcher has to ask broad questions initially and then narrow them down to specific areas, ask questions in an unbiased way, offer clarification when needed, and help respondents to think through difficult issues. The responses should be transcribed immediately and should not be trusted to memory and later recall.

Having looked at unstructured and structured interviews and learned something about how to conduct the interviews, we can now discuss face-to-face and telephone interviews.

Face-to-face and telephone interviews

Interviews can be conducted either face to face or over the telephone. They may also be computer-assisted. Although most unstructured interviews in business research are conducted face to face, structured interviews may be either face to face or through the medium of the telephone, depending on the level of complexity of the issues involved, the likely duration of the interview, the convenience of both parties, and the geographical area covered by the survey. Telephone interviews are best suited when information from a large number of respondents spread over a wide geographic area is to be obtained quickly, and the likely duration of each interview is, say, ten minutes or less. Many market surveys, for instance, are conducted through structured **telephone interviews**. In addition, **computer-assisted telephone interviews (CATI)** are also possible, and easy to manage.

Face-to-face interviews and telephone interviews have other advantages and disadvantages. These will now be briefly discussed.

Face-to-face interviews: advantages and disadvantages

The main advantage of face-to-face or direct interviews is that the researcher can adapt the questions as necessary, clarify doubts, and ensure that the responses are properly understood, by repeating or rephrasing the questions. The researcher can also pick up nonverbal cues from the respondent. Any discomfort, stress, or problem that the respondent experiences can be detected through frowns, nervous tapping, and other body language unconsciously exhibited by her. This would be impossible to detect in a telephone interview.

The main disadvantages of face-to-face interviews are the geographical limitations they may impose on the surveys and the vast resources needed if such surveys need to be done nationally or internationally. The costs of training interviewers to minimize interviewer bias (e.g., differences in questioning methods, interpretation of responses) are also high. Another drawback is that respondents might feel uneasy about the anonymity of their responses when they interact face to face with the interviewer.

Telephone interviews: advantages and disadvantages

The main advantage of telephone interviewing, from the researcher's point of view, is that a number of different people can be reached (if need be, across the country or even internationally) in a relatively short period of time. From the respondents' standpoint it eliminates any discomfort that some of them might feel in facing the interviewer. It is also possible that most of them might feel less uncomfortable disclosing personal information over the phone than face to face.

A main disadvantage of telephone interviewing is that the respondent could unilaterally terminate the interview without warning or explanation, by hanging up the phone. Caller ID might further aggravate the situation. This is understandable, given the numerous telemarketing calls people are bombarded with on a daily basis. To minimize this type of nonresponse problem, it is advisable to call the interviewee ahead of time to request participation in the survey, giving an approximate idea of how long the interview will last, and setting up a mutually convenient time. Interviewees usually tend to appreciate this courtesy and are more likely to cooperate. It is a good policy not to prolong the interview beyond the time originally stated. As mentioned earlier, another disadvantage of the telephone interview is that the researcher will not be able to see the respondent to read the nonverbal communication.

Additional sources of bias in interview data

We have already discussed several sources of bias in data collection. Biased data will be obtained when respondents are interviewed while they are extremely busy or are not in good humor. Responses to issues such as strikes, layoffs, or the like could also be biased. The personality of the interviewer, the introductory sentence, inflection of the voice, and such other aspects could introduce additional bias. Awareness of the many sources of bias will enable interviewers to obtain relatively valid information.

Sampling biases, which include inability to contact persons whose telephone numbers have changed, could also affect the quality of the research data. Likewise, people with unlisted numbers who are not contacted could also bias the sample (discussed in Chapter 13), and, hence, the data obtained. With the introduction of caller ID, it is possible for telephone interviews to be ridden with complexity.

Computer-assisted interviewing

With computer-assisted interviews (CAI) questions are flashed onto the computer screen and interviewers can enter the answers of the respondents directly into the computer. The accuracy of data collection is considerably enhanced since the software can be programmed to flag the "offbase" or "out-of-range" responses. CAI software also prevents interviewers from asking the wrong questions or in the wrong sequence since the questions are automatically flashed to the respondent in an ordered sequence. This, to some extent, eliminates interviewer-induced bias.

CATI and CAPI

There are two types of computer-assisted interview programs: CATI (computer-assisted telephone interviewing) and CAPI (computer-assisted personal interviewing).

CATI, used in research organizations, is useful inasmuch as responses to surveys can be obtained from people all over the world. The computer prompts the questions with the help of software and the respondent provides the answers. The computer selects the telephone number, dials, and places the responses in a file. The data are analyzed later. Computerized, voice-activated telephone interviews are also possible for short surveys. Data can also be gathered during field surveys through handheld computers that record and analyze responses.

CAPI involves rather big investments in hardware and software. CAPI has an advantage in that it can be self-administered; that is, respondents can use their own computers to run the program by themselves once they receive the software and enter their responses, thereby reducing errors in recording. However, not everyone is comfortable using a personal computer and some may not have access to one.

The voice recording system assists CATI programs by recording interviewees' responses. Courtesy, ethics, and legal requirements require that the respondents' permission to record be obtained before the voice capture system (VCS) is activated. The VCS allows the computer to capture respondents' answers, which are recorded in a digital mode and stored in a data file. They can be played back later, for example, to listen to customers by region, industry, or any combination of different sets of factors.

In sum, the advantages of computer-assisted interviews can be stated simply as quick and more accurate information gathering, plus faster and easier analysis of data. The field costs are low and automatic tabulation of results is possible. It is more efficient in terms of costs and time, once the initial heavy investment in equipment and software has been made. However, to be really cost-effective, large surveys should be done frequently enough to warrant the heavy front-end investment and programming costs.

Software packages

Field notes taken by interviewers as they collect data generally have to be transcribed, hand-coded, hand-tabulated, and so on – all of which are tedious and time consuming. In the present day there is a lot of software available that may ease the interviewers' job with regard to these activities.

Group interviews

Interviews may be conducted on an individual basis, but also on a group basis, where the interviewer puts open questions to a group of participants. The term "focus group" is used for a particular type of group interview, where the topic is clearly defined and there is a focus on facilitating discussion between participants.

Focus groups

Focus groups consist typically of eight to ten members with a moderator leading the discussions on a particular topic, concept, or product. Members are generally chosen on the basis of their familiarity with the topic on which information is sought. For example, women with children may compose a focus group to identify how organizations can help working mothers. Large organizations such as Coca-Cola, Unilever, and Nike regularly convene young men and women from around the world to tap them for ideas for a new product.

The focus sessions are aimed at obtaining respondents' impressions, interpretations, and opinions, as the members talk about the event, concept, product, or service. The moderator plays a vital role in steering the discussions in a manner that draws out the information sought, and keeps the members on track.

Focus group discussions on a specific topic at a particular location and at a specified time provide the opportunity for a flexible, free-flowing format for the members. The unstructured and spontaneous responses are expected to reflect the genuine opinions, ideas, and feelings of the members about the topic under discussion. Focus groups are relatively inexpensive and can provide fairly dependable data within a short time frame.

Role of the moderator The selection and role of the moderator are critical. The moderator introduces the topic, observes, and takes notes and/or records the discussions. The moderator never becomes an integral part of the discussions, but merely steers the group persuasively to obtain all the relevant information, and helps the group members to get through any impasse that might occur. The moderator also ensures that all members participate in the discussion and that no member dominates the group. Someone from the research team may also observe the proceedings through a one-way mirror, listening to the verbal statements and noticing the nonverbal cues of the members.

The nature of data obtained through focus groups It should be noted that although data obtained through these homogeneous group members are less expensive than those obtained through the various other data collection methods, and also lend themselves to quick analysis, the content analysis of the data so obtained provides only qualitative and not quantitative information. Also, since the members are not selected scientifically to reflect the opinions of the population at large (see Chapter 13 on Sampling for more details on this), their opinions cannot be considered to be truly representative. However, when exploratory information is collected as a basis for further scientific research, focus groups serve an important function. Consider, for example, the value of focus groups in exploring the concept of "intellectual property." When animated discussions take place, there is a serendipitous flow of new ideas among the group members who discuss the nuances of each thought process. Researchers are thereby helped to obtain valuable insights from the snowballing effects of the discussions.

Videoconferencing If regional variations in responses are expected, several focus groups could be formed, including trained moderators, at different locations. This process is easily facilitated through videoconferencing. By zooming in on a particular member, the nonverbal cues and gestures of that individual can be captured, as and when desired. This also obviates the need for an observer looking through a one-way mirror.

With the great strides that have been made in technological advancement, videoconferencing as a means of gathering information from different groups in distant locations has become rather common these days.

In sum, focus groups are used for:

1. Exploratory studies.
2. Making generalizations based on the information generated by them.
3. Conducting sample surveys.

Focus groups have been credited with enlightening investigators as to why certain products are not doing well, why certain advertising strategies are effective, why specific management techniques do not work, and the like.

Expert panels

"Focus group research" is a generic term for any research that studies how groups of people talk about a clearly defined issue. An **expert panel** is a group of people specifically convened by the researcher to elicit expert knowledge and opinion about a certain issue. The criteria for qualification as an expert are many and varied, but the expert panel usually comprises independent specialists, recognized in at least one of the fields addressed during the panel sessions. Expert panels may thus bring together a wide variety of experts, including scientists, policy makers, and community stakeholders.

ADVANTAGES AND DISADVANTAGES OF INTERVIEWS

Interviews are one method of obtaining data; they can be either unstructured or structured, and can be conducted face to face, over the telephone, or via the computer. Interviews may be conducted on an individual basis, but also on a group basis. Unstructured interviews are usually conducted to obtain definite ideas about what is, and is not, important and relevant to particular problem situations. Structured interviews give more in-depth information about specific variables of interest. To minimize bias in responses, the interviewer must establish rapport with the respondents and ask unbiased questions. The face-to-face interview and that conducted over the telephone have their advantages and disadvantages, and both have their uses in different circumstances. Computer-assisted interviewing, which entails heavy initial investment, is an asset for interviewing and for the analysis of qualitative, spontaneous responses. Computer interactive interviews have become an increasingly important mode of data collection in recent years.

The advantages and disadvantages of personal or face-to-face interviews and telephone interviews are presented in Table 7.1.

TABLE 7.1

Advantages and disadvantages of interviews

Mode of data collection	Advantages	Disadvantages
Personal or face-to-face interviews	Can establish rapport and motivate respondents. Can clarify the questions, clear doubts, add new questions. Can read nonverbal cues. Can use visual aids to clarify points. Rich data can be obtained. CAPI can be used and responses entered in a portable computer.	Takes personal time. Costs more when a wide geographic region is covered. Respondents may be concerned about confidentiality of information given. Interviewers need to be trained. Can introduce interviewer bias.
Telephone interviews	Less costly and speedier than personal interviews. Can reach a wide geographic area. Greater anonymity than personal interviews. Can be done using CATI.	Nonverbal cues cannot be read. Interviews will have to be kept short. Obsolete telephone numbers could be contacted, and unlisted ones omitted from the sample. Respondents can terminate the interview at any time.

SUMMARY

- **Learning objective 1: Differentiate primary from secondary data collection methods.**
  Data collection methods are an integral part of research design. Primary data collection methods involve data collection from original sources for the specific purpose of the study. The discussion on primary data collection methods is organized around four principal methods of primary data collection: interviews, observation, administering questionnaires, and experiments. The primary data collection decision is interrelated with the other steps in the research process.

- **Learning objective 2: Plan, design, and carry out a personal interview.**
  A commonly used method of collecting data in business research is to interview respondents to obtain information on an issue of interest. An interview is a guided, purposeful conversation between two or more people. There are many different types of interviews. Individual interviews may be unstructured or structured, and conducted face to face, by telephone, or online.

- **Learning objective 3: Plan, design, and carry out a group interview.**
  Interviews may be conducted on an individual basis, but also on a group basis, where the interviewer asks open questions of a group of participants. The term "focus group" is used for a particular type of group interview, where the topic is clearly defined and there is a focus on facilitating discussion between participants. An expert panel is a group of people specifically convened by the researcher to elicit expert knowledge and opinion about a certain issue.

- **Learning objective 4: Discuss the advantages and disadvantages of interviewing.**
  Problems researched with the use of appropriate methods greatly enhance the value of the study. That is why the choice of method(s) will depend on the objective(s) of the study, the research questions, and the research strategy. Other factors, such as facilities available, the degree of accuracy required, the type of data required, the time span of the study, the expertise of the reviewer, and costs will also affect the choice of method(s). The advantages and disadvantages of interviews are discussed in the final part of this chapter.

In the next chapter, we discuss observation as a method of collecting data.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: Kyoto Midtown Shopping Centre**.

DISCUSSION QUESTIONS

1. Describe the different data sources, explaining their usefulness and disadvantages.
2. As a manager, you have invited a research team to come in, study, and offer suggestions on how to improve the performance of your staff. What steps will you take to relieve staff apprehensions and worries even before the research team sets foot in your department?
3. What is bias, and how can it be reduced during interviews?
4. Discuss the advantages and disadvantages of personal and telephone interviews.
5. What are projective techniques and how can they be used profitably?
6. How has the advancement in technology helped data gathering via interviewing?

Now do Exercises 7.1 and 7.2.

EXERCISE 7.1

First conduct an unstructured and later a structured interview, to learn about how people use and process information to choose among alternative brands when they are looking for furniture, clothing, household appliances, and the like. Select a specific product and ask people, for instance, about the product attributes they consider, and how important these attributes are. Write up the results, and include the formats you used for both stages of the research.

EXERCISE 7.2

Design an interview schedule to assess the "intellectual capital" as perceived by employees in an organization – the dimensions and elements for which you developed earlier.

CHAPTER 8

Data collection methods: Observation

LEARNING OBJECTIVES

After completing Chapter 8 you should be able to:

1. Define observation and discuss how observation may help to solve business problems.
2. Demonstrate the ability to make an informed decision on an appropriate type of observational method for a specific study.
3. Explain the issues related to participant observation and structured observation.
4. Discuss the advantages and disadvantages of observation.

INTRODUCTION

Actions and behavior of employees, consumers, investors, and the like may play an important role in business research. Researchers and managers might be interested in the way workers carry out their jobs, the impact of new manufacturing techniques on employee activity, in how consumers watch commercials, use products, or behave in waiting areas, or in how a merchant bank trades and operates. A useful and natural technique to collect data on actions and behavior is observation. Observation involves going into "the field" – the factory, the supermarket, the waiting room, the office, or the trading room – watching what workers, consumers, or day traders do, and describing, analyzing, and interpreting what one has seen.

Observational methods are best suited for research requiring non-self-report descriptive data; that is, when behavior is to be examined without directly asking the respondents themselves. Observational data are rich and uncontaminated by self-report bias. However, observational methods are also time consuming and challenging in a lot of other ways as you will learn in this chapter. Indeed, they are not without difficulties for the untrained researcher.

This chapter starts with a definition of observation, followed by an overview of observational methods distinguished by four basic dimensions: control, group membership, structure, and concealment. Subsequently we examine two important observational methods, participant observation and structured observation, in more detail. Finally, we discuss advantages and disadvantages of observation.

EXAMPLE

Examples of observation discussed in further detail later in this chapter

- Shadowing a Wall Street broker engaged in his daily routine.
- Observing in-store shopping behavior of consumers via a camera.
- Sitting in the corner of an office to observe how a merchant bank trader operates.
- Working in a plant to study factory life.
- Studying the approach skills of sales people disguised as a shopper.

DEFINITION AND PURPOSE OF OBSERVATION

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Definition and purpose of observation**.

Observation concerns the planned watching, recording, analysis, and interpretation of behavior, actions, or events. Various approaches of observation have been used in business research. These may be distinguished by four key dimensions that characterize the way observation is conducted: (1) control (are the observations conducted in an artificial or in a natural setting?), (2) whether the observer is a member of the group that is observed or not (participant versus nonparticipant observation), (3) structure (to what extent the observation is focused, predetermined, systematic, and quantitative in nature), and (4) concealment of observation (are the members of the social group under study told that they are being studied or not?). These key dimensions that distinguish particular methods of observation are discussed next.

FOUR KEY DIMENSIONS THAT CHARACTERIZE THE TYPE OF OBSERVATION

Controlled versus uncontrolled observational studies

A distinction can be made between observation conducted in controlled (or artificial) versus uncontrolled (or natural) settings. Observation is often conducted in a natural setting. However, observation is also a potential method of data collection within an experimental, controlled research tradition.

An observational study is said to be high in control when the situation or setting is manipulated or contrived by the researcher; the exposure of subjects (for instance, consumers, employees, or investors) to a certain situation or condition (for instance a specific store layout, specific labor conditions, or a certain amount of time pressure) allows the researcher to observe differences between individual behavioral reactions to the situation. Controlled observation may be carried out in a laboratory (for instance, a simulated store environment or trading room) or in the field (for instance, a store).

Controlled observation occurs when observational research is carried out under carefully arranged conditions. **Uncontrolled observation** is an observational technique that makes no attempt to control, manipulate, or influence the situation. Events are running their natural course and the researcher observes these events without interfering in the real-life setting. An advantage of uncontrolled observation is that people can be observed in their natural shopping or work environment. A major drawback of uncontrolled observation is, however, that it is usually difficult to untangle the often complex situation since we do not control any factor in this. Accordingly, it is very hard to distinguish *the causes* of events, actions, and behavior.

Participant versus nonparticipant observation

The researcher can play one of two roles while gathering observational data – that of a nonparticipant or a participant observer. In the case of **nonparticipant observation,** the researcher is never directly involved in the actions of the actors, but observes them from outside the actors' visual horizon, for instance via a one-way mirror or a camera.

Participant observation is an approach that has frequently been used in case studies, ethnographic studies, and grounded theory studies (see Chapter 6 for a discussion on the relationship between participant observation and ethnography). In participant observation the researcher gathers data by participating in the daily life of the group or organization under study.

Spradley (1980) has developed a typology to describe a continuum in *the degree of participation* of researchers. The lowest level of participant observation is *passive participation*. Passive participation allows the researcher to collect the required data without becoming an integral part of the (organizational) system. For example, the researcher might sit in the corner of an office and watch and record how a merchant bank trader spends her time. *Moderate participation* occurs when the researcher does not actively participate and only occasionally interacts with the social group under study. In new research settings, in which the researcher is not familiar with the activities, habits, and/or the jargon of the group, many researchers begin at the level of moderate participation until a more active role is possible. *Active participation* is when the researcher actually engages in almost everything that the group under study is doing as a means of trying to learn about their behavior. The researcher may also play the role of the complete participant-observer. In *complete participant observation*, the researcher becomes a member of the social group under study. Complete participant observation involves "immersion" in the social group under study. For instance, if a researcher wants to study group dynamics in work organizations, then she may join the organization as an employee and observe the dynamics in groups while being a part of the work organization and work groups. Like this, complete participant observation aims to generate an understanding of a social group from an "insider's point of view" (Hume & Mulcock, 1994).

EXAMPLE

A famous example of complete participant observation in a business context is Beynon's (1975) study. Beynon spent much of 1967 in Ford's Halewood plant to study factory life and the experience of people who worked at the assembly lines of the Ford Motor Company. Beynon entered the Ford Motor Company and became a member of the social group under study (workers within a car assembly plant) to investigate "life on the line."

Structured versus unstructured observational studies

As we have seen, observational studies can be of either the nonparticipant-observer or the participant-observer type. Both of these, again, can be either structured or unstructured. Where the observer has a predetermined set of categories of activities or phenomena planned to be studied, it is a *structured observational study*. Formats for recording the observations can be specifically designed and tailored to each study to suit the goal of that research. **Structured observation** is generally quantitative in nature.

Usually, matters that pertain to the feature of interest, such as the duration and frequency of an event (for instance, how long does it take to get a meal at a fast-food restaurant?), as well as certain activities that precede and follow it, are recorded. Environmental conditions (for instance, labor conditions) and any changes in setting are also noted, if considered relevant. Task-relevant behaviors of the actors, their perceived emotions, verbal and nonverbal communication, and the like, may also be recorded. Observations that are recorded in worksheets or field notes are then systematically analyzed.

At the beginning of a study, it is also possible that the observer has no definite ideas of the particular aspects that need focus. Observing events as they take place may also be a part of the plan as in many other forms of exploratory and qualitative research. In such cases, the observer will record practically everything that is observed. Such a study will be an *unstructured observational study*. Unstructured observational studies are claimed to be the hallmark of qualitative research. Qualitative data analysis (Chapter 16) is used to analyze and interpret what the researcher has seen.

Unstructured observation may eventually lead to a set of tentative hypotheses that are tested in subsequent research that is deductive in nature. Hence, inductive discovery via observation can pave the way for subsequent theory building and hypotheses testing.

Concealed versus unconcealed observation

Concealment of observation relates to whether the members of the social group under study are told that they are being investigated. A primary advantage of **concealed observation** is that the research subjects are not influenced by the awareness that they are being observed. Indeed, **reactivity** or the extent to which the observer affects the situation under observation could be a major threat to the validity of the results of observational studies. **Unconcealed observation** is more obtrusive, perhaps upsetting the authenticity of the behavior under study.

EXAMPLE

The Hawthorne studies

A famous example of subject responses to unconcealed observation is the "Hawthorne effect." In a relay assembly line, many experiments were conducted that increased lighting and the like, based on the original hypothesis that these would account for increases in productivity. However, as it turned out, the mere fact that people were chosen for the study gave them a feeling of importance that increased their productivity whether or not lighting, heating, or other effects were improved, thus the coining of the term the *Hawthorne effect*.

Concealed observation

To avoid reactivity, McClung, Grove & Hughes (1989) used researchers disguised as shoppers to collect data on the approach skills of salespeople. They decided to employ concealed observation because unconcealed observation could have an effect on the validity of their observations.

Concealed observation has some serious ethical drawbacks. While less reactive, concealed observation raises ethical concerns since it may violate the principles of informed consent, privacy, and confidentiality (Burgess 1989; Lauder 2003). For this reason concealed observation may harm the subjects in several ways. However, in some situations, for instance when a (marketing) researcher watches a service encounter between a bus driver and a bus passenger, the researcher is likely to be less culpable than in other situations, for instance when the researcher immerses herself in a certain social group such as a specific department within an organization (cf. Grove and Fisk, 1992). Note that there are no strict rules for assessing the ethicality of concealed observational research. Instead, a careful, well-judged assessment of the potential harmful consequences of concealed observational research should be made by the researcher. Frederichs and Ludtke (1975, p. 12) provide an elegant guideline for such an assessment: the research plan "should be able to justify itself to the members of the scientific community as well as to those involved in the study."

TWO IMPORTANT APPROACHES TO OBSERVATION

We have just briefly discussed the key dimensions that differentiate various approaches to observation. Two important, distinct approaches to observation are *participant observation* and *structured observation*. The remaining part of this chapter will discuss these two approaches in more detail.

Participant observation: introduction

Earlier in this chapter we have explained that the researcher can play one of two roles while gathering observational data: that of a nonparticipant or a participant observer. A key characteristic of participant observation is that the researcher gathers data by participating in the daily life of the group or organization under study. This enables the researcher to learn about the activities of the group under study in a natural setting from an insider's point of view through observing and participating in these activities. When Malinowski introduced this method in his influential work *Argonauts of the Western Pacific* he argued that it puts the researcher in a position "to grasp the native's point of view, his relation to life, to realize *his* vision of *his* world" (Malinowksi, 1992, p. 25). Today, this is still regarded as the key objective and one of the main strengths of participant observation. Since the time of Malinowski, the method of participant observation has been thoroughly developed and refined. It is now common to distinguish between two basic ways of conceiving of the method (Zahle, 2012). It may be narrowly identified as participation in the way of life of the social group under study combined with observing what is going on. Or, it may be labeled more broadly to involve not only participation and observation but also the use of other methods such as interviews. In this chapter, we take on a more narrow view of participant observation; we look at participant observation as one of several qualitative research methods aiming to understand the nature of phenomena.

The participatory aspect of participant observation

Participant observation combines the processes of participation and observation. Nonetheless, participant observation should be distinguished from both pure observation and pure participation (Bernard, 1994). **Pure observation** seeks to remove the researcher from the observed actions and behavior; the researcher is never directly involved in the actions and behavior of the group under study. **Pure participation** has been described as "**going native**"; the researcher becomes so involved with the group under study that eventually every objectivity and research interest is lost (Jorgensen, 1989; DeWalt & DeWalt, 2002). Within these two extremes, participant observation has been successfully employed by many researchers engaged in business research.

A distinctive feature of participant observation is that the researcher participates in the social group under study. As we have explained earlier in this chapter, the researcher may do so to different extents. The highest degree of participation occurs with *complete participation*. In this case, the researcher lives or works with the subjects under study and tends to assume a pre-established role (for instance, the role of coworker). In complete participation, the researcher may conceal that she is an observer, behaving as naturally as possible and seeking to become an accepted member of the social group. This technique assures close intimacy with the subjects; the researcher interacts with the subjects and also carries out their activities. A disadvantage of this method is that complete participation may limit freedom of movement outside the adopted role: it is difficult to abandon the role of complete participant as the research proceeds. What's more, the methodological problem of "going native" may result in a fading research perspective and an increased likelihood of biased research findings. Finally, there are important ethical problems with *concealed* complete participation. Becoming a member of a social group and deliberately deceiving the members of this group is regarded as unethical by many. For these reasons, complete participation has become increasingly rare.

In many situations, observational studies are based on *moderate* participation. In the case of moderate participation, the researcher assumes an intermediate position between being a complete insider (a complete participant) and being a complete outsider (as in nonparticipation observational studies). In moderate participation, the researcher observes the scene under study, maintaining a certain distance from it and never intervening. Indeed, the role of the researcher is often the role of a passive witness or bystander. Another technique that is sometimes used is "shadowing." Shadowing implies that the researcher closely follows a subject (for instance, a manager or a Wall Street broker) engaged in his or her daily routine.

EXAMPLE

Typical examples of passive participation are observations conducted in service consumption settings, such as in a lecture room, a theater, a waiting room, or a theme park.

In the case of *active* participation, the researcher is not satisfied with the role of the bystander. In this case, the researcher does not conceal that she is an observer but explains the fact that she is an observer to the social group under study right from the start. This allows the researcher to not only observe the everyday activities of the subjects (workers, managers, consumers, brokers), but also to engage in those activities and thus to put them into practice. The goal of active participation is not to become like the subjects, and to immerse in their activities, but to carry out certain activities and hence to acquire a better understanding of their practices.

EXAMPLE

To what extent should I participate?

The extent to which the researcher participates depends on a range of factors. For instance, it may be determined by the research questions, ethical considerations, methodological considerations, but also by more practical factors such as by how much the researcher feels happy about participating or by the extent to which either contextual factors or the members of the group under study are willing to let the researcher participate.

The observation aspect of participant observation

While participating, the researcher should observe and record, and at a later stage analyze behavior, actions, interactions, events, and the like. Getting started with participant observation and becoming a part of a social group is not without its difficulties. There are several issues that must be addressed. These include choosing a "site" (a specific department, business unit, plant, supermarket, etc.), gaining permission, the selection of key informants, and familiarizing oneself with the research setting (Bernard, 1994).

In most observational studies, gaining access begins with obtaining permission to carry out research from highly ranked people within the organization, preferably from top management. To gain permission to carry out the study, it is important to carefully explain the purpose of the research. If the purpose of the research is understood (and accepted) you will eventually get permission to carry out your research project. You may also benefit from letters of introduction (for instance, from the sponsor of the study) that will ease entry.

Getting permission is only the first step in carrying out participant observation. Becoming an accepted member of the social group under study is the next. Numerous ethnographers have noticed that some members of the social group under study are more open and more likely to approach the researcher early in the fieldwork than others (DeWalt & DeWalt, 2002).

EXAMPLE

On "deviants" and "professional stranger handlers"

Agar suggests that the researcher be careful to accept the first people she encounters as key informants, since they are often either "deviants" or "professional stranger handlers." Deviants are "members who are on the boundaries of the group in some low-status position" (Agar, 1996, p. 136). Association with deviants may alienate the researcher from the rest of the group and provide the researcher with a flawed view on the social group under study. Professional stranger handlers are persons who take it upon themselves to check out the new person and what it is this person is after. "They can [. . .] quickly improvise some information that satisfies her without representing anything potentially harmful to the group" (Agar, 1996, p. 135).

Agar suggests that the researcher finds a well-liked and respected person who can act as a sponsor. This "sponsor" is a group member who is willing to introduce you to the group, to vouch for you, and to explain your presence to the other group members.

An essential aspect of participant observation is establishing "**rapport**." Establishing rapport involves establishing a trusting relationship with the social group under study, by showing respect, being truthful, and showing commitment to the well-being of the group or the individual members of the group, so that they feel secure in sharing (sensitive) information with the researcher. Jorgensen (1989) has argued that the degree to which rapport is established influences the degree to which the information that is collected in participant observation is accurate and dependable. In a similar vein, rapport has been referred to as "the only basis on which really reliable information can be obtained" (Villa Rojas, 1979, p. 59).

EXAMPLE

How do I establish rapport?

Rapport is built over time. Hanging out with the subjects under study – that is, meeting and chatting with them to develop relationships over an extended period of time – is the process through which the researcher gains trust and establishes rapport with participants (DeMunck & Sobo, 1998). Establishing rapport involves active listening, reciprocity (giving back something to the subjects under study), and confidentiality; the subjects must be assured that they can share personal and sensitive information without their identity being exposed to others.

What to observe

A potential problem with observational studies is getting overwhelmed by massive amounts of often disconnected data. For this reason, the researcher should try to keep a certain focus during the various stages of the observation process. Generally speaking, the most important factor in determining what to observe is the aim or purpose of the study. However, "[w]here to begin looking depends on the research question, but where to focus or stop action cannot be determined ahead of time" (Merriam, 1988, p. 97). Werner and Schoepfle (1987) discern three consecutive processes in observation that may provide an increasingly deep understanding of the setting that is being studied: (1) descriptive observation, (2) focused observation, and (3) selective observation.

In descriptive observation, the researcher is open to everything that is going on; data are collected that describe the setting, the subjects, and the events that are taking place.

EXAMPLE

What to observe in the descriptive observation stage

Spradley (1980) distinguishes the following dimensions on which descriptive data might be collected:

- *space* layout of the physical setting such as the factory floor layout;
- *objects* physical elements such as office equipment, machines, and power tools;
- *actors* relevant details of the persons involved;
- *feelings, emotions, activities, actions,* and *goals* of the actors;
- *events* for instance meetings; and
- *time* or the *time sequence* of events, feelings, actions, and the like.

The data collected during descriptive observation provide an initial story or narrative account which may serve as a basis for the development of a set of concepts, a theory, or even a conceptual framework. The development of concepts, theories, and conceptual frameworks is facilitated by a greater focus via focused and selective observation. Focused observation emphasizes observation (often supported by interviews) in which the researcher will concentrate on particular types of feelings, emotions, actions, activities, and/or events and look for emerging themes. Finally, in selective observation the researcher focuses on different types of actions, activities, or events and look for regularities in them, while being open to variations from or exceptions to emerging patterns (Emerson, Fretz & Shaw, 1995).

EXAMPLE

What to observe in the focused and selective observation stages

To help researchers decide on what to observe in the focused and selective observation stages, DeWalt & DeWalt (2002) suggest that they:

- observe events, actions, and behavior and look for a story line;
- sort out the regular from the irregular activities;
- look for variation in the storyline;
- look for negative cases or exceptions; and,
- in case the observation is structured, develop a plan for systematic observation, including an estimate of how many observations will be enough.

The most important method of *capturing data* in participant observation is writing field notes. Notes taken to capture data include records of what is observed, records of informal conversations with the subjects under study, and journal notes that are kept on a daily basis. Most researchers write down words, phrases, or even whole sentences during the course of the day or the event and write more expanded notes during quieter times. The quality of field notes relies heavily on the level of detail and the accuracy of the description (Schensul, Schensul & LeCompte, 1999). The documentation of observations should therefore be as accurate, complete, detailed, and objective as possible. How much is actually written down during the course of the day or the event depends on the quality of the memory of the researcher and the circumstances under which the researcher is working (DeWalt & DeWalt, 2002). Schensul, Schensul, and Lecompte (1999) provide a range of characteristics of good field notes. These are summarized in Box 8.1.

BOX 8.1

CHARACTERISTICS OF GOOD FIELD NOTES

Good field notes:

- use exact quotes when possible;
- use pseudonyms to protect confidentiality;
- describe activities in the order in which they occur;
- provide descriptions without inferring meaning;
- include relevant background information to situate the event;
- separate one's own thoughts and assumptions from what one actually observes;
- record the date, time, place, and name of researcher on each set of notes.

Schensul, Schensul, and LeCompte (1999).

One should be aware of the fact that field notes are a construction of the researcher; it is the researcher who decides what goes into the field notes, the level of detail to include, how much context to include, and so on. For this reason field notes are often regarded as being simultaneously data and data analysis, or as the first step in the process of data analysis (e.g., DeWalt & DeWalt, 2002).

To summarize, participant observation requires many skills, such as commitment, the ability to fit in, tact, the ability to communicate with different members of the social group at their level, patience, the ability to observe, the ability to separate the role of participant from that of observer, and so on. Therefore, before committing yourself to participant observation you need to be certain you have the time, resources, and skills required to carry out and carry through this exceptionally challenging type of research.

We conclude our discussion of participant observation with some suggestions for conducting participant observation adapted from DeWalt and DeWalt (2002), Merriam (1998), and Wolcott (2001). These suggestions are specified in Box 8.2.

Structured observation: introduction

Structured observation is focused in nature, as it looks selectively at predetermined phenomena. The focus of structured observation is fragmented into small and manageable pieces of information (such as information on behavior, actions, interactions, or events).

BOX 8.2

SUGGESTIONS FOR CONDUCTING PARTICIPANT OBSERVATION

1. Be unobtrusive in your actions.
2. Become familiar with the setting before collecting other types of data.
3. Be tolerant of ambiguity: this includes being adaptive and flexible.
4. Pay attention, and alternate between a wide (a view of the overall situation) and a narrow (focusing on a single person, activity, or interaction) perspective.
5. Look at interactions in the setting: who talks to whom, who is respected, and how are decisions made.
6. Listen carefully to conversations, look for key words in conversations, and write these down to prompt later recollection of the conversation.
7. Concentrate on the first and last remarks of a conversation, as these are most easily remembered.
8. Being attentive for a long time is difficult; pay attention off and on. Capitalize on moments of attention.
9. Field work often involves more than observation. It may also involve (informal) interviews and structured interviews, such as questionnaires.
10. Be determined and have faith in yourself.

Adapted from DeWalt and DeWalt (2002), Merriam (1998), and Wolcott (2001).

There are different levels of structure in structured observation. For instance, the researcher may have decided on the observation categories in a rather precise and mutually exclusive way in advance (highly structured observation) or start with a detailed plan of what will be observed and how, but collect the data in a less systematic or predetermined way (semi-structured observation).

An example of the use of (nonexperimental) structured observation in marketing is the employment of mystery shoppers – thoroughly trained researchers who accurately record employee behavior using checklists and codes – to gather specific information on service performance. Service providers such as fast-food chains use this particular type of observation to monitor the quality of their service.

Structured observation can also be used to generate numerical data to test hypotheses, as the following example illustrates.

EXAMPLE

A master's student of Tilburg University, Thomas Perks, is currently engaged in a research project aimed at investigating the effect of GDA labels on the consumption of candy bars. (A GDA label shows the number of calories and grams of sugars, fat, saturates (saturated fat), and salt per portion of food, and expresses these quantities as a percentage of your Guideline Daily Amount.)

To be able to observe the effect of GDA labels on the consumption of candy bars, Thomas is allegedly waiting for his car at a car dealer. In fact, he is observing the behavior of people who are waiting for their cars, sitting at a large table. To test one of the hypotheses of his study – GDA labels have a negative effect on the consumption of candy bars – he has put two bowls filled with candy bars on this table. In the experimental condition, the candy bars in the bowls contain a GDA-label; in the control condition they do not contain such a label.

In order to minimize possible observer effects, Thomas is keeping a low profile: he avoids eye contact and he smiles politely when people are trying to start a conversation. Nonetheless, he gets engaged in conversations about the weather, computer problems, gas prices, and so on every now and then. While Thomas is waiting for his car (observing the behavior of the subjects under study) he is working on his laptop (keeping a detailed account of the behavior of the subjects).

Thomas is using a coding scheme that allows him to collect data in a structured way. His coding scheme contains predetermined categories that enable him to systematically generate information on characteristics of the subjects, events, and behavior of the subjects. The categories are closely related to the variables (including a range of confounding variables) in Thomas' conceptual causal model.

The use of coding schemes in structured observation

The development of a coding scheme is a crucial aspect of structured observation. **Coding schemes** contain predetermined categories for recording what is observed. Such schemes come in many forms and shapes. Some of them are very simple; they merely allow the researcher to note whether or not a particular event has taken place. Other schemes are more complex; they include multiple categories, timescales, and the like. Note that the development of an adequate coding scheme is never a straightforward task.

The type of coding scheme you will use depends on the information that you want to collect. Again, the research questions of your study serve as the starting point, in this case for the development of a coding scheme. Based on the research questions, sometimes refined via a pilot study, you define the important concepts (variables) in your study and develop a coding scheme that allows you to collect information on these concepts.

The following considerations should be taken into account with regard to the construction of a coding scheme.

- *Focus.* From the coding scheme it should be clear what is to be observed. For instance, Thomas' coding scheme should help him to establish which aspects of the setting (for instance, how many people are waiting for their car) and which types of behavior (for instance, the subject is walking through the showroom of the car dealer, the subject is eating a candy bar) are to be observed and recorded.
- *Objective.* The coding scheme and the categories should require little inference or interpretation from the researcher. Clear guidelines and detailed definitions of categories should help the observer to objectively code events, actions, and behavior.
- *Ease of use.* A good coding scheme is easy to use.
- *Mutually exclusive and collectively exhaustive.* Categories in a coding scheme should be mutually exclusive and collectively exhaustive. Categories are mutually exclusive if none of the categories overlap one another. A coding scheme that is collectively exhaustive covers all possibilities (for instance, all the relevant events, actions, and behavior) so that it is always possible to code.

Standard coding schemes may help you to develop your own coding scheme, allowing you to provide an answer to your research questions. In some cases, frequency measures suffice to provide an answer to the research questions. For instance, a researcher who is merely interested in *how often* a manager attends scheduled and unscheduled meetings, answers telephone calls, or writes emails may simply wait for these activities to happen and record the incidences on a simple checklist. However, many researchers are not only interested in how often certain events take place, but also in the circumstances under which these events take place. In these cases, the researcher is not only interested in the frequency of certain behavior, but also in the timing of certain behavior.

(a) Simple checklist

Event	1	2	3	4
	~~////~~	//	/	///

(b) Sequence record

Event	1	4	2	4	1	1	3	1	4	2	1

(c) Sequence record on timescale

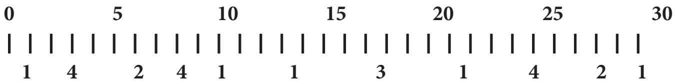


FIGURE 8.1

Alternative ways of coding events

Figure 8.1 illustrates various ways in which the researcher can code events: (a) a **simple checklist** provides information about how often a certain event has occurred; (b) a **sequence record** allows the researcher to collect information on how often an event occurs and about the order in which the events occur; and, finally, (c) a sequence record on a timescale adds a further level of detail, showing the time intervals between the events.

Simple checklists and sequence records are often very useful to the researcher conducting structured observation. Sometimes, however, the researcher may need information about the duration of particular events. In that case the researcher will also code the start and the finish of a certain activity or event.

You have probably noticed by now that structured observation is largely quantitative in nature. Indeed, structured observation allows you to collect quantitative information that may be used to test the hypotheses of your study. The specific instrument for collecting the necessary data is your coding scheme. It is therefore important that your coding scheme is good; in other words, that it is valid and reliable. **Validity** indicates the extent to which observations accurately record the behavior in which you are interested. **Reliability** refers to the consistency of observations, usually whether two (or more) observers, or the same observer on separate occasions, observing the same event attain the same results.

We have just discussed two important approaches to observation. Of course, there is much more to say about both participant observation and structured observation. If you are interested in learning more about these approaches you may benefit from a range of excellent books and research articles such as, for instance, *Participant Observation: A Guide for Fieldworkers* by DeWalt and DeWalt (2002). We will now conclude this chapter on observation by discussing advantages and disadvantages of observation.

ADVANTAGES AND DISADVANTAGES OF OBSERVATION

One of the main advantages of observation is its directness. Whereas interviews and questionnaires elicit verbal responses about actions and behavior from the subjects (which merely allows behavior to be inferred from these verbal responses), *observation allows the researcher to gather behavioral data without asking questions*. People can be observed in their natural work environment or in the lab setting, and their activities and behaviors or other items of interest can be noted, recorded, analyzed, and interpreted.

Apart from the activities performed by the individuals under study, their movements, work habits, the statements made and meetings conducted by them, other – environmental – factors such as layout, work-flow patterns, the closeness of the seating arrangement, and the like, can also be noted. In observational studies, it is also relatively easy to discern situational factors such as the weather (hot, cold, rainy), the day of the week (midweek as opposed to Monday or Friday), and other factors that might have a bearing on, for example, productivity, the sales of a product, traffic patterns, absenteeism, and the like. These factors can be recorded and meaningful patterns might emerge from this type of data. However, note that it is often very difficult to establish the *specific* effects of situational factors on behavior and actions of the subjects under study. As we explained earlier in this chapter, it is often difficult to untangle the often complex situation. Accordingly, it is sometimes very difficult to establish *cause-and-effect* relationships between situational factors and events, actions, and behavior.

Another advantage of observation is that is possible to observe certain groups of individuals – for example, very young children and extremely busy executives – from whom it may be otherwise difficult to obtain information. Children can be observed as to their interests and attention span with various stimuli, such as their involvement with different toys. Such observation would help toy manufacturers, child educators, day-care administrators, and others deeply involved in or responsible for children's development, to design and model ideas based on children's interests, which are more easily observed than traced in any other manner. The data obtained through observation of events as they normally occur are generally more reliable and free from respondent bias.

Observation is not without challenges and difficulties. The following drawbacks of observational studies have to be noted. Reactivity (the extent to which the observer affects the situation under study) could be a major threat to the validity of the results of observational studies, because those who are observed may behave differently during the period of the study. Observational research may be particularly vulnerable to reactivity if the observations are confined to a short period of time. In studies of longer duration, the subjects under study will become more relaxed as the study progresses and tend to behave normally, as illustrated in the following passage, provided by Malinowski, who carried out ethnographic field work in Omarkana Trobriand Islands:

> ***It must be remembered that the natives saw me constantly every day, they ceased to be interested or alarmed, or made self-conscious by my presence, and I ceased to be a disturbing element in the tribal life which I was to study, altering it by my very approach, as always happens to a newcomer to every savage community. In fact, as they knew that I would thrust my nose into everything, even where a well-mannered native would not dream of intruding, they finished by regarding me as a part and parcel of their life, a necessary evil or nuisance, mitigated by donations of tobacco.***
>
> **Malinowski, 1992, pp. 7–8**

Researchers doing observational studies often discount the data recorded in the first few days, especially if they seem to be (very) different from what is observed later.

Data observed from the researcher's point of view are likely to be prone to observer biases. For instance, a possible problem in participant observation is that the research perspective fades or even disappears completely because the role that the researcher has adopted in the group has taken over: the researcher has "gone native." This may lead to deficient, flawed, and biased accounts; there could be recording errors and errors in interpreting activities, behaviors, events, and nonverbal cues.

Observation of the happenings day in and day out, over extended periods of time, could also afflict the observer with ennui and could also introduce biases in the recording of the observations.

To minimize observer bias, observers are usually given training on how to observe and what to record. Good observational studies would also establish interobserver reliability. This could also be established during the training of the observers, when videotaped stimuli could be used to determine interobserver reliability. A simple formula can be used for the purpose – dividing the number of agreements among the trainees by the number of agreements and disagreements – thus establishing the reliability coefficient.

Observation is an obvious and appropriate technique to study actions and behavior. Though moods, feelings, and attitudes can be guessed by observing facial expressions and other nonverbal behaviors, the cognitive thought processes of individuals cannot be captured. In other words, it is very difficult to identify reasons behind behavior of the subjects under study. Observation is therefore often used as a technique to collect data that complement data obtained by other techniques such as interviews.

A practical problem of observation is that it is time consuming. Many forms of observation require the observer to be physically present, often for prolonged periods of time. For instance, participant observation entails the immersion of the researcher into the social group that is under study for many months and often even years. For this reason, this method of collecting data is not only slow, but also tedious and expensive.

In the following chapter, we turn to another method of collecting data: namely, questionnaires.

SUMMARY

- **Learning objective 1: Define observation and discuss how observation may help to solve business problems.**
  Actions and behavior of people may play an important role in business research. A useful and natural technique to collect data on actions and behavior is observation. Observation concerns the planned watching, recording, analysis, and interpretation of behavior, actions, or events.

- **Learning objective 2: Demonstrate the ability to make an informed decision on an appropriate type of observational method for a specific study.**
  Various approaches of observation may be distinguished by four key dimensions that characterize the way observation is conducted: (1) control; (2) whether the observer is a member of the group that is observed or not; (3) structure; and (4) concealment of observation.

- **Learning objective 3: Explain the issues related to participant observation and structured observation.**
  Two important, distinct approaches to observation are *participant observation* and *structured observation*. A key characteristic of participant observation is that the researcher gathers data by participating in the daily life of the group or organization under study. Participant observation requires many skills, such as commitment, the ability to fit in, tact, the ability to communicate with different members of the social group at their level, patience, the ability to observe, the ability to separate the role of participant from that of observer, and so on. Structured observation is focused in nature, as it looks selectively at predetermined phenomena. The focus of structured observation is fragmented into small and manageable pieces of information. The development of a coding scheme is a crucial aspect of structured observation. Coding schemes contain predetermined categories for recording what is observed.

- **Learning objective 4: Discuss the advantages and disadvantages of observation.**
  One of the main advantages of observation is its directness. Another advantage of observation is that it is possible to observe certain groups of individuals from whom it may otherwise be difficult to obtain information. Drawbacks of observational studies are reactivity, observer bias, and that it is time consuming, tedious and expensive.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: Performance Improvement Through Mystery Shopping.**

DISCUSSION QUESTIONS

1. Describe the key purpose of observation.
2. Discuss four dimensions that distinguish various approaches to observation.
3. Under which circumstances would you prefer observation as a method to collect data over other methods of data collection such as interviews and questionnaires?
4. How does participant observation differ from structured observation?
5. Discuss how ethnography and participant observation are related.
6. How does moderate participation differ from complete participation?
7. Although participant observation combines the processes of participation and observation it should be distinguished from both pure observation and pure participation. Explain.
8. What is rapport and how is rapport established in participant observation?
9. Field notes are often regarded as being simultaneously data and data analysis. Why?
10. Is it possible to test hypotheses with structured observation? Why (not)?
11. How does a simple checklist differ from a sequence record on time-scale?
12. "One of the main advantages of observation is its directness." Discuss.
13. What is reactivity?
14. A disadvantage of observation is observer bias. Discuss at least two ways of minimizing observer bias.
15. Discuss the ethics of concealed observation.

Now do Exercises 8.1, 8.2, and 8.3.

EXERCISE 8.1

You are investigating the service quality of restaurants. You are collecting primary data through interviews and observation. Your task is to go to a restaurant and collect descriptive observational data on the following factors: *space* (layout of the physical setting), *objects* (physical elements such as equipment, tables, chairs, and the like), *actors* (staff and clients), and interactions between staff members and clients.

EXERCISE 8.2

Seek permission from a professor to sit in two sessions of his or her class, and do an unstructured, nonparticipant-observer study. Give your conclusions on the data, and include in the short report your observation sheets and tabulations.

EXERCISE 8.3

Read all relevant information regarding Thomas Perks' study. From this information, develop a coding scheme to test the effect of GDA labels[1] on the consumption of candy bars (chocolate bars). Do not forget to include categories allowing you to collect data on relevant covariates.

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[1] GDA labels show the number of calories and grams of sugars, fat, saturates (saturated fats), and salt per portion of food, and expresses these quantities as a percentage of your "Guideline Daily Amount."

CHAPTER 9

Administering questionnaires

LEARNING OBJECTIVES

After completing Chapter 9, you should be able to:

1. Compare and contrast different types of questionnaires.
2. Design questionnaires to tap different variables.
3. Discuss the issues related to cross-cultural research.
4. Discuss the advantages and disadvantages of various data collection methods in survey research.
5. Discuss the advantages of multisources and multimethods of data collection.
6. Demonstrate awareness of the role of the manager in primary data collection.
7. Demonstrate awareness of the role of ethics in primary data collection.

INTRODUCTION

In Chapter 7, we have already explained that in business research, three important data collection methods are interviewing, observing people, and administering questionnaires. We have discussed interviewing in Chapter 7 and observation in Chapter 8. In this chapter, we will discuss questionnaires and questionnaire design. A **questionnaire** is a preformulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives.

TYPES OF QUESTIONNAIRES

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Questionnaires**.

Questionnaires are generally designed to collect large numbers of quantitative data. They can be administered personally, distributed electronically, or mailed to the respondents. Questionnaires are generally less expensive and time consuming than interviews and observation, but they also introduce a much larger chance of nonresponse and nonresponse error. An overview of the advantages and disadvantages of questionnaires (and other methods of data collection) and a section on when to use each of these methods is provided later in this chapter.

Personally administered questionnaires

When the survey is confined to a local area a good way to collect data is to personally administer the questionnaires. The main advantage of this is that the researcher or a member of the research team can collect all the completed responses within a short period of time. Any doubts that the respondents might have on any question can be clarified on the spot. The researcher also has the opportunity to introduce the research topic and motivate the respondents to offer their frank answers. Administering questionnaires to large numbers of individuals at the same time is less expensive and consumes less time than interviewing; equally, it does not require as much skill to administer a questionnaire as it does to conduct interviews. Wherever possible, questionnaires are best administered personally because of these advantages. A disadvantage of personally administered questionnaires is that the researcher may introduce a bias by explaining questions differently to different people; participants may be in fact answering different questions as compared to those to whom the questionnaire was mailed. What's more, personally administered questionnaires take time and a lot of effort. For this reason, electronic questionnaires are widely used these days.

Mail questionnaires

A mail questionnaire is a self-administered (paper and pencil) questionnaire that is sent to respondents via the mail. This method has long been the backbone of business research, but with the arrival of the Internet, mobile phones, and social networks, mail questionnaires have become redundant or even obsolete. Instead, online questionnaires are posted on the Internet or sent via email.

Electronic and online questionnaires

The distribution of electronic or online questionnaires is easy and fast. All you have to do is to email the invitations to complete a survey, post a link on a website or personal blog, or use social networks. Online questionnaires are usually created as "web forms" with a database to store the answers and statistical software to provide statistical analysis. Until recently, conducting online surveys was a time-consuming and tedious task requiring familiarity with web authoring programs, HTML codes, and/or scripting programs. Today, survey development software packages and online survey services make online survey research much easier and more accessible.

Online questionnaires are often used to gain a deeper understanding of consumers' opinions and preferences. A big advantage of online survey research is that it makes the most of the ability of the Internet to provide access to groups and individuals who would be difficult, if not impossible, to reach through other channels. Virtual communities flourish online, and hundreds of thousands of people regularly participate in discussions about almost every conceivable issue and interest (Wright, 2005). A second advantage of online questionnaires is that a wide geographical area can be covered in the survey. A (link to the) questionnaire is sent to the respondents, who can complete it at their convenience, in their homes, and at their own pace. The automatic processing of the survey saves further costs, time, and energy.

However, there are also important disadvantages to online questionnaires. When conducting online research, researchers often encounter problems with regard to sampling. For instance, self-selection and extremely low response rates make it difficult to establish the representativeness of the sample and to generalize the findings, because those responding to the survey may not at all represent the population they are supposed to (see Box 9.1). Indeed, the return rates of such questionnaires are typically low. A 30% response rate is considered acceptable, and in many cases even exceptional.

BOX 9.1

HOW TO IMPROVE YOUR RESPONSE RATES

Some effective techniques can be employed for improving the rates of response. Sending follow-up mails and keeping the questionnaire brief usually help. Electronic questionnaires are also expected to meet with a better response rate when respondents are notified in advance about the forthcoming survey, and a reputed research organization administers them with its own introductory cover letter. A small monetary incentive is also an effective technique to increase response rates.

Posting invitations to participate in a survey on social networks, discussion groups, and chat rooms is often perceived as rude or offensive. This is another drawback of online questionnaires. Many people consider this type of posting to be "spam", and the researcher may be flooded with emails from angry members of a virtual community. Researchers sending email invitations to participate in a study may face similar issues. An unwanted email is often considered an invasion of privacy and the invitation for the survey may be deleted, or the researcher may receive email from participants complaining about it (Wright, 2005). A final disadvantage of electronic questionnaires is that any doubts the respondents might have cannot be clarified.

The advantages and disadvantages of personally administered questionnaires, mail questionnaires, and electronic questionnaires are presented in Table 9.1.

TABLE 9.1

Advantages and disadvantages of different questionnaires

Mode of data collection	Advantages	Disadvantages
Personally administered questionnaires	Can establish rapport and motivate respondent. Doubts can be clarified. Less expensive when administered to groups of respondents. Almost 100% response rate ensured. Anonymity of respondent is high.	Explanations may introduce a bias. Take time and effort.
Mail questionnaires	Anonymity is high. Wide geographic regions can be reached. Token gifts can be enclosed to seek compliance. Respondent can take more time to respond at convenience. Can be administered electronically, if desired.	Response rate is almost always low. A 30% rate is quite acceptable. Cannot clarify questions. Follow-up procedures for nonresponses are necessary.
Electronic questionnaires	Easy to administer. Can reach globally. Very inexpensive. Fast delivery. Respondents can answer at their convenience like the mail questionnaire. Automatic processing of answers.	Computer literacy is a must. Sampling issues. High non-response. Not always possible to generalize findings. Respondent must be willing to complete the survey. People find invitations via email rude and offensive; emails are deleted or people complain.

The choice of using the questionnaire as a data gathering method might be restricted if the researcher has to reach subjects with very little education. Adding pictures to the questionnaires, if feasible, might be of help in such cases. For most business research, however, after the variables for the research have been identified and the measures therefore found or developed, the questionnaire is a convenient data collection mechanism. Survey research, case study research, and experimental designs often use questionnaires to measure the variables of interest. Because questionnaires are in common use, it is necessary to know how to design them effectively. A set of guidelines for questionnaire construction follows.

GUIDELINES FOR QUESTIONNAIRE DESIGN

Sound questionnaire design principles should focus on three areas. The first relates to the wording of the questions. The second refers to the planning of issues with regard to how the variables will be categorized, scaled, and coded after receipt of the responses. The third pertains to the general appearance of the questionnaire. All three are important issues in questionnaire design because they can minimize bias in research. These issues are discussed below. The important aspects are schematically depicted in Figure 9.1.

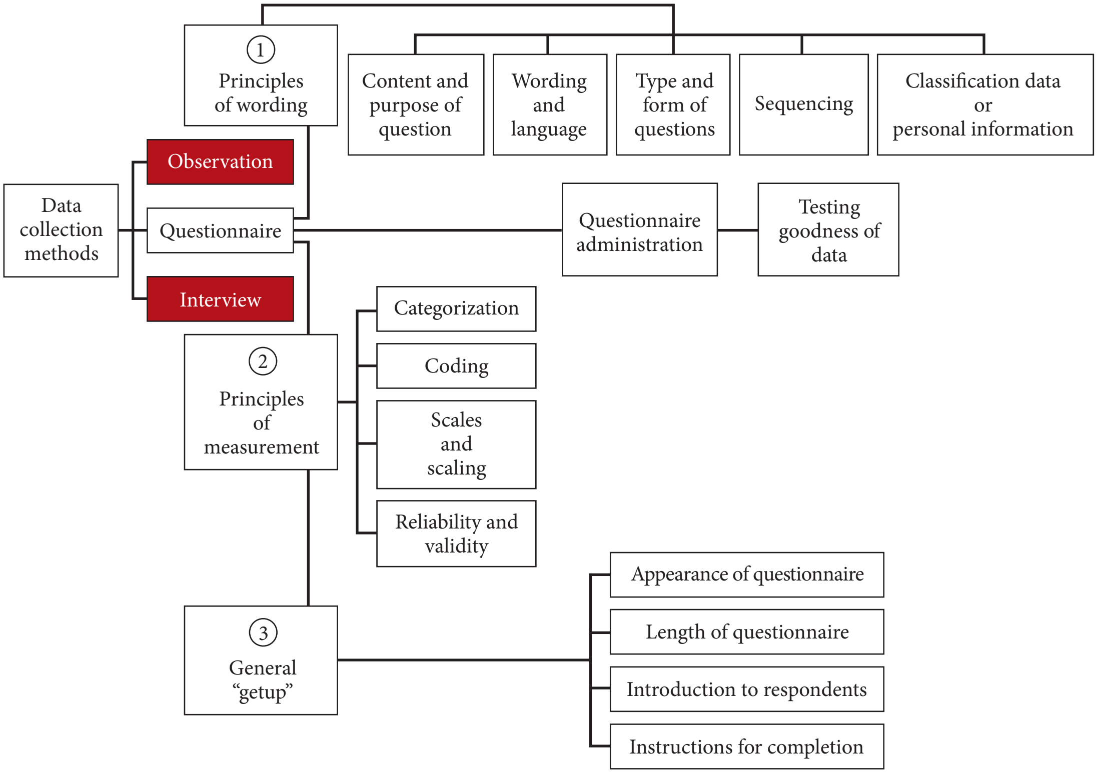

① Principles of wording
Content and purpose of question
Wording and language
Type and form of questions
Sequencing
Classification data or personal information
Observation
Data collection methods
Questionnaire
Interview
Questionnaire administration
Testing goodness of data
② Principles of measurement
Categorization
Coding
Scales and scaling
Reliability and validity
③ General "getup"
Appearance of questionnaire
Length of questionnaire
Introduction to respondents
Instructions for completion

FIGURE 9.1

Principles of questionnaire design

Principles of wording

The principles of wording refer to such factors as:

1. The appropriateness of the content of the questions.
2. How questions are worded and the level of sophistication of the language used.
3. The type and form of questions asked.
4. The sequencing of the questions.
5. The personal data sought from the respondents.

Each of these is explained below.

Content and purpose of the questions

The nature of the variable tapped – subjective feelings or objective facts – will determine what kinds of questions are asked. If the variables tapped are of a subjective nature (e.g., satisfaction, involvement), where respondents' beliefs, perceptions, and attitudes are to be measured, the questions should tap the dimensions and elements of the concept. Where objective variables, such as age and educational levels of respondents, are tapped, a single direct question – preferably one that has an ordinal scaled set of categories – is appropriate. Thus, the purpose of each question should be carefully considered so that the variables are adequately measured and yet no superfluous questions are asked.

Language and wording of the questionnaire

The language of the questionnaire should approximate the level of understanding of the respondents. The choice of words will depend on their educational level, the usage of terms and idioms in the culture, and the frames of reference of the respondents. For instance, even when English is the spoken or official language in two cultures, certain words may be alien to one culture. Terms such as "working here is a drag" and "she is a compulsive worker" may not be interpreted the same way in different cultures. Some blue-collar workers may not understand terminology such as "organizational structure." Thus, it is essential to word the questions in a way that can be understood by the respondent. If some questions are either not understood or are interpreted differently by the respondent, the researcher will obtain the wrong answers to the questions, and responses will thus be biased. Hence, the questions asked, the language used, and the wording should be appropriate to tap respondents' attitudes, perceptions, and feelings.

Type and form of questions

The type of question refers to whether the question is open-ended or closed. The form of the question refers to whether it is positively or negatively worded.

Open-ended versus closed questions **Open-ended questions** allow respondents to answer them in any way they choose. An example of an open-ended question is asking the respondent to state five things that are interesting and challenging in the job. Another example is asking what the respondents like about their supervisors or their work environment. A third example is to invite their comments on the investment portfolio of the firm.

A **closed question**, in contrast, asks the respondents to make choices among a set of alternatives given by the researcher. For instance, instead of asking the respondent to state any five aspects of the job that she finds interesting and challenging, the researcher might list 10 or 15 aspects that might seem interesting or challenging in jobs and ask the respondents to rank the first five among these in the order of their preference. All items in a questionnaire using a nominal, ordinal, Likert, or ratio scale are considered closed.

Closed questions help the respondents to make quick decisions to choose among the several alternatives before them. They also help the researcher to code the information easily for subsequent analysis. Care has to be taken to ensure that the alternatives are mutually exclusive and collectively exhaustive. If there are overlapping categories, or if all possible alternatives are not given (i.e., the categories are not exhaustive), the respondents might get confused and the advantage of their being enabled to make a quick decision is thus lost.

Some respondents may find even well-delineated categories in a closed question rather confining and might avail themselves of the opportunity to make additional comments. This is the reason why many questionnaires end with a final open-ended question that invites respondents to comment on topics that might not have been covered fully or adequately. The responses to such open-ended questions have to be edited and categorized for subsequent data analysis.

Positively and negatively worded questions Instead of phrasing all questions positively, it is advisable to include some negatively worded questions as well, so the tendency in respondents to mechanically circle the points toward one end of the scale is minimized. For example, let us say that a set of six questions is used to tap the variable "perceived success" on a five-point scale, with 1 being "very low" and 5 being "very high" on the scale. A respondent who is not particularly interested in completing the questionnaire is more likely to stay involved and remain alert while answering the questions when positively and negatively worded questions are interspersed in it. For instance, if the respondent has circled 5 for a positively worded question such as, "*I feel I have been able to accomplish a number of different things in my job*," he cannot circle number 5 again to the negatively worded question, "*I do not feel I am very effective in my job*." The respondent is now shaken out of any likely tendency to mechanically respond to one end of the scale. In case this does still happen, the researcher has an opportunity to detect such bias. A good questionnaire should therefore include both positively and negatively worded questions. The use of double negatives and excessive use of the words "not" and "only" should be avoided in negatively worded questions because they tend to confuse respondents. For instance, it is better to say "*Coming to work is not great fun*" than to say "*Not coming to work is greater fun than coming to work*." Likewise, it is better to say "*The rich need no help*" than to say "*Only the rich do not need help*."

Double-barreled questions A question that lends itself to different possible responses to its subparts is called a **double-barreled question**. Such questions should be avoided and two or more separate questions asked instead. For example, the question "*Do you think there is a good market for the product and that it will sell well?*" could bring a "yes" response to the first part (i.e., there is a good market for the product) and a "no" response to the latter part (i.e., it will not sell well for various other reasons). In this case, it would be better to ask two questions: (1) "*Do you think there is a good market for the product?*" and (2) "*Do you think the product will sell well?*" The answers might be "yes" to both, "no" to both, "yes" to the first and "no" to the second, or "yes" to the second and "no" to the first. If we combined the two questions and asked a double-barreled question, we would confuse the respondents and obtain ambiguous responses. Hence, double-barreled questions should be eliminated.

Ambiguous questions Even questions that are not double-barreled might be ambiguously worded and the respondent may not be sure what exactly they mean. An example of such a question is "*To what extent would you say you are happy?*" Respondents might find it difficult to decide whether the question refers to their state of feelings in the workplace, or at home, or in general. Thus, responses to **ambiguous questions** have built-in bias inasmuch as different respondents might interpret such items in the questionnaire differently.

The result is a mixed bag of ambiguous responses that do not accurately provide the correct answer to the question.

Recall-dependent questions Some questions might require respondents to recall experiences from the past that are hazy in their memory. Answers to such questions might have bias. For instance, if an employee who has had 30 years' service in the organization is asked to state when he first started working in a particular department and for how long, he may not be able to give the correct answers and may be way off in his responses. A better source for obtaining that information would be the personnel records.

Leading questions Questions should not be phrased in such a way that they lead the respondents to give the responses that the researcher would like them to give. An example of such a question is: "*Don't you think that in these days of escalating costs of living, employees should be given good pay rises?*" By asking a **leading question**, we are signaling and pressuring respondents to say "yes." Tagging the question to rising living costs makes it difficult for most respondents (unless they are the top bosses in charge of budget and finances) to say, "No; not unless their productivity increases too!" Another way of asking the question about pay rises to elicit less biased responses would be: "*To what extent do you agree that employees should be given higher pay rises?*" If respondents think that the employees do not deserve a higher pay rise at all, their response will be "Strongly Disagree"; if they think that respondents should definitely be given a high pay rise, they will respond to the "Strongly Agree" end of the scale, and the in-between points will be chosen depending on the strength of their agreement or disagreement. In this case, the question is not framed in a suggestive manner as in the previous instance.

Loaded questions Another type of bias in questions occurs when they are phrased in an emotionally charged manner. An example of such a **loaded question** is asking employees: "*To what extent do you think management is likely to be vindictive if the union decides to go on strike?*" The words "strike" and "vindictive" are emotionally charged terms, polarizing management and unions. Hence, asking a question such as the above would elicit strongly emotional and highly biased responses. If the purpose of the question is twofold – that is, to find (1) the extent to which employees are in favor of a strike and (2) the extent to which they fear adverse reactions if they do go on strike – then these are the two specific questions that need to be asked. It may turn out that the employees are not strongly in favor of a strike and they also do not believe that management would retaliate if they did go on strike!

Social desirability Questions should not be worded such that they elicit socially desirable responses. For instance, a question such as "*Do you think that older people should be laid off?*" would elicit a response of "no," mainly because society would frown on a person who said that elderly people should be fired even if they are capable of performing their jobs satisfactorily. Hence, irrespective of the true feelings of the respondent, a socially desirable answer would be provided. If the purpose of the question is to gauge the extent to which organizations are seen as obligated to retain those above 65 years of age, a differently worded question with less pressure toward **social desirability** would be: "*There are advantages and disadvantages to retaining senior citizens in the workforce. To what extent do you think companies should continue to keep the elderly on their payroll?*"

Sometimes certain items that tap social desirability are deliberately introduced at various points in the questionnaire and an index of each individual's social desirability tendency is calculated therefrom. This index is then applied to all other responses given by the individual in order to adjust for social desirability bias (Crowne & Marlowe, 1980; Edwards, 1957).

Length of questions Finally, simple, short questions are preferable to long ones. As a rule of thumb, a question or a statement in the questionnaire should not exceed 20 words, or exceed one full line in print (Horst, 1968; Oppenheim, 1986).

Sequencing of questions

The sequence of questions in the questionnaire should be such that the respondent is led from questions of a general nature to those that are more specific, and from questions that are relatively easy to answer to those that are progressively more difficult. This funnel approach, as it is called (Festinger & Katz, 1966), facilitates the easy and smooth progress of the respondent through the items in the questionnaire. The progression from general to specific questions might mean that the respondent is first asked questions of a global nature that pertain to the issue, and then is asked more incisive questions regarding the specific topic. Easy questions might relate to issues that do not involve much thinking; the more difficult ones might call for more thought, judgment, and decision making in providing the answers.

In determining the sequence of questions, it is advisable not to place contiguously a positively worded and a negatively worded question tapping the same element or dimension of a concept. For instance, placing two questions such as the following, one immediately after the other, is not only awkward but might also seem insulting to the respondent.

I have opportunities to interact with my colleagues during work hours.

I have few opportunities to interact with my colleagues during work hours.

First, there is no need to ask the very same question in both a positive and a negative way. Second, if for some reason this is deemed necessary (e.g., to check the consistency of the responses), the two questions should be placed in different parts of the questionnaire, as far apart as possible.

The way questions are sequenced can also introduce certain biases, frequently referred to as ordering effects. Though randomly placing the questions in the questionnaire reduces any systematic bias in the responses, it is very rarely done, because of subsequent confusion while categorizing, coding, and analyzing the responses.

In sum, the language and wording of the questionnaire focus on such issues as the type and form of questions asked (i.e., open-ended and closed questions, and positively and negatively worded questions), as well as avoiding double-barreled questions, ambiguous questions, leading questions, loaded questions, questions prone to tap socially desirable answers, and those involving distant recall. Questions should also not be unduly long. Using the funnel approach helps respondents to progress through the questionnaire with ease and comfort.

Classification data or personal information

Classification data, also known as personal information or demographic questions, elicit such information as age, educational level, marital status, and income. Unless absolutely necessary, it is best not to ask for the name of the respondent. If, however, the questionnaire has to be identified with the respondents for any reason, then the questionnaire can be numbered and connected by the researcher to the respondent's name, in a separately maintained, private document. This procedure should be clearly explained to the respondent. The reason for using the numerical system in questionnaires is to ensure the anonymity of the respondent.

Whether questions seeking personal information should appear at the beginning or at the end of the questionnaire is a matter of choice for the researcher. Some researchers ask for personal data at the end rather than the beginning of the questionnaire (Oppenheim, 1986). Their reasoning may be that by the time the respondent reaches the end of the questionnaire he or she has been convinced of the legitimacy and genuineness of the questions framed by the researcher and, hence, is more inclined and amenable to share personal information. Researchers who prefer to elicit most of the personal information at the very beginning may opine that once respondents have shared some of their personal history, they may have psychologically identified themselves with the questionnaire, and may feel a commitment to respond. Thus, whether one asks for this information at the beginning or at the end of the questionnaire is a matter of individual choice. However, questions seeking details of income, or other highly sensitive information – if deemed necessary – are best placed at the very end of the questionnaire. Even so, it is a wise policy to ask for such information by providing a range of response options, rather than seeking exact figures. For example, the variables may be tapped as shown below:

Age	Annual income
Under 20	Less than $20 000
20–30	$20 000–30 000
31–40	$30 001–40 000
41–50	$40 001–50 000
51–60	$50 001–70 000
Over 60	$70 001–90 000
	Over $90 000

In surveys, it is advisable to gather certain demographic data such as age, sex, educational level, job level, department, and number of years in the organization, even if the theoretical framework does not necessitate or include these variables. Such data help to describe the sample characteristics in the report written after data analysis. However, when there are only a few respondents in a department, then questions likely to reveal their identity might render them futile, objectionable, and threatening to employees. For instance, if there is only one female in a department, then she might refrain from responding to the question on gender, because it would establish the source of the data; this apprehension is understandable.

To sum up, certain principles of wording need to be followed while designing a questionnaire. The questions asked must be appropriate for tapping the variable. The language and wording used should be such that it is meaningful to the employees. The form and type of questions should be geared to minimize respondent bias. The sequencing of the questions should facilitate the smooth progress of the responses from start to finish. The personal data should be gathered with due regard to the sensitivity of the respondents' feelings, and with respect for privacy.

Principles of measurement

Just as there are guidelines to be followed to ensure that the wording of the questionnaire is appropriate to minimize bias, so also are there some principles of measurement to be followed to ensure that the data collected are appropriate to test our hypotheses. These refer to the scales and scaling techniques used in measuring concepts, as well as the assessment of reliability and validity of the measures used, which are all discussed in Chapter 12.

Appropriate scales have to be used depending on the type of data that need to be obtained. The different scaling mechanisms that help us to anchor our scales appropriately should be properly used. Wherever possible, the interval and ratio scales should be used in preference to nominal or ordinal scales. Once data are obtained, the "goodness of data" should be assessed through tests of validity and reliability. Validity establishes how well a technique, instrument, or process measures a particular concept, and reliability indicates how stably and consistently the instrument taps the variable. Finally, the data have to be obtained in a manner that makes for easy categorization and coding, both of which are discussed later.

General appearance or "getup" of the questionnaire

Not only is it important to address issues of wording and measurement in questionnaire design, but it is also necessary to pay attention to how the questionnaire looks. An attractive and neat questionnaire with appropriate introduction, instructions, and well-arrayed set of questions and response alternatives will make it easier for the respondents to answer them. A good introduction, well-organized instructions, and neat alignment of the questions are all important. These elements are briefly discussed with examples.

A good introduction A proper introduction that clearly discloses the identity of the researcher and conveys the purpose of the survey is absolutely necessary. It is also essential to establish some rapport with the respondents and motivate them to respond to the questions in the questionnaire wholeheartedly and enthusiastically. Assurance of confidentiality of the information provided by them will allow for less biased answers. The introduction section should end on a courteous note, thanking the respondent for taking the time to respond to the survey. The following is an example of an appropriate introduction.

EXAMPLE

Dear Participant Date

This questionnaire is designed to study aspects of life at work. The information you provide will help us better understand the quality of our work life. Because you are the one who can give us a correct picture of how you experience your work life, I request you to respond to the questions frankly and honestly.

Your response will be kept strictly confidential. Only members of the research team will have access to the information you give. In order to ensure the utmost privacy, we have provided an identification number for each participant. This number will be used by us only for follow-up procedures. The numbers, names, and the completed questionnaires will not be made available to anyone other than the research team. A summary of the results will be mailed to you after the data are analyzed.

Thank you very much for your time and cooperation. I greatly appreciate the help of your organization and yourself in furthering this research endeavor.

Cordially,
(Sd)
A. Professor, PhD

Organizing questions, giving instructions and guidance, and good alignment Organizing the questions logically and neatly in appropriate sections and providing instructions on how to complete the items in each section will help the respondents to answer them without difficulty. Questions should also be neatly aligned in a way that allows the respondent to complete the task of reading and answering the questionnaire by expending the least time and effort and without straining the eyes.

A specimen of the portion of a questionnaire incorporating the above points follows.

EXAMPLE

Section Two: About Work Life

The questions below ask about how you experience your work life. Think in terms of your everyday experiences and accomplishments on the job and put the most appropriate response number for you beside each item, using the scale below.

Strongly Agree 1	Agree 2	Slightly Agree 3	Neutral 4	Slightly Disagree 5	Disagree 6	Strongly Disagree 7

I do my work best when my job assignments are fairly difficult.	___
When I have a choice, I try to work in a group instead of by myself.	___
In my work assignments, I try to be my own boss.	___
I seek an active role in the leadership of a group.	___
I try very hard to improve on my past performance at work.	___
I pay a good deal of attention to the feelings of others at work.	___
I go my own way at work, regardless of the opinions of others.	___
I avoid trying to influence those around me to see things my way.	___
I take moderate risks, sticking my neck out to get ahead at work.	___
I prefer to do my own work, letting others do theirs.	___
I disregard rules and regulations that hamper my personal freedom.	___

Personal data Demographic or personal data could be organized as in the example that follows. Note the ordinal scaling of the age variable.

EXAMPLE

Section One: About Yourself

Please circle the numbers representing the most appropriate responses for you in respect of the following items.

1. Your age

1 Under 20
2 20–35
3 36–50
4 51–65
5 Over 65

2. Your highest completed level of education

1 Elementary school
2 High school
3 College degree
4 Graduate degree
5 Other (specify)

3. Your gender

1 Female
2 Male

4. Your marital status

1 Married
2 Single
3 Widowed
4 Divorced or separated
5 Other (specify)

5. Number of preschool children (under 5 years of age)

1 None
2 One
3 Two
4 Three or more

6. Age of the eldest child in your care (years)

1 Under 5
2 5-12
3 13–19
4 Over 19
5 Not applicable

7. Number of years worked in the organization

1 Less than 1
2 1–2
3 3–5
4 6–10
5 Over 10

8. Number of other organizations worked for before joining this organization

1 None
2 One
3 Two
4 Three
5 Four or more

9. Present work shift

1 First
2 Second
3 Third

10. Job status

1 Top management
2 Middle management
3 First-level supervisor
4 Nonmanagerial

Information on income and other sensitive personal data Although demographic information can be sought either at the beginning or at the end of the questionnaire, information of a very private and personal nature such as income, state of health, and so on, if considered at all necessary for the survey, should be asked at the end of the questionnaire, rather than the beginning. Also, such questions should be justified by explaining how this information might contribute to knowledge and problem solving, so that respondents do not perceive them to be of an intrusive or prying nature (see example below). Postponing such questions to the end will help reduce respondent bias if the individual is vexed by the personal nature of the question.

EXAMPLE

Because many people believe that income is a significant factor in explaining the type of career decisions individuals make, the following two questions are very important for this research. Like all other items in this questionnaire, the responses to these two questions will be kept confidential. Please circle the most appropriate number that describes your position.

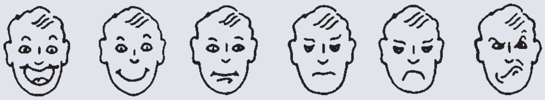
Roughly, *my total yearly* income before taxes and other deductions is:	Roughly, the *total yearly income* before taxes and other deductions of my *immediate family* – *including* my own job income, income from other sources, and the income of my spouse – is:
1 Less than $36 000	1 Less than $36 000
2 $36 000–50 000	2 $36 000–50 000
3 $50 001–70 000	3 $50 001–70 000
4 $70 001–90 000	4 $70 001–90 000
5 Over $90 000	5 $90 001–120 000
	6 $120 001–150 000
	7 Over $150 000

Open-ended question at the end The questionnaire could include an open-ended question at the end, allowing respondents to comment on any aspect they choose. It should end with an expression of sincere thanks to respondents. The last part of the questionnaire could look as follows.

EXAMPLE

The questions in the survey may not be all-embracing and comprehensive and may not therefore have afforded you an opportunity to report some things you may want to say about your job, the organization, or yourself. Please make any additional comments needed in the space provided.

How did you feel about completing this questionnaire? Check the face in the following diagram that reflects your feelings.



☐ ☐ ☐ ☐ ☐ ☐

Concluding the questionnaire The questionnaire should end on a courteous note, reminding the respondent to check that all the items have been completed, as per the example below.

EXAMPLE

I sincerely appreciate your time and cooperation. Please check to make sure that you have not skipped any questions inadvertently, and then drop the questionnaire in the locked box, clearly marked for the purpose, at the entrance of your department.

Thank you!

Review of questionnaire design

We have devoted a lot of attention to questionnaire design because questionnaires are the most common method of collecting data. The principles of questionnaire design relate to how the questions are worded and measured, and how the entire questionnaire is organized. To minimize respondent bias and measurement errors, all the principles discussed have to be followed carefully.

Questionnaires are most useful as a data collection method, especially when large numbers of people are to be reached in different geographical regions. They are a popular method of collecting data because researchers can obtain information fairly easily, and the questionnaire responses are easily coded. When well-validated instruments are used, the findings of the study benefit the scientific community since the results can be replicated and additions to the theory base made.

There are several ways of administering questionnaires. Questionnaires can be personally administered to respondents, electronically distributed to respondents, a link can be posted on a website, a blog, or on your social network account, they can be inserted in magazines, periodicals, or newspapers, or mailed to respondents. Software is also available to frame subsequent questions based on the subject's response to the preceding question. Companies' websites can also elicit survey responses; for example, reactions to customer service, product utility, and the like. Global research is now vastly facilitated by the Internet.

Pretesting of structured questions

Whether it is a structured interview where the questions are posed to the respondent in a predetermined order, or a questionnaire that is used in a survey, it is important to pretest the instrument to ensure that the questions are understood by the respondents (i.e., there is no ambiguity in the questions) and that there are no problems with the wording or measurement. **Pretesting** involves the use of a small number of respondents to test the appropriateness of the questions and their comprehension. This helps to rectify any inadequacies before administering the instrument orally or through a questionnaire to respondents, and thus reduces bias.

It would be good to debrief the results of the pretest and obtain additional information from the small group of participants (who serve the role of a focus group) on their general reactions to the questionnaire and how they felt about completing the instrument.

Electronic questionnaire and survey design

We have explained earlier in this chapter that online surveys are easily designed and administered. Electronic *survey design systems* (for instance, InstantSurvey, Infopoll, SurveyGold, Statpac, SurveyMonkey, SurveyPro, The Survey System), which facilitate the preparation and administration of questionnaires, are particularly useful for online research. Such systems usually include a range of programs enabling the user to design sophisticated questionnaires, computerize the data collection process, check for syntactical or logical errors in the coding, and analyze the data collected. More reliable data are likely to result since the respondent can go back and forth and easily change a response, and various on- and off-screen stimuli are provided to sustain respondents' interest.

Even as the survey is in progress, descriptive summaries of the cumulative data can be obtained either on the screen or in printed form. After data collection is complete, a data-editing program identifies missing or out-of-range data (e.g., a 6 in response to a question on a five-point scale). The researcher can set the parameters to either delete missing responses if there are too many of them, or compute the mean of other responses and substitute this figure for the missing response. Such systems also include data analytic programs such as ANOVA, multiple regression, and others (discussed later in the book). Randomization of questions and the weighting of respondents to ensure more representative results (in cases where the sample either overrepresents or underrepresents certain population groups – discussed in Chapter 13 on Sampling) are some of the attractive features of survey design systems.

Electronic questionnaires are very popular at the moment, also because electronic nonresponse rates may not be any lower than those for mail questionnaires. With the increased computer literacy, we can expect electronic questionnaire administration to keep on growing in the future.

INTERNATIONAL DIMENSIONS OF SURVEYS

We have so far discussed instrument development for eliciting responses from subjects within a country. With the globalization of business operations, managers often need to compare the business effectiveness of their subsidiaries in different countries. Researchers engaged in cross-cultural research may attempt to trace the similarities and differences in the behavioral and attitudinal responses of employees, consumers, or investors in different cultures. When data are collected through questionnaires and occasionally through interviews, one should pay attention to the measuring instruments and how data are collected, in addition to being sensitive to cultural differences in the use of certain terms. Such research should be tailored to the different cultures, as discussed below.

Special issues in instrumentation for cross-cultural research

Certain special issues need to be addressed while designing instruments for collecting data from multiple countries. Since different languages are spoken in different countries, it is important to ensure that the translation of the instrument to the local language matches accurately to the original language. For this purpose, the instrument should be first translated by a local expert. Supposing a comparative survey is to be done between Japan and the United States, and the researcher is a US national, then the instrument has first to be translated from English to Japanese. Then, another bilinguist should translate it back to English. This back translation, as it is called, ensures vocabulary equivalence (i.e., that the words used have the same meaning). Idiomatic equivalence could also become an issue, where some idioms unique to one language just do not lend themselves for translation to another language. Conceptual equivalence, where the meanings of certain words could differ in different cultures, is yet another issue to which attention has to be paid. For instance, the meaning of the concept "love" may differ in different cultures. All these issues can be taken care of through good back translation by persons who are fluent with the relevant languages and are also knowledgeable about the customs and usages in the cultures concerned.

The following examples culled from *BusinessWeek* show the pitfalls in cross-cultural advertising and emphasize the need for back translation of messages for idiomatic and conceptual equivalence. Not only is the meaning lost in some advertisement messages by literally translating the English words into the native languages, but in some cases they actually become offensive.

EXAMPLE

1. Pepsi's "Come alive with the Pepsi generation" when translated into Chinese means "Pepsi brings your ancestors from the grave."
2. Frank Perdue's chicken slogan "It takes a strong man to make a tender chicken" translates in Spanish to "It takes an aroused man to make a chicken affectionate."
3. When American Airlines wanted to advertise its new leather first-class seats to Mexico, its "Fly in Leather" campaign would have literally translated to "Fly Naked" in Spanish.

Issues in cross-cultural data collection

At least three issues are important for cross-cultural data collection – response equivalence, timing of data collection, and the status of the individual collecting the data. Response equivalence is ensured by adopting uniform data collection procedures in the different cultures. Identical methods of introducing the study, the researcher, task instructions, and closing remarks, in personally administered questionnaires, provide equivalence in motivation, goal orientation, and response attitudes. Timing of data collected across cultures is also critical for cross-cultural comparison. Data collection should be completed within acceptable time frames in the different countries – say within three to four months. If too much time elapses in collecting data in the different countries, much might change during the time interval in any one country or all the countries.

As pointed out as early as 1969 by Mitchell, in interview surveys, the egalitarian-oriented interviewing style used in the West may not be appropriate in societies that have well-defined status and authority structures. Also, when a foreigner comes to collect data, the responses might be biased for fear of portraying the country to a "foreigner" in an "adverse light". The researcher has to be sensitive to these cultural nuances while engaging in cross-cultural research. It is worth while collaborating with a local researcher while developing and administering the research instrument, particularly when the language and customs of the respondents are different from those of the researcher.

REVIEW OF THE ADVANTAGES AND DISADVANTAGES OF DIFFERENT DATA COLLECTION METHODS AND WHEN TO USE EACH

Having discussed the various data collection methods, we will now briefly recount the advantages and disadvantages of the three most commonly used methods – interviews, observation, and questionnaires – and examine when each method can be most profitably used.

Face-to-face interviews provide rich data, offer the opportunity to establish rapport with the interviewees, and help to explore and understand complex issues. Many ideas ordinarily difficult to articulate can also be brought to the surface and discussed during such interviews. On the negative side, face-to-face interviews have the potential for introducing interviewer bias and can be expensive if a large number of subjects are involved. Where several interviewers become necessary, adequate training becomes a necessary first step. Face-to-face interviews are best suited to the exploratory stages of research when the researcher is trying to get an overarching view of the concepts or the situational factors.

Telephone interviews help to contact subjects dispersed over various geographic regions and obtain immediate responses from them. They are, hence, an efficient way of collecting data when one has specific, structured questions to ask, needs the responses quickly, and has a sample spread over a wide area. On the negative side, the interviewer cannot observe the nonverbal responses of the respondents, and the interviewee can block the call.

Observational studies help us to comprehend complex issues through direct observation (either as a participant or a nonparticipant observer) and then, if possible, asking questions to seek clarification on certain issues. The data obtained are rich and uncontaminated by self-report bias. On the negative side, they are expensive, since long periods of observation (usually encompassing several weeks or even months) are required, and observer bias may well be present in the data. Because of the costs involved, very few observational studies are done in business. Henry Mintzberg's (1971) study of managerial work is one of the best-known published works that used an observational data collection method. Observational studies are best suited for research requiring non-self-report descriptive data; that is, when behaviors are to be understood without directly asking the respondents themselves. Observational studies can also capture marketing information such as the in-store buying behavior of customers.

Personally administering questionnaires to groups of individuals helps to (1) establish rapport with the respondents while introducing the survey, (2) provide clarification sought by the respondents on the spot, and (3) collect the questionnaires immediately after they are completed. In that sense, there is a 100% response rate. On the negative side, administering questionnaires personally is expensive, especially if the sample is widely dispersed geographically. Personally administered questionnaires are best suited when data are collected from subjects that are located in close proximity to one another and groups of respondents can be conveniently assembled.

Electronic questionnaires are advantageous when responses to many questions have to be obtained from a sample that is geographically dispersed, or it is difficult or not possible to conduct telephone interviews without much expense. On the negative side, such questionnaires usually have a low response rate and one cannot be sure if the data obtained are unbiased since the nonrespondents may be different from those who did respond. The electronic questionnaire survey is best suited (and perhaps the only alternative open to the researcher) when information is to be obtained on a substantial scale through structured questions, at a reasonable cost, from a sample that is widely dispersed geographically.

MULTIMETHODS OF DATA COLLECTION

Because almost all data collection methods have some bias associated with them, collecting data through multimethods and from multiple sources lends rigor to research. For instance, if the responses collected through interviews, questionnaires, and observation are strongly correlated with one another, then we will have more confidence about the goodness of the collected data. If the same question fetches discrepant answers in the questionnaire and during the interview, then an air of uncertainty emerges and we will be inclined to discard both data as being biased.

Likewise, if data obtained from several sources bear a great degree of similarity, we will have stronger conviction in the goodness of the data. For example, if an employee rates his performance as 4 on a five-point scale, and his supervisor gives him a similar rating, we may be inclined to consider him a better than average worker. On the contrary, if he gives himself a 5 on the five-point scale and his supervisor gives him a rating of 2, then we will not know to what extent there is a bias and from which source. Therefore, high correlations among data obtained on the same variable from different sources and through different data collection methods lend more credibility to the research instrument and to the data obtained through these instruments. Good research entails collection of data from multiple sources and through multiple data collection methods. Such research, though, is more costly and time consuming.

EXAMPLE

The Delphi Technique

The **Delphi Technique** builds on the idea of using expert panels (discussed in Chapter 7), but seeks to combine expert panel discussions with other research methods such as (email) questionnaires. A panel of experts often answers questionnaires in two or more rounds. In the first round they are asked to answer a series of questions on the likelihood of a future scenario or any other issue about which there is unsure or incomplete knowledge. The contributions from all the experts are then collected, summarized, and fed back in the form of a second-round questionnaire. After reviewing the first-round results, the experts assess the same issue once more, taking the opinions of other experts into account. This process goes on until it is stopped by the researcher. The rationale behind this iterative process is that eventually it may lead to a consensus about the issue that is being investigated.

The identity of participants is usually not revealed, even after the completion of the final report. This should prevent some experts from dominating others, allow experts to unreservedly express their opinions, and encourage them to admit mistakes, if any, by revising their earlier judgments. The Delphi Technique has been widely used for long-run business forecasting.

MANAGERIAL IMPLICATIONS

As a manager, you will perhaps engage consultants to do research and may not be collecting data yourself through interviews, questionnaires, or observation. However, some basic knowledge of the characteristics and the advantages and disadvantages of primary methods to data collection will help you to evaluate alternative approaches to primary data collection and to understand why a consultant has opted for a certain method or for a combination of methods. As the sponsor of research, you will be able to decide at what level of sophistication you want data to be collected, based on the complexity and gravity of the situation. Your input will help researchers/consultants to think about their topic list (in interviews), their coding scheme (in observation), or the content of their questions (in questionnaires).

As a constant (participant-) observer of all that goes on around you at the workplace, you will be able to understand the dynamics operating in the situation. Also, as a manager, you will be able to differentiate between good and bad questions used in surveys, with sensitivity to cultural variations, not only in scaling but also in developing the entire survey instrument, and in collecting data, as discussed in this chapter.

ETHICS IN DATA COLLECTION

Several ethical issues should be addressed while collecting primary data. As previously noted, these pertain to those who sponsor the research, those who collect the data, and those who offer them. The sponsors should ask for the study to be done to better the purpose of the organization, and not for any other self-serving reason. They should respect the confidentiality of the data obtained by the researcher, and not ask for the individual or group responses to be disclosed to them, or ask to see the questionnaires. They should have an open mind in accepting the results and recommendations in the report presented by the researchers.

Ethics and the researcher

1. Treating the information given by the respondent as strictly confidential and guarding his or her privacy is one of the primary responsibilities of the researcher. If the vice president or some other top executive wishes to take a look at the completed questionnaires, the obligatory need to preserve the confidentiality of the documents should then be pointed out. They should be reminded that prior understanding of this had already been reached with them before starting the survey.

   Also, data for a subgroup of, say, less than ten individuals, should be dealt with tactfully to preserve the confidentiality of the group members. The data can be combined with others, or treated in another unidentifiable manner. It is difficult to sanitize reports to protect sources and still preserve the richness of detail of the study. An acceptable alternative has to be found, since preserving confidentiality is the fundamental goal.
2. Personal or seemingly intrusive information should not be solicited, and if it is absolutely necessary for the project, it should be tapped with high sensitivity to the respondent, offering specific reasons.
3. Whatever the nature of the data collection method, the self-esteem and self-respect of the subjects should never be violated.
4. No one should be forced to respond to the survey and if someone does not want to avail themselves of the opportunity to participate, the individual's desire should be respected. Informed consent of the

subjects should be the goal of the researcher. This holds true even when data are collected through mechanical means, such as recording interviews, videotaping, and the like.

5. Nonparticipant observers should be as unintrusive as possible. In qualitative studies, personal values could easily bias the data. It is necessary for the researcher to make explicit his or her assumptions, expectations, and biases, so that informed decisions regarding the quality of the data can be made by the manager.
6. Posting invitations to participate in a survey on social networks, discussion groups, and chat rooms is often perceived as "spam". Make sure that you are familiar with, and that you act in accordance with, anti-spam legislation and guidelines.
7. There should be absolutely no misrepresentation or distortion in reporting the data collected during the study.

Ethical behavior of respondents

1. The subject, once having exercised the choice to participate in a study, should cooperate fully in the tasks ahead, such as responding to a survey.
2. The respondent also has an obligation to be truthful and honest in the responses. Misrepresentation or giving information, knowing it to be untrue, should be avoided.

SUMMARY

- **Learning objective 1: Compare and contrast different types of questionnaires.**
  Questionnaires are generally designed to collect large numbers of (quantitative) data. They can be administered personally, mailed to the respondents, or distributed electronically. When the survey is limited to a local area a good way to collect data is to personally administer the questionnaires. A mail questionnaire is a self-administered (paper and pencil) questionnaire that is sent to respondents via the mail. This method has long been the backbone of business research, but with the arrival of the Internet, mail questionnaires have become redundant or obsolete. Instead, online questionnaires are posted on the Internet or sent via email.

- **Learning objective 2: Design questionnaires to tap different variables.**
  Sound questionnaire design principles should focus on three areas. The first concerns the wording of the questions; the second refers to the planning of issues with regard to how the variables will be categorized, scaled, and coded after the responses are received; and the third pertains to the general appearance of the questionnaire. All three are important issues because they can minimize bias in research.

- **Learning objective 3: Discuss the issues related to cross-cultural research.**
  With the globalization of business, managers are often interested in similarities and differences in behavioral and attitudinal responses of people (employees, consumers, investors) in different cultures. Surveys should be tailored to the specific needs and features of different cultures. At least three issues are important for cross-cultural data collection – response equivalence, timing of data collection, and the status of the individual collecting the data.

- **Learning objective 4: Discuss the advantages and disadvantages of various data collection methods in survey research.**
  Having discussed the primary data collection methods in survey research (interviews, observation, and administering questionnaires), this chapter recounts the advantages and disadvantages of these methods and examines when each method can be most profitably used.

- **Learning objective 5: Discuss the advantages of multisources and multimethods of data collection.**
  Because almost all data collection methods have some bias associated with them, collecting data through multimethods and from multiple sources lends rigor to research. If data obtained from several sources bear a great degree of similarity, we will have stronger conviction of the goodness of the data.

- **Learning objective 6: Demonstrate awareness of the role of the manager in primary data collection.**
  Managers often engage consultants to do research and may not be collecting data themselves through interviews, questionnaires, or observation. However, some basic knowledge of the characteristics and the advantages and disadvantages of primary methods of data collection will help them to evaluate alternative approaches to primary data collection and/or to understand why a consultant has opted for a certain method or for a combination of methods.

- **Learning objective 7: Demonstrate awareness of the role of ethics in primary data collection.**
  Several ethical issues should be addressed while collecting primary data. These pertain to those who sponsor the research, those who collect the data, and those who offer them.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: An online shopping questionnaire**.

DISCUSSION QUESTIONS

1. Discuss the advantages and disadvantages of personally administered questionnaires, mail questionnaires, and electronic questionnaires.
2. Explain the principles of wording, stating how these are important in questionnaire design, citing examples not in the book.
3. How are multiple methods of data collection and from multiple sources related to the reliability and validity of the measures?
4. "Every data collection method has its own built-in biases. Therefore, resorting to multimethods of data collection is only going to compound the biases." How would you critique this statement?
5. "One way to deal with discrepancies found in the data obtained from multiple sources is to average the figures and take the mean as the value of the variable." What is your reaction to this?
6. How has the advancement in technology helped data gathering via questionnaires?

Now do Exercises 9.1, 9.2, and 9.3.

EXERCISE 9.1

David Shen Liang is a business student engaged in a management project for Ocg Business Services (OBS), a supplier of office equipment to a large group of (international) customers. OBS operates in the Business-to-business market. David wants to test the following hypotheses:

1. Service quality has a positive effect on customer satisfaction.
2. Price perception has a negative effect on customer satisfaction.

For this purpose he has developed the following questionnaire:

- -

Dear Sir,

My name is David Shen Liang. I am a business student currently engaged in a management project for Ocg Business Services (OBS). I am interested in how satisfied you – as a client of OBS – are about your relationship with OBS. For this purpose I would like you to fill in the following questionnaire. It will take no more than five minutes to fill in the questionnaire. Thank you so much for your time.

Kind regards,

David Shen Liang.

OBS is in an easily accessible location
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS has convenient opening hours
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS delivers fast service
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS informs you on the status of your order
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS provides its services on the agreed time
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS offers a range of products and services that fits your needs
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

The end-products of OBS are sound
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

The facilities of OBS look well-cared for
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

Employees of OBS are helpful and friendly
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

Employees of OBS give good advice
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

Employees of OBS respond to your requests promptly
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS is reliable
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

When a problem occurs, OBS will help you adequately
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS is innovative
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS has your best interests at heart.
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

OBS fully informs you about the products and services it provides within your organization and about everything else you may want to learn from OBS or its employees
Strongly disagree -1---2---3---4---5---6---7- Strongly agree

The price of OBS products is:
Very Low -1---2---3---4---5---6---7- Very high

In general, how satisfied are you about the services you received?
Very satisfied -1---2---3---4---5---6---7- Very dissatisfied

Which services do you miss at Ocg Business Services?

When was your first contact with Ocg? ____________ ago.

Are the services of Ocg Business Services of added value to your organization?

[_] Yes, they are.
[_] Irrelevant, the services are not better or worse than those of other providers.
[_] No, I would prefer another provider.

General Questions

Age ___
Gender Male/Female

Position

☐ Secretarial
☐ Facility
☐ Engineers
☐ Management
☐ Marketing/sales
☐ Purchasing
☐ Administration
☐ Project
☐ Other

This was the final question of this questionnaire.
Thank you very much for your cooperation!

Comment on the foregoing questionnaire. Pay attention to:

- principles of wording;
- the classification data (personal information); and
- the general appearance or "getup" of the questionnaire.

EXERCISE 9.2

A production manager wants to assess the reactions of the blue-collar workers in his department (including foremen) to the introduction of computer-integrated manufacturing (CIM) systems. He is particularly interested to know how they perceive the effects of CIM on:

1. Their future jobs.
2. Additional training that they will have to receive.
3. Future job advancement.

Design a questionnaire for the production manager.

EXERCISE 9.3

Design a questionnaire that you could use to assess the quality of your on-campus dining facilities. Make sure you can test the following hypotheses:

H_1: *There is a positive relationship between the service quality of the on-campus dining facilities and customer loyalty.*
H_2: *The relationship between service quality and customer loyalty is mediated by customer satisfaction.*

CHAPTER 10

Experimental designs

LEARNING OBJECTIVES

After completing Chapter 10, you should be able to:

1. Describe lab experiments and discuss the internal and external validity of this type of experiment.
2. Describe field experiments and discuss the internal and external validity of this type of experiment.
3. Describe, discuss, and identify threats to internal and external validity and make a trade-off between internal and external validity.
4. Describe the different types of experimental designs.
5. Discuss when and why simulation might be a good alternative to lab and field experiments.
6. Discuss the role of the manager in experimental designs.
7. Discuss the role of ethics in experimental designs.

INTRODUCTION

In Chapter 6, we examined basic research strategies. We distinguished experimental from non-experimental approaches and explained that experimental designs are typically used in *deductive* research where the researcher is interested in establishing cause-and-effect relationships. In the last three chapters we discussed non-experimental approaches to primary data collection. In this chapter we look at experimental designs.

Consider the following three scenarios.

EXAMPLE

Cause-and-effect relationship after randomization

Scenario A A manufacturer of luxury cars has decided to launch a global brand communications campaign to reinforce the image of its cars. An 18-month campaign is scheduled that will be rolled out worldwide, with advertising in television, print, and electronic media. Under the title "Bravura", a renowned advertising agency developed three different campaign concepts. To determine which of these concepts is most effective, the car manufacturer wants to test their effects on the brand's image. But how can the car manufacturer test the effectiveness of these concepts?

Scenario B A study of absenteeism and the steps taken to curb it indicates that companies use the following incentives to reduce it:

14% give bonus days;
39% offer cash;
39% present recognition awards;
4% award prizes; and
4% pursue other strategies.

Asked about their effectiveness,

22% of the companies said they were very effective;
66% said they were somewhat effective; and
12% said they were not at all effective.

What does the above information tell us? How do we know what kinds of incentives cause people not to absent themselves? What particular incentive(s) did the 22% of companies that found their strategies to be "very effective" offer? Is there a direct causal connection between one or two specific incentives and absenteeism?

Scenario C The dagger effect of layoffs is that there is a sharp drop in the commitment of workers who are retained, even though they might well understand the logic of the reduction in the workforce.

Does layoff really cause employee commitment to drop off, or is something else operating in this situation?

The answers to the questions raised in Scenarios A, B, and C might be found by using experimental designs in researching the issues.

In Chapter 6 we touched on experimental designs. In this chapter, we will discuss lab experiments and field experiments in detail. Experimental designs, as we know, are set up to examine possible cause-and-effect relationships among variables, in contrast to correlational studies, which examine the relationships among variables without necessarily trying to establish if one variable causes another.

We have already explained that in order to establish that a change in the independent variable *causes* a change in the dependent variable: (1) the independent and the dependent variable should covary; (2) the independent variable should precede the dependent variable; (3) no other factor should be a possible cause of the change in the dependent variable; (4) a logical explanation is needed about why the independent variable affects the dependent variable.

The third condition implies that to establish causal relationships between two variables in an organizational setting, several variables that might covary with the dependent variable have to be controlled. This then allows us to say that variable *X*, and variable *X* alone, causes the dependent variable *Y*. However, it is not always possible to control all the covariates while manipulating the causal factor (the independent variable that is causing the dependent variable) in organizational settings, where events flow or occur naturally and normally. It is, however, possible to first isolate the effects of a variable in a tightly controlled artificial setting (the lab setting), and after testing and establishing the cause-and-effect relationship under these tightly controlled conditions, see how generalizable such relationships are to the field setting.

Let us illustrate this with an example.

EXAMPLE

Suppose a manager believes that staffing the accounting department completely with personnel with M.Acc. (Master of Accountancy) degrees will increase its productivity. It is well nigh impossible to transfer all those without the M.Acc. degree currently in the department to other departments and recruit fresh M.Acc. degree holders to take their place. Such a course of action is bound to disrupt the work of the entire organization inasmuch as many new people will have to be trained, work will slow down, employees will get upset, and so on. However, the hypothesis that possession of an M.Acc. degree would cause increases in productivity can be tested in an artificially created setting (i.e., not at the regular workplace) in which an accounting job can be given to three groups of people: those with an M.Acc. degree, those without an M.Acc. degree, and a mixed group of those with and without an M.Acc. degree (as is the case in the present work setting). If the first group performs exceedingly well, the second group poorly, and the third group falls somewhere in the middle, there will be evidence to indicate that the M.Acc. degree qualification might indeed cause productivity to rise. If such evidence is found, then planned and systematic efforts can be initiated to gradually transfer those without the M.Acc. degree in the accounting department to other departments and recruit others with this degree to this department. It is then possible to see to what extent productivity does, in fact, go up in the department because all the staff members are M.Acc. degree holders.

As we saw earlier, experimental designs fall into two categories: experiments done in an artificial or contrived environment, known as **lab experiments**, and those done in the natural environment in which activities regularly take place, known as **field experiments**.

THE LAB EXPERIMENT

As stated earlier, when a cause-and-effect relationship between an independent and a dependent variable of interest is to be clearly established, then all other variables that might contaminate or confound the relationship have to be tightly controlled. In other words, the possible effects of other variables on the dependent variable have to be accounted for in some way, so that the actual causal effects of the investigated independent variable on the dependent variable can be determined. It is also necessary to manipulate the independent variable so that the extent of its causal effects can be established. The control and manipulation are best done in an artificial setting (the laboratory), where the causal effects can be tested. When control and manipulation are introduced to establish cause-and-effect relationships in an artificial setting, we have laboratory experimental designs, also known as lab experiments.

Because we use the terms control and manipulation, let us examine what these concepts mean.

Control

When we postulate cause-and-effect relationships between two variables *X* and *Y*, it is possible that some other factor, say *A*, might also influence the dependent variable *Y*. In such a case, it will not be possible to determine the extent to which *Y* occurred only because of *X*, since we do not know how much of the total variation in *Y* was caused by the presence of the other factor *A*. For instance, a Human Resource Development manager might arrange special training for a set of newly recruited secretaries in creating web pages, to prove to the VP (his boss) that such training causes them to function more effectively. However, some of the new secretaries might function more effectively than others mainly or partly because they have had previous intermittent experience with using the web. In this case, the manager cannot prove that the special training alone caused greater effectiveness, since the previous intermittent web experience of some secretaries is a contaminating factor. If the true effect of the training on learning is to be assessed, then the learners' previous experience has to be controlled. This might be done by not including in the experiment those who already have had some experience with the web. This is what we mean when we say we have to control the contaminating factors, and we will later see how this is done.

Manipulation

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Manipulation**.

To examine the causal effects of an independent variable on a dependent variable, certain manipulations need to be tried. **Manipulation** simply means that we create different levels of the independent variable to assess the impact on the dependent variable. For example, we may want to test the theory that depth of knowledge of various manufacturing technologies is caused by rotating the employees on all the jobs on the production line and in the design department, over a four-week period. Then we can manipulate the independent variable, "rotation of employees," by rotating one group of production workers and exposing them to all the systems during the four-week period, rotating another group of workers only partially during the four weeks (i.e., exposing them to only half of the manufacturing technologies), and leaving the third group to continue to do what they are currently doing, without any special rotation. By measuring the depth of knowledge of these groups both before and after the manipulation (also known as the treatment), it is possible to assess the extent to which the treatment caused the effect, after controlling the contaminating factors. If deep knowledge is indeed caused by rotation and exposure, the results will show that the third group had the lowest increase in depth of knowledge, the second group had some significant increase, and the first group had the greatest gains!

Let us look at another example of how causal relationships are established by manipulating the independent variable.

EXAMPLE

Let us say we want to test the effects of lighting on worker production levels among sewing machine operators. To establish a cause-and-effect relationship, we must first measure the production levels of all the operators over a 15-day period with the usual amount of light they work with – say 60 watt lamps. We might then want to split the group of 60 operators into three groups of 20 members each, and while allowing one subgroup to continue to work under the same conditions as before (60 watt electric light bulbs), we might want to manipulate the intensity of the light for the other two subgroups, by making one group work with 75 watt and the other with 100 watt light bulbs. After the different groups have worked with these varying degrees of light exposure for 15 days, each group's total production for these 15 days may be analyzed to see if the difference between the pre-experimental and the post-experimental production among the groups is directly related to the intensity of the light to which they have been exposed. If our hypothesis that better lighting increases the production levels is correct, then the subgroup that did not have any change in the lighting (called the **control group**), should have no increase in production and the other two groups should show increases, with those having the most light (100 watts) showing greater increases than those who had the 75 watt lighting.

In the above case the independent variable, lighting, has been manipulated by exposing different groups to different degrees of changes in it. This manipulation of the independent variable is also known as the **treatment**, and the results of the treatment are called treatment effects.

Let us illustrate how variable *X* can be both controlled and manipulated in the lab setting through another example.

EXAMPLE

Let us say an entrepreneur – the owner of a toy factory – is rather disappointed with the number of imitation Batman action figures produced by his workers, who are paid wages at an hourly rate. He might wonder whether paying them piece rates would increase their production levels. However, before implementing the piece-rate system, he wants to make sure that switching over to the new system would indeed achieve the objective.

In a case like this, the researcher might first want to test the causal relationships in a lab setting, and if the results are encouraging, conduct the experiment later in a field setting. In designing the lab experiment, the researcher should first think of possible factors affecting the production level of the workers, and then try to control these. Other than piece rates, previous job experience might also influence the rate of production because familiarity with the job makes it easy for people to increase their productivity levels. In some cases, where the jobs are very strenuous and require muscular strength, gender differences may affect productivity. Let us say that for the type of production job discussed earlier, age, gender, and prior experience of the employees are the factors that influence the production levels of the employees. The researcher needs to control these three variables. Let us see how this can be done.

Suppose the researcher intends to set up four groups of 15 people each for the lab experiment – one to be used as the control group, and the other three subjected to three different pay manipulations. Now, the variables that may have an impact on the cause-and-effect relationship can be controlled in two different ways: either by matching the groups or through randomization. These concepts are explained before we proceed further.

Controlling the contaminating exogenous or "nuisance" variables

Matching groups

One way of controlling the contaminating or "nuisance" variables is to **match** the various **groups** by picking the confounding characteristics and deliberately spreading them across groups. For instance, if there are 20 women among the 60 members, then each group will be assigned five women, so that the effects of gender are distributed across the four groups. Likewise, age and experience factors can be matched across the four groups, such that each group has a similar mix of individuals in terms of gender, age, and experience. Because the suspected contaminating factors are matched across the groups, we can be confident in saying that variable *X* alone causes variable *Y* (if, of course, that is the result of the study).

Randomization

Another way of controlling the contaminating variables is to assign the 60 members randomly (i.e., with no predetermination) to the four groups. That is, every member will have a known and equal chance of being assigned to any of these four groups. For instance, we might throw the names of all the 60 members into a hat and draw their names. The first 15 names drawn may be assigned to the first group, the second 15 to the second group, and so on, or the first person drawn might be assigned to the first group, the second person drawn to the second group, and so on. Thus, in **randomization**, the process by which individuals are drawn (i.e., everybody has a known and equal chance of being drawn) and their assignment to any particular group (each individual could be assigned to any one of the groups set up) are both random. By thus randomly assigning members to the groups we are distributing the confounding variables among the groups equally. That is, the variables of age, sex, and previous experience – *the controlled variables* – will have an equal probability of being distributed among the groups.

The process of randomization ideally ensures that each group is comparable to the others, and that all variables, including the effects of age, sex, and previous experience, are controlled. In other words, each of the groups will have some members who have more experience mingled with those who have less or no experience. All groups will have members of different age and sex composition. Thus, randomization ensures that if these variables do indeed have a contributory or confounding effect, we have controlled their confounding effects (along with those of other unknown factors) by distributing them across groups. This is achieved because when we manipulate the independent variable of piece rates by having no piece rate system at all for one group (control) and having different piece rates for the other three groups (experimental), we can determine the causal effects of the piece rates on production levels. Any errors or biases caused by age, sex, and previous experience are now distributed equally among all four groups. Any causal effects found will be over and above the effects of the confounding variables.

To make it clear, let us illustrate this with some actual figures, as in Table 10.1. Note that because the effects of experience, sex, and age were controlled in all the four groups by randomly assigning the members to them,

TABLE 10.1

Cause-and-effect relationship after randomization

Groups	Treatment	Treatment effect (% increase in production over pre-piece rate system)
Experimental group 1	$1.00 per piece	10
Experimental group 2	$1.50 per piece	15
Experimental group 3	$2.00 per piece	20
Control group (no treatment)	Old hourly rate	0

and the control group had no increase in productivity, it can be reliably concluded from the result that the percentage increases in production are a result of the piece rate (treatment effects). In other words, piece rates are the cause of the increase in the number of toys produced. We cannot now say that the cause-and-effect relationship has been confounded by other "nuisance" variables, because they have been controlled through the process of randomly assigning members to the groups. Here, we have high internal validity or confidence in the cause-and-effect relationship.

Advantages of randomization The difference between matching and randomization is that in the former case individuals are deliberately and consciously matched to control the differences among group members, whereas in the latter case we expect that the process of randomization will distribute the inequalities among the groups, based on the laws of normal distribution. Thus, we need not be particularly concerned about any known or unknown confounding factors.

In sum, compared to randomization, matching might be less effective, since we may not know all the factors that could possibly contaminate the cause-and-effect relationship in any given situation, and hence fail to match some critical factors across all groups while conducting an experiment. Randomization, however, will take care of this, since all the contaminating factors will be spread across all groups. Moreover, even if we know the confounding variables, we may not be able to find a match for all such variables. For instance, if gender is a confounding variable, and if there are only two women in a four-group experimental design, we will not be able to match all the groups with respect to gender. Randomization solves these dilemmas as well. Thus, lab experimental designs involve control of the contaminating variables through the process of either matching or randomization, and the manipulation of the treatment.

Internal validity of lab experiments

Internal validity refers to the confidence we place in the cause-and-effect relationship. In other words, it addresses the question, "*To what extent does the research design permit us to say that the independent variable* A *causes a change in the dependent variable B?*" As Kidder and Judd (1986) note, in research with high internal validity, we are relatively better able to argue that the relationship is causal, whereas in studies with low internal validity, causality cannot be inferred at all. In lab experiments where cause-and-effect relationships are substantiated, internal validity can be said to be high.

So far we have talked about establishing cause-and-effect relationships within the lab setting, which is an artificially created and controlled environment. You might yourself have been a subject taking part in one of the lab experiments conducted by the psychology or other departments on campus at some time. You might not have been specifically told what cause-and-effect relationships the experimenter was looking for, but you would have been told what is called a "cover story." That is, you would have been apprised in general terms of some reason for the study and your role in it, without divulging its true purpose. After the end of the experiment you would also have been debriefed and given a full explanation of the experiment, and any questions you might have had would have been answered. This is how lab experiments are usually conducted: subjects are selected and assigned to different groups through matching or randomization; they are moved to a lab setting; they are given some details of the study and a task to perform; and some kind of questionnaire or other tests are administered both before and after the task is completed. The results of these studies indicate the cause-and-effect relationship between the variables under investigation.

External validity or generalizability of lab experiments

To what extent are the results found in the lab setting transferable or generalizable to actual organizational or field settings? In other words, if we do find a cause-and-effect relationship after conducting a lab experiment, can we then confidently say that the same cause-and-effect relationship will also hold true in the organizational setting?

Consider the following situation. If, in a lab experimental design, the groups are given the simple production task of screwing bolts and nuts onto a plastic frame, and the results indicate that the groups who were paid piece rates were more productive than those who were paid hourly rates, to what extent can we then say that this would be true of the sophisticated nature of the jobs performed in organizations? The tasks in organizational settings are far more complex, and there might be several confounding variables that cannot be controlled – for example, experience. Under such circumstances, we cannot be sure that the cause-and-effect relationship found in the lab experiment is necessarily likely to hold true in the field setting. To test the causal relationships in the organizational setting, field experiments are carried out. These will now be briefly discussed.

THE FIELD EXPERIMENT

A **field experiment**, as the name implies, is an experiment done in the natural environment in which work (or life) goes on as usual, but treatments are given to one or more groups. Thus, in the field experiment, even though it may not be possible to control all the nuisance variables because members cannot be either randomly assigned to groups, or matched, the treatment can still be manipulated. Control groups can also be set up in field experiments. The experimental and control groups in the field experiment may be made up of the people working at several plants within a certain radius, or from the different shifts in the same plant, or in some other way. If there are three different shifts in a production plant, for instance, and the effects of the piece-rate system are to be studied, one of the shifts can be used as the control group, and the two other shifts given two different treatments or the same treatment – that is, different piece rates or the same piece rate. Any cause-and-effect relationship found under these conditions will have wider generalizability to other similar production settings, even though we may not be sure to what extent the piece rates alone were the cause of the increase in productivity, because some of the other confounding variables could not be controlled.

EXTERNAL AND INTERNAL VALIDITY IN EXPERIMENTS

What we just discussed can be referred to as an issue of external validity versus internal validity. **External validity** refers to the extent of generalizability of the results of a causal study to other settings, people, or events, and **internal validity** refers to the degree of our confidence in the causal effects (i.e., that variable X causes variable Y). Field experiments have more external validity (i.e., the results are more generalizable to other similar organizational settings), but less internal validity (i.e., we cannot be certain of the extent to which variable X alone causes variable Y). Note that in the lab experiment, the reverse is true: the internal validity is high but the external validity is rather low. In other words, in lab experiments we can be sure that variable X causes variable Y because we have been able to keep the other confounding exogenous variables under control, but we have so tightly controlled several variables to establish the cause-and-effect relationship that we do not know to what extent the results of our study can be generalized, if at all, to field settings. In other words, since the lab setting does not reflect the “real-world” setting, we do not know to what extent the lab findings validly represent the realities in the outside world.

Trade-off between internal and external validity

There is thus a trade-off between internal validity and external validity. If we want high internal validity, we should be willing to settle for lower external validity and vice versa. To ensure both types of validity, researchers usually try first to test the causal relationships in a tightly controlled artificial or lab setting, and once the relationship has been established, they try to test the causal relationship in a field experiment. Lab experimental designs in the management area have thus far been done to assess, among other things, gender differences in leadership styles and managerial aptitudes. However, gender differences and other factors found in the lab settings are frequently not found in field studies (Osborn & Vicars, 1976). These problems of external validity usually limit the use of lab experiments in the management area. Field experiments are also infrequently undertaken because of the resultant unintended consequences – personnel becoming suspicious, rivalries and jealousies being created among departments, and the like.

Factors affecting the validity of experiments

Even the best designed lab studies may be influenced by factors that might affect the internal validity of the lab experiment. That is, some confounding factors might still be present that could offer rival explanations as to what is causing the dependent variable. These possible confounding factors pose a threat to internal validity. The seven major threats to internal validity are the effects of history, maturation, (main) testing, selection, mortality, statistical regression, and instrumentation, and these are explained below with examples. Two threats to external validity are (interactive) testing and selection. These threats to the validity of experiments are discussed next.

History effects

Certain events or factors that have an impact on the independent variable–dependent variable relationship might unexpectedly occur while the experiment is in progress, and this history of events would confound the cause-and-effect relationship between the two variables, thus affecting the internal validity. For example, let us say that the manager of a Dairy Products Division wants to test the effects of the "buy one, get one free" sales promotion on the sale of the company-owned brand of packaged cheese for a week. She carefully records the sales of the packaged cheese during the previous two weeks to assess the effect of the promotion. However, on the very day that her sales promotion goes into effect, the Dairy Farmers' Association unexpectedly launches a multimedia advertisement on the benefits of consuming dairy products, especially cheese. The sales of all dairy products, including cheese, go up in all the stores, including the one where the experiment had been in progress. Here, because of an unexpected advertisement, one cannot be sure how much of the increase in sales of the packaged cheese in question was due to the sales promotion and how much to the advertisement by the Dairy Farmers' Association! The effects of history have reduced the internal validity or the faith that can be placed on the conclusion that the sales promotion caused the increase in sales. The **history effects** in this case are illustrated in Figure 10.1.

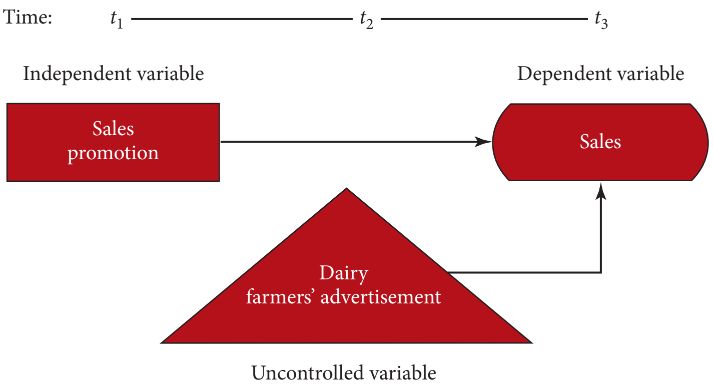


FIGURE 10.1

Illustration of history effects in experimental design

To give another example, let us say a bakery is studying the effects of adding to its bread a new ingredient that is expected to enrich it and offer more nutritional value to children under 14 years of age within 30 days, subject to a certain daily intake. At the start of the experiment the bakery takes a measure of the health of 30 children through some medical yardsticks. Thereafter, the children are given the prescribed intakes of bread daily. Unfortunately, on day 20 of the experiment, a flu virus hits the city in epidemic proportions affecting most of the children studied. This unforeseen and uncontrollable effect of history, flu, has contaminated the cause-and-effect relationship study for the bakery.

Maturation effects

Cause-and-effect inferences can also be contaminated by the effects of the passage of time – another uncontrollable variable. Such contamination effects are denoted **maturation effects**. The maturation effects are a function of the processes – both biological and psychological – operating within the respondents as a result of the passage of time. Examples of maturation processes include growing older, getting tired, feeling hungry, and getting bored. In other words, there could be a maturation effect on the dependent variable purely because of the passage of time. For instance, let us say that an R&D director contends that increases in the efficiency of workers will result within three months' time if advanced technology is introduced in the work setting. If, at the end of the three months, increased efficiency is indeed found, it will be difficult to claim that the advanced technology (and it alone) increased the efficiency of workers because, with the passage of time, employees will also have gained experience, resulting in better job performance and therefore in improved efficiency. Thus, the internal validity also gets reduced owing to the effects of maturation inasmuch as it is difficult to pinpoint how much of the increase is attributable to the introduction of the enhanced technology alone. Figure 10.2 illustrates the maturation effects in the above example.

Testing effects

Frequently, to test the effects of a treatment, subjects are given what is called a pretest. That is, first a measure of the dependent variable is taken (the **pretest**), then the treatment is given, and after that a second measure of the dependent variable is taken (the **posttest**). The difference between the posttest and the pretest scores is then attributed to the treatment. However, the exposure of participants to the pretest may affect both the internal and external validity of the findings. Indeed, the aforementioned process may lead to two types of **testing effects**.

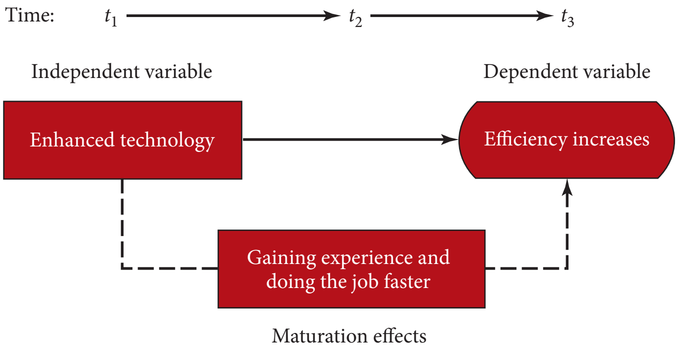


FIGURE 10.2

Illustration of maturation effects on a cause-and-effect relationship

A *main testing effect* occurs when the prior observation (the pretest) affects *the later observation* (the posttest). Main testing effects typically occur because participants want to be consistent. Let us assume that we have tested the effect of a television commercial (the treatment) on attitudes toward the brand using a pretest and a posttest. Suppose that no significant difference in attitude toward the brand was found. This finding could lead to the conclusion that the commercial was ineffective. However, an alternative explanation is that our participants tried to be consistent and answered the later questions so that their answers were similar to the answers they gave the first time. The pretest may thus have affected the results of the experiment. Along these lines, main testing effects are another threat to internal validity.

Interactive testing effects occur when the pretest affects the participant's *reaction to the treatment* (the independent variable). Again, let's assume that we are testing the effect of a television commercial on attitude toward the brand using a pretest and a posttest. It is possible that because of the pretest, the participants watch the television commercial more closely than consumers that do not take part in the experiment. For this reason, any effects that are found may not necessarily be generalizable to the population. Hence, interactive treatment effects are a threat to the external validity of an experiment.

In sum, testing effects may affect both the internal and external validity of our findings. Main testing effects threaten the internal validity, whereas interactive testing effects threaten the external validity.

Selection bias effects

Another threat to both the internal and external validity of our findings is the selection of participants. First, we will discuss how selection may affect the external validity of our findings. Then, we will discuss how selection may affect the internal validity.

In a lab setting, the types of participants selected for the experiment may be very different from the types of employees recruited by organizations. For example, students in a university might be allotted a task that is manipulated to study the effects on their performance. The findings from this experiment cannot be generalized, however, to the real world of work, where the employees and the nature of the jobs are both quite different. Thus, subject selection poses a threat to external validity.

The threat to internal validity comes from improper or unmatched selection of subjects for the experimental and control groups. For example, if a lab experiment is set up to assess the impact of the working environment on employees' attitudes toward work, and if one of the experimental conditions is to have a group of subjects work for about two hours in a room with a mildly unpleasant smell, an ethical researcher might disclose this condition to prospective subjects, who may decline to participate in the study. However, some volunteers might be lured through incentives (say, a payment of $70 for the two hours of participation in the study). The volunteers so selected may be quite different from the others (inasmuch as they may come from an environment of deprivation) and their responses to the treatment might be quite different. Such bias in the selection of the subjects might contaminate the cause-and-effect relationships and pose a threat to internal validity as well. Hence, newcomers, volunteers, and others who cannot be matched with the control groups pose a threat to internal validity in certain types of experiment. For this reason, randomization or matching groups is highly recommended.

Mortality effects

Another confounding factor on the cause-and-effect relationship is the **mortality** or attrition of the members in the experimental or control group, or both, as the experiment progresses. When the group composition changes over time across the groups, comparison between the groups becomes difficult, because those who dropped out of the experiment may confound the results. Again, we will not be able to say how much of the effect observed arises from the treatment, and how much is attributable to the members who dropped out, since those who stayed with the experiment may have reacted differently from those who dropped out. Let us see an example.

EXAMPLE

A sales manager had heard glowing reports about three different training programs that train salespersons in effective sales strategies. All three were of six weeks' duration. The manager was curious to know which one would offer the best results for the company. The first program took the trainees daily on field trips and demonstrated effective and ineffective sales strategies through practical experience. The second program trained groups on the same strategies but indoors in a classroom setting, with lectures, role playing, and answering questions from the participants. The third program used mathematical models and simulations to increase sales effectiveness. The manager chose eight trainees each for the three different programs and sent them to training. By the end of the fourth week, three trainees from the first group, one from the second group, and two from the third group had dropped out of the training programs for a variety of reasons, including ill health, family exigencies, transportation problems, and a car accident. This attrition from the various groups made it impossible to compare the effectiveness of the various programs. Thus, mortality can also lower the internal validity of an experiment.

Statistical regression effects

The effects of **statistical regression** are brought about when the members chosen for the experimental group have extreme scores on the dependent variable to begin with. For instance, if a manager wants to test whether he can increase the "salesmanship" repertoire of the sales personnel through Dale Carnegie-type programs, he should not choose those with extremely low or extremely high abilities for the experiment. This is because we know from the laws of probability that those with very low scores on a variable (in this case, current sales ability) have a greater probability of showing improvement and scoring closer to the mean on the posttest after being exposed to the treatment. This phenomenon of low scorers tending to score closer to the mean is known as "regressing toward the mean" (statistical regression). Likewise, those with very high abilities also have a greater tendency to regress toward the mean – they will score lower on the posttest than on the pretest. Thus, those who are at either end of the continuum with respect to a variable will not "truly" reflect the cause-and-effect relationship. The phenomenon of statistical regression is thus yet another threat to internal validity.

Instrumentation effects

Instrumentation effects are yet another source of threat to internal validity. These might arise because of a change in the measuring instrument between pretest and posttest, and not because of the treatment's differential impact at the end (Cook & Campbell, 1979a). For instance, an observer who is involved in observing a particular pattern of behavior in respondents before a treatment might start concentrating on a different set of behaviors after the treatment. The frame of measurement of behavior (in a sense, the measuring instrument) has now changed and will not reflect the change in behavior that can be attributed to the treatment. This is also true in the case of physical measuring instruments like the spring balance or other finely calibrated instruments that might lose their accuracy due to a loss of tension with constant use, resulting in erroneous final measurement.

In organizations, instrumentation effects in experimental designs are possible when the pretest is done by the experimenter, treatments are given to the experimental groups, and the posttest on measures such as performance is done by different managers. One manager might measure performance by the final units of output, a second manager might take into account the number of rejects as well, and a third manager might also take into consideration the amount of resources expended in getting the job done! Here, there are at least three different measuring instruments, if we treat each manager as a performance measuring instrument.

Thus, instrumentation effects also pose a threat to internal validity in experimental design.

Identifying threats to validity

Let us examine each of the possible seven threats to validity in the context of the following scenario.

EXAMPLE

An organizational consultant wanted to demonstrate to the president of a company, through an experimental design, that the democratic style of leadership best enhances the morale of employees. She set up three experimental groups and one control group for the purpose and assigned members to each of the groups randomly. The three experimental groups were headed by an autocratic leader, a democratic leader, and a laissez-faire leader, respectively.

The members in the three experimental groups were administered a pretest. Since the control group was not exposed to any treatment, they were not given a pretest. As the experiment progressed, two members in the democratic treatment group got quite excited and started moving around to the other members saying that the participative atmosphere was "great" and "performance was bound to be high in this group." Two members from each of the autocratic and laissez-faire groups left after the first hour saying they had to go and could no longer participate in the experiment. After two hours of activities, a posttest was administered to all the participants, including the control group members, on the same lines as the pretest.

1. *History effects*. The action of the two members in the participative group by way of unexpectedly moving around in an excited manner and remarking that participative leadership is "great" and the "performance is bound to be high in this group" might have boosted the morale of all the members in the group. It would be difficult to separate out how much of the increase in morale was due to the participative condition alone and how much to the sudden enthusiasm displayed by the two members.
2. *Maturation effects.* It is doubtful that maturation had any effect on morale in this situation, since the passage of time, in itself, may not have anything much to do with increases or decreases in morale.
3. *Testing effects*. The pretests are likely to have sensitized the respondents to both the treatment and the posttest. Thus, main and interactive testing effects exist. However, if all the groups had been given both the pre- and the posttests, the main testing effects (but not the interactive testing effects!) across all groups would have been taken care of (i.e., nullified) and the posttests of each of the experimental groups could have been compared with that of the control group to detect the effects of the treatment. Unfortunately, the control group was not given the pretest, and thus this group's posttest scores were not biased by the pretest – a phenomenon that could have occurred in the experimental groups. Hence, it is incorrect, on the face of it, to compare the experimental groups' scores with those of the control group. Interactive testing poses a threat to the external validity of the findings.
4. *Selection bias effects.* Since members were randomly assigned to all groups, selection bias should not have affected the internal validity of the findings. The external validity of the findings should also not have been threatened by selection: there is no reason to assume that the participants selected for the experiment are different from the other employees of the organization.

5. *Mortality effects.* Since members dropped out of two experimental groups, the effects of mortality could affect internal validity.
6. *Statistical regression effects.* Though not specifically stated, we can assume that all the members participating in the experiment were selected randomly from a normally distributed population, in which case the issue of statistical regression contaminating the experiment does not arise.
7. *Instrumentation effects.* Since the same questionnaire measured morale both before and after the treatment for all members, there should not have been any instrumentation bias.

In effect, three of the seven threats to internal validity do apply in this case. The history, main testing, and mortality effects are of concern and, therefore, the internal validity will not be high. Interactive testing effects threaten the external validity of the findings.

EXAMPLE

Internal Validity in Case Studies

If there are several threats to internal validity even in a tightly controlled lab experiment, it should be quite clear why we cannot draw conclusions about causal relationships from case studies that describe the events that occurred during a particular time. Unless a well-designed experimental study, randomly assigning members to experimental and control groups, and successfully manipulating the treatment indicates possible causal relationships, it is impossible to say which factor causes another. For instance, there are several causes attributed to "Slice," the soft drink introduced by PepsiCo Inc., not taking off after its initial success. Among the reasons given are: (1) a cutback in advertisements for Slice, (2) operating on the mistaken premise that the juice content in Slice would appeal to health-conscious buyers, (3) PepsiCo's attempts to milk the brand too quickly, (4) several strategic errors made by PepsiCo, (5) underestimation of the time taken to build a brand, and the like. While all the above could provide the basis for developing a theoretical framework for explaining the variance in the sales of a product such as Slice, conclusions about cause-and-effect relationships cannot be determined from anecdotal events.

Review of factors affecting internal and external validity

Whereas internal validity raises questions about whether it is the treatment alone or some additional extraneous factor that causes the effects, external validity raises issues about the generalizability of the findings to other settings.

Interactive testing and **selection effects** may restrict the external validity of our findings. These threats to external validity can be combated by creating experimental conditions that are as close as possible to the situations to which the results of the experiment are to be generalized.

At least seven contaminating factors exist that might affect the internal validity of experimental designs. These are the effects of history, maturation, (main) testing, instrumentation, selection, statistical regression, and mortality. It is, however, possible to reduce these biases by enhancing the level of sophistication of the experimental design. Whereas some of the more sophisticated designs, discussed next, help to increase the internal validity of the experimental results, they also become expensive and time consuming.

The different types of experimental design and the extent to which internal and external validity are met in each are discussed next.

TYPES OF EXPERIMENTAL DESIGN AND VALIDITY

Let us consider some of the commonly used experimental designs and determine the extent to which they guard against the seven factors that could contaminate the internal validity of experimental results. The shorter the time span of the experiments, the less the chances are of encountering history, maturation, and mortality effects. Experiments lasting an hour or two do not usually meet with many of these problems. It is only when experiments are spread over an extended period of, say, several months, that the possibility of encountering more of the confounding factors increases.

Quasi-experimental designs

Some studies expose an experimental group to a treatment and measure its effects. Such an **experimental design** is the weakest of all designs, and it does not measure the true cause-and-effect relationship. This is so because there is no comparison between groups, nor any recording of the status of the dependent variable as it was prior to the experimental treatment and how it changed after the treatment. In the absence of such control, the study is of no scientific value in determining cause-and-effect relationships. Hence, such a design is referred to as a *quasi-experimental design*. The following three designs are quasi-experimental designs.

Pretest and posttest experimental group design

An **experimental group** (without a control group) may be given a pretest, exposed to a treatment, and then given a posttest to measure the effects of the treatment. This can be illustrated as in Table 10.2, where O refers to some process of observation or measurement, X represents the exposure of a group to an experimental treatment, and the X and Os in the row are applied to the same specific group. Here, the effects of the treatment can be obtained by measuring the difference between the posttest and the pretest ($O_2 - O_1$). Note, however, that testing effects might contaminate both the internal (main testing effects) and external (interactive testing effects) validity of the findings. If the experiment is extended over a period of time, history, mortality, and maturation effects may also confound the results.

Posttests only with experimental and control groups

Some experimental designs are set up with an experimental and a control group, the former alone being exposed to a treatment and not the latter. The effects of the treatment are studied by assessing the difference in the outcomes – that is, the posttest scores of the experimental and control groups. This is illustrated in Table 10.3. Here is a case where the testing effects have been avoided because there is no pretest, only a posttest. Care has to be taken, however, to make sure that the two groups are matched for all the possible contaminating **"nuisance" variables**. Otherwise, the true effects of the treatment cannot be determined by merely looking at the difference in the posttest scores of the two groups. Randomization would take care of this problem.

Mortality (the dropping out of individuals from groups) is a problem for all experimental designs, including this one. It can confound the results, and thus pose a threat to internal validity.

TABLE 10.2

Pretest and posttest experimental group design

Group	Pretest score	Treatment	Posttest score
Experimental group	O_1	X	O_2
	Treatment effect = $(O_2 - O_1)$		

TABLE 10.3

Posttest only with experimental and control groups

Group	Treatment	Outcome
Experimental group	X	O_1
Control group		O_2
	Treatment effect = $(O_1 - O_2)$	

Time series design

A time series design (sometimes called an interrupted time series design) differs from the aforementioned designs in that it collects data on the same variable at regular intervals (for instance weeks, months, or years). A time series design thus allows the researcher to assess the impact of a treatment over time. Figure 10.3 visually describes a time series design. It shows that a series of measurements on the dependent variable is taken before and after the treatment is administered (either by the researcher or naturally).

Figure 10.4 depicts the results of a time series experiment testing the effect of price reduction (in week 4) on sales. The horizontal scale (*x*-axis) is divided into weeks, and the vertical scale (*y*-axis) shows the values of sales (the dependent variable) as they fluctuate over a period of nine weeks. Assuming that other factors, such as the other marketing-mix variables and the marketing mix of competitors, stay the same, the impact of the price cut is the difference in sales before and after the change. From Figure 10.4 it is easy to see that there was an increase in sales after the price of the product went down. The question is, however, whether the increase in sales, depicted by the two horizontal lines in Figure 10.4, is significant. Bayesian moving average models (for instance,

$$O_1 \quad O_2 \quad O_3 \quad O_4 \quad O_5 \quad X \quad O_6 \quad O_7 \quad O_8 \quad O_9 \quad O_{10}$$

FIGURE 10.3

Time series design

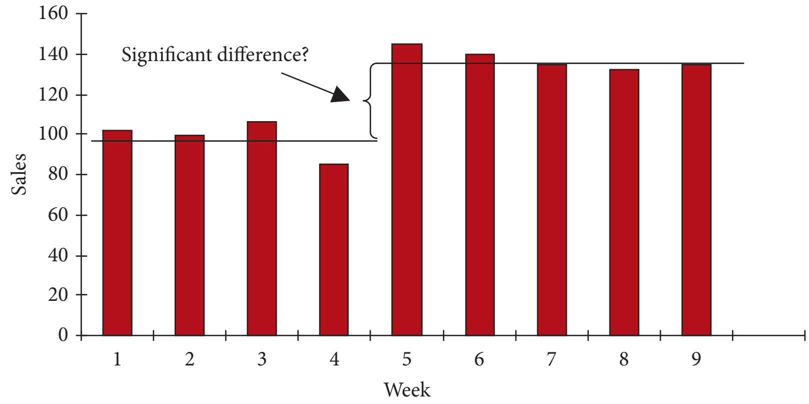


FIGURE 10.4

Effect of price cut in week 4

Box & Jenkins, 1970) are frequently used to test the impact of a treatment on the dependent variable when a time series design is used.

A key problem of time series is history: certain events or factors that have an impact on the independent variable–dependent variable relationship might unexpectedly occur while the experiment is in progress. Other problems are main and interactive testing effects, mortality, and maturation.

True experimental designs

Experimental designs that include both the treatment and control groups and record information both before and after the experimental group is exposed to the treatment are known as **ex post facto experimental designs**. These are discussed below.

Pretest and posttest experimental and control group design

This design can be visually depicted as in Table 10.4. Two groups – one experimental and the other control – are both exposed to the pretest and the posttest. The only difference between the two groups is that the former is exposed to a treatment whereas the latter is not. Measuring the difference between the differences in the post- and pretest scores of the two groups gives the net effects of the treatment. Both groups have been exposed to both the pre- and posttests, and both groups have been randomized; thus we can expect the history, maturation, main testing, and instrumentation effects to have been controlled. This is so due to the fact that whatever happened with the experimental group (e.g., maturation, history, main testing, and instrumentation) also happened with the control group, and in measuring the net effects (the difference in the differences between the pre- and post-test scores) we have controlled these contaminating factors. Through the process of randomization, we have also controlled the effects of selection bias and statistical regression.

Mortality could, again, pose a problem in this design. In experiments that take several weeks, as in the case of assessing the impact of training on skill development, or measuring the impact of technology advancement on effectiveness, some of the subjects in the experimental group may drop out before the end of the experiment. It is possible that those who drop out are in some way different from those who stay on until the end and take the posttest. If so, mortality could offer a plausible rival explanation for the difference between O_2 and O_1. Interactive testing effects could also cause a problem in this design; the fact that the participants in the experimental group are asked to do a pretest could make them more sensitive to the manipulation.

Solomon four-group design

To gain more confidence in internal validity in experimental designs, it is advisable to set up two experimental groups and two control groups for the experiment. One experimental group and one control group can be given both the pretest and the posttest, as shown in Table 10.5. The other two groups will be given only the posttest.

TABLE 10.4

Pretest and posttest experimental and control groups

Group	Pretest	Treatment	Posttest
Experimental group	O_1	X	O_2
Control group	O_3		O_4

Treatment effect $= [(O_2 - O_1) - (O_4 - O_3)]$

TABLE 10.5

Solomon four-group design

Group	Pretest	Treatment	Posttest
1. Experimental	O_1	X	O_2
2. Control	O_3		O_4
3. Experimental		X	O_5
4. Control			O_6

Here, the effects of the treatment can be calculated in several different ways, as indicated below. To the extent that we come up with almost the same results in each of the different calculations, we can attribute the effects to the treatment. This increases the internal validity of the results of the experimental design. This design, known as the **Solomon four-group design**, is perhaps the most comprehensive and the one with the least number of problems with internal validity.

Solomon four-group design and threats to validity The Solomon four-group design, also known as the four-group six-study design, is a highly sophisticated experimental design. This design controls for all the threats to internal validity, except for mortality (which is a problem for all experimental designs) and also for interactive testing effects. For this reason, the Solomon four-group design is very useful when interactive testing effects are expected.

Treatment effect (E) could be judged by:

$$E = (O_2 - O_1)$$
$$E = (O_2 - O_4)$$
$$E = (O_5 - O_6)$$
$$E = (O_5 - O_3)$$
$$E = [(O_2 - O_1) - (O_4 - O_3)]$$

If all Es are similar, the cause-and-effect relationship is highly valid.

To be able to calculate the effect of the experimental treatment, an estimate of the prior measurements is needed for Groups 3 and 4. The best estimate of this premeasure is the average of the two pretests; that is, $(O_1 + O_3)/2$. Together with the six pre- and posttest observations, the estimates of the premeasures can then be used to generate estimations of the impact of the experimental treatment (E), interactive testing effects (I), and the effects of uncontrolled variables (U). Estimates of these effects are made by comparing the before and after measures of the four groups.

The following equations provide an overview of the potential impact of the experimental treatment (E), interactive testing effects (I), and uncontrolled variables (U) for each group:

$$\textit{Group 1:} (O_2 - O_1) = E + I + U$$
$$\textit{Group 2:} (O_4 - O_3) = U$$
$$\textit{Group 3:} [O_5 - 1/2(O_1 + O_3)] = E + U$$
$$\textit{Group 4:} [O_6 - 1/2(O_1 + O_3)] = U$$

We can use these equations to estimate the effects of *E*, *I*, and *U* by comparing the pre- and posttests of the groups. For instance, to estimate the effect of the experimental stimulus (*E*) the results of Groups 3 and 4 are used:

$$\left[O_5 - \tfrac{1}{2}(O_1 + O_3)\right] - \left[O_6 - \tfrac{1}{2}(O_1 + O_3)\right] = \left[E + U\right] - U = E$$

To calculate the effect of *I* (the interactive testing effect) the results of Groups 1 and 3 are used:

$$(O_2 - O_1) - \left[O_5 - \tfrac{1}{2}(O_1 + O_3)\right] = (E + I + U) - (E + U) = I.$$

Thus we are able to control for interactive testing effects that threaten the external validity of our findings. Let us now examine how the threats to internal validity are taken care of in the Solomon four-group design.

It is important to note that subjects should be randomly selected and randomly assigned to groups. This removes the statistical regression and selection biases. Group 2, the control group that was exposed to both the pre- and posttest, helps us to see whether or not history, maturation, (main) testing, instrumentation, or regression threaten internal validity. Mortality (the loss of participants during the course of the experiment) is a potential problem for all experimental designs, even for this one.

Thus, the Solomon four-group experimental design guarantees the maximum internal and external validity, ruling out many other rival hypotheses. Where establishing a cause-and-effect relationship is critical for the survival of businesses (e.g., pharmaceutical companies, which often face lawsuits for questionable products) the Solomon four-group design is eminently useful. However, because of the number of subjects that need to be recruited, the care with which the study has to be designed, the time that needs to be devoted to the experiment, and other reasons, the cost of conducting such an experiment is high. For this reason it is rarely used.

Table 10.6 summarizes the threats to validity covered by the different experimental designs. If the subjects have all been randomly assigned to the groups, then selection bias and statistical regression are eliminated in all cases.

Double-blind studies

When extreme care and rigor are needed in experimental designs, as in the case of discovery of new medicines that could have an impact on human lives, blind studies are conducted to avoid any bias that might creep in. For example, pharmaceutical companies experimenting with the efficacy of newly developed drugs in the prototype stage ensure that the subjects in the experimental and control groups are kept unaware of who is given the drug, and who the placebo. Such studies are called blind studies.

TABLE 10.6

Major threats to validity in different experimental designs when members are randomly selected and assigned

Types of experimental design	Major threats to validity
1. Pretest and posttest with one experimental group only	History, maturation, main testing, interactive testing, mortality
2. Pretest and posttest with one experimental and one control group	Interactive testing, mortality
3. Posttests only with one experimental and one control group	Mortality
4. Solomon four-group design	Mortality

When Aviron tested and announced the Flu-mist vaccine, neither the subjects nor the researchers who administered the vaccine to them were aware of the "true" versus the "placebo" treatment. The entire process was conducted by an outside testing agency, which alone knew who got what treatment. Since, in this case, both the experimenter and the subjects are blinded, such studies are called **double-blind studies**. Since there is no tampering with the treatment in any way, such experimental studies are the least biased.

As mentioned previously, managers rarely undertake the study of cause-and-effect relationships in organizations using experimental designs because of the inconvenience and disruption they cause to the system.

Ex post facto designs

Cause-and-effect relationships are sometimes established through what is called the **ex post facto experimental design**. Here, there is no manipulation of the independent variable in the lab or field setting, but subjects who have already been exposed to a stimulus and those not so exposed are studied. For instance, training programs might have been introduced in an organization two years earlier. Some might have already gone through the training while others might not. To study the effects of training on work performance, performance data might now be collected for both groups. Since the study does not immediately follow after the training, but much later, it is an ex post facto design.

More advanced experimental designs such as the completely randomized design, randomized block design, Latin square design, and the factorial design are described in the appendix to this chapter, for those students interested in these.

SIMULATION

An alternative to lab and field experimentation currently being used in business research is simulation. Simulation uses a model-building technique to determine the effects of changes. Simulations are becoming popular in business research. A **simulation** can be thought of as an experiment conducted in a specially created setting that very closely represents the natural environment in which activities are usually carried out. In that sense, the simulation lies somewhere between a lab and a field experiment, insofar as the environment is artificially created but not too different from "reality." Participants are exposed to real-world experiences over a period of time, lasting anywhere from several hours to several weeks, and they can be randomly assigned to different treatment groups. If managerial behavior as a function of a specific treatment is to be studied, subjects will be asked to operate in an environment very much like an office, with desks, chairs, cabinets, telephones, and the like. Members will be randomly assigned the roles of directors, managers, clerks, and so on, and specific stimuli will be presented to them. Thus, while the researcher retains control over the assignment and manipulation, the subjects are left free to operate as in a real office. In essence, some factors will be built into or incorporated in the simulated system and others left free to vary (participants' behavior, within the rules of the game). Data on the dependent variable can be obtained through observation, videotaping, audio recording, interviews, or questionnaires.

Causal relationships can be tested since both manipulation and control are possible in simulations. Two types of simulation can be made: one in which the nature and timing of simulated events are totally determined by the researcher (called experimental simulation), and the other (called free simulation) where the course of activities is at least partly governed by the reaction of the participants to the various stimuli as they interact among themselves. *Looking Glass*, the free simulation developed by Lombardo, McCall, and DeVries (1983) to study leadership styles, has been quite popular in the management area.

Cause-and-effect relationships are better established in experimental simulations where the researcher exercises greater control. In simulations involving several weeks, however, there may be a high rate of attrition of members. Experimental and free simulations are both expensive, since creating real-world conditions in an artificial setting and collecting data over extended periods of time involve the deployment of many types of resources. Simulations can be done in specially created settings using subjects, computers, and mathematical models. Steufert, Pogash, and Piasecki (1988), who assessed managerial competence through a six-hour computer-assisted simulation, are of the opinion that simulation technology may be the only viable method to simultaneously study several types of executive style.

Computer-based simulations are frequently used in the accounting and finance areas. For example, the effectiveness of various analytic review procedures in detecting errors in account balances has been tested through simulations (Knechel, 1986). In the finance area, risk management has been studied through simulations. Simulations have also been used to understand the complex relationships in the financing of pension plans and making important investment decisions (Perrier & Kalwarski, 1989). It is possible to vary several variables (workforce demographics, inflation rates, etc.) singly or simultaneously in such models.

Prototypes of machines and instruments are often the result of simulated models. Simulation has also been used by many companies to test the robustness and efficacy of various products. We are also familiar with flight simulators, driving simulators, and even nuclear reactor simulators. Here, the visual patterns presented keep changing in response to the reactions of the individual (the pilot, the driver, or the emergency handler) to the previous stimulus presented, and not in any predetermined order. Entire business operations, from office layout to profitability, can be simulated using different prospective scenarios. With increasing access to sophisticated technology, and the advancement of mathematical models, simulation is becoming an important managerial decision-making tool. It is quite likely that we will see simulation being used as a managerial tool, to enhance motivation, leadership, and the like, in the future. Simulation can also be applied as a problem-solving managerial tool in other behavioral and administrative areas. Programmed, computer-based simulation models in behavioral areas could serve managerial decision making very well indeed.

ETHICAL ISSUES IN EXPERIMENTAL DESIGN RESEARCH

It is appropriate at this juncture to briefly discuss a few of the many ethical issues involved in doing research, some of which are particularly relevant to conducting lab experiments. The following practices are considered unethical:

- Putting pressure on individuals to participate in experiments through coercion, or applying social pressure.
- Giving menial tasks and asking demeaning questions that diminish participants' self-respect.
- Deceiving subjects by deliberately misleading them as to the true purpose of the research.
- Exposing participants to physical or mental stress.
- Not allowing subjects to withdraw from the research when they want to.
- Using the research results to disadvantage the participants, or for purposes not to their liking.
- Not explaining the procedures to be followed in the experiment.
- Exposing respondents to hazardous and unsafe environments.
- Not debriefing participants fully and accurately after the experiment is over.
- Not preserving the privacy and confidentiality of the information given by the participants.
- Withholding benefits from control groups.

The last item is somewhat controversial in terms of whether or not it should be an ethical dilemma, especially in organizational research. If three different incentives are offered for three experimental groups and none is offered to the control group, it is a fact that the control group has participated in the experiment with absolutely no benefit. Similarly, if four different experimental groups receive four different levels of training but the control group does not, the other four groups have gained expertise that the control group has been denied. But should this be deemed an ethical dilemma preventing experimental designs with control groups in organizational research? Perhaps not, for at least three reasons. One is that several others in the system who did not participate in the experiment did not benefit either. Second, even in the experimental groups, some would have benefited more than others (depending on the extent to which the causal factor was manipulated). Finally, if a cause-and-effect relationship is found, the system will, in all probability, implement the new-found knowledge sooner or later and everyone will ultimately stand to gain. The assumption that the control group did not benefit from participating in the experiment may not be a sufficient reason not to use lab or field experiments.

Many universities have a "human subjects committee" to protect the right of individuals participating in any type of research activity involving people. The basic function of these committees is to discharge the moral and ethical responsibilities of the university system by studying the procedures outlined in the research proposals and giving their stamp of approval to the study. The human subjects committee might require the investigators to modify their procedures or inform the subjects fully, if occasion demands it.

MANAGERIAL IMPLICATIONS

Before using experimental designs in research studies, it is essential to consider whether they are necessary at all, and if so, at what level of sophistication. This is because experimental designs call for special efforts and varying degrees of interference with the natural flow of activities. Some questions that need to be addressed in making these decisions are the following:

1. Is it really necessary to identify causal relationships, or would it suffice if the correlates that account for the variance in the dependent variable were known?
2. If it is important to trace the causal relationships, which of the two, internal validity or external validity, is needed more, or are both needed? If only internal validity is important, a carefully designed lab experiment is the answer; if generalizability is the more important criterion, then a field experiment is called for; if both are equally important, then a lab study should be first undertaken, followed by a field experiment (if the results of the former warrant the latter).
3. Is cost an important factor in the study? If so, would a less rather than a more sophisticated experimental design do?

These decision points are illustrated in the chart in Figure 10.5.

Though some managers may not be interested in cause-and-effect relationships, a good knowledge of experimental designs could foster some pilot studies to be undertaken to examine whether factors such as bonus systems, piece rates, rest pauses, and so on lead to positive outcomes such as better motivation, improved job performance, and other favorable working conditions at the workplace. Marketing managers could use experimental designs to study the effects on sales of advertisements, sales promotions, pricing, and the like. Awareness of the usefulness of simulation as a research tool can also result in creative research endeavors in the management area, as it currently does in the manufacturing side of businesses.

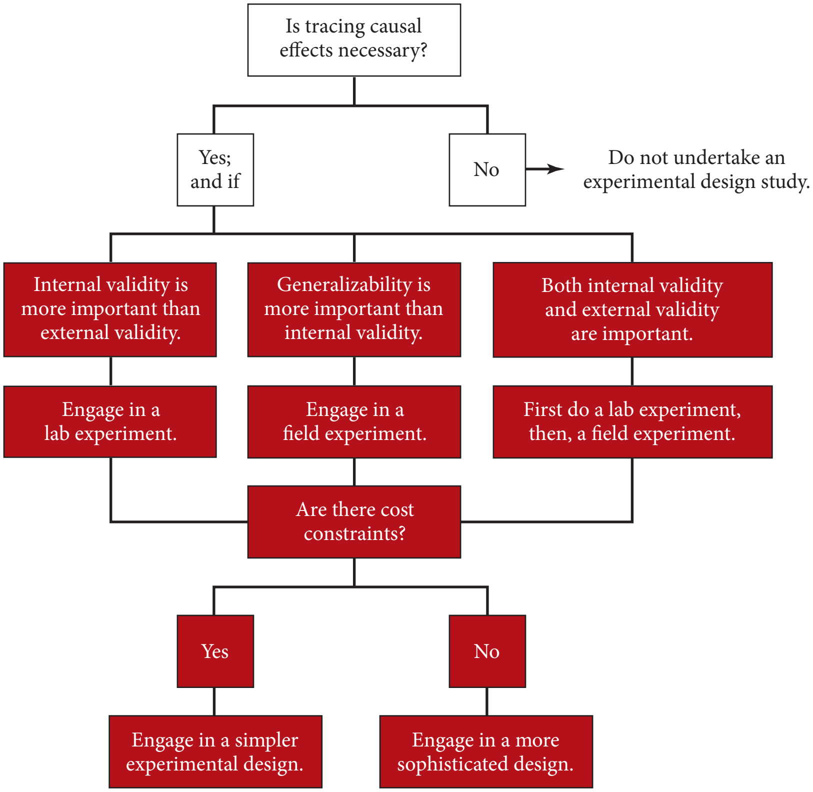

Is tracing causal effects necessary?
Yes; and if
No
Do not undertake an experimental design study.
Internal validity is more important than external validity.
Generalizability is more important than internal validity.
Both internal validity and external validity are important.
Engage in a lab experiment.
Engage in a field experiment.
First do a lab experiment, then, a field experiment.
Are there cost constraints?
Yes
No
Engage in a simpler experimental design.
Engage in a more sophisticated design.

FIGURE 10.5

Decision points for embarking on an experimental design

SUMMARY

- **Learning objective 1: Describe lab experiments and discuss the internal and external validity of this type of experiment.**
  When control and manipulation are introduced to establish cause-and-effect relationships in an artificial setting, we have lab experiments. The goal of the researcher is to keep every variable constant except for the independent variable. Manipulation means that we create different levels of the independent variable to assess the impact on the dependent variable. One way of controlling for contaminating variables is to match the various groups in an experiment. Another way of controlling the contaminating variables is to assign participants randomly to groups. In lab experiments internal validity can be said to be high. On the other hand, the external validity of lab experiments is typically low.

- **Learning objective 2: Describe field experiments and discuss the internal and external validity of this type of experiment.**
  A field experiment is an experiment done in the natural environment. In the field experiment, it is not possible to control all the nuisance variables. The treatment however can still be manipulated. Control groups can also be set up in field experiments. Cause-and-effect relationships found under these conditions will have a wider generalizability to other similar settings (the external validity is typically high; the internal validity of field experiments is low).

- **Learning objective 3: Describe, discuss, and identify threats to internal and external validity and make a trade-off between internal and external validity.**
  External validity refers to the extent of generalizability of the results of a causal study to other settings. Internal validity refers to the degree of our confidence in the causal effects. Field experiments have more external validity, but less internal validity. In lab experiments, the internal validity is high but the external validity is low. There is thus a trade-off between internal validity and external validity. Even the best designed lab studies may be influenced by factors affecting the internal validity. The seven major threats to internal validity are the effects of history, maturation, (main) testing, selection, mortality, statistical regression, and instrumentation. Two threats to external validity are (interactive) testing and selection.

- **Learning objective 4: Describe the different types of experimental designs.**
  A quasi-experimental design is the weakest of all designs, and it does not measure the true cause-and-effect relationship. Pretest and posttest experimental group designs, posttests only with experimental and control groups, and time series designs are examples of quasi-experimental designs. True experimental designs that include both treatment and control groups and record information both before and after the experimental group is exposed to the treatment are known as ex post facto experimental designs. Pretest and posttest experimental and control group designs, Solomon four-group designs, and double blind studies are examples of true experimental designs. In ex post facto experimental design there is no manipulation of the independent variable in the lab or field setting, but subjects who have already been exposed to a stimulus and those not so exposed are studied.

- **Learning objective 5: Discuss when and why simulation might be a good alternative to lab and field experiments.**
  An alternative to lab and field experimentation, simulation uses a model-building technique to determine the effects of changes.

- **Learning objective 6: Discuss the role of the manager in experimental designs.**
  Knowledge of experimental designs may help the manager to (engage a consultant to) establish cause-and-effect relationships. Through the analysis of the cause-and effect relationships, it is possible to find answers or solutions to a problem. Experiments may help managers to examine whether bonus systems lead to more motivation, whether piece rates lead to higher productivity, or whether price cuts lead to more sales.

- **Learning objective 7: Discuss the role of ethics in experimental designs.**
  Ethics in experiments refers to the correct rules of conduct necessary when carrying out experimental research. Researchers have a duty to respect the rights and dignity of research participants. This means that they should take certain rules of conduct into account.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: The moderating effect of involvement in product placement effectiveness**.

DISCUSSION QUESTIONS

1. What are the differences between causal and correlational studies?
2. In what ways do lab experiments differ from field experiments?
3. Define the terms control and manipulation. Describe a possible lab experiment where you would need to control a variable. Include also a variable over which you would have no control but which could affect your experiment.
4. Explain the possible ways in which you can control "nuisance" variables.
5. What is internal validity and what are the threats it stands exposed to?
6. Explain the concept of "trade-off between internal validity and external validity."
7. Explain how the selection of participants may affect both the internal and external validity of your experiments.
8. Explain the difference between main and interactive testing effects. Why is this difference important?
9. History is a key problem in a time series design. Other problems are main and interactive testing effects, mortality, and maturation. Explain.
10. Explain why mortality remains a problem even when a Solomon four-group design is used.
11. "If a control group is a part of an experimental design, one need not worry about controlling other exogenous variables." Discuss this statement.
12. "The Solomon four-group design is the answer to all our research questions pertaining to cause-and-effect relationships because it guards against all the threats to internal validity." Comment.
13. Below is an adapted note from *BusinessWeek* published some time ago. After reading it, apply what you have learned in this chapter, and design a study after sketching the theoretical framework.

The vital role of self-esteem

Why do some people earn more than others? Economists focused on the importance of education, basic skills, and work experience – what they called human capital – on increased productivity, and said these were reflected in greater earning power. Researchers also found that self-esteem was instrumental in acquiring human capital.

14. Design a study to examine the following situation.

An organization would like to introduce one of two types of new manufacturing process to increase the productivity of workers, and both involve heavy investment in expensive technology. The company wants to test the efficacy of each process in one of its small plants.

APPENDIX

Further experimental designs

In this chapter we discussed different types of experimental design where groups were subjected to one or more treatments and the effects of the manipulation measured. However, we may sometimes wish to assess the simultaneous effects of two or more variables on a dependent variable, and this calls for more complex designs. Among the many advanced experimental designs available, we will examine here the completely randomized design, the randomized block design, the Latin square design, and the factorial design.

It would be useful to understand some terms before describing the various designs. The term "factor" is used to denote an independent variable – for example, price. The term "level" is used to denote various gradations of the factor – for example, high price, medium price, low price – while making it clear as to what these gradations signify (e.g., high price is anything over $2 per piece; medium is $1–2 per piece; low price is anything less than $1 per piece). "Treatment" refers to the various levels of the factors. A "blocking factor" is a preexisting variable in a given situation that might have an effect on the dependent variable in addition to the treatment, the impact of which is important to assess. In effect, a blocking factor is an independent variable that has an effect on the dependent variable, but which preexists in a given situation: for example, the number of women and men in an organization; or teenagers, middle-aged men, and senior citizens as customers of a store; and so on.

The completely randomized design

Let us say that a bus transportation company manager wants to know the effects of fare reduction by 5, 7, and 10 cents on the average daily increase in the number of passengers using the bus as a means of transportation. He may take 27 routes that the buses usually ply, and randomly assign nine routes for each of the treatments (i.e., reduction of fares by 5, 7, and 10 cents) for a two-week period. His experimental design is shown in Table 10.7, where the *O*s on the left indicate the number of passengers that used the bus for the two weeks preceding the treatment; X_1, X_2, and X_3 indicate the three different treatments (fare reductions of 5, 7, and 10 cents per mile), and the *O*s on the right indicate the number of passengers that used the bus as a transportation mode during the two weeks when the fares were reduced. The manager will be able to assess the impact of the three treatments by deducting each of the three *O*s on the left from its corresponding *O* on the right. The results of this study will provide the answer to the bus company manager's question.

TABLE 10.7

Illustration of a completely randomized design

Routes	Number of passengers before	Treatment	Number of passengers after
Group 1 of nine routes	O_1	X_1	O_2
Group 2 of nine routes	O_3	X_2	O_4
Group 3 of nine routes	O_5	X_3	O_6

TABLE 10.8

Illustration of a randomized block design

	Blocking factor: residential areas		
Fare reduction	**Suburbs**	**Crowded urban areas**	**Retirement areas**
5c	X_1	X_1	X_1
7c	X_2	X_2	X_2
10c	X_3	X_3	X_3

Note that the *X*s only indicate various levels of the blocking factor and the *O*s (the number of passengers before and after each treatment at each level) are not shown, though these measures will be taken.

Randomized block design

In the foregoing case, the bus company manager was interested only in the effects of different levels of price reduction on the increase in the number of passengers in general. He may be more interested, however, in targeting the price reduction on the right routes or sectors. For example, it is likely that the reduction in fares will be more welcome to senior citizens and residents of crowded urban areas where driving is stressful, than to car owners living in the suburbs, who may not be equally appreciative of and sensitive to price reduction. Thus, reductions in fares will probably attract more passengers if targeted at the right groups (i.e., the right blocking factor – the residential areas). In this case, the bus company manager should first identify the routes that fall into the three blocks – those in suburbs, crowded urban areas, or residential areas with retirees. Thus, the 27 routes will get assigned to one or other of three blocks and will then be randomly assigned, within the blocks, to the three treatments. The experimental design is shown in Table 10.8.

Through the above randomized block design, not only can the direct effect of each treatment (i.e., the main effect of the level, which is the effect of each type of fare reduction) be assessed, but also the joint effects of price and the residential area route (the interaction effect). For example, the general effect of a 5 cent reduction for all routes will be known by the increase in passengers across all three residential areas, and the general effect of a 5 cent reduction on those in the suburbs alone will also be known by seeing the effects in the first cell. If the highest average daily number of increased passengers is 75 for a 7 cent decrease for the crowded urban area route, followed by an increase of 30 for the retirees' areas for the 10 cent decrease, and an increase of five passengers for a 5 cent reduction for the suburbs, the bus company manager can work out a cost–benefit analysis and decide on the course of action to be taken. Thus, the randomized block design is a more powerful technique, providing more information for decision making. However, the cost of this experimental design will be higher.

Latin square design

Whereas the randomized block design helps the experimenter to minimize the effects of one nuisance variable (variation among the rows) in evaluating the treatment effects, the Latin square design is very useful when two nuisance blocking factors (i.e., variations across both the rows and the columns) are to be controlled. Each treatment appears an equal number of times in any one ordinal position in each row. For instance, in studying the effects of bus fare reduction on passengers, two nuisance factors could be: (1) the day of the week, (a) midweek (Tuesday through Thursday), (b) weekend, (c) Monday and Friday; and (2) the (three) residential localities of the passengers. A three by three Latin square design can be created in this case, to which will be randomly assigned the three treatments (5, 7, and 10 cent fare reductions), such that each treatment occurs only once in each row and column intersection. The Latin square design is shown in Table 10.9. After the experiment is carried out and

TABLE 10.9

Illustration of the Latin square design

	Day of the week		
Residential area	**Midweek**	**Weekend**	**Monday/Friday**
Suburbs	X_1	X_2	X_3
Urban	X_2	X_3	X_1
Retirement	X_3	X_1	X_2

the net increase in passengers under each treatment calculated, the average treatment effects can be gauged. The price reduction that offers the best advantage can also be assessed.

A problem with the Latin square design is that it presupposes the absence of interaction between the treatments and blocking factors, which may not always be the case. We also need as many cells as there are treatments. Furthermore, it is an uneconomical design compared to some others.

Factorial design

Thus far we have discussed experimental designs in the context of examining a cause-and-effect relationship between one independent variable and the dependent variable. The factorial design enables us to test the effects of two or more manipulations at the same time on the dependent variable. In other words, two treatments can be simultaneously manipulated and their single and joint (known as main and interaction) effects assessed. For example, the manager of the bus company might be interested in knowing passenger increases if he used three different types of buses (Luxury Express, Standard Express, and Regular) and manipulated both the fare reduction and the type of vehicle used, simultaneously. Table 10.10 illustrates the 3 × 3 factorial design that would be used for the purpose.

TABLE 10.10

Illustration of a 3 × 3 factorial design

	Bus fare reduction rates		
Type of bus	**5c**	**7c**	**10c**
Luxury Express	X_1Y_1	X_2Y_1	X_3Y_1
Standard Express	X_2Y_2	X_1Y_2	X_3Y_2
Regular	X_3Y_3	X_2Y_3	X_1Y_3

Here, two factors are used with three levels in each. The above is completely randomized, since the fares are randomly assigned to one of nine treatment combinations. A wealth of information can be obtained from this design. For example, the bus company manager will know the increase in passengers for each fare reduction, for each type of vehicle, and for the two in combination. Thus, the main effects of the two independent variables, as well as the interactions among them, can be assessed. For this reason, the factorial design is more efficient than several single-factor randomized designs.

It is also statistically possible to control one or more variables through covariance analysis. For example, it may be suspected that even after randomly assigning members to treatments, there is a further "nuisance" factor. It is possible to statistically block such factors while analyzing the data.

Several other complex experimental designs are also available and are treated in books devoted to experimental designs.

CHAPTER 11

Measurement of variables: Operational definition

LEARNING OBJECTIVES

After completing Chapter 11, you should be able to:

1. Explain how variables are measured.
2. Explain when operationalization of variables is necessary.
3. Operationally define (or operationalize) abstract and subjective variables.

INTRODUCTION

Measurement of the variables is an integral part of research and an important aspect of research design (see shaded portion in Figure 11.1). Unless the variables are measured in some way, we will not be able to find answers to our research questions. Surveys and experimental designs, discussed in the previous chapters, often use questionnaires to measure the variables of interest. In this chapter we will discuss how variables lend themselves to measurement.

HOW VARIABLES ARE MEASURED

To test the hypothesis that workforce diversity affects organizational effectiveness we have to measure workforce diversity and organizational effectiveness. *Measurement* is the assignment of numbers or other symbols to characteristics (or attributes) of objects according to a prespecified set of rules. *Objects* include persons, strategic business units, companies, countries, bicycles, elephants, kitchen appliances, restaurants, shampoo, yogurt, and so on. Examples of *characteristics* of objects are arousal-seeking tendency, achievement motivation, organizational effectiveness, shopping enjoyment, length, weight, ethnic diversity, service quality, conditioning effects, and taste. It is important that you realize that you cannot measure objects (for instance, a company); you measure characteristics or attributes of objects (for instance, the organizational effectiveness of a company). In a similar fashion, you can measure the length (the attribute) of a person (the object), the weight of an elephant, the arousal-seeking tendency of stockbrokers, the shopping enjoyment of women, the service quality of a restaurant, the conditioning effects of a shampoo, and the taste of a certain brand of yogurt. To be able to measure you need an object and attributes of the object, but you also need a judge. A *judge* is someone who has the necessary knowledge and skills to assess "the

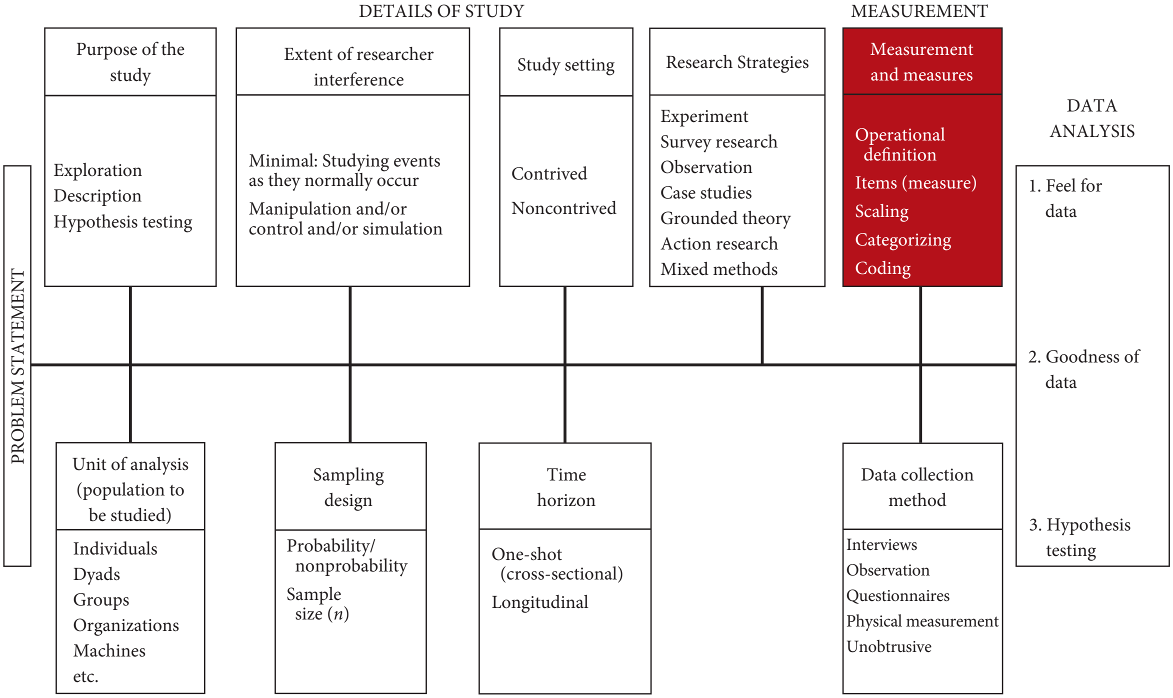

DETAILS OF STUDY
MEASUREMENT
DATA ANALYSIS
PROBLEM STATEMENT
Purpose of the study
Exploration
Description
Hypothesis testing
Extent of researcher interference
Minimal: Studying events as they normally occur
Manipulation and/or control and/or simulation
Study setting
Contrived
Noncontrived
Research Strategies
Experiment
Survey research
Observation
Case studies
Grounded theory
Action research
Mixed methods
Measurement and measures
Operational definition
Items (measure)
Scaling
Categorizing
Coding
1. Feel for data
2. Goodness of data
3. Hypothesis testing
Unit of analysis (population to be studied)
Individuals
Dyads
Groups
Organizations
Machines
etc.
Sampling design
Probability/ nonprobability
Sample size (n)
Time horizon
One-shot (cross-sectional)
Longitudinal
Data collection method
Interviews
Observation
Questionnaires
Physical measurement
Unobtrusive

FIGURE 11.1

Research design and where this chapter fits in

quality" of something, such as the taste of yogurt, the arousal-seeking tendency of stockbrokers, or the communication skills of students. In many cases the object and the judge are the same person. For instance, if you want to measure the gender (the attribute) of your employees (the objects), or the shopping enjoyment (the attribute) of women (the objects), you can simply ask the objects (employees and women respectively) to provide you with the necessary details via a self-administered questionnaire. However, it is unlikely that the object has the necessary knowledge and skills to act as a judge when you want to measure the taste (the attribute) of yogurt (the object), the service quality of a restaurant, the communication skills of students, or even the managerial expertise of supervisors.

Now do Exercise 11.1.

EXERCISE 11.1

Identify the object and the attribute. Give your informed opinion about who would be an adequate judge.

- **a.** Price consciousness of car buyers.
- **b.** Self-esteem of dyslexic children.
- **c.** Organizational commitment of school teachers.
- **d.** Marketing orientation of companies.
- **e.** Product quality of tablets (such as the Apple iPad and the Samsung Galaxy Tab).

Attributes of objects that can be physically measured by some calibrated instruments pose no measurement problems. For example, the length and width of a rectangular office table can be easily measured with a measuring tape or a ruler. The same is true for measuring the office floor area and for measuring the weight of an elephant (at least to some extent). Data representing several demographic characteristics of office personnel are also easily obtained by asking employees simple, straightforward questions, such as: "*How long have you been working in this organization?*" or "*What is your marital status?*"

The measurement of more abstract and subjective attributes is more difficult, however. For instance, it is relatively difficult to measure the level of *achievement motivation* of office clerks, the *shopping enjoyment* of women, or the *need for cognition* of students. Likewise, it is not straightforward to test hypotheses on the relationship between workforce diversity, managerial expertise, and organizational effectiveness. The problem is that we cannot simply ask questions like "*How diverse is your company's workforce?*" or "*How effective is your organization?*" because of the abstract nature of the variables "workforce diversity" and "organizational effectiveness." Of course, there are solutions to this problem. One of these solutions is discussed next. But let us, before we discuss the solution, summarize the problem.

Certain variables lend themselves to easy measurement through the use of appropriate measuring instruments; for example, physiological phenomena pertaining to human beings, such as blood pressure, pulse rates, and body temperature, as well as certain physical attributes such as length and weight. But when we get into the realm of people's subjective feelings, attitudes, and perceptions, the measurement of these factors or variables becomes more difficult. Accordingly, there are at least two types of variables: one lends itself to objective and precise measurement; the other is more nebulous and does not lend itself to accurate measurement because of its abstract and subjective nature.

OPERATIONAL DEFINITION (OPERATIONALIZATION)

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Operational definition (operationalization)**.

Despite the lack of physical measuring devices to measure the more nebulous variables, there are ways of tapping these types of variable. One technique is to reduce these abstract notions or concepts to observable behavior and/or characteristics. In other words, the abstract notions are broken down into observable behavior or characteristics. For instance, the concept of *thirst* is abstract; we cannot see it. However, we would expect a thirsty person to drink plenty of fluids. In other words, the expected reaction of people to thirst is to drink fluids. If several people say they are thirsty, then we may determine the thirst levels of each of these individuals by the measure of the quantity of fluids that they drink to quench their thirst. We will thus be able to measure their levels of thirst, even though the concept of thirst itself is abstract and nebulous. Reduction of abstract concepts to render them measurable in a tangible way is called **operationalizing** the concepts.

Operationalizing is done by looking at the behavioral dimensions, facets, or properties denoted by the concept. These are then translated into observable and measurable elements so as to develop an index of measurement of the concept. Operationalizing a concept involves a series of steps. The first step is to come up with a definition of the construct that you want to measure. Then, it is necessary to think about the content of the measure; that is, an instrument (one or more items or questions) that actually measures the concept that one wants to measure has to be developed. Subsequently, a response format (for instance, a seven-point rating scale with end-points anchored by "strongly disagree" and "strongly agree") is needed, and, finally, the validity and reliability of the measurement scale has to be assessed. The next chapter discusses steps 3 and 4. In this chapter we will discuss step 2: the development of an adequate and representative set of items or questions.

EXAMPLE

Operationalizing the concept "need for cognition"

We have just reduced the abstract concept *thirst* into observable behavior by measuring the amount of drinks people use to quench their thirst. Other abstract concepts such as need for cognition (the tendency to engage in and enjoy thinking (Cacioppo & Petty, 1982)) can be reduced to observable behavior and/or characteristics in a similar way. For instance, we would expect individuals with a high need for cognition to prefer complex to simple problems, to find satisfaction in deliberating hard and for long hours, and to enjoy tasks that involve coming up with new solutions to problems (examples taken from Cacioppo & Petty, 1982). We may thus identify differences between individuals in need of cognition by measuring to what extent people prefer complex to simple problems, find satisfaction in deliberating hard and for long hours, and enjoy tasks that involve coming up with new solutions to problems.

In 1982, Cacioppo and Petty reported four studies to develop and validate a measurement scale to assess need for cognition. In a first study, a pool of 45 items that appeared relevant to need for cognition was generated (based on prior research) and administered to groups "known to differ in need for cognition." The results of this study revealed that the 45 items exhibited a high degree of interrelatedness and thus suggested that need for cognition is a *unidimensional* construct (that is, it does not have more than one main component or dimension; we will come back to this issue further on in this chapter). This finding was replicated in a second study. Two further studies (studies three and four) were carried out to validate the findings of the first two studies. The outcome of this validation process was a valid and reliable need for cognition measure containing 34 items, such as "I would prefer complex to simple problems," "I find satisfaction in deliberating hard and for long hours," and "I really enjoy tasks that involve coming up with new solutions to problems."

Now do Exercise 11.2.

EXERCISE 11.2

a. Read the paper by Cacioppo and Petty (1982) and describe how the authors generated the pool of 45 scale items that appeared relevant to need for cognition.

b. Why do we need 34 items to measure "need for cognition"? Why do three or four items not suffice?

Operationalization: dimensions and elements

The examples of thirst and need for cognition illustrate how abstract concepts are operationalized by using observable and measurable elements, such as the amount of drinks people use to quench their thirst, and the extent to which people prefer complex to simple problems. You may have noticed that whereas only one item is needed to measure thirst ("*how many drinks did you use to quench your thirst?*"), 34 items are needed to measure need for cognition. These 34 items are needed because if we used fewer than these 34 items, our measurement scale would probably not represent the entire domain or universe of need for cognition; in other words, our measure would probably not include an adequate and representative set of items (or *elements*). As a consequence, our measure would not be valid. A valid measure of need for cognition thus contains 34 items even though need for cognition is a unidimensional construct.

An example of a construct with more than one dimension is aggression. Aggression has at least two *dimensions*: verbal aggression and physical aggression. That is, aggression might include behavior such as shouting and swearing at a person (verbal aggression), but also throwing objects, hitting a wall, and physically hurting others (physical aggression). A valid measurement scale of aggression would have to include items that measure verbal aggression and items that measure physical aggression. A measurement scale that would only include items measuring physical aggression would not be valid if our aim were to measure aggression. Likewise, a scale that would only include items measuring verbal aggression would also not be a valid measure of aggression. Thus, a valid measurement scale includes quantitatively measurable questions or items (or elements) that adequately represent the domain or universe of the construct; if the construct has more than one domain or dimension, we have to make sure that questions that adequately represent these domains or dimensions are included in our measure.

Now do Exercise 11.3.

EXERCISE 11.3

Try to come up with two unidimensional and two multidimensional abstract concepts. Explain why these concepts have either one or more than one dimension.

Operationalizing the (multidimensional) concept of achievement motivation

Suppose that we are interested in establishing a relationship between gender and achievement motivation. To test this relationship we will have to measure both gender and achievement motivation. At this point, you will probably understand that whereas measuring gender will not cause any problems, measuring achievement motivation probably will, because the latter construct is abstract and subjective in nature. For this reason we must infer achievement motivation by measuring behavioral dimensions, facets, or characteristics we would expect to find in people with high achievement motivation. Indeed, without measuring these dimensions, facets, or characteristics we will not be able to arrive at bottom-line statements about the relationship between gender and achievement motivation.

After we have defined the construct, the next step in the process of measuring abstract constructs such as achievement motivation is to go through the literature to find out whether there are any existing measures of the concept. Both scientific journals and "scale handbooks" are important sources of existing measures. As a rule, empirical articles published in academic journals provide a detailed description of how specific constructs were measured; information is often provided on what measures were used, when and how these measures were developed, by whom, and for how long they have been in use. Scale handbooks are also a useful source of existing measurement scales. Scale handbooks, such as the *Marketing Scales Handbook* or the *Handbook of Organizational Measurement*, provide an exhaustive overview of measurement scales that have appeared in the academic literature. These handbooks help you to determine whether a measurement scale exists and, if more than one measurement scale exists, to make a logical selection between available measures. The use of existing measurement scales has several advantages. First, it saves you a lot of time and energy. Second, it allows you to verify the findings of others and to build on the work of others (this is very important in scientific research but impossible if you use measures that differ from those that our predecessors have used!). Hence, if you want to measure something, see if it has been measured before and then use this measure (adapt it to your specific needs whenever this is needed). Make sure that you document the use of existing measurement scales properly.

EXAMPLE

Documenting the use of existing measurement scales

Service encounter dissatisfaction and anger were measured with seven-point, multi-item rating scales adapted from previous studies (Crosby & Stephens, 1987; Izard, 1977). These scales were introduced with the following question: "*How did you feel about your service experience on this particular occasion?*" A seven-point, multi-item measurement scale adapted from prior research (Nasr-Bechwati & Morrin, 2003) was used to measure the desire to get even with the service provider. Scales measuring customers' behavioral intentions closely followed existing scales measuring reactions to service failure. Intentions to engage in negative word-of-mouth communication, complaint filing (Zeithaml, Berry & Parasuraman, 1996), and switching (Oliver, 1996) were assessed by having participants indicate the degree to which they were inclined to such behavior on a seven-point rating scale, anchored by "not at all" and "very much."

There are several measures of achievement motivation available from the literature (Amabile, Hill, Hennessey & Tighe, 1994; Gordon, 1973; Heggestad & Kanfer, 1999; Super, 1970). But what if there were no existing measures available? In such a case, we would have to develop a measure ourselves; this means that we would have to break down the concept "achievement motivation" into observable behavior or characteristics, as detailed next.

Dimensions and elements of achievement motivation

Let us try to operationalize "achievement motivation," a concept of interest to educators, managers, and students alike. What behavioral dimensions, facets, or characteristics would we expect to find in people with high achievement motivation? They would probably have the following five typical broad characteristics, which we will call dimensions:

1. They would be driven by work; that is, they would be working almost round the clock in order to derive the satisfaction of having "achieved and accomplished."
2. Many of them would generally be in no mood to relax and direct their attention to anything other than work-related activity.
3. Because they want always to be achieving and accomplishing, they would prefer to work on their own rather than with others.
4. With mind and heart set on accomplishment and achievement, they would rather engage in challenging jobs than easy, hum-drum ones. However, they would not want to take on excessively challenging jobs because the expectation and probability of accomplishment and achievement in such jobs would not be very high.

5. They would be yearning to know how they are progressing in their jobs as they go along. That is, they would like to get frequent feedback in direct and subtle ways from their superiors, colleagues, and on occasion even their subordinates, to know how they are progressing.

Thus, we would expect those with high achievement motivation to drive themselves hard at work, find it difficult to relax, prefer to work alone, engage in challenging (but not too challenging) jobs, and seek feedback. Although breaking the concept into these five dimensions has somewhat reduced its level of abstraction, we have still not operationalized the concept into measurable elements of behavior. This could be done by examining each of the five dimensions and breaking each one down further into its elements, thus delineating the actual patterns of behavior that would be exhibited. These should somehow be quantitatively measurable so that we can distinguish those who have high motivation from those with less. Let us see how this can be done.

Elements of dimension 1 It is possible to describe the behavior of a person who is driven by work. Such a person will (1) be at work all the time, (2) be reluctant to take time off from work, and (3) persevere even in the face of some setbacks. These types of behavior lend themselves to measurement. For instance, we can count the number of hours employees engage themselves in work-related activities during work hours, beyond working hours at the workplace, and at home, where they are likely to pursue their unfinished assignments. Thus, the number of hours put in by them on their work is an index of the extent to which work "drives" them.

Next, keeping track of how frequently people persevere with their job despite failures is a reflection of how persevering they are in achieving their goals. A student who drops out of school due to failure to pass the first exam can by no means be deemed to be a highly persevering, achievement-oriented individual. However, a student who, despite getting D grades on three quizzes, toils day and night unceasingly in order to understand and master a course he considers difficult, is exhibiting perseverance and achievement-oriented behavior. Achievement-motivated individuals do not usually want to give up on their tasks even when confronted by initial failures. Perseverance urges them to continue. Hence, a measure of perseverance could be obtained by the number of setbacks people experience on the task and yet continue to work, undaunted by failures. For example, an accountant might find that she is unable to balance the books. She spends an hour trying to detect the error, fails to do so, gives up, and leaves the workplace. Another employee in the same position stays patiently on the job, discovers the error, and balances the books, spending the entire evening in the process. In this case it is easy to tell which of the two is the more persevering by merely observing them.

Finally, in order to measure reluctance to take time off, we need only know how frequently people take time off from their jobs, and for what reasons. If an employee is found to have taken seven days off during the previous six months to watch football games, attend an out-of-town circus, and visit friends, we can conclude that the individual probably would not hesitate in taking time away from the job. However, if an individual has not been absent even a single day during the past 15 months, and has not missed work even when slightly indisposed, it is evident that he is too dedicated to work to take time off from the job.

Thus, if we can measure how many hours per week individuals spend on work-related activities, how persevering they are in completing their daily tasks, and how frequently and for what reasons they take time off from their jobs, we will have a measure of the extent to which employees are driven by work. This variable, when thus measured, would place individuals on a continuum ranging from those who are least driven by work to those whose very life is work. This, then, would give some indication of the extent of their achievement motivation.

Figure 11.2 schematically outlines the dimensions (the several facets or main characteristics) and the elements (representative behaviors) for the concept of achievement motivation. Frequent reference to this figure will help you follow the ensuing discussions.

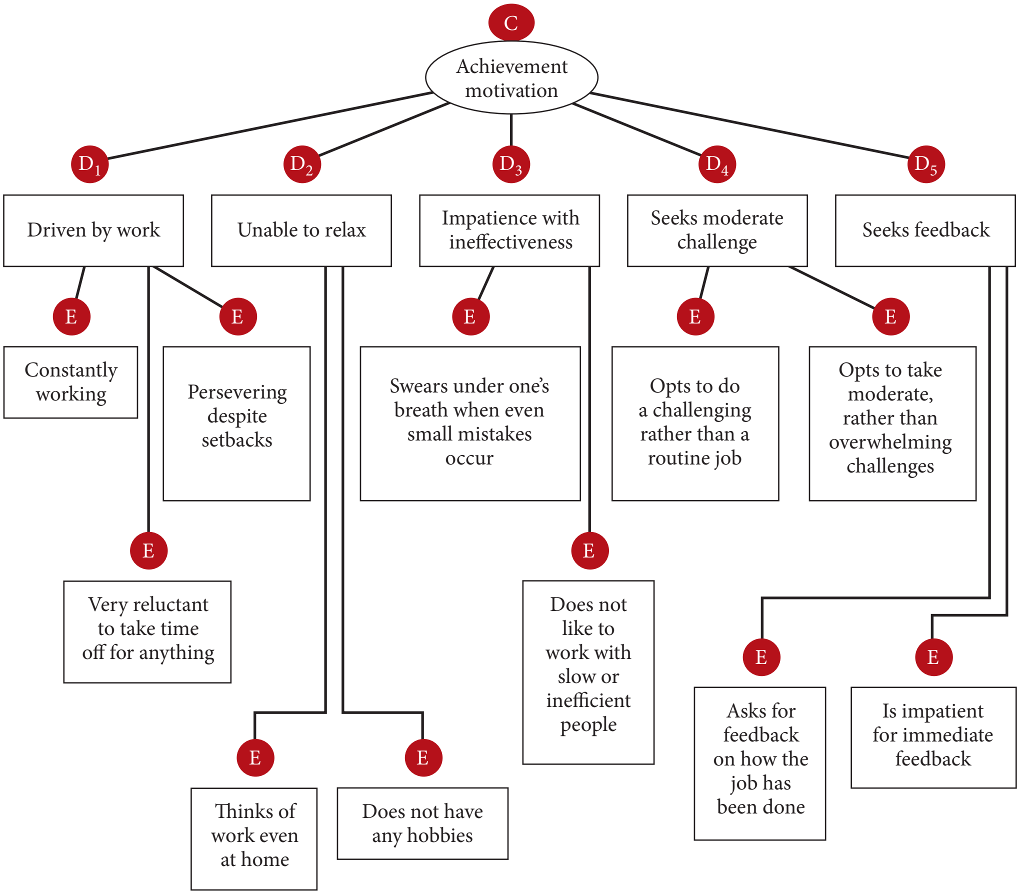

C
Achievement motivation
D1
D2
D3
D4
D5
Driven by work
Unable to relax
Impatience with ineffectiveness
Seeks moderate challenge
Seeks feedback
E
Constantly working
E
Persevering despite setbacks
E
Very reluctant to take time off for anything
E
Thinks of work even at home
E
Does not have any hobbies
E
Swears under one's breath when even small mistakes occur
E
Does not like to work with slow or inefficient people
E
Opts to do a challenging rather than a routine job
E
Opts to take moderate, rather than overwhelming challenges
E
Asks for feedback on how the job has been done
E
Is impatient for immediate feedback

FIGURE 11.2

Dimensions (D) and elements (E) of the concept (C) "achievement motivation"

Elements of dimension 2 The degree of unwillingness to relax can be measured by asking persons such questions as:

1. How often do you think about work while you are away from the workplace?
2. What are your hobbies?
3. How do you spend your time when you are away from the workplace?

Those who are able to relax would indicate that they do not generally think about work or the workplace while at home, that they spend time on hobbies, engage in leisure-time activities, and spend their waking hours with the family or in other social or cultural activities.

Thus, we can place employees on a continuum ranging from those who relax very well to those who relax very little. This dimension also then becomes measurable.

Elements of dimension 3 Individuals with high achievement motivation have no patience with ineffective people and are reluctant to work with others. Whereas achievement-motivated persons in the organization may rank very high on these behavioral predispositions, there may be others who are not highly achievement motivated. The latter may not at all mind ineffectiveness in either themselves or others, and may be quite willing to work with almost anybody. Thus, impatience with ineffectiveness can also be measured by observing behavior.

Elements of dimension 4 A measure of how excited people are at seeking challenging jobs can be had by asking employees what kinds of jobs they prefer. A number of different job descriptions could be presented – some jobs entailing stereotyped work of a routine nature, and others with gradations of challenge built into them. Employee preferences for different types of jobs could then be placed on a continuum ranging from those who prefer fairly routine jobs to those who prefer jobs with a progressive increase in challenge. Those opting for medium degrees of challenge are likely to be more achievement motivated than those who opt for either lower or higher degrees of challenge. Achievement-oriented individuals tend to be realistic and choose jobs that are reasonably challenging and within reach of accomplishment. Heedless and overconfident persons would perhaps choose the highly challenging jobs where the success is slow in coming, oblivious to whether or not the end results will be achieved. Those who are low in achievement motivation would perhaps choose the more routine jobs. Thus, those seeking moderate challenges can also be identified.

Elements of dimension 5 Those who desire feedback seek it from their superiors, coworkers, and sometimes even from their subordinates. They want to know others' opinions on how well they are performing. Feedback, both positive and negative, indicates to them how much they are achieving and accomplishing. If they receive messages suggesting a need for improvement, they will act on them. Hence, they constantly seek feedback from several sources. By keeping track of how often individuals seek feedback from others during a certain period of time – say, over several months – employees can again be placed on a continuum ranging from those who seek extensive feedback from all sources to those who never seek any feedback from anyone at any time.

Having thus operationalized the concept of achievement motivation by reducing its level of abstraction to observable behaviors, it is possible to develop a good measure to tap the concept of achievement motivation. Its usefulness is that others could use the same measure, thus ensuring replicability. It should, however, be recognized that any operationalization is likely to, first, exclude some of the important dimensions and elements arising from failure to recognize or conceptualize them and, second, include certain irrelevant features, mistakenly thought to be relevant.

BOX 11.1

THE POSITIVIST VIEW

You will recall that we earlier pointed out that *business research* cannot be 100% scientific because we often do not have the "perfect" measuring instruments. That is why, for a positivist, the purpose of science is to stick to what we can observe (and hence, what we can measure). Knowledge of anything beyond that is impossible. Since we cannot directly observe achievement motivation, job satisfaction, and service quality, these are not appropriate topics for a scientific study.

Box 11.1 provides the (somewhat exaggerated) viewpoint of the positivist on the measurement of abstract and subjective variables. For a pragmatist or a critical realist, operationalizing the concept, nevertheless, is the best way to measure it. Actually observing and counting the number of times individuals behave in particular ways, even if practical, would be too laborious and time consuming. So, instead of actually observing the behavior of individuals, we could ask them to report their own behavior patterns by asking them appropriate questions, which they could respond to on some (rating) scale that we provide. In the following example we will look at the type of questions that may be asked to tap achievement motivation.

EXAMPLE

Answers to the following questions from respondents would be one way of tapping the level of achievement motivation.

1. To what extent would you say you push yourself to get the job done on time?
2. How difficult do you find it to continue to do your work in the face of initial failure or discouraging results?
3. How often do you neglect personal matters because you are preoccupied with your job?
4. How frequently do you think of your work when you are at home?
5. To what extent do you engage yourself in hobbies?
6. How disappointed would you feel if you did not reach the goals you had set for yourself?
7. How much do you concentrate on achieving your goals?
8. How annoyed do you get when you make mistakes?
9. To what extent would you prefer to work with a friendly but incompetent colleague, rather than a difficult but competent one?
10. To what extent would you prefer to work by yourself rather than with others?
11. To what extent would you prefer a job that is difficult but challenging, to one that is easy and routine?
12. To what extent would you prefer to take on extremely difficult assignments rather than moderately challenging ones?
13. During the past three months, how often have you sought feedback from your superiors on how well you are performing your job?
14. How often have you tried to obtain feedback on your performance from your coworkers during the past three months?
15. How often during the past three months have you checked with your subordinates that what you are doing is not getting in the way of their efficient performance?
16. To what extent would it frustrate you if people did not give you feedback on how you are progressing?

The foregoing illustrates a possible way to measure variables relating to the subjective domain of people's attitudes, feelings, and perceptions by first operationalizing the concept. Operationalization consists of the reduction of the concept from its level of abstraction, by breaking it into its dimensions and elements, as discussed. By tapping the behaviors associated with a concept, we can measure the variable. Of course, the questions will ask for responses on some scale attached to them (such as "very little" to "very much"), which we will discuss in the next chapter.

What operationalization is not

Just as it is important to understand what operationalization is, it is equally important to remember what it is not. An operationalization does not describe the correlates of the concept. For example, success in performance cannot be a dimension of achievement motivation, even though a motivated person is likely to meet with it in large measure. Thus, achievement motivation and performance and/or success may be highly correlated, but we cannot measure an individual's level of motivation through success and performance. Performance and success may have been made possible as a consequence of achievement motivation, but in and of themselves, the two are not measures of it. To elaborate, a person with high achievement motivation might have failed for some reason, perhaps beyond her control, to perform the job successfully. Thus, if we judge the achievement motivation of this person with performance as the yardstick, we will have measured the wrong concept. Instead of measuring achievement motivation – our variable of interest – we will have measured performance, another variable we did not intend to measure nor were interested in.

Thus, it is clear that operationalizing a concept does not consist of delineating the reasons, antecedents, consequences, or correlates of the concept. Rather, it describes its observable characteristics in order to be able to measure the concept. It is important to remember this because if we either operationalize the concepts incorrectly or confuse them with other concepts, then we will not have valid measures. This means that we will not have "good" data, and our research will not be scientific.

Review of operationalization

We have thus far examined how to operationally define concepts. Operationalizations are necessary to measure abstract and subjective concepts such as feelings and attitudes. More objective variables such as age or educational level are easily measured through simple, straightforward questions and do not have to be operationalized. We have pointed out that operationalization starts with a definition of the concept. The next step is to either find or develop an adequate (set of) closed-end question(s) that allow(s) you to measure the concept in a reliable and valid way. Luckily, measures for many concepts that are relevant in business research have already been developed by researchers. While you review the literature in a given area, you might want to particularly note the reference that discusses the instrument used to tap the concept in the study, and read it. The article will tell you when the measure was developed, by whom, and for how long it has been in use. If you cannot find or use an existing measure, you have to develop your own measure. To be able to do this, you will need to become an expert in a particular domain; this enables you to include the relevant dimensions and elements in your measure. Only a well-developed instrument, which has been operationalized with care, will be accepted and frequently used by other researchers.

Now do Exercises 11.4, 11.5, and 11.6.

EXERCISE 11.4

Provide an operational definition of the concept of "service quality" and develop questions that would measure service quality.

EXERCISE 11.5

Compare your service quality measure to the measure of Zeithaml, Berry, and Parasuraman (1996) presented in the *Journal of Retailing*.

a. How does your measure differ from this measure in terms of dimensions and elements?
b. Would you prefer using your own measure or the measure of Zeithaml, Berry, and Parasuraman? Why?

EXERCISE 11.6

Find the paper "Consumer values orientation for materialism and its measurement: Scale development and validation," written by Marsha Richins and Scott Dawson.

a. Provide an overview of the dimensions and elements of Richins and Dawson's materialism scale.
b. Use Bruner, Hensel, and James' the *Marketing Scales Handbook* or your local (electronic) library to find at least two other materialism scales. Compare the scales you have found with the Richins and Dawson scale.

INTERNATIONAL DIMENSIONS OF OPERATIONALIZATION

In conducting transnational research, it is important to remember that certain variables have different meanings and connotations in different cultures. For instance, the term "love" is subject to several interpretations in different cultures and has at least 20 different interpretations in some countries. Likewise, the concept "knowledge" is equated with "jnana" in some Eastern cultures and construed as "realization of the Almighty." Thus, it is wise for researchers who hail from a country speaking a different language to recruit the help of local scholars to operationalize certain concepts while engaging in cross-cultural research.

SUMMARY

- **Learning objective 1: Explain how variables are measured.**
  To test hypotheses the researcher has to measure. Measurement is the assignment of numbers or other symbols to characteristics (or attributes) of objects according to a prespecified set of rules. There are at least two types of variables: one lends itself to objective and precise measurement; the other is more nebulous and does not lend itself to accurate measurement because of its abstract and subjective nature.

- **Learning objective 2: Explain when operationalization of variables is necessary.**
  Despite the lack of physical measuring devices to measure the more nebulous variables, there are ways of tapping these types of variables. One technique is to reduce these abstract notions to observable behavior and/or characteristics. This is called operationalizing the concepts. A valid measurement scale includes quantitatively measurable questions or items (or elements) that adequately represent the domain or universe of the construct; if the construct has more than one domain or dimension, the researcher has to make sure that questions that adequately represent these domains or dimensions are included in the measure. An operationalization does not describe the correlates of the concept.

- **Learning objective 3: Operationally define (or operationalize) abstract and subjective variables.**
  In conducting transnational research, it is important to remember that certain variables have different meanings and connotations in different cultures.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: The Standard Asian Merchant Bank**.

DISCUSSION QUESTIONS

1. Define measurement.
2. Explain why it is impossible to measure an object.
3. Provide (relevant) measurable attributes for the following objects:
    a. a restaurant;
    b. an investment banker;
    c. a consumer;
    d. a bicycle;
    e. a pair of sunglasses;
    f. a strategic business unit.
4. Why is it wrong to use correlates of a concept to measure that concept?
5. What is meant by operational definition, when is it necessary, and why is it necessary?
6. Operationalize the following:
    a. customer loyalty;
    b. price consciousness;
    c. career success.
7. Is it useful to draw on existing measures to measure abstract and subjective constructs such as customer loyalty? Why (not)?
8. "Since we cannot directly observe achievement motivation, job satisfaction, and service quality, these are not appropriate topics for a scientific study." Discuss this statement.

CHAPTER 12

Measurement: Scaling, reliability and validity

LEARNING OBJECTIVES

After completing Chapter 12, you should be able to:

1. Describe the characteristics and power of the four types of scales – nominal, ordinal, interval, and ratio.
2. Describe and know how and when to use different forms of rating scales.
3. Describe and know how and when to use different forms of ranking scales.
4. Discuss international dimensions of scaling.
5. Describe validity and reliability and how they are established and assess the reliability and validity of a scale.
6. Explain the difference between reflective and formative scales.

INTRODUCTION

In the previous chapter, we explained that measurement is the assignment of numbers or other symbols to characteristics (or attributes) of objects according to a prespecified set of rules. Now that we have learned how to operationally define (or operationalize) a concept (or variable), we need to assign numbers (or other symbols) to it in some manner. Note that it is important that the rules for assigning numbers to characteristics of objects should be standardized and applied in a consistent manner.

Numbers allow us to perform statistical analysis on the resulting data and (in deductive research) to test the hypotheses that we have developed. What's more, they facilitate the communication of our research results.

In this chapter we will examine the types of scales that can be applied to assign numbers to characteristics of objects and subsequently see how we actually apply them. We will first discuss four different types of scales (nominal, ordinal, interval, and ratio scales) and point out that the statistical analysis we can perform later on in the research process is directly related to the type of scales we use. We will also discuss two main categories of attitudinal scales (not to be confused with the four different types of scales, discussed first in this chapter) – the rating scale and the ranking scale. **Rating scales** have several response categories and are used to elicit responses with regard to the object, event, or person studied. **Ranking scales**, on the other hand, make comparisons between or among objects, events, or persons and elicit the preferred choices and ranking among them.

FOUR TYPES OF SCALES

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: The four types of scales**.

Measurement means gathering data in the form of numbers. To be able to assign numbers to attributes of objects we need a scale. A **scale** is a tool or mechanism by which individuals are distinguished as to how they differ from one another on the variables of interest to our study. Scaling involves the creation of a continuum on which our objects are located.

Suppose that we want to measure consumer attitudes toward soft drink consumption. After we have developed one or more scale items or questions, the next step in measurement is to decide on a scale that allows us to assign numbers to the attribute (attitude toward soft drink consumption) of our objects (consumers). This allows us to subsequently classify our objects (consumers) in terms of how unfavorable or favorable they are toward drinking a soft drink. One of the many options we have to classify consumers is a **Likert scale**. The Likert scale is a scale designed to examine how strongly respondents agree with a statement (such as "*I enjoy having a soft drink*") on a five-point scale with the following anchors: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree Nor Disagree, 4 = Agree, 5 = Strongly Agree (further on in this chapter we will thoroughly discuss a wide variety of rating and ranking scales, including the Likert scale). Hence, the Likert scale allows us to distinguish consumers in terms of how they differ from one another in their attitude toward soft drinks, each respondent being assigned a number indicating a more or less unfavorable, neutral, or more or less favorable.

The million dollar question is: What is the *meaning* of the numbers 1, 2, 3, 4, and 5? Does the scale that we have used allow us for instance to rank our objects (2 is more than 1)? Does it allow us to compare differences between objects (in other words is the difference between 1 and 2 the same as the difference between 2 and 3? And does it allow us to calculate certain statistics such as a mean (or average) and a standard deviation? The answer is: it depends. It depends on the type of scale (that is, the *basic* scale type) that we have used.

There are four basic types of scales: nominal, ordinal, interval, and ratio. The degree of sophistication to which the scales are fine-tuned increases progressively as we move from the nominal to the ratio scale. That is why information on the variables can be obtained in greater detail when we employ an interval or a ratio scale rather than using the other two scales. As the calibration or fine-tuning of the scale increases in sophistication, so does the power of the scale. With more powerful scales, increasingly sophisticated data analyses can be performed, which, in turn, means that more meaningful answers can be found to our research questions. However, certain variables lend themselves with greater ease to more powerful scaling than others. Let us now examine each of these four scales.

Nominal scale

A **nominal scale** is one that allows the researcher to assign subjects to certain categories or groups. For example, with respect to the variable of gender, respondents can be grouped into two categories – male and female. These two groups can be assigned code numbers 1 and 2. These numbers serve as simple and convenient category labels with no intrinsic value, other than to assign respondents to one of two nonoverlapping, or mutually exclusive, categories. Note that the categories are also collectively exhaustive. In other words, there is no third category into which respondents would normally fall. Thus, nominal scales categorize individuals or objects into mutually exclusive and collectively exhaustive groups. The information that can be generated from nominal scaling is the calculation of the percentage (or frequency) of males and females in our sample of respondents. For example, if we had interviewed 200 people, and assigned code number 1 to all male respondents and number 2 to all female respondents, then computer analysis of the data at the end of the survey may show that 98 of the respondents are men and 102 are women. This frequency distribution tells us that 49% of the survey's respondents are men and 51% women. Other than this marginal information, such scaling tells us nothing more about the two groups. Thus, the nominal scale gives some basic, categorical, gross information.

EXAMPLE

Let us take a look at another variable that lends itself to nominal scaling – the nationality of individuals. We could nominally scale this variable in the following mutually exclusive and collectively exhaustive categories.

American
Australian
Chinese
Japanese
Polish
Russian
German
Indian
Other
Swiss
Zambian

Note that every respondent has to fit into one of the above 11 categories and that the scale allows computation of the numbers and percentages of respondents that fit into them.

Now do Exercise 12.1.

EXERCISE 12.1

Suggest two variables that would be natural candidates for nominal scales, and set up mutually exclusive and collectively exhaustive categories for each.

Ordinal scale

An **ordinal scale** not only categorizes the variables in such a way as to denote differences among the various categories, it also rank-orders the categories in some meaningful way. With any variable for which the categories are to be ordered according to some preference, the ordinal scale would be used. The preference would be ranked (e.g., from best to worst; first to last) and numbered 1, 2, and so on. For example, respondents might be asked to indicate their preferences by ranking the importance they attach to five distinct characteristics in a job that the researcher might be interested in studying. Such a question might take the form shown in the following example.

The ordinal scale helps the researcher to determine the percentage of respondents who consider interaction with others as most important, those who consider using a number of different skills as most important, and so on. Such knowledge might help in designing jobs that are seen as most enriched by the majority of the employees.

We can now see that the ordinal scale provides more information than the nominal scale. The ordinal scale goes beyond differentiating the categories to providing information on how respondents distinguish them by rank-ordering them. Note, however, that the ordinal scale does not give any indication of the magnitude of the differences among the ranks. For instance, in the job characteristics example, the first-ranked job characteristic might be only marginally preferred over the second-ranked characteristic, whereas the characteristic that is ranked third might be preferred in a much larger degree than the one ranked fourth. Thus, in ordinal scaling, even though differences in the ranking of objects, persons, or events investigated are clearly known, we do not know their magnitude. This deficiency is overcome by interval scaling, which is discussed next.

EXAMPLE

Rank the following five characteristics in a job in terms of how important they are for you. You should rank the most important item as 1, the next in importance as 2, and so on, until you have ranked each of them 1, 2, 3, 4, or 5.

Job characteristic	Ranking of importance
The opportunity provided by the job to:	
Interact with others	—
Use a number of different skills.	—
Complete a whole task from beginning to end.	—
Serve others.	—
Work independently.	—

Now do Exercise 12.2.

EXERCISE 12.2

Develop an ordinal scale for consumer preferences for different brands of cars.

Interval scale

In an **interval scale**, or *equal* interval scale, numerically equal distances on the scale represent equal values in the characteristics being measured. Whereas the nominal scale allows us only to qualitatively distinguish groups by categorizing them into mutually exclusive and collectively exhaustive sets, and the ordinal scale to rank-order the preferences, the interval scale allows us to compare differences between objects. The difference between any two values on the scale is identical to the difference between any other two neighboring values of the scale. The clinical thermometer is a good example of an interval-scaled instrument; it has an arbitrary origin and the magnitude of the difference between 98.6 degrees (supposed to be the normal body temperature) and 99.6 degrees is the same as the magnitude of the difference between 104 and 105 degrees. Note, however, that one may not be seriously concerned if one's temperature rises from 98.6 to 99.6, but one is likely to be so when the temperature goes up from 104 to 105 degrees!

The interval scale, then, taps the differences, the order, and the equality of the magnitude of the differences in the variable. As such, it is a more powerful scale than the nominal and ordinal scales, and has for its measure of central tendency the arithmetic mean. Its measures of dispersion are the range, the standard deviation, and the variance.

Ratio scale

The ratio scale overcomes the disadvantage of the arbitrary origin point of the interval scale, in that it has an absolute (in contrast to an arbitrary) zero point, which is a meaningful measurement point. Thus, the **ratio scale** not only measures the magnitude of the differences between points on the scale but also taps the proportions in the differences. It is the most powerful of the four scales because it has a unique zero origin (not an arbitrary origin) and subsumes all the properties of the other three scales. The weighing balance is a good example of a ratio scale. It has an absolute (and not arbitrary) zero origin calibrated on it, which allows us to calculate the ratio of the weights of two individuals. For instance, a person weighing 250 pounds is twice as heavy as one who weighs 125 pounds. Note that multiplying or dividing both of these numbers (250 and 125) by any given number will preserve the ratio of 2:1. The measure of central tendency of the ratio scale may be either the arithmetic or the geometric mean and the measure of dispersion may be either the standard deviation, or variance, or the coefficient of variation. Some examples of ratio scales are those pertaining to actual age, income, and the number of organizations individuals have worked for.

Now do Exercise 12.3 and Exercise 12.4.

EXERCISE 12.3

Measure any three variables on an interval or a ratio scale.

EXERCISE 12.4

Mention one variable for each of the four scales in the context of a market survey, and explain how or why it would fit into the scale.

The properties of the scales, as fine-tuning is increasingly achieved, are summarized in Table 12.1. We may also see from the table how the power of the statistic increases as we move away from the nominal scale (where we group subjects or items under some categories), to the ordinal scale (where we rank-order the categories), to the interval scale (where we tap the magnitude of the differences), to the ratio scale (which allows us to measure the proportion of the differences).

You must have surmised by now that some variables, such as gender, can be measured only on the nominal scale, while others, such as temperature, can be measured on an ordinal scale (hot/medium/low), or the interval scale through a thermometer. Whenever it is possible to use a more powerful scale, it is wise to do so.

Ordinal or interval?

Likert scales (discussed later in this chapter) are a commonly used way of measuring opinions and attitudes. They measure the extent to which participants agree or disagree with a given statement, and typically range from 1 (strongly disagree) to 5 (strongly agree) with a neutral point in the middle (e.g. neither agree nor disagree). Whether this scale is ordinal or interval in nature is a subject of much debate. Some people argue that a Likert scale is ordinal in nature. They correctly point out that one cannot assume that all pairs of adjacent

TABLE 12.1

Properties of the four scales

	Highlights						
Scale	**Difference**	**Order**	**Distance**	**Unique origin**	**Measures of central tendency**	**Measures of dispersion**	**Some tests of significance**
Nominal	Yes	No	No	No	Mode	—	χ^2
Ordinal	Yes	Yes	No	No	Median	Semi-interquartile range	Rank-order correlations
Interval	Yes	Yes	Yes	No	Arithmetic mean	Standard deviation, variance, coefficient of variation	t, F
Ratio	Yes	Yes	Yes	Yes	Arithmetic or geometric mean	Standard deviation or variance or coefficient of variation	t, F

Note: The interval scale has 1 as an arbitrary starting point. The ratio scale has the natural origin 0, which is meaningful.

levels are equidistant (of the same distance). Nonetheless, Likert scales (and a few other scales, that is, the semantic differential scale and the numerical scale – also discussed later on in this chapter) are generally treated as if they were interval scales, because it allows researchers to calculate averages and standard deviations and to apply other, more advanced statistical techniques (for instance, to test hypotheses).

An example of a Likert scale is provided next. How would you treat this scale?

EXAMPLE

Indicate the extent to which you agree with the following statements as they relate to your job, by circling the appropriate number against each, using the scale given below.

	Strongly Disagree 1	Disagree 2	Neither Agree Nor Disagree 3	Agree 4	Strongly Agree 5
The following opportunities offered by the job are very important to me:					
a. Interacting with others	1	2	3	4	5
b. Using a number of different skills	1	2	3	4	5
c. Completing a task from beginning to end	1	2	3	4	5
d. Serving others	1	2	3	4	5
e. Working independently	1	2	3	4	5

Now that we have looked at the four types of scales, let us see, through the following examples, when and how they should be used.

EXAMPLE

Use of the nominal scale

The nominal scale is always used for obtaining personal data such as gender or department in which one works, where grouping of individuals or objects is useful, as shown below.

1. Your gender

__ Male
__ Female

2. Your department

__ Production
__ Sales
__ Accounting
__ Finance
__ Personnel
__ R&D
__ Other (specify)

Use of the ordinal scale

The ordinal scale is used to rank the preferences or usage of various brands of a product by individuals and to rank-order individuals, objects, or events, as per the examples below.

1. Rank the following personal computers with respect to their usage in your office, assigning the number 1 to the most used system, 2 to the next most used, and so on. If a particular system is not used at all in your office, put a 0 next to it.

__ Apple
__ Compaq
__ Comp USA
__ Dell Computer
__ Gateway
__ Hewlett-Packard
__ IBM
__ Packard Bell
__ Sony
__ Toshiba
__ Other (Specify)

2. Rank the cities listed below in the order that you consider suitable for opening a new plant. The city considered the most suitable should be ranked 1, the next 2, and so on.

__ Cincinnati
__ Detroit
__ Des Moines
__ Houston
__ Milwaukee
__ Pittsburgh
__ St Louis

Use of the interval scale

The interval scale (note that a Likert scale – *formally an ordinal scale* – is used in the following example) is used when responses to various items that measure a variable can be tapped on a five-point (or seven-point or any other number of points) scale, which can thereafter be summed across the items. See the following example of a Likert scale.

Using the scale below, please indicate your response to each of the items that follow, by circling the number that best describes your feeling.

	Strongly Disagree	**Disagree**	**Neither Agree Nor Disagree**	**Agree**	**Strongly Agree**
	1	**2**	**3**	**4**	**5**
1. My job offers me a chance to test myself and my abilities.	1	2	3	4	5
2. Mastering this job meant a lot to me.	1	2	3	4	5
3. Doing this job well is a reward in itself.	1	2	3	4	5
4. Considering the time spent on the job, I feel thoroughly familiar with my tasks and responsibilities.	1	2	3	4	5

Use of the ratio scale

Ratio scales are usually used in business research when exact numbers on objective (as opposed to subjective) factors are called for, as in the following questions:

1. How many other organizations did you work for before joining this system? __

2. Please indicate the number of children you have in each of the following categories:

__ below 3 years of age
__ between 3 and 6
__ over 6 years but under 12
__ 12 years and over

3. How many retail outlets do you operate? __

The responses to the questions could range from 0 to any reasonable figure.

Review of scales

The four scales that can be applied to the measurement of variables are the nominal, ordinal, interval, and ratio scales. The nominal scale highlights the differences by classifying objects or persons into groups, and provides the least amount of information on the variable. The ordinal scale provides some additional information by rank-ordering the categories of the nominal scale. The interval scale not only ranks, but also provides us with information on the magnitude of the differences in the variable. The ratio scale indicates not only the magnitude of the differences but also their proportion. Multiplication or division would preserve these ratios. As we move from the nominal to the ratio scale, we obtain progressively increasing precision in quantifying the data, and greater flexibility in using more powerful statistical tests. Hence, whenever possible and appropriate, a more powerful rather than a less powerful scale should be used to measure the variables of interest.

The specific scaling techniques commonly used in business research can be classified into rating scales and the ranking scales. In rating scales each object is scaled independently of the other objects under study. Ranking scales, on the other hand, make comparisons between or among objects and elicit the preferred choices and ranking among them. Specific rating and ranking scales are discussed next.

RATING SCALES

The following rating scales are often used in business research:

- Dichotomous scale
- Category scale
- Semantic differential scale
- Numerical scale
- Itemized rating scale
- Likert scale
- Fixed or constant sum rating scale
- Stapel scale
- Graphic rating scale
- Consensus scale

Other scales, such as the Thurstone Equal Appearing Interval Scale, and the multidimensional scale, are less frequently used. We will briefly describe each of the above attitudinal scales.

Dichotomous scale

The **dichotomous scale** is used to elicit a Yes or No answer, as in the example below. Note that a nominal scale is used to elicit the response.

EXAMPLE

Do you own a car? Yes No

Category scale

The **category scale** uses multiple items to elicit a single response, as per the following example. This also uses the nominal scale.

EXAMPLE

Where in London do you reside?

__ East London
__ South London
__ West London
__ North London
__ Outskirts

Semantic differential scale

Several bipolar attributes are identified at the extremes of the scale, and respondents are asked to indicate their attitudes, on what may be called a semantic space, toward a particular individual, object, or event on each of the attributes. The bipolar adjectives used might employ such terms as Good–Bad; Strong–Weak; Hot–Cold. The **semantic differential scale** is used to assess respondents' attitudes toward a particular brand, advertisement, object, or individual. The responses can be plotted to obtain a good idea of their perceptions. A semantic differential scale is ordinal in nature. However, it is often treated as an interval scale. An example of the semantic differential scale follows.

EXAMPLE

Responsive	— — — — — —	Unresponsive
Beautiful	— — — — — —	Ugly
Courageous	— — — — — —	Timid

Numerical scale

The **numerical scale** is similar to the semantic differential scale, with the difference that numbers on a five-point or seven-point scale are provided, with bipolar adjectives at both ends, as illustrated below. This scale is also often treated as an interval scale, although it is formally ordinal in nature.

EXAMPLE

How pleased are you with your new estate agent?

Extremely Pleased 7 6 5 4 3 2 1 Extremely Displeased

Itemized rating scale

A five-point or seven-point scale with anchors, as needed, is provided for each item and the respondent states the appropriate number on the side of each item, or circles the relevant number against each item, as per the examples that follow. The responses to the items are then summed. This uses an interval scale.

EXAMPLE

Respond to each item using the scale below, and indicate your response number on the line by each item.

1 Very Unlikely	2 Unlikely	3 Neither Unlikely Nor Likely	4 Likely	5 Very Likely

1	I will be changing my job within the next 12 months.	—
2	I will take on new assignments in the near future.	—
3	It is possible that I will be out of this organization within the next 12 months.	—

Note that the above is a balanced rating scale with a neutral point.

	Not at All Interested 1	Somewhat Interested 2	Moderately Interested 3	Very Much Interested 4
How would you rate your interest in changing current organizational policies?	1	2	3	4

This is an unbalanced rating scale which does not have a neutral point.

The itemized rating scale provides the flexibility to use as many points in the scale as considered necessary (4, 5, 7, 9, or whatever), and it is also possible to use different anchors (e.g., Very Unimportant to Very Important; Extremely Low to Extremely High). When a neutral point is provided, it is a balanced rating scale, and when it is not, it is an **unbalanced rating scale**.

Research indicates that a five-point scale is just as good as any, and that an increase from five to seven or nine points on a rating scale does not improve the reliability of the ratings (Elmore & Beggs, 1975).

The itemized rating scale is frequently used in business research, since it adapts itself to the number of points the researcher wishes to use, as well as the nomenclature of the anchors, as is considered necessary to accommodate the needs of the researcher for tapping the variable.

Likert scale

The Likert scale is designed to examine how strongly subjects agree or disagree with statements on a five-point scale with the following anchors:

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

The responses over a number of items tapping a particular concept or variable can be analyzed item by item, but it is also possible to calculate a total or summated score for each respondent by summing across items. The summated approach is widely used, and therefore the Likert scale is also referred to as a summated scale.

In the following example, the scores on the second item have to be reversed before calculating the summated score, because a high score on this item reflects an unfavorable attitude to work, whereas a high score on items 1 and 3 reflects a favorable attitude to work. This will lead to high total scores for respondents who have a favorable attitude toward work and to low total scores for respondents who have an unfavorable attitude toward work.

EXAMPLE

Using the preceding Likert scale, state the extent to which you agree with each of the following statements:

My work is very interesting	1	2	3	4	5
I am not engrossed in my work all day	1	2	3	4	5
Life without my work would be dull	1	2	3	4	5

Whether a Likert scale is an ordinal or an interval scale is a subject of much debate. People who treat a Likert scale as an ordinal scale argue that one cannot assume that all pairs of adjacent levels are equidistant. Nonetheless, Likert scales are generally treated as interval scales.

Fixed or constant sum scale

The respondents are here asked to distribute a given number of points across various items as per the example below. This is more in the nature of an ordinal scale.

EXAMPLE

In choosing a toilet soap, indicate the importance you attach to each of the following five aspects by allotting points for each to total 100 in all.

Fragrance	—
Color	—
Shape	—
Size	—
Texture of lather	—
Total points	100

Stapel scale

This scale simultaneously measures both the direction and intensity of the attitude toward the items under study. The characteristic of interest to the study is placed at the center with a numerical scale ranging, say, from +3 to –3, on either side of the item, as illustrated in the example below. This gives an idea of how close or distant the individual response to the stimulus is. Since this does not have an absolute zero point, this is an interval scale.

EXAMPLE

State how you would rate your supervisor's abilities with respect to each of the characteristics mentioned below, by circling the appropriate number.

+3	+3	+3
+2	+2	+2
+1	+1	+1
Adopting modern technology	Product innovation	Interpersonal skills
−1	−1	−1
−2	−2	−2
−3	−3	−3

Graphic rating scale

A graphical representation helps the respondents to indicate on this scale their answers to a particular question by placing a mark at the appropriate point on the line, as in the following example. This is an ordinal scale, though the following example might make it look like an interval scale.

EXAMPLE

On a scale of 1 to 10, how would you rate your supervisor?	–	10 Excellent
	–	
	–	
	–	
	–	
	–	5 Adequate
	–	
	–	
	–	
	–	1 Very bad

This scale is easy to respond to. The brief descriptions on the scale points are meant to serve as a guide in locating the rating rather than representing discrete categories. The **faces scale**, which depicts faces ranging from smiling to sad (illustrated in Chapter 9), is also a graphic rating scale used to obtain responses regarding people's feelings with respect to some aspect – say, how they feel about their jobs.

Consensus scale

Scales can also be developed by consensus, where a panel of judges selects certain items, which in its view measure the relevant concept. The items are chosen particularly based on their pertinence or relevance to the concept. Such a **consensus scale** is developed after the selected items have been examined and tested for their validity and reliability. One such consensus scale is the Thurstone Equal Appearing Interval Scale, where a concept is measured by a complex process followed by a panel of judges. Using a pile of cards containing several descriptions of the concept, a panel of judges offers inputs to indicate how close or not the statements are to the concept under study. The scale is then developed based on the consensus reached. However, this scale is rarely used for measuring organizational concepts because of the time necessary to develop it.

Other scales

There are also some advanced scaling methods such as multidimensional scaling, where objects, people, or both, are visually scaled, and a conjoint analysis is performed. This provides a visual image of the relationships in space among the dimensions of a construct.

It should be noted that the Likert or some form of numerical scale is the one most frequently used to measure attitudes and behaviors in business research.

RANKING SCALES

As already mentioned, **ranking scales** are used to tap preferences between two or among more objects or items (ordinal in nature). However, such ranking may not give definitive clues to some of the answers sought. For instance, let us say there are four product lines and the manager seeks information that would help decide which product line should get the most attention. Let us also assume that 35% of the respondents choose the first product, 25% the second, and 20% choose each of products three and four as being of importance to them. The manager cannot then conclude that the first product is the most preferred, since 65% of the respondents did not choose that product! Alternative methods used are paired comparisons, forced choice, and the comparative scale, which are discussed below.

Paired comparison

The **paired comparison** scale is used when, among a small number of objects, respondents are asked to choose between two objects at a time. This helps to assess preferences. If, for instance, in the previous example, during the paired comparisons, respondents consistently show a preference for product one over products two, three, and four, the manager can reliably understand which product line demands his utmost attention. However, as the number of objects to be compared increases, so does the number of paired comparisons. The number of paired choices for n objects will be $(n)(n-1)/2$. The greater the number of objects or stimuli, the greater the number of paired comparisons presented to the respondents, and the greater the respondent fatigue. Hence, paired comparison is a good method if the number of stimuli presented is small.

Forced choice

The **forced choice** enables respondents to rank objects relative to one another, among the alternatives provided. This is easier for the respondents, particularly if the number of choices to be ranked is limited in number.

EXAMPLE

Rank the following magazines that you would like to subscribe to in the order of preference, assigning 1 to the most preferred choice and 5 to the least preferred.

Fortune	—
Playboy	—
Time	—
People	—
Prevention	—

Comparative scale

The **comparative scale** provides a benchmark or a point of reference to assess attitudes toward the current object, event, or situation under study. An example of the use of the comparative scale follows.

EXAMPLE

In a volatile financial environment, compared to stocks, how wise or useful is it to invest in Treasury bonds? Please circle the appropriate response.

More useful		About the same		Less useful
1	2	3	4	5

In sum, nominal data lend themselves to dichotomous or category scales; ordinal data to any one of the ranking scales – paired comparison, forced choice, or comparative scales; and interval or interval-like data to the other rating scales, as seen from the various examples above. The semantic differential and the numerical scales are, strictly speaking, not interval scales, though they are often treated as such in data analysis.

Rating scales are used to measure most behavioral concepts. Ranking scales are used to make comparisons or rank the variables that have been tapped on a nominal scale.

INTERNATIONAL DIMENSIONS OF SCALING

Apart from sensitivity to operational definition of concepts in other cultures, the issue of scaling also needs to be addressed in cross-cultural research. Different cultures react differently to issues of scaling. For instance, a five-point or a seven-point scale may make no difference in the United States, but could in the responses of subjects in other countries (see Sekaran & Martin, 1982; Sekaran & Trafton, 1978). Barry (1969), for instance, found that in some countries, a seven-point scale is more sensitive than a four-point scale in eliciting unbiased responses.

Recent research has shown that people from different countries differ in both their tendency to use the extremes of the rating scale (for instance 1 and 5 or 1 and 7) and to respond in a socially desirable way (De Jong, 2006). These findings illustrate that analyzing and interpreting data that are collected in multiple countries is an extremely challenging undertaking.

GOODNESS OF MEASURES

Now that we have seen how to operationally define variables and apply different scaling techniques, it is important to make sure that the instrument that we develop to measure a particular concept is indeed accurately measuring the variable, and that, in fact, we are actually measuring the concept that we set out to measure. This ensures that in operationally defining perceptual and attitudinal variables, we have not overlooked some important dimensions and elements or included some irrelevant ones. The scales developed can often be imperfect, and errors are prone to occur in the measurement of attitudinal variables. The use of better instruments will ensure more accuracy in results, which in turn will enhance the scientific quality of the research. Hence, in some way, we need to assess the "goodness" of the measures developed. That is, we need to be reasonably sure that the instruments we use in our research do indeed measure the variables they are supposed to, and that they measure them accurately.

Let us now examine how we can ensure that the measures developed are reasonably good. First, an item analysis of the responses to the questions tapping the variable is carried out, and then the reliability and validity of the measures are established, as described below.

Item analysis

Item analysis is carried out to see if the items in the instrument belong there or not. Each item is examined for its ability to discriminate between those subjects whose total scores are high and those with low scores. In item analysis, the means between the high-score group and the low-score group are tested to detect significant differences through the *t*-values. The items with a high *t*-value (test which is able to identify the highly discriminating items in the instrument) are then included in the instrument. Thereafter, tests for the reliability of the instrument are carried out and the validity of the measure is established.

Very briefly, **reliability** is a test of how consistently a measuring instrument measures whatever concept it is measuring. **Validity** is a test of how well an instrument that is developed measures the particular concept it is intended to measure. In other words, validity is concerned with whether we measure the right concept, and reliability with stability and consistency of measurement. Validity and reliability of the measure attest to the scientific rigor that has gone into the research study. These two criteria will now be discussed. The various forms of reliability and validity are depicted in Figure 12.1.

Validity

In Chapter 10 we examined the terms *internal validity* and *external validity* in the context of experimental designs. That is, we will be concerned about the issue of the authenticity of the cause-and-effect relationships (internal validity), and their generalizability to the external environment (external validity). For now, we are going to examine the validity of the measuring instrument itself. That is, when we ask a set of questions (i.e., develop a measuring instrument) with the hope that we are tapping the concept, how can we be reasonably certain that we are indeed measuring the concept we set out to measure and not something else? This can be determined by applying certain validity tests.

Several types of validity test are used to test the **goodness of measures** and writers use different terms to denote them. For the sake of clarity, we may group validity tests under three broad headings: content validity, criterion-related validity, and construct validity.

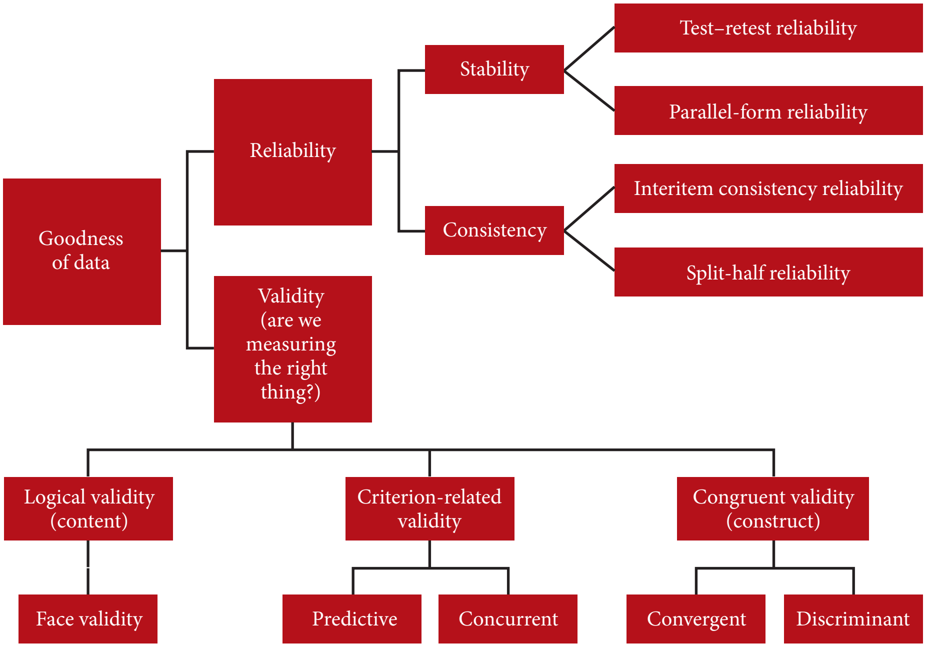

Goodness of data
Reliability
Stability
Test–retest reliability
Parallel-form reliability
Consistency
Interitem consistency reliability
Split-half reliability
Validity (are we measuring the right thing?)
Logical validity (content)
Face validity
Criterion-related validity
Predictive
Concurrent
Congruent validity (construct)
Convergent
Discriminant

FIGURE 12.1

Testing goodness of measures: forms of reliability and validity

Content validity

Content validity ensures that the measure includes an adequate and representative set of items that tap the concept. The more the scale items represent the domain or universe of the concept being measured, the greater the content validity. To put it differently, content validity is a function of how well the dimensions and elements of a concept have been delineated.

A panel of judges can attest to the content validity of the instrument. Kidder and Judd (1986) cite the example where a test designed to measure degrees of speech impairment can be considered as having validity if it is so evaluated by a group of expert judges (i.e., professional speech therapists).

Face validity is considered by some a basic and minimum index of content validity. **Face validity** indicates that the items that are intended to measure a concept, do, on the face of it, look like they measure the concept. Some researchers do not see fit to treat face validity as a valid component of content validity.

Criterion-related validity

Criterion-related validity is established when the measure differentiates individuals on a criterion it is expected to predict. This can be done by establishing concurrent validity or predictive validity, as explained below.

Concurrent validity is established when the scale discriminates individuals who are known to be different; that is, they should score differently on the instrument, as in the example that follows.

EXAMPLE

If a measure of work ethic is developed and administered to a group of welfare recipients, the scale should differentiate those who are enthusiastic about accepting a job and glad of an opportunity to be off welfare, from those who do not want to work, even when offered a job. Obviously, those with high work ethic values do not want to be on welfare and yearn for employment to be on their own. Those who are low on work ethic values, on the other hand, might exploit the opportunity to survive on welfare for as long as possible, deeming work to be drudgery. If both types of individual have the same score on the work ethic scale, then the test is not a measure of work ethic, but of something else.

Predictive validity indicates the ability of the measuring instrument to differentiate among individuals with reference to a future criterion.

EXAMPLE

If an aptitude or ability test administered to employees at the time of recruitment is to differentiate individuals on the basis of their future job performance, then those who score low on the test should be poor performers and those with high scores good performers.

Construct validity

Construct validity testifies to how well the results obtained from the use of the measure fit the theories around which the test is designed. This is assessed through convergent and discriminant validity, which are explained below.

Convergent validity is established when the scores obtained with two different instruments measuring the same concept are highly correlated.

Discriminant validity is established when, based on theory, two variables are predicted to be uncorrelated, and the scores obtained by measuring them are indeed empirically found to be so. Validity can thus be established in different ways. Published measures for various concepts usually report the kinds of validity that have been established for the instrument, so that the user or reader can judge the "goodness" of the measure. Table 12.2 summarizes the kinds of validity discussed here.

Some of the ways in which the above forms of validity can be established are through the following:

1. Correlational analysis (as in the case of establishing concurrent and predictive validity or convergent and discriminant validity).
2. Factor analysis, a multivariate technique that confirms the dimensions of the concept that have been operationally defined, as well as indicating which of the items are most appropriate for each dimension (establishing construct validity).
3. The multitrait, multimethod matrix of correlations derived from measuring concepts by different forms and different methods, additionally establishing the robustness of the measure.

In sum, the goodness of measures is established through the different kinds of validity and reliability depicted in Figure 12.1. The results of any research can only be as good as the measures that tap the concepts in the theoretical

TABLE 12.2

Types of validity

Validity	Description
Content validity	Does the measure adequately measure the concept?
Face validity	Do "experts" validate that the instrument measures what its name suggests it measures?
Criterion-related validity	Does the measure differentiate in a manner that helps to predict a criterion variable?
Concurrent validity	Does the measure differentiate in a manner that helps to predict a criterion variable currently?
Predictive validity	Does the measure differentiate individuals in a manner that helps predict a future criterion?
Construct validity	Does the instrument tap the concept as theorized?
Convergent validity	Do two instruments measuring the concept correlate highly?
Discriminant validity	Does the measure have a low correlation with a variable that is supposed to be unrelated to this variable?

framework. We need to use well-validated and reliable measures to ensure that our research is scientific. Fortunately, measures have been developed for many important concepts in business research and their psychometric properties (i.e., the reliability and validity) established by the developers. Thus, researchers can use the instruments already reputed to be "good," rather than laboriously developing their own measures. When using these measures, however, researchers should cite the source (i.e., the author and reference) so that the reader can seek more information if necessary.

It is not unusual for two or more equally good measures to be developed for the same concept. For example, there are several different instruments for measuring the concept of "job satisfaction". One of the most frequently used scales for the purpose, however, is the Job Descriptive Index (JDI) developed by Smith, Kendall, and Hulin (1969). When more than one scale exists for any variable, it is preferable to use the measure that has better reliability and validity, and is also more frequently used.

At times, we may also have to adapt an established measure to suit the setting. For example, a scale that is used to measure job performance, job characteristics, or job satisfaction in the manufacturing industry may have to be modified slightly to suit a utility company or a health care organization. The work environment in each case is different and the wordings in the instrument may have to be suitably adapted. However, in doing this, we are tampering with an established scale, and it is advisable to test it for the adequacy of the validity and reliability afresh.

A sample of a few measures used to tap some frequently researched concepts in the management and marketing areas is provided in the appendix to this chapter.

Finally, it is important to note that validity is a necessary but not sufficient condition of the test of goodness of a measure. A measure should not only be valid but also reliable. A measure is reliable if it provides consistent results. We will now discuss the concept of reliability.

Reliability

The **reliability** of a measure indicates the extent to which it is without bias (error free) and hence ensures consistent measurement across time and across the various items in the instrument. In other words, the reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the "goodness" of a measure.

Stability of measures

The ability of a measure to remain the same over time – despite uncontrollable testing conditions or the state of the respondents themselves – is indicative of its stability and low vulnerability to changes in the situation. This attests to its "goodness" because the concept is stably measured, no matter when it is done. Two tests of **stability** are test–retest reliability and parallel-form reliability.

Test–retest reliability The reliability coefficient obtained by repetition of the same measure on a second occasion is called the **test–retest reliability**. That is, when a questionnaire containing some items that are supposed to measure a concept is administered to a set of respondents, now and again to the same respondents, say several weeks to six months later, then the correlation between the scores obtained at the two different times from one and the same set of respondents is called the test–retest coefficient. The higher it is, the better the test–retest reliability and, consequently, the stability of the measure across time.

Parallel-form reliability When responses on two comparable sets of measures tapping the same construct are highly correlated, we have **parallel-form reliability**. Both forms have similar items and the same response format, the only changes being the wording and the order or sequence of the questions. What we try to establish here is the error variability resulting from wording and ordering of the questions. If two such comparable forms are highly correlated (say 8 and above), we may be fairly certain that the measures are reasonably reliable, with minimal error variance caused by wording, ordering, or other factors.

Internal consistency of measures

The **internal consistency** of measures is indicative of the homogeneity of the items in the measure that taps the construct. In other words, the items should "hang together as a set," and be capable of independently measuring the same concept so that the respondents attach the same overall meaning to each of the items. This can be seen by examining whether the items and the subsets of items in the measuring instrument are correlated highly. Consistency can be examined through the interitem consistency reliability and split-half reliability tests.

Interitem consistency reliability The **interitem consistency reliability** is a test of the consistency of respondents' answers to all the items in a measure. To the degree that items are independent measures of the same concept, they will be correlated with one another. The most popular test of interitem consistency reliability is Cronbach's coefficient alpha (Cronbach, 1946), which is used for multipoint-scaled items, and the Kuder–Richardson formulas (Kuder & Richardson, 1937), used for dichotomous items. The higher the coefficients, the better the measuring instrument.

Split-half reliability **Split-half reliability** reflects the correlations between two halves of an instrument. The estimates will vary depending on how the items in the measure are split into two halves. Split-half reliabilities may be higher than Cronbach's alpha only in the circumstance of there being more than one underlying response dimension tapped by the measure and when certain other conditions are met as well (for complete details, refer to Campbell, 1976). Hence, in almost all cases, Cronbach's alpha can be considered a perfectly adequate index of the inter-item consistency reliability.

REFLECTIVE VERSUS FORMATIVE MEASUREMENT SCALES

At this moment, it is important to come back to the contention that the items of a multi-item measure should hang together as a set and be capable of independently measuring the same concept (it may give you a headache right now, but it most certainly will save you an even bigger headache in your future career as a researcher, so bear with us). The fact is that the items that measure a concept should not always hang together: this is only true for reflective, but not for formative, scales.

What is a reflective scale?

In a **reflective scale**, the items (all of them!) are expected to correlate. Unlike the items used in a formative scale, discussed next, each item in a reflective scale is assumed to share a common basis (the underlying construct of interest). Hence, an increase in the value of the construct will translate into an increase in the value for all the items representing the construct. An example of a reflective scale is the Attitude Toward the Offer scale developed by Burton and Lichtenstein (1988). This is a six-item, nine-point summated ratings scale measuring a person's attitude about a certain product offered at a certain price. The scale is composed of five bipolar adjectives (unfavorable–favorable; bad–good; harmful–beneficial; unattractive–attractive; poor–excellent) and one disagree–agree item (introduced by the stem: "I like this deal"), measured on a nine-point graphic scale. Indeed, we would expect that a more favorable attitude toward the offer would translate into an increase in the value of all the six items representing attitude toward the offer. Hence, we would expect all the six items to correlate. Note that the direction of "causality" is from the construct to the items.

What is a formative scale and why do the items of a formative scale not necessarily hang together?

A **formative scale** is used when a construct is viewed as an explanatory combination of its indicators (Fornell, 1987; Fornell & Bookstein, 1982). Take the Job Description Index (Smith, Kendall & Hulin, 1969), a composite measure purporting to evaluate job satisfaction. This measure includes five dimensions: type of work (18 items), opportunities for promotion (9 items), satisfaction with supervision (18 items), coworkers (18 items), and pay (9 items). The five dimensions are seen as the five defining characteristics of job satisfaction.

The five dimensions are translated into 72 observable and measureable elements such as "Good opportunity for advancement", "Regular promotions," "Fairly good chance for promotion," "Income adequate for normal expenses," "Highly paid," and "Gives sense of accomplishment." The idea is that we would expect the first three items ("Good opportunity for advancement," "Regular promotions," and "Fairly good chance for promotion") to be correlated (after all, they all aim to measure one particular dimension of job satisfaction, i.e., "opportunities for promotion"). However, these items do not necessarily correlate with the items that measure "Pay" (a second dimension), such as "Income adequate for normal expenses" and "Highly paid," because the dimension "Good opportunities for advancement" is not necessarily related to the dimension "Pay." Indeed, a first worker may have a very good salary but no opportunities for promotion, a second worker may have very good opportunities for promotion but a very poor salary, and a third worker may have a very good salary and very good opportunities for promotion.

Likewise, we would expect the items "Income adequate for normal expenses" and "Highly paid" to be correlated to each other (since both items measure pay), but we would not necessarily expect these items to correlate with the item "Gives sense of accomplishment" (because this last item does not measure pay but another dimension of the Job Description Index).

In summary, the Job Description Index includes five dimensions and 72 items. These 72 items are not necessarily related to each other, because the five dimensions they represent do not necessarily hang together.

A scale that contains items that are not necessarily related is called a formative scale. We have already explained that formative scales are used when a construct (such as job satisfaction) is viewed as an explanatory combination of its indicators (promotions, pay, satisfaction with supervision, coworkers, and work); that is, when a change in any one of the indicators (dimensions) is expected to change the score of the overall construct, regardless of the value of the other indicators (dimensions). The Job Description Index is formative in nature, since an increase in the value of one of its indicators, such as "opportunities for promotion," is expected to translate into a higher score for job satisfaction, regardless of the value of the other indicators. Thus, the Job Description Index conceptualizes job satisfaction as the total weighted score across the 72 job satisfaction items, where each item corresponds to a specific independent dimension of job satisfaction.

A good (that is, a valid) formative scale is one that represents the entire domain of the construct. This means that a valid scale should represent all the relevant aspects of the construct of interest, even if these aspects do not necessarily correlate.

While it makes sense to test the interitem consistency of reflective scales, it does not make sense to test the interitem consistency of formative scales. The reason is that we do not expect the items in a formative scale to be homogeneous; in other words, we do not expect all the items to correlate. For this reason, tests of the consistency of respondents' answers to the items of a formative measure do not tell us anything about the quality of our measuring instrument. Note that there are other methods to assess the goodness of formative scales (see, for instance, Jarvis, MacKenzie & Podsakoff, 2003).

SUMMARY

- **Learning objective 1: Describe the characteristics and power of the four types of scales – nominal, ordinal, interval, and ratio.**
  To be able to assign numbers to attributes of objects we need a scale. A scale is a tool or mechanism by which individuals are distinguished as to how they differ from one another on the variables of interest to our study. Scaling involves the creation of a continuum on which our objects are located. There are four basic types of scales: nominal, ordinal, interval, and ratio. The degree of sophistication to which the scales are fine-tuned increases progressively as we move from the nominal to the ratio scale.

- **Learning objective 2: Describe and know how and when to use different forms of rating scales.**
  In rating scales each object is scaled independently of the other objects under study. The following rating scales are often used in business research: dichotomous scale, category scale, semantic differential scale, numerical scale, itemized rating scale, Likert scale, fixed or constant sum rating scale, Stapel scale, graphic rating scale, and consensus scale. The Likert scale or some form of numerical scale is the one most frequently used to measure attitudes and behaviors in business research.

- **Learning objective 3: Describe and know how and when to use different forms of ranking scales.**
  Ranking scales are used to tap preferences between two or among more objects or items. The paired comparison scale is used when, among a small number of objects, respondents are asked to choose between two objects at a time. The forced choice enables respondents to rank objects relative to one another, among the alternatives provided. The comparative scale provides a benchmark or a point of reference to assess attitudes toward the current object, event, or situation under study.

- **Learning objective 4: Discuss international dimensions of scaling.**
  Different cultures react differently to issues of scaling. What's more, recent research has shown that people from different countries differ in both their tendency to use the extremes of the rating scale (for instance 1 and 5 or 1 and 7) and to respond in a socially desirable way. These findings illustrate that analyzing and interpreting data that are collected in multiple countries is a challenging task.

- **Learning objective 5: Describe validity and reliability and how they are established and assess the reliability and validity of a scale.**
  Reliability is a test of how consistently a measuring instrument measures whatever concept it is measuring. Validity is a test of how well an instrument that is developed measures the particular concept it is intended to measure. Several types of validity test are used to test the goodness of measures. Content validity ensures that the measure includes an adequate and representative set of items that tap the concept. Criterion-related validity is established when the measure differentiates individuals on a criterion it is expected to predict. Construct validity testifies to how well the results obtained from the use of the measure fit the theories around which the test is designed. Two tests of stability are test–retest reliability and parallel-form reliability. The internal consistency of measures is indicative of the homogeneity of the items in the measure that taps the construct.

- **Learning objective 6: Explain the difference between reflective and formative scales.**
  The items that measure a concept should not always hang together: this is only true for reflective, but not for formative, scales. In a reflective scale, the items (all of them!) are expected to correlate. A formative scale is used when a construct is viewed as an explanatory combination of its indicators.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: The Standard Asian Merchant Bank**.

DISCUSSION QUESTIONS

1. Describe the four types of scales.
2. How is the interval scale more sophisticated than the nominal and ordinal scales?
3. Why is the ratio scale considered to be the most powerful of the four scales?
4. Briefly describe the difference between attitude rating scales and ranking scales and indicate when the two are used.
5. Why is it important to establish the "goodness" of measures and how is this done?
6. Describe the difference between formative and reflective scales.
7. Explain why it does not make sense to assess the internal consistency of a formative scale.
8. "The job involvement measure described in the appendix is reflective in nature." Comment on this statement.

9. Construct a semantic differential scale to assess the properties of a particular brand of coffee or tea.
10. Whenever possible, it is advisable to use instruments that have already been developed and repeatedly used in published studies, rather than developing our own instruments for our studies. Do you agree? Discuss the reasons for your answer.
11. "A valid instrument is always reliable, but a reliable instrument may not always be valid." Comment on this statement.

Now do Exercise 12.5 and Exercise 12.6.

EXERCISE 12.5

Develop and name the type of measuring instrument you would use to tap the following:

- **a.** Which brands of toothpaste are consumed by how many individuals?
- **b.** Among the three types of exams – multiple choice, essay type, and a mix of both – which is the one preferred most by students?
- **c.** To what extent do individuals agree with your definition of accounting principles?
- **d.** How much people like an existing organizational policy.
- **e.** The age of employees in an organization.
- **f.** The number of employees in each of the 20 departments of a company.

EXERCISE 12.6

"The SERVQUAL-scale described in the appendix is formative in nature." Comment on this statement. Explain why it does not make sense to assess the interitem consistency of this scale.

APPENDIX

Examples of some measures

Some of the measures used in business research can be found in the *Marketing Scales Handbook* by Bruner, Hensel and James. The latest volumes (5, 6 and 7) are the only ones available at this time. The earlier volumes in the series are no longer being published but revised versions of their scale reviews are in the database. Volume 5 contains reviews of scales published in scholarly marketing articles between 2002 and 2005. Volume 6 has reviews that were reported in articles from 2006 to 2009. Volume 7 is the newest book and covers 2010 and 2011. To be included in these volumes, the scales had to be composed of three or more items, have empirical evidence of their psychometric quality, and have been treated by their users as reflective measures rather than formative. Other useful (but somewhat outdated) sources are the *Handbook of Organizational Measurement* by Price and Mueller (1986) and the *Michigan Organizational Assessment Package* published by the Institute of Survey Research in Ann Arbor, Michigan. Several measures can also be seen in Psychological Measurement Yearbooks and in other published books. A sample of measures from the accounting, finance, management, and marketing areas is provided in this appendix.

Measures from behavioral finance research

Below is a sample of scales used to measure variables related to behavioral finance research.

Information overload

Information Overload Measure (on a scale of 1 to 6, from strongly disagree to strongly agree)

1. There were too many different options to consider. ______
2. This decision required a great deal of thought. ______
3. This was a difficult decision. ______
4. I found this decision to be overwhelming. ______
5. It was difficult to comprehend all of the information available to me. ______
6. This task was stressful. ______
7. It was a relief to make a decision. ______

Source: Agnew, J. R. & Szykman, L. R. (2010) Asset allocation and information overload: The influence of information display, asset choice, and investor experience. *Journal of Behavioral Finance*, 6(2), 57–70. Reproduced with permission.

Orientation towards finance: interest in financial information

Interest in Financial Information Measure (on a scale of 1 to 5, from strongly disagree to strongly agree)

I never read the financial pages of my newspaper *(reverse coding)*. ______
I try to keep track of general economic trends. ______
I am not attracted by the financial part of life *(reverse coding)*. ______
I regularly look for interesting investment opportunities for my money. ______
I am interested in the evolution of currency rates. ______

Source: Loix, E., Pepermans, R., Mentens, C., Goedee, M. & Jegers (2005), M. Orientation toward finances: Development of a measurement scale. *Journal of Behavioral Finance*, 6(4), 192–201. Reproduced with permission.

Measures from management accounting research

Below is a sample of scales used to measure variables related to management accounting research.

Formality of performance evaluation:

My superior does not explicitly document work objectives in writing.	1 2 3 4 5	My superior explicitly documents work objectives in writing.
When judging my performance, my superior uses his/her personal judgment of my performance.	1 2 3 4 5	When judging my performance, my superior relies on objective information from the information system.
My pay is based on my superior's personal judgment of my performance.	1 2 3 4 5	My pay is based on objective information from the information system.

Source: Hartmann, F. & Slapničar, S. (2012) The perceived fairness of performance evaluation: The role of uncertainty. *Management Accounting Research*, 23(1), 17–33. Reproduced with permission.

Organizational performance (measured on a scale of 1 to 5, from strongly disagree to strongly agree):

Your company performance on return on investment is better than your competitors. ______
Your company performance on gross margin is better than your competitors. ______
Your company performance on customer satisfaction is better than your competitors. ______
Your company performance on quality of product/service is better than your competitors. ______
Your company performance on employee productivity is better than your competitors. ______

Source: Lee, C. & Yang, H. (2011). Organization structure, competition and performance measurement systems and their joint effects on performance. *Management Accounting Research*, 22(2), 84–104. Reproduced with permission.

Measures from management research

Below is a sample of scales used to measure variables related to management research.

Job involvement

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. My job means a lot more to me than just money.	1	2	3	4	5
2. The major satisfaction in my life comes from my job.	1	2	3	4	5
3. I am really interested in my work.	1	2	3	4	5
4. I would probably keep working even if I didn't need the money.	1	2	3	4	5
5. The most important things that happen to me involve my work.	1	2	3	4	5
6. I will stay overtime to finish a job, even if I am not paid for it.	1	2	3	4	5
7. For me, the first few hours at work really fly by.	1	2	3	4	5
8. I actually enjoy performing the daily activities that make up my job.	1	2	3	4	5
9. I look forward to coming to work each day.	1	2	3	4	5

Source: White, J. K. and Ruh, R. A. (1973) Effects of personal values on the relationship between participation and job attitudes. *Administrative Science Quarterly*, 18(4), p. 509. Reproduced with permission.

Participation in decision making

	Not at all	Very little	Somewhat	To a moderate extent	To a large extent
1. In general, how much say or influence do you have on how you perform your job?	1	2	3	4	5
2. To what extent are you able to decide how to do your job?	1	2	3	4	5
3. In general, how much say or influence do you have on what goes on in your work group?	1	2	3	4	5
4. In general, how much say or influence do you have on decisions that affect your job?	1	2	3	4	5
5. My superiors are receptive and listen to my ideas and suggestions.	1	2	3	4	5

Source: White, J. K. and Ruh, R. A. (1973) Effects of personal values on the relationship between participation and job attitudes. *Administrative Science Quarterly*, 18(4), p. 509. Reproduced with permission.

Career salience

Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

1	My career choice is a good occupational decision for me.	_____
2	My career enables me to make significant contributions to society.	_____
3	The career I am in fits me and reflects my personality.	_____
4	My education and training are not tailored for this career.	_____
5	I don't intend changing careers.	_____
6	All the planning and thought I gave to pursuing this career are a waste.	_____
7	My career is an integral part of my life.	_____

Source: Sekaran, U. (1986) *Dual-Career Families: Contemporary Organizational and Counseling Issues*. San Francisco: Jossey-Bass. Reproduced with permission.

Measures from marketing research

Below is a sample of some scales used to measure commonly researched concepts in marketing. Bruner and Hensel have done extensive work since 1992 in documenting and detailing several scores of scales in marketing research. For each scale examined, they have provided the following information:

1. Scale description
2. Scale origin
3. Samples in which the scale was used
4. Reliability of the scale
5. Validity of the scale
6. How the scale was administered
7. Major findings of the studies using the scale

The interested student should refer to the five volumes of *Marketing Scales Handbook* by G. C. Bruner and P. J. Hensel (Volume 1 and 2); G. C. Bruner, P. J. Hensel, and K. E. James published by the American Marketing Association (Volume 1, 2, and 3) and Thomson (Volume 4 and 5). The first volume covers scales used in articles published in the 1980s, and volume two covers scales used in articles published from 1990 to 1993. The third volume covers the period from 1994 to 1997. The fourth volume covers marketing scales that were reported in articles published from 1998 to 2001. The fifth volume covers the period from 2001 to 2005.

Complaint success likelihood

The likelihood of the complaint being successful (5-point scale with end-points labeled "very unlikely" and "very likely"):

At the moment of the service failure, how likely was it that the service provider would. . .

. . .take appropriate action to take care of your problem if you reported the incident? ______

. . .solve your problem and give better service to you in the future if you reported the incident? ______

. . .be more careful in the future and everyone would benefit if you reported the incident. ______

Source: Bougie, R., Pieters, R. and Zeelenberg, M. (2003) Angry customers don't come back, they get back: The experience and behavioral implications of anger and dissatisfaction in services. *Journal of the Academy of Marketing Science*, 31, 377–393. Reproduced with permission.

SERVQUAL: A multidimensional scale to capture customer perceptions and expectations of service quality

Reliability items:

1. When XYZ Company promises to do something by a certain time, it does so.
2. When you have a problem, XYZ Company shows a sincere interest in solving it.
3. XYZ Company performs the service right the first time.
4. XYZ Company provides its services at the time it promises to do so.
5. XYZ Company keeps customers informed about when services will be performed.

Responsiveness items:

1. Employees in XYZ Company give you prompt service.
2. Employees in XYZ Company are always willing to help you.
3. Employees in XYZ Company are never too busy to respond to your request.

Assurance items:

1. The behavior of employees in XYZ Company instills confidence in you.
2. You feel safe in your transactions with XYZ Company.
3. Employees in XYZ Company are consistently courteous with you.
4. Employees in XYZ Company have the knowledge to answer your questions.

Empathy items:

1. XYZ Company gives you individual attention.
2. XYZ Company has employees who give you individual attention.
3. XYZ Company has your best interests at heart.
4. Employees of XYZ Company understand your specific needs.

Tangibles items:

1. XYZ Company has modern-looking equipment.
2. XYZ Company's physical facilities are visually appealing.
3. XYZ Company's employees appear neat.
4. Materials associated with the service (such as pamphlets or statements) are visually appealing at XYZ Company.
5. XYZ Company has convenient business hours.

Source: Parasuraman, A., Zeithaml, V. A. and Berry, L. L. (1988) SERVQUAL: A multi-item scale for measuring consumer perceptions of service quality. *Journal of Retailing* 64(1) (Spring). Reproduced with permission.

Role ambiguity (salesperson)

Very False						**Very True**
1	**2**	**3**	**4**	**5**	**6**	**7**

1. I feel certain about how much authority I have in my selling position. ___
2. I have clearly planned goals for my selling job. ___
3. I am sure I divide my time properly while performing my selling tasks. ___
4. I know my responsibilities in my selling position. ___
5. I know exactly what is expected of me in my selling position. ___
6. I receive lucid explanations of what I have to do in my sales job. ___

Source: Modified from Rizzo, J. R., House, R. J. and Lirtzman, S. L. (1970) Role conflict and role ambiguity in complex organizations. *Administrative Science Quarterly*, 15, 156.

CHAPTER 13

Sampling

LEARNING OBJECTIVES

After completing Chapter 13, you should be able to:

1. Define sampling, sample, population, element, sampling unit, and subject.
2. Discuss statistical terms in sampling.
3. Describe and discuss the sampling process.
4. Compare and contrast specific probability sampling designs.
5. Compare and contrast specific nonprobability sampling designs.
6. Discuss precision and confidence and the trade-off between precision and confidence.
7. Discuss how hypotheses can be tested with sample data.
8. Discuss the factors to be taken into consideration for determining sample size and determine the sample size for any given research project.
9. Discuss sampling in qualitative research.
10. Discuss the role of the manager in sampling.

INTRODUCTION

Experimental designs and surveys are useful and powerful in finding answers to research questions through data collection and subsequent analyses, but they can do more harm than good if the population is not correctly targeted. That is, if data are not collected from the people, events, or objects that can provide the correct answers to solve the problem, the research will be in vain. The process of selecting the right individuals, objects, or events as representatives for the entire population is known as **sampling**, which we will examine in some detail in this chapter (see shaded portion in Figure 13.1).

The *reasons* for using a sample, rather than collecting data from the entire population, are self-evident. In research investigations involving several hundreds and even thousands of elements, it would be practically impossible to collect data from, or test, or examine, every element. Even if it were possible, it would be prohibitive in terms of time, cost, and other human resources. Study of a sample rather than the entire population is also sometimes likely to produce more reliable results. This is mostly because fatigue is reduced and fewer errors

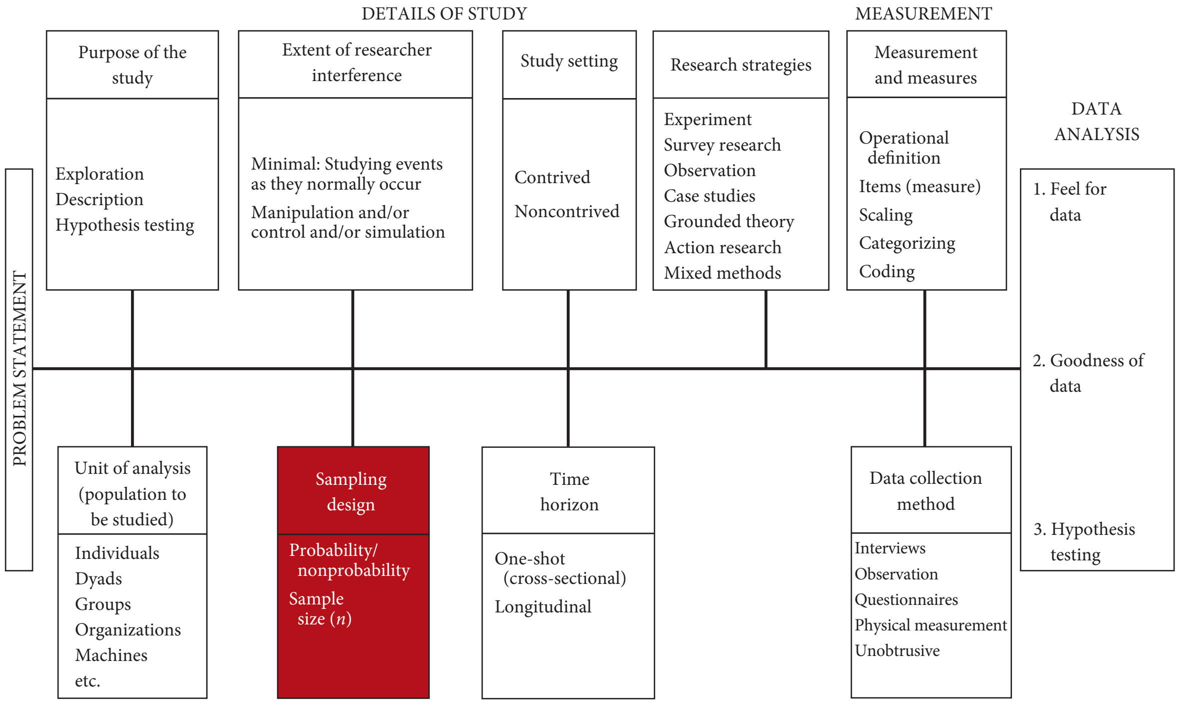

DETAILS OF STUDY
MEASUREMENT
DATA ANALYSIS
PROBLEM STATEMENT
Purpose of the study
Exploration
Description
Hypothesis testing
Extent of researcher interference
Minimal: Studying events as they normally occur
Manipulation and/or control and/or simulation
Study setting
Contrived
Noncontrived
Research strategies
Experiment
Survey research
Observation
Case studies
Grounded theory
Action research
Mixed methods
Measurement and measures
Operational definition
Items (measure)
Scaling
Categorizing
Coding
1. Feel for data
2. Goodness of data
3. Hypothesis testing
Unit of analysis (population to be studied)
Individuals
Dyads
Groups
Organizations
Machines
etc.
Sampling design
Probability/ nonprobability
Sample size (n)
Time horizon
One-shot (cross-sectional)
Longitudinal
Data collection method
Interviews
Observation
Questionnaires
Physical measurement
Unobtrusive

FIGURE 13.1

The research process and where this chapter fits in

therefore result in collecting data, especially when a large number of elements is involved. In a few cases, it would also be impossible to use the entire population to gain knowledge about, or test, something. Consider, for instance, the case of electric light bulbs. In testing the life of bulbs, if we were to burn every single bulb produced, there would be none left to sell! This is known as *destructive sampling*.

POPULATION, ELEMENT, SAMPLE, SAMPLING UNIT, AND SUBJECT

In learning how representative data (i.e., as reflected in the universe) can be collected, a few terms, as described below, have first to be understood.

Population

The **population** refers to the entire group of people, events, or things of interest that the researcher wishes to investigate. It is the group of people, events, or things of interest for which the researcher wants to make inferences (based on sample statistics). For instance, if the CEO of a computer firm wants to know the kinds of advertising strategies adopted by computer firms in the Silicon Valley, then all computer firms situated there will be the population. If an organizational consultant is interested in studying the effects of a four-day work week on the white-collar workers in a telephone company in Ireland, then all white-collar workers in that company will make up the population. If regulators want to know how patients in nursing homes run by a company in France are cared for, then all the patients in all the nursing homes run by them will form the population. If, however, the regulators are interested only in one particular nursing home run by that company, then only the patients in that specific nursing home will form the population.

Element

An **element** is a single member of the population. If 1000 blue-collar workers in a particular organization happen to be the population of interest to a researcher, each blue-collar worker therein is an element. If 500 pieces of machinery are to be approved after inspecting a few, there will be 500 elements in this population. Incidentally, the census is a count of all elements in the human population.

Sample

A **sample** is a subset of the population. It comprises some members selected from it. In other words, some, but not all, elements of the population form the sample. If 200 members are drawn from a population of 1000 blue-collar workers, these 200 members form the sample for the study. That is, from a study of these 200 members, the researcher will draw conclusions about the entire population of 1000 blue-collar workers. Likewise, if there are 145 in-patients in a hospital and 40 of them are to be surveyed by the hospital administrator to assess their level of satisfaction with the treatment received, then these 40 members will be the sample.

A sample is thus a subgroup or subset of the population. By studying the sample, the researcher should be able to draw conclusions that are generalizable to the population of interest.

Sampling unit

The **sampling unit** is the element or set of elements that is available for selection in some stage of the sampling process. Examples of sampling units in a multistage sample are city blocks, households, and individuals within the households.

Subject

A **subject** is a single member of the sample, just as an element is a single member of the population. If 200 members from the total population of 1000 blue-collar workers form the sample for the study, then each blue-collar worker in the sample is a subject. As another example, if a sample of 50 machines from a total of 500 machines is to be inspected, then every one of the 50 machines is a subject, just as every single machine in the total population of 500 machines is an element.

SAMPLE DATA AND POPULATION VALUES

When we sample, the sampling units (employees, consumers, and the like) provide us with *responses*. For instance, a consumer responding to a survey question may give a response of “3”. When we examine the responses that we get for our entire sample, we make use of *statistics*. In Chapter 14 we will explain that there is a wide variety of statistics we can use, such as the mean, the median, or the mode. The reason we sample, however, is that we are interested in the characteristics of the population we sample from. If we study the entire population and calculate the mean or the standard deviation, then we don’t refer to this as a statistic. Instead, we call it a *parameter* of the population.

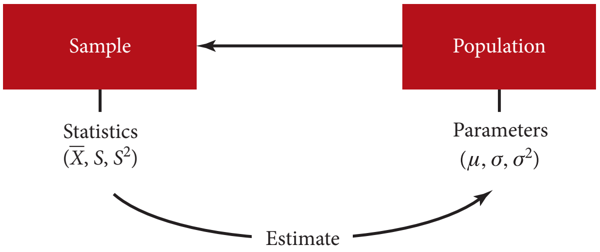


FIGURE 13.2

The relationship between sample and population

Parameters

The characteristics of the population such as μ (the population mean), σ (the population standard deviation), and σ^2 (the population variance) are referred to as its *parameters*. The central tendencies, the dispersions, and other statistics in the sample of interest to the research are treated as approximations of the central tendencies, dispersions, and other parameters of the population. As such, all conclusions drawn about the sample under study are generalized to the population. In other words, the sample statistics – X (the sample mean), S (the standard deviation), and S^2 (the variation in the sample) – are used as estimates of the population parameters μ, σ, and σ^2. Figure 13.2 shows the relationship between the sample and the population.

Representativeness of Samples

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Representativeness of samples**.

The need to choose the right sample for a research investigation cannot be overemphasized. We know that rarely will the sample be an exact replica of the population from which it is drawn. For instance, very few sample means (X) are likely to be exactly equal to the population means (μ). Nor is the standard deviation of the sample (S) likely to be the same as the standard deviation of the population (σ). However, if we choose the sample in a scientific way, we can be reasonably sure that the sample statistic (e.g., X, S, or S^2) is fairly close to the population parameter (i.e., μ, σ, or σ^2). To put it differently, it is possible to choose the sample in such a way that it is **representative** of the population. There is always a slight probability, however, that sample values might fall outside the population parameters.

Normality of Distributions

Attributes or characteristics of the population are generally normally distributed. For instance, when attributes such as height and weight are considered, most people will be clustered around the mean, leaving only a small number at the extremes who are either very tall or very short, very heavy or very light, and so on, as indicated in Figure 13.3. If we are to estimate the population characteristics from those represented in a sample with reasonable accuracy, the sample has to be chosen so that the distribution of the characteristics of interest follows the same pattern of normal distribution in the sample as it does in the population. From the central limit theorem, we know that the sampling distribution of the sample mean is normally distributed. As the **sample size** n increases, the means of the random samples taken from practically any population approach a normal distribution with

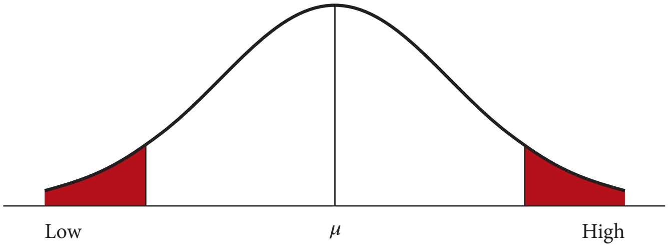


FIGURE 13.3

Normal distribution in a population

mean μ and standard deviation σ. In sum, irrespective of whether or not the attributes of the population are normally distributed, if we take a sufficiently *large number* of samples and *choose* them with care, we will have a sampling distribution of the means that has normality. This is the reason why two important issues in sampling are the sample size (n) and the sampling design, as discussed later.

When the properties of the population are not overrepresented or underrepresented in the sample, we have a representative sample. When a sample consists of elements in the population that have extremely high values on the variable we are studying, the sample mean X will be far higher than the population mean μ. If, in contrast, the sample subjects consist of elements in the population with extremely low values on the variable of interest, the sample mean will be much lower than the true population mean μ. If our sampling design and sample size are right, however, the sample mean X will be within close range of the true population mean μ. Thus, through appropriate sampling design, we can ensure that the sample subjects are not chosen from the extremes, but are truly representative of the properties of the population. The more representative of the population the sample is, the more generalizable are the findings of the research. Recall that generalizability is one of the hallmarks of scientific research, as we saw in Chapter 2.

While, in view of our concern about generalizability, we may be particular about choosing representative samples for most research, some cases may not call for such regard to generalizability. For instance, at the exploratory stages of fact finding, we may be interested only in "getting a handle" on the situation, and therefore limit the interview to only the most conveniently available people. The same is true when time is of the essence, and urgency in getting information overrides a high level of accuracy in terms of priority. For instance, a film agency might want to find out quickly the impact on the viewers of a newly released film shown the previous evening. The interviewer might question the first 20 people leaving the theater after seeing the film and obtain their reactions. On the basis of their replies, she may form an opinion as to the likely success of the film. As another example, a restaurant manager might want to find the reactions of customers to a new item added to the menu to determine whether or not it has been a popular and worth while addition. For this purpose, the first 15 people who chose the special item might be interviewed, and their reactions obtained. In such cases, having instant information may be more gainful than obtaining the most representative facts. It should, however, be noted that the results of such convenient samples are not reliable and can never be generalized to the population.

THE SAMPLING PROCESS

Sampling is the *process* of selecting a sufficient number of the right elements from the population, so that a study of the sample and an understanding of its properties or characteristics make it possible for us to generalize such properties or characteristics to the population elements. The major steps in sampling include:

1. Define the population.
2. Determine the sample frame.
3. Determine the sampling design.
4. Determine the appropriate sample size.
5. Execute the sampling process.

Defining the population

Sampling begins with precisely defining the target population. The target population must be defined in terms of elements, geographical boundaries, and time. For instance, for a banker interested in saving habits of blue-collar workers in the mining industry in the United States, the target population might be all blue-collar workers in that industry throughout the country. For an advertising agency interested in reading habits of elderly people, the target population might be the German population aged 50 and over. These examples illustrate that the research objective and the scope of the study play a crucial role in defining the target population.

Determining the sample frame

The **sampling frame** is a (physical) representation of all the elements in the population from which the sample is drawn. The payroll of an organization would serve as the sampling frame if its members are to be studied. Likewise, the university registry containing a listing of all students, faculty, administrators, and support staff in the university during a particular academic year or semester could serve as the sampling frame for a study of the university population. A roster of class students could be the sampling frame for the study of students in a class. The telephone directory is also frequently used as a sampling frame for some types of study, even though it has an inherent bias inasmuch as some numbers are unlisted and certain others may have become obsolete.

Although the sampling frame is useful in providing a listing of each element in the population, it may not always be a current, up-to-date document. For instance, the names of members who have recently left the organization or dropped out of the university, as well as members who have only recently joined the organization or the university may not appear in the organization's payroll or the university registers on a given day. The most recently installed or disconnected telephones will not, likewise, be included in the current telephone directory. Hence, though the sampling frame may be available in many cases, it may not always be entirely correct or complete. When the sampling frame does not exactly match the population *coverage error* occurs. In some cases, the researcher might recognize this problem and not be too concerned about it, because the discrepancy between the target population and the sampling frame is small enough to ignore. However, in most cases, the researcher should deal with this error by either redefining the target population in terms of the sampling frame, screening the respondents with respect to important characteristics to ensure that they meet the criteria for the target population, or adjusting the collected data by a weighting scheme to counterbalance the coverage error.

Determining the sampling design

There are two major types of sampling design: probability and nonprobability sampling. In **probability sampling**, the elements in the population have some known, nonzero chance or probability of being selected as sample subjects. In **nonprobability sampling**, the elements do not have a known or predetermined chance of being selected as subjects. Probability sampling designs are used when the representativeness of the sample is of importance in the interests of wider generalizability. When time or other factors, rather than generalizability, become critical, nonprobability sampling is generally used. Each of these two major designs has different sampling strategies. Depending on the extent of generalizability desired, the demands of time and other resources, and the purpose of the study, different types of probability and nonprobability sampling design are chosen.

The choice of the sampling procedure is a very important one. Therefore, this chapter will elaborately discuss the different types of sampling designs, bearing in mind the following points in the determination of the choice:

- What is the relevant target population of focus to the study?
- What exactly are the parameters we are interested in investigating?
- What kind of a sampling frame is available?
- What costs are attached to the sampling design?
- How much time is available to collect the data from the sample?

Determining the sample size

Is a sample size of 40 large enough? Or do you need a sample size of 75, 180, 384, or 500? Is a large sample better than a small sample; that is, is it more representative? The decision about how large the sample size should be can be a very difficult one. We can summarize the factors affecting decisions on sample size as:

1. The research objective.
2. The extent of precision desired (the confidence interval).
3. The acceptable risk in predicting that level of precision (confidence level).
4. The amount of variability in the population itself.
5. The cost and time constraints.
6. In some cases, the size of the population itself.

Thus, how large your sample should be is a function of these six factors. We will have more to say about sample size later on in this chapter, after we have discussed sampling designs.

Executing the sampling process

The following two examples illustrate how, in the final stage of the sampling process, decisions with respect to the target population, the sampling frame, the sample technique, and the sample size have to be implemented.

EXAMPLE

A satisfaction survey was conducted for a computer retailer in New Zealand. The objective of this survey was to improve internal operations and thus to retain more customers. The survey was transactional in nature; service satisfaction and several related variables were measured following a service encounter (i.e., a visit to the retailer). Hence, customer feedback was obtained while the service experience was still fresh. To obtain a representative sample of customers of the computer retailer (*the target population*), every tenth person, leaving one out of ten randomly selected stores, in randomly selected cities, in randomly selected regions, was approached during a one-week period (*the sampling technique*). Trained interviewers that were sent out with standardized questionnaires approached 732 customers leaving the stores (*the sample size*).

A young researcher was investigating the antecedents of salesperson performance. To examine his hypotheses, data were collected from chief sales executives in the United Kingdom (*the target population*) via mail questionnaires. The sample was initially drawn from a published business register (*the sampling frame*), but supplemented with respondent recommendations and other additions, in a *judgment sampling methodology*. Before distributing the questionnaires, the young researcher called each selected company to obtain the name of the chief sales executive, who was contacted and asked to participate in the study. The questionnaires were subsequently distributed to chief sales executives of 450 companies (*the sample size*). To enhance the response rate, pre-addressed and stamped envelopes were provided, anonymity was assured, and a summary of the research findings as an incentive to the participants was offered. Several follow-up procedures, such as telephone calls and new mailings, were planned in order to receive as many responses as possible.

BOX 13.1

NONRESPONSE AND NONRESPONSE ERROR

A failure to obtain information from a number of subjects included in the sample (nonresponse) may lead to nonresponse error. **Nonresponse error** exists to the extent that those who did respond to your survey are different from those who did not on (one of the) characteristics of interest in your study. Two important sources of nonresponse are not-at-homes and refusals. An effective way to reduce the incidence of not-at-homes is to call back at another time, preferably at a different time of day. The rate of refusals depends, among other things, on the length of the survey, the data collection method, and the patronage of the research. Hence, a decrease in survey length, in the data collection method (personal interviews instead of mail questionnaires), and the auspices of the research often improve the overall return rate. Personalized cover letters, a small incentive for participating in the study, and an advance notice that the survey is taking place may also help you to increase the response rate. Nonetheless, it is almost impossible to entirely avoid nonresponse in surveys. In these cases you may have to turn to methods to deal with nonresponse error, such as generalizing the results to the respondents only or statistical adjustment (weighting the data by observable variables).

PROBABILITY SAMPLING

When elements in the population have a known, nonzero chance of being chosen as subjects in the sample, we resort to a probability sampling design. Probability sampling can be either unrestricted (simple random sampling) or restricted (complex probability sampling) in nature.

Unrestricted or simple random sampling

In the **unrestricted probability sampling** design, more commonly known as **simple random sampling**, every element in the population has a *known and equal* chance of being selected as a subject. Let us say there are 1000 elements in the population, and we need a sample of 100. Suppose we were to drop pieces of paper in a hat, each bearing the name of one of the elements, and draw 100 of those from the hat with our eyes closed. We know that the first piece drawn will have a 1/1000 chance of being drawn, the next one a 1/999 chance of being drawn, and so on. In other words, we know that the probability of any one of them being chosen is 1 in the number of the population, and we also know that each single element in the hat has the same or equal probability of being chosen. We certainly know that computers can generate random numbers and one does not have to go through the tedious process of pulling out names from a hat!

When we thus draw the elements from the population, it is most likely that the distribution patterns of the characteristics we are interested in investigating in the population are also likewise distributed in the subjects we draw for our sample. This sampling design, known as simple random sampling, has the least bias and offers the most generalizability. However, this sampling process could become cumbersome and expensive; in addition, an entirely updated listing of the population may not always be available. For these and other reasons, other probability sampling designs are often chosen instead.

Restricted or complex probability sampling

As an alternative to the simple random sampling design, several **complex probability sampling** (**restricted probability**) designs can be used. These probability sampling procedures offer a viable, and sometimes more efficient, alternative to the unrestricted design we just discussed. Efficiency is improved in that more information can be obtained for a given sample size using some of the complex probability sampling procedures than the simple random sampling design. The five most common complex probability sampling designs – systematic sampling, stratified random sampling, cluster sampling, area sampling, and double sampling – will now be discussed.

Systematic sampling

The **systematic sampling** design involves drawing every *n*th element in the population starting with a randomly chosen element between 1 and *n*. The procedure is exemplified below.

EXAMPLE

If we wanted a sample of 35 households from a total population of 260 houses in a particular locality, then we could sample every seventh house starting from a random number from 1 to 7. Let us say that the random number was 7, then houses numbered 7, 14, 21, 28, and so on, would be sampled until the 35 houses were selected. The one problem to be borne in mind in the systematic sampling design is the probability of a systematic bias creeping into the sample. In the above example, for instance, let us say that every seventh house happened to be a corner house. If the focus of the research study conducted by the construction industry was to control "noise pollution" experienced by residents through the use of appropriate filtering materials, then the residents of corner houses may not be exposed to as much noise as the houses that are in between. Information on noise levels gathered from corner house dwellers might therefore bias the researcher's data. The likelihood of drawing incorrect conclusions from such data is thus high. In view of the scope for such systematic bias, the researcher must consider the plans carefully and make sure that the systematic sampling design is appropriate for the study, before deciding on it. For market surveys, consumer attitude surveys, and the like, the systematic sampling design is often used, and the telephone directory frequently serves as the sampling frame for this sampling design.

Stratified random sampling

While sampling helps to estimate population parameters, there may be identifiable subgroups of elements within the population that may be expected to have different parameters on a variable of interest to the researcher. For example, to the human resources management director interested in assessing the extent of training that the employees in the system feel they need, the entire organization will form the population for study. But the extent, quality, and intensity of training desired by middle-level managers, lower-level managers, first-line supervisors, computer analysts, clerical workers, and so on will be different for each group. Knowledge of the kinds of differences in needs that exist for the different groups will help the director to develop useful and meaningful training programs for each group in the organization. Data will therefore have to be collected in a manner that will help the assessment of needs at each subgroup level in the population. The unit of analysis then will be at the group level and the stratified random sampling process will come in handy.

Stratified random sampling, as its name implies, involves a process of stratification or segregation, followed by random selection of subjects from each stratum. The population is first divided into mutually exclusive groups that are relevant, appropriate, and meaningful in the context of the study. For instance, if the president of a company is concerned about low motivational levels or high absenteeism rates among the employees, it makes sense to stratify the population of organizational members according to their job levels. When the data are collected and the analysis is done, we may find that, contrary to expectations, it is the middle-level managers that are not motivated. This information will help the president to focus on action at the right level and devise better methods to motivate this group. Tracing the differences in the parameters of the subgroups within a population would not be possible without the stratified random sampling procedure. If either the simple random sampling or the systematic sampling procedure were used in a case like this, then the high motivation at some job levels and the low motivation at other levels would cancel each other out, thus masking the real problems that exist at a particular level or levels.

Stratification also helps when research questions such as the following are to be answered:

1. Are the machinists more accident prone than clerical workers?
2. Are Hispanics more loyal to the organization than Native Americans?

Stratifying customers on the basis of life stages, income levels, and the like to study buying patterns and stratifying companies according to size, industry, profits, and so forth to study stock market reactions are common examples of the use of stratification as a sampling design technique.

Stratification is an efficient research sampling design; that is, it provides more information with a given sample size. Stratification should follow the lines appropriate to the research question. If we are studying consumer preferences for a product, stratification of the population could be by geographical area, market segment, consumers' age, consumers' gender, or various combinations of these. If an organization contemplates budget cuts, the effects of these cuts on employee attitudes can be studied with stratification by department, function, or region. Stratification ensures homogeneity within each stratum (i.e., very few differences or dispersions on the variable of interest within each stratum), but heterogeneity (variability) between strata. In other words, there will be more between-group differences than within-group differences.

Proportionate and disproportionate stratified random sampling Once the population has been stratified in some meaningful way, a sample of members from each stratum can be drawn using either a simple random sampling or a systematic sampling procedure. The subjects drawn from each stratum can be either proportionate or disproportionate to the number of elements in the stratum. For instance, if an organization

TABLE 13.1

Proportionate and disproportionate stratified random sampling

Job level	Number of elements	Number of subjects in the sample	
		Proportionate sampling (20% of the elements)	**Disproportionate sampling**
Top management	10	2	7
Middle-level management	30	6	15
Lower-level management	50	10	20
Supervisors	100	20	30
Clerks	500	100	60
Secretaries	20	4	10
Total	710	142	142

employs 10 top managers, 30 middle managers, 50 lower-level managers, 100 supervisors, 500 clerks, and 20 secretaries, and a stratified sample of about 140 people is needed for some specific survey, the researcher might decide to include in the sample 20% of members from each stratum. That is, members represented in the sample from each stratum will be *proportionate* to the total number of elements in the respective strata. This would mean that two from the top, six from the middle, and ten from the lower levels of management would be included in the sample. In addition, 20 supervisors, 100 clerks, and four secretaries would be represented in the sample, as shown in the third column of Table 13.1. This type of sampling is called a **proportionate stratified random sampling** design.

In situations like the one above, researchers might sometimes be concerned that information from only two members at the top and six from the middle levels would not truly reflect how all members at those levels would respond. Therefore, a researcher might decide, instead, to use a **disproportionate stratified random sampling** procedure. The number of subjects from each stratum would now be altered, while keeping the sample size unchanged. Such a sampling design is illustrated in the far right-hand column in Table 13.1. The idea here is that the 60 clerks might be considered adequate to represent the population of 500 clerks; seven out of ten managers at the top level might also be considered representative of the top managers, and likewise 15 out of the 30 managers at the middle level. This redistribution of the numbers in the strata might be considered more appropriate and representative for the study than the previous proportionate sampling design.

Disproportionate sampling decisions are made either when some stratum or strata are too small or too large, or when there is more variability suspected within a particular stratum. As an example, the educational levels among supervisors, which may be considered to influence perceptions, may range from elementary school to master's degrees. Here, more people will be sampled at the supervisory level. Disproportionate sampling is also sometimes done when it is easier, simpler, and less expensive to collect data from one or more strata than from others.

In summary, stratified random sampling involves stratifying the elements along meaningful levels and taking proportionate or disproportionate samples from the strata. This sampling design is more efficient than the simple random sampling design because, for the same sample size, each important segment of the population is better represented, and more valuable and differentiated information is obtained with respect to each group.

Cluster sampling

Cluster samples are samples gathered in groups or chunks of elements that, ideally, are natural aggregates of elements in the population. In **cluster sampling**, the target population is first divided into clusters. Then, a random sample of clusters is drawn and for each selected cluster either all the elements or a sample of elements are included in the sample. Cluster samples offer more heterogeneity within groups and more homogeneity among groups – the reverse of what we find in stratified random sampling, where there is homogeneity within each group and heterogeneity across groups.

A specific type of cluster sampling is **area sampling**. In this case, clusters consist of geographic areas such as counties, city blocks, or particular boundaries within a locality. If you wanted to survey the residents of a city, you would get a city map, take a sample of city blocks and select respondents within each city block. Sampling the needs of consumers before opening a 24-hour convenience store in a particular part of town would involve area sampling. Location plans for retail stores, advertisements focused specifically on local populations, and TV and radio programs beamed at specific areas could all use an area sampling design to gather information on the interests, attitudes, predispositions, and behaviors of the local area people.

Area sampling is less expensive than most other probability sampling designs, and it is not dependent on a sampling frame. A city map showing the blocks of the city is adequate information to allow a researcher to take a sample of the blocks and obtain data from the residents therein. Indeed, the key motivation for cluster sampling is cost reduction. The unit costs of cluster sampling are much lower than those of other probability sampling designs of simple or stratified random sampling or systematic sampling. However, cluster sampling exposes itself to greater bias and is the least generalizable of all the probability sampling designs, because most naturally occurring clusters in the organizational context do not contain heterogeneous elements. In other words, the conditions of intracluster heterogeneity and intercluster homogeneity are often not met.

For these reasons, the cluster sampling technique is not very common in organizational research. Moreover, for marketing research activities, naturally occurring clusters, such as clusters of residents, buyers, students, or shops, do not have much heterogeneity among the elements. As stated earlier, there is more intracluster homogeneity than heterogeneity in such clusters. Hence, cluster sampling, though less costly, does not offer much efficiency in terms of precision or confidence in the results. However, cluster sampling offers convenience. For example, it is easier to inspect an assortment of units packed inside, say, four boxes (i.e., all the elements in the four clusters) than to open 30 boxes in a shipment in order to inspect a few units from each at random.

Single-stage and multistage cluster sampling We have thus far discussed single-stage cluster sampling, which involves the division of the population into convenient clusters, randomly choosing the required number of clusters as sample subjects, and investigating all the elements in each of the randomly chosen clusters. Cluster sampling can also be done in several stages and is then known as **multistage cluster sampling**. For instance, if we were to do a national survey of the average monthly bank deposits, cluster sampling would first be used to select the urban, semi-urban, and rural geographical locations for study. At the next stage, particular areas in each of these locations would be chosen. At the third stage, banks within each area would be chosen. In other words, multistage cluster sampling involves a probability sampling of the primary sampling units; from each of these primary units, a probability sample of the secondary sampling units is then drawn; a third level of probability sampling is done from each of these secondary units, and so on, until we have reached the final stage of breakdown for the sample units, when we sample every member in those units.

Double sampling

This plan is resorted to when further information is needed from a subset of the group from which some information has already been collected for the same study. A sampling design where initially a sample is used in a study to collect some preliminary information of interest, and later a subsample of this primary sample is used to examine the matter in more detail, is called **double sampling**. For example, a structured interview might indicate that a subgroup of the respondents has more insight into the problems of the organization. These respondents might be interviewed again and asked additional questions. This research adopts a double sampling procedure.

Review of probability sampling designs

There are two basic probability sampling plans: the unrestricted or simple random sampling, and the restricted or complex probability sampling plans. In the simple random sampling design, every element in the population has a known and equal chance of being selected as a subject. The complex probability plan consists of five different sampling designs. Of these five, the cluster sampling design is probably the least expensive as well as the least dependable, but is used when no list of the population elements is available. The stratified random sampling design is probably the most efficient, in the sense that for the same number of sample subjects, it offers precise and detailed information. The systematic sampling design has the built-in hazard of possible systematic bias. Area sampling is a popular form of cluster sampling, and double sampling is resorted to when information in addition to that already obtained by using a primary sample has to be collected using a subgroup of the sample.

NONPROBABILITY SAMPLING

In **nonprobability sampling** designs, the elements in the population do not have any probabilities attached to their being chosen as sample subjects. This means that the findings from the study of the sample cannot be confidently generalized to the population. As stated earlier, however, researchers may, at times, be less concerned about generalizability than obtaining some preliminary information in a quick and inexpensive way. They might then resort to nonprobability sampling. Sometimes nonprobability sampling is the only way to obtain data, as discussed later.

Some of the nonprobability sampling plans are more dependable than others and could offer some important leads to potentially useful information with regard to the population. Nonprobability sampling designs, which fit into the broad categories of convenience sampling and purposive sampling, are discussed next.

Convenience sampling

As its name implies, **convenience sampling** refers to the collection of information from members of the population who are conveniently available to provide it. One would expect the "Pepsi Challenge" contest to have been administered on a convenience sampling basis. Such a contest, with the purpose of determining whether people prefer one product to another, might be held at a shopping mall visited by many shoppers. Those inclined to take the test might form the sample for the study of how many people prefer Pepsi over Coke or product X to product Y. Such a sample is a convenience sample.

Consider another example. A convenience sample of five officers who attended a competitor's showcase demonstration at the county fair the previous evening offered the vice president of the company information on the "new" products of the competitor and their pricing strategies, which helped the VP to formulate some ideas on the next steps to be taken by the company.

Convenience sampling is most often used during the exploratory phase of a research project and is perhaps the best way of getting some basic information quickly and efficiently.

Purposive sampling

Instead of obtaining information from those who are most readily or conveniently available, it might sometimes become necessary to obtain information from specific target groups. The sampling here is confined to specific types of people who can provide the desired information, either because they are the only ones who have it, or they conform to some criteria set by the researcher. This type of sampling design is called **purposive sampling**, and the two major types of purposive sampling – judgment sampling and quota sampling – will now be explained.

Judgment sampling

Judgment sampling involves the choice of subjects who are most advantageously placed or in the best position to provide the information required. For instance, if a researcher wants to find out what it takes for women managers to make it to the top, the only people who can give first-hand information are the women who have risen to the positions of presidents, vice presidents, and important top-level executives in work organizations. They could reasonably be expected to have expert knowledge by virtue of having gone through the experiences and processes themselves, and might perhaps be able to provide good data or information to the researcher. Thus, the **judgment sampling** design is used when a limited number or category of people have the information that is sought. In such cases, any type of probability sampling across a cross-section of the entire population is purposeless and not useful.

Judgment sampling may curtail the generalizability of the findings, due to the fact that we are using a sample of experts who are conveniently available to us. However, it is the only viable sampling method for obtaining the type of information that is required from very specific pockets of people who alone possess the needed facts and can give the information sought. In organizational settings, and particularly for market research, opinion leaders who are very knowledgeable are included in the sample. Enlightened opinions, views, and knowledge constitute a rich data source.

Judgment sampling calls for special efforts to locate and gain access to the individuals who do have the requisite information. As already stated, this sampling design may be the only useful one for answering certain types of research question.

Quota sampling

Quota sampling, a second type of purposive sampling, ensures that certain groups are adequately represented in the study through the assignment of a quota. Generally, the quota fixed for each subgroup is based on the total numbers of each group in the population. However, since this is a nonprobability sampling plan, the results are not generalizable to the population.

Quota sampling can be considered a form of proportionate stratified sampling, in which a predetermined proportion of people are sampled from different groups, but on a convenience basis. For instance, it may be surmised that the work attitude of blue-collar workers in an organization is quite different from that of white-collar workers. If there are 60% blue-collar workers and 40% white-collar workers in this organization, and if a total of 30 people are to be interviewed to find the answer to the research question, then a quota of 18 blue-collar workers and 12 white-collar workers will form the sample, because these numbers represent 60% and 40% of the sample size. The first 18 conveniently available blue-collar workers and 12 white-collar workers will be sampled according to this quota. Needless to say, the sample may not be totally representative of the population; hence the generalizability of the findings will be restricted. However, the convenience it offers in terms of effort, cost, and time makes quota sampling attractive for some research efforts. Quota sampling also becomes a necessity when a subset of the population is underrepresented in the organization – for example, minority groups, foremen, and so on. In other words, quota sampling ensures that all the subgroups in the population are adequately represented in the sample. Quota samples are basically stratified samples from which subjects are selected nonrandomly.

In a workplace (and society) that is becoming increasingly heterogeneous because of the changing demographics, quota sampling can be expected to be used more frequently in the future. For example, quota sampling can be used to gain some idea of the buying predispositions of various ethnic groups, to get a feel of how employees from different nationalities perceive the organizational culture, and so on.

Although quota sampling is not generalizable like stratified random sampling, it does offer some information, based on which further investigation, if necessary, can proceed. That is, it is possible that the first stage of research will use the nonprobability design of quota sampling, and once some useful information has been obtained, a probability design will follow. The converse is also entirely possible. A probability sampling design might indicate new areas for research, and nonprobability sampling designs might be used to explore their feasibility.

Review of nonprobability sampling designs

There are two main types of nonprobability sampling design: convenience sampling and purposive sampling. Convenience sampling is the least reliable of all sampling designs in terms of generalizability, but sometimes it may be the only viable alternative when quick and timely information is needed, or for exploratory research purposes. Purposive sampling plans fall into two categories: judgment and quota sampling designs. Judgment sampling, though restricted in generalizability, may sometimes be the best sampling design choice, especially when there is a limited population that can supply the information needed. Quota sampling is often used on considerations of cost and time and the need to adequately represent minority elements in the population. Although the generalizability of all nonprobability sampling designs is very restricted, they have certain advantages and are sometimes the only viable alternative for the researcher.

Table 13.2 summarizes the probability and nonprobability sampling designs discussed thus far, and their advantages and disadvantages. Figure 13.4 offers some decision choice points as to which design might be useful for specific research goals.

TABLE 13.2

Probability and nonprobability sampling designs

Sampling design	Description	Advantages	Disadvantages
Probability sampling			
1. Simple random sampling	All elements in the population are considered and each element has an equal chance of being chosen as the subject.	High generalizability of findings.	Not as efficient as stratified sampling.
2. Systematic sampling	Every *n*th element in the population is chosen starting from a random point in the sampling frame.	Easy to use if sampling frame is available.	Systematic biases are possible.

Sampling design	Description	Advantages	Disadvantages
3. Stratified random sampling (Str.R.S.) Proportionate Str.R.S. Disproportionate Str.R.S.	Population is first divided into meaningful segments; thereafter subjects are drawn in proportion to their original numbers in the population. Based on criteria other than their original population numbers.	Most efficient among all probability designs. All groups are adequately sampled and comparisons among groups are possible.	Stratification must be meaningful. More time consuming than simple random sampling or systematic sampling. Sampling frame for each stratum is essential.
4. Cluster sampling	Groups that have heterogeneous members are first identified; then some are chosen at random; all the members in each of the randomly chosen groups are studied.	In geographic clusters, costs of data collection are low.	The least reliable and efficient among all probability sampling designs since subsets of clusters are more homogeneous than heterogeneous.
5. Area sampling	Cluster sampling within a particular area or locality.	Cost-effective. Useful for decisions relating to a particular location.	Takes time to collect data from an area.
6. Double sampling	The same sample or a subset of the sample is studied twice.	Offers more detailed information on the topic of study.	Original biases, if any, will be carried over. Individuals may not be happy responding a second time.
Nonprobability sampling			
7. Convenience sampling	The most easily accessible members are chosen as subjects.	Quick, convenient, less expensive.	Not generalizable at all.
8. Judgment sampling	Subjects selected on the basis of their expertise in the subject investigated.	Sometimes, the only meaningful way to investigate.	Generalizability is questionable; not generalizable to entire population.
9. Quota sampling	Subjects are conveniently chosen from targeted groups according to some predetermined number or quota.	Very useful where minority participation in a study is critical.	Not easily generalizable.

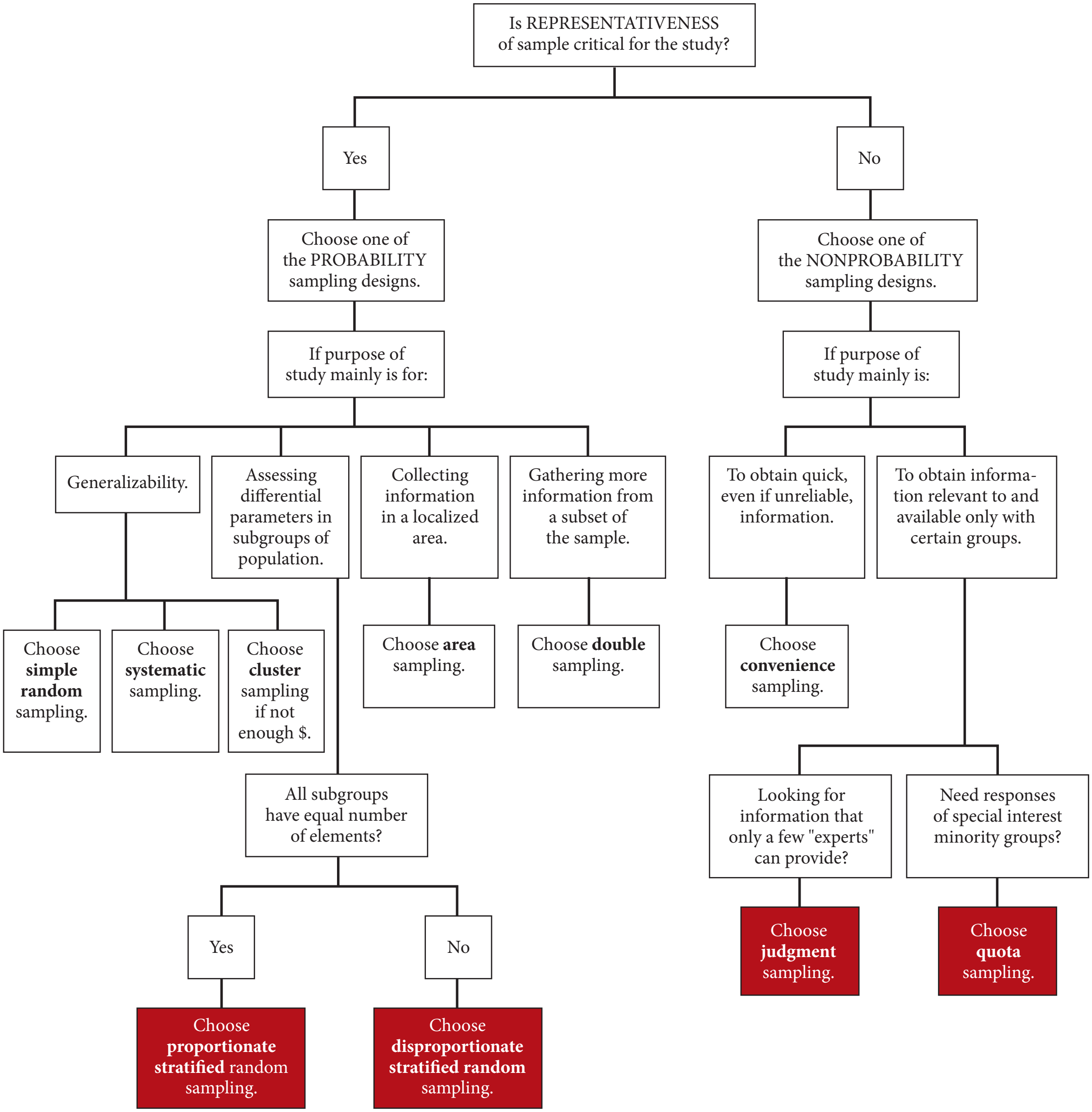

Is REPRESENTATIVENESS of sample critical for the study?
Yes
No
Choose one of the PROBABILITY sampling designs.
Choose one of the NONPROBABILITY sampling designs.
If purpose of study mainly is for:
If purpose of study mainly is:
Generalizability.
Assessing differential parameters in subgroups of population.
Collecting information in a localized area.
Gathering more information from a subset of the sample.
To obtain quick, even if unreliable, information.
To obtain information relevant to and available only with certain groups.
Choose simple random sampling.
Choose systematic sampling.
Choose cluster sampling if not enough $.
Choose area sampling.
Choose double sampling.
Choose convenience sampling.
All subgroups have equal number of elements?
Yes
No
Choose proportionate stratified random sampling.
Choose disproportionate stratified random sampling.
Looking for information that only a few "experts" can provide?
Need responses of special interest minority groups?
Choose judgment sampling.
Choose quota sampling.

FIGURE 13.4

Choice points in sampling design

INTERMEZZO: EXAMPLES OF WHEN CERTAIN SAMPLING DESIGNS WOULD BE APPROPRIATE

Simple random sampling

This sampling design is best when the generalizability of the findings to the whole population is the main objective of the study. Consider the following two examples.

EXAMPLE

The human resources director of a company with 82 people on its payroll has been asked by the vice president to consider formulating an implementable flextime policy. The director feels that such a policy is not necessary since everyone seems happy with the 9-to-5 hours, and no one has complained. Formulating such a policy now, in the opinion of the director, runs the risk of creating domestic problems for the staff and scheduling problems for the company. She wants, however, to resort to a simple random sampling procedure to do an initial survey, and, with the results, convince the VP that there is no need for flextime, and urge him to drop the matter. Since simple random sampling offers the greatest generalizability of the results to the entire population, and the VP needs to be convinced, it is important to resort to this sampling design.

The regional director of sales operations of a medium-sized company, which has 20 retail stores in each of its four geographical regions of operation, wants to know what types of sales gimmicks worked best for the company overall during the past year. This is to help formulate some general policies for the company *as a whole* and prioritize sales promotion strategies for the coming year. Instead of studying each of the 80 stores, some *dependable* (i.e., *representative* and *generalizable*) information can be had, based on the study of a few stores drawn through a simple random sampling procedure. That is, each one of the 80 stores would have an equal chance of being included in the sample, and the results of the study would be the most generalizable. A simple random sampling procedure is recommended in this case since the policy is to be formulated for the company as a whole. This implies that the most representative information has to be obtained that can be generalized to the entire company. This is best accomplished through this design.

It has to be noted that in some cases, where *cost* is a primary consideration (i.e., resources are limited), and the number of elements in the population is very large and/or geographically dispersed, the simple random sampling design may not be the most desirable, because it could become quite expensive. Thus, both the criticality of generalizability and considerations of cost come into play in the choice of this sampling design.

Stratified random sampling

This sampling design, which is the most efficient, is a good choice when differentiated information is needed regarding various strata within the population, which are known to differ in their parameters. See the examples on the following page.

EXAMPLE

The director of human resources of a manufacturing firm wants to offer stress management seminars to the personnel who experience high levels of stress. He conjectures that three groups are most prone to stress: the workmen who constantly handle dangerous chemicals, the foremen who are held responsible for production quotas, and the counselors who, day in and day out, listen to the problems of the employees, internalize them, and offer them counsel, with no idea of how much they have really helped the clients. To get a feel for the experienced level of stress within each of the three groups and the rest of the firm, the director might stratify the sample into four distinct categories: (1) the workmen handling the dangerous chemicals, (2) the foremen, (3) the counselors, and (4) all the rest. He might then choose a *disproportionate random sampling* procedure (since group (3) can be expected to be very small, and groups (2) and (1) are much smaller than group (4)).

This is the only sampling design that would allow the designing of stress management seminars in a meaningful way, targeted at the right groups.

If, in the earlier example, the regional director had wanted to know which sales promotion gimmick offered the best results for *each* of the geographical areas, so that different sales promotion strategies (according to regional preferences) could be developed, then the 80 stores would first be stratified on the basis of the geographical region, and then a representative sample of stores would be drawn from each of the geographical regions (strata) through a simple random sampling procedure. In this case, since each of the regions has 20 stores, a proportionate stratified random sampling process (say, five stores from each region) would be appropriate. If, however, the northern region had only three stores, the southern had 15, and the eastern and western regions had 24 and 38 stores, respectively, then a *disproportionate stratified random sampling* procedure would be the right choice, with all three stores in the northern region being studied, because of the small number of elements in that population. If the sample size was retained at 20, then the north, south, east, and west regions would probably have samples respectively of three, four, five and eight. It is interesting to note that sometimes when stratified random sampling might seem logical, it might not really be necessary. For example, when test-marketing results show that Cubans, Puerto Ricans, and Mexicans perceive and consume a particular product the same way, there is no need to segment the market and study each of the three groups using a stratified sampling procedure.

Systematic sampling

If the sampling frame is large, and a listing of the elements is conveniently available in one place (as in the telephone directory, company payroll, chamber of commerce listings, etc.), then a systematic sampling procedure will offer the advantages of ease and quickness in developing the sample, as illustrated by the following example.

EXAMPLE

An administrator wants to assess the reactions of employees to a new and improved health benefits scheme that requires a modest increase in the premiums to be paid by the employees for their families. The administrator can assess the enthusiasm for the new scheme by using a systematic sampling design. The company's records will provide the sampling frame, and every *n*th employee can be sampled. A stratified plan is not called for here since the policy is for the entire company.

BOX 13.2

NOTE

Systematic sampling is inadvisable where systematic bias can be anticipated to be present. For example, systematic sampling from the personnel directory of a company (especially when it has an equal number of employees in each department), which lists the names of the individuals department-wise, with the head of the department listed first, and the secretary listed next, has inherent bias. The possibility of systematic bias creeping into the data cannot be ruled out in this case, since the selection process may end up picking each of the heads of the department or the departmental secretaries as the sample subjects. The results from such a sample will clearly be biased and not generalizable, despite the use of a probability sampling procedure. Systematic sampling will have to be scrupulously avoided in cases where known systematic biases are possible.

Cluster sampling

This sampling design is most useful when a heterogeneous group is to be studied at one time. Two examples are offered below.

EXAMPLE

A human resources director is interested in knowing why staff resign. Cluster sampling will be useful in this case for conducting exit interviews of all members completing their final papers in the human resources department on the same day (cluster), before resigning. The clusters chosen for interview will be based on a simple random sampling of the various clusters of personnel resigning on different days. The interviews will help to understand the reasons for turnover of a heterogeneous group of individuals (i.e., from various departments), and the study can be conducted at a low cost.

A financial analyst wishes to study the lending practices of banks in the Netherlands. All the banks in each city will form a cluster. By randomly sampling the clusters, the analyst will be able to draw conclusions on the lending practices.

Area sampling

Area sampling is best suited when the goal of the research is confined to a particular locality or area, as per the example below.

EXAMPLE

A telephone company wants to install a public telephone outlet in a locality where crime is most rampant, so that victims can have access to a telephone. Studying the crime statistics and interviewing the residents in a particular area will help to choose the right location for installation of the phone.

Double sampling

This design provides added information at minimal additional expenditure. See the example below.

EXAMPLE

In the previous exit interview example, some individuals (i.e., a subset of the original cluster sample) might have indicated that they were resigning because of philosophical differences with the company's policies. The researcher might want to do an in-depth interview with these individuals to obtain further information regarding the nature of the policies disliked, the actual philosophical differences, and why these particular issues were central to the individuals' value systems. Such additional detailed information from the target group through the double sampling design could help the company to look for ways of retaining employees in the future.

Convenience sampling

This nonprobability design, which is not generalizable at all, is used at times to obtain some "quick" information to get a "feel" for the phenomenon or variables of interest. See the example below.

EXAMPLE

The accounts executive has established a new accounting system that maximally utilizes computer technology. Before making further changes, he would like to get a feel for how the accounting clerks react to the new system without making it seem that he has doubts about its acceptability. He may then "casually" talk to the first five accounting personnel that walk into his office, trying to gauge their reactions.

BOX 13.3

NOTE

Convenience sampling should be resorted to in the interests of expediency, with the full knowledge that the results are not generalizable at all.

Judgment sampling: one type of purposive sampling

A judgment sampling design is used where the collection of "specialized informed inputs" on the topic area researched is vital, and the use of any other sampling design would not offer opportunities to obtain the specialized information, as per the example that follows.

EXAMPLE

A pharmaceutical company wants to trace the effects of a new drug on patients with specific health problems (muscular dystrophy, sickle cell anemia, rheumatoid arthritis, etc.). It then contacts such individuals and, with a group of voluntarily consenting patients, tests the drug. This is a judgment sample because data are collected from appropriate special groups.

Quota sampling: a second type of purposive sampling

This sampling design allows for the inclusion of *all* groups in the system researched. Thus, groups who are small in number are not neglected, as per the example below.

EXAMPLE

A company is considering operating an on-site kindergarten facility. But before taking further steps, it wants to get the reactions of four groups to the idea: (1) employees who are parents of kindergarten-age children, and where both are working outside of the home, (2) employees who are parents of kindergarten-age children, but where one of them is *not* working outside of the home, (3) single parents with kindergarten-age children, and (4) all those without children of kindergarten age. If the four groups are expected to represent 60%, 7%, 23%, and 10%, respectively, in the population of 420 employees in the company, then a quota sampling will be appropriate to represent the four groups.

BOX 13.4

NOTE

The last group in the above example should also be included in the sample since there is a possibility that they may perceive this as a facility that favors only the parents of kindergarten children, and therefore resent the idea. It is easy to see that resorting to quota sampling would be important in a case such as this.

In effect, as can be seen from the discussions on sampling designs thus far, *decisions on which design to use* depend on many factors, including the following:

1. Extent of prior knowledge in the area of research undertaken.
2. The main objective of the study – generalizability, efficiency, knowing more about subgroups within a population, obtaining some quick (even if unreliable) information, etc.
3. Cost considerations – is exactitude and generalizability worth the extra investment of time, cost, and other resources in resorting to a more, rather than less, sophisticated sampling design? Even if it is, is suboptimization because of cost or time constraints called for? (See also Figure 13.4.)

The advantages and disadvantages of the different probability and nonprobability sampling designs are listed in Table 13.2.

In sum, choosing the appropriate sampling plan is one of the more important research design decisions the researcher has to make. The choice of a specific design will depend broadly on the goal of research, the characteristics of the population, and considerations of cost.

ISSUES OF PRECISION AND CONFIDENCE IN DETERMINING SAMPLE SIZE

Having discussed the various probability and nonprobability sampling designs, we now need to focus attention on the second aspect of the sampling design issue – the sample size. Suppose we select 30 people from a population of 3000 through a simple random sampling procedure. Will we be able to generalize our findings to the population with confidence, since we have chosen a probability design that has the most generalizability? What is the sample size required to make reasonably precise generalizations with confidence? What do precision and confidence mean? These issues will be considered now.

A reliable and valid sample should enable us to generalize the findings from the sample to the population under investigation. In other words, the sample statistics should be reliable estimates and reflect the population parameters as closely as possible within a narrow margin of error. No sample statistic (X, for instance) is going to be *exactly* the same as the population parameter (μ), no matter how sophisticated the probability sampling design is. Remember that the very reason for a probability design is to increase the probability that the sample statistics will be as close as possible to the population parameters. Though the point estimate X may not accurately reflect the population mean, μ, an interval estimate can be made within which μ will lie, with probabilities attached – that is, at particular confidence levels. The issues of confidence interval and confidence level are addressed in the following discussions on precision and confidence.

Precision

Precision refers to how close our estimate is to the true population characteristic. Usually, we estimate the population parameter to fall within a range, based on the sample estimate. For example, let us say that from a study of a simple random sample of 50 of the total 300 employees in a workshop, we find that the average daily production rate per person is 50 pieces of a particular product ($\bar{X} = 50$). We might then (by doing certain calculations, as we shall see later) be able to say that the true average daily production of the product (μ) lies anywhere between 40 and 60 for the population of employees in the workshop. In saying this, we offer an interval estimate, within which we expect the true population mean production to be ($\mu = 50 \pm 10$). The narrower this interval, the greater the precision. For instance, if we are able to estimate that the population mean will fall anywhere between 45 and 55 pieces of production ($\mu = 50 \pm 5$) rather than 40 and 60 ($\mu = 50 \pm 10$), then we have more precision. That is, we now estimate the mean to lie within a narrower range, which in turn means that we estimate with greater exactitude or precision.

Precision is a function of the range of variability in the sampling distribution of the sample mean. That is, if we take a number of different samples from a population, and take the mean of each of these, we will usually find that they are all different, are normally distributed, and have a dispersion associated with them. The smaller this dispersion or variability, the greater the probability that the sample mean will be closer to the population mean. We need not necessarily take several different samples to estimate this variability. Even if we take only one sample of 30 subjects from the population, we will still be able to estimate the variability of the sampling distribution of the sample mean. This variability is called the standard error, denoted by $S_{\bar{X}}$. The standard error is calculated by the following formula:

$$S_{\bar{X}} = \frac{S}{\sqrt{n}}$$

where S is the standard deviation of the sample, n is the sample size, and $S_{\bar{X}}$ indicates the standard error or the extent of precision offered by the sample.

Note that the standard error varies inversely with the square root of the sample size. Hence, if we want to reduce the standard error given a particular standard deviation in the sample, we need to increase the sample size.

Another noteworthy point is that the smaller the variation in the population, the smaller the standard error, which in turn implies that the sample size need not be large. Thus, low variability in the population requires a smaller sample size.

In sum, the closer we want our sample results to reflect the population characteristics, the greater the precision we should aim at. The greater the precision required, the larger the sample size needed, especially when the variability in the population itself is large.

Confidence

Whereas precision denotes how close we estimate the population parameter based on the sample statistic, **confidence** denotes how *certain* we are that our estimates will really hold true for the population. In the previous example of production rate, we know we are more precise when we estimate the true mean production (μ) to fall somewhere between 45 and 55 pieces than somewhere between 40 and 60. However, we may have more confidence in the latter estimation than in the former. After all, anyone can say with 100% certainty or confidence that the mean production (μ) will fall anywhere between zero and infinity! Other things being equal, the narrower the range, the lower the confidence. In other words, there is a trade-off between precision and confidence for any given sample size, as we shall see later in this chapter.

In essence, confidence reflects the level of certainty with which we can state that our estimates of the population parameters, based on our sample statistics, will hold true. The level of confidence can range from 0 to 100%. A 95% confidence is the conventionally accepted level for most business research, most commonly expressed by denoting the significance level as $p \leq 0.05$. In other words, we say that at least 95 times out of 100 our estimate will reflect the true population characteristic.

Sample Data, Precision, and Confidence in Estimation

Precision and confidence are important issues in sampling because when we use sample data to draw inferences about the population, we hope to be fairly "on target," and have some idea of the extent of possible error. Because a point estimate provides no measure of possible error, we do an interval estimation to ensure a *relatively accurate* estimation of the population parameter. Statistics that have the same distribution as the sampling distribution of the mean are used in this procedure, usually a z or a t statistic.

For example, we may want to estimate the mean dollar value of purchases made by customers when they shop at department stores. From a sample of 64 customers sampled through a systematic sampling design procedure, we may find that the sample mean $\bar{X} = 105$, and the sample standard deviation $S = 10$. $\bar{X}$, the sample mean, is a point estimate of μ, the population mean. We could construct a confidence interval around X to estimate the range within which μ will fall. The standard error $S_{\bar{X}}$ and the percentage or level of confidence we require will determine the width of the interval, which can be represented by the following formula, where K is the t statistic for the level of confidence desired.

$$\mu = X \pm KS$$

We already know that:

$$S_{\bar{X}} = \frac{S}{\sqrt{n}}$$

Here,

$$S_{\bar{X}} = \frac{10}{\sqrt{64}} = 1.25$$

From the table of critical values for t in any statistics book (see Table II, columns 5, 6, and 8, in the statistical tables given toward the end of this book), we know that:

For a 90% confidence level, the K value is 1.645.
For a 95% confidence level, the K value is 1.96.
For a 99% confidence level, the K value is 2.576.

If we desire a 90% confidence level in the above case, then $\mu = 105 \pm 1.645\,(1.25)$ (i.e., $\mu = 105 \pm 2.056$). μ thus falls between 102.944 and 107.056. These results indicate that using a sample size of 64, we could state with 90% confidence that the true population mean value of purchases for all customers would fall between \$102.94 and \$107.06. If we now want to be 99% confident of our results without increasing the sample size, we necessarily have to sacrifice precision, as may be seen from the following calculation: $\mu = 105 \pm 2.576\,(1.25)$. The value of μ now falls between 101.78 and 108.22. In other words, the width of the interval has increased and we are now less precise in estimating the population mean, though we are a lot more confident about our estimation. It is not difficult to see that if we want to maintain our original precision while increasing the confidence, or maintain the confidence level while increasing precision, or we want to increase both the confidence and the precision, we need a larger sample size.

In sum, the sample size, n, is a function of:

1. the variability in the population;
2. precision or accuracy needed;
3. confidence level desired; and
4. type of sampling plan used – for example, simple random sampling versus stratified random sampling.

Trade-Off Between Confidence and Precision

We have noted that if we want more precision, or more confidence, or both, the sample size needs to be increased – unless, of course, there is very little variability in the population itself. However, if the sample size (n) cannot be increased, for whatever reason – say, we cannot afford the costs of increased sampling – then, with the same n, the only way to maintain the same level of precision is to forsake the confidence with which we can predict our estimates. That is, we reduce the confidence level or the certainty of our estimate. This trade-off between precision and confidence is illustrated in Figures 13.5 (a) and (b). Figure 13.5 (a) indicates that 50% of the time the true mean will fall within the narrow range indicated in the figure, the 0.25 in each tail representing the 25% nonconfidence, or the probability of making errors, in our estimation on either side. Figure 13.5 (b) indicates that

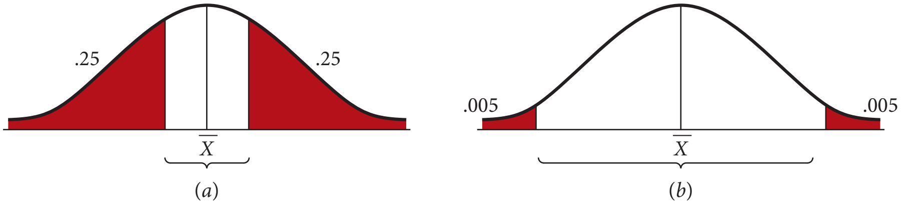


FIGURE 13.5

Illustration of the trade-off between precision and confidence. (a) More precision but less confidence; (b) more confidence but less precision.

99% of the time we expect the true mean μ to fall within the much wider range indicated in the figure and there is only a 0.005% chance that we are making an error in this estimation. That is, in Figure 13.5 (a), we have more precision but less confidence (our confidence level is only 50%). In Figure 13.5 (b), we have high confidence (99%), but then we are far from being precise – that is, our estimate falls within a broad interval range.

It thus becomes necessary for researchers to consider at least four aspects while making decisions on the sample size needed to do the research:

1. How much precision is really needed in estimating the population characteristics of interest – that is, what is the *margin* of allowable error?
2. How much confidence is really needed – that is, how much *chance* can we take of making errors in estimating the population parameters?
3. To what extent is there *variability* in the population on the characteristics investigated?
4. What is the *cost–benefit* analysis of increasing the sample size?

SAMPLE DATA AND HYPOTHESIS TESTING

So far we have discussed sample data as a means of estimating the population parameters, but sample data can also be used to test hypotheses about population values rather than simply to estimate population values. The procedure for this testing incorporates the same information as in interval estimation, but the goals behind the two methods are somewhat different.

Referring to the earlier example of the average dollar value purchases of customers in a department store, instead of trying to estimate the average purchase value of the store's customers with a certain degree of accuracy, let us say that we now wish to determine whether or not customers expend the same average amount in purchases in Department Store A as in Department Store B. From Chapter 5, we know that we should first set the null hypothesis, which will state that there is no difference in the dollar values expended by customers shopping at the two different stores. This is expressed as:

$$H_0 : \mu_A - \mu_B = 0$$

The alternate hypothesis of differences will be stated nondirectionally (since we have no idea whether customers buy more at Store A or Store B) as:

$$H_A : \mu_A - \mu_B \neq 0$$

If we take a sample of 20 customers from each of the two stores and find that the mean dollar value purchases of customers in Store A is 105 with a standard deviation of 10, and the corresponding figures for Store B are 100 and 15, respectively, we see that:

$$X_A - X_B = 105 - 100 = 5$$

whereas our null hypothesis had postulated no difference (difference = 0). Should we then conclude that our alternate hypothesis is to be accepted? We cannot say! To determine this we must first find the probability or likelihood of the two group means having a difference of 5 in the context of the null hypothesis or a difference of 0. This can be done by converting the difference in the sample means to a *t* statistic and seeing what the probability is of finding a *t* of that value. The *t* distribution has known probabilities attached to it (see Table II (*t* distribution) in the statistical tables given toward the end of the book). Looking at the *t* distribution table, we find that, with two samples of 20 each (the degrees of freedom become $\left(n_1 + n_2\right) - 2 = 38$), for the *t* value to be significant at the 0.05 level, the critical value should be around 2.021 (see *t* distribution table column 6 against *v*40). We need to use the two-tailed test since we do not know whether the difference between Store A and Store B will be positive or negative. For even a 90% probability, it should be at least 1.684 (see the number to the left of 2.021). The *t* statistic can be calculated for testing our hypothesis as follows:

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{S_{\bar{X}_1 - \bar{X}_2}}$$

$$S_{\bar{X}_1 - \bar{X}_2} = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{(n_1 + n_2 - 2)}\left(\frac{1}{n_1} + \frac{1}{n2}\right)}$$

$$= \sqrt{\frac{(20 \times 10^2) + (20 \times 15^2)}{20 + 20 - 2}\left(\frac{1}{20} + \frac{1}{20}\right)}$$

$$t = \frac{(\bar{X}_A - \bar{X}_B) - (\mu_A - \mu_B)}{4.136}$$

We already know that

$$\bar{X}_A - \bar{X}_B = 5 \text{ (the difference in the means of the two stores)}$$

and

$$\mu_A - \mu_B = 0 \text{ (from our null hypothesis)}$$

Then

$$t = \frac{5 - 0}{4.136} = 1.209$$

This *t* value of 1.209 is way below the value of 2.021 (for 40 degrees of freedom for a two-population *t*-test, the closest to the actual 38 degrees of freedom $[(20 + 20) - 2]$) required for the conventional 95% probability, and even for the 90% probability, which requires a value of 1.684. We can thus say that the difference of 5 that we found between the two stores is not significantly different from 0. The conclusion, then, is that there is no significant difference between how much customers buy (dollars expended) at Department Store A and Department Store B. We will thus accept the null hypothesis and reject the alternative.

Sample data can thus be used not only for estimating the population parameters, but also for testing hypotheses about population values, population correlations, and so forth, as we will see more fully in Chapter 15.

THE SAMPLE SIZE

Both sampling design and the sample size are important to establish the representativeness of the sample for generalizability. If the appropriate sampling design is not used, a large sample size will not, in itself, allow the findings to be generalized to the population. Likewise, unless the sample size is adequate for the desired level of precision and confidence, no sampling design, however sophisticated, will be useful to the researcher in meeting the objectives of the study. Hence, sampling decisions should consider both the sampling design and the sample size.

Determining the Sample Size

Now that we are aware of the fact that the sample size is governed by the extent of precision and confidence desired, how do we determine the sample size required for our research? The procedure can be illustrated through an example.

EXAMPLE

Suppose a manager wants to be 95% confident that the expected monthly withdrawals in a bank will be within a confidence interval of ±$500. Let us say that a study of a sample of clients indicates that the average withdrawals made by them have a standard deviation of $3500. What would be the sample size needed in this case?

We noted earlier that the population mean can be estimated by using the formula:

$$\mu = \bar{X} \pm K S_{\bar{X}}$$

Since the confidence level needed here is 95%, the applicable K value is 1.96 (t table). The interval estimate of ±$500 will have to encompass a dispersion of (1.96 × standard error). That is,

$$500 = 1.96 \times S_{\bar{X}} \bar{X}$$

We already know that:

$$S_{\bar{X}} = \frac{S}{\sqrt{n}}$$

$$255.10 = \frac{3500}{\sqrt{n}}$$

$$n = 188$$

The sample size indicated above is 188. However, let us say that this bank has a total clientele of only 185. This means we cannot sample 188 clients. We can, in this case, apply a correction formula and see what sample size would be needed to have the same level of precision and confidence given the fact that we have a total of only 185 clients. The correction formula is as follows:

$$S_{\bar{X}} = \frac{S}{\sqrt{n}} \times \sqrt{\frac{N-n}{N-1}}$$

where N is the total number of elements in the population, n is the sample size to be estimated, $S_{\bar{X}}$ is the standard error of the estimate of the mean, and S is the standard deviation of the sample mean.

Applying the correction formula, we find that:

$$255.10 = \frac{3500}{\sqrt{n}} \times \sqrt{\frac{185-n}{184}}$$

$$n = 94$$

We would now sample 94 of the total 185 clients.

To understand the impact of precision and/or confidence on the sample size, let us try changing the confidence level required in the bank withdrawal example, which needed a sample size of 188 for a confidence level of 95%. Let us say that the bank manager now wants to be 99% sure that the expected monthly withdrawals will be within the interval of ±$500. What will be the sample size now needed?

$S_{\bar{X}}$ will now be:

$$\frac{500}{2.576} = 194.099$$

$$194.099 = \frac{3500}{\sqrt{n}}$$

$$n = 325$$

The sample has now to be increased 1.73 times (from 188 to 325) to increase the confidence level from 95% to 99%!

Try calculating the sample size if the precision has to be narrowed down from $500 to $300 for a 95% and a 99% confidence level! Your answers should show the sample sizes needed as 523 and 902, respectively. These results dramatically highlight the costs of increased precision, confidence, or both. It is hence a good idea to think through how much precision and confidence one really needs, before determining the sample size for the research project.

So far we have discussed sample size in the context of precision and confidence with respect to one variable only. However, in research, the theoretical framework has several variables of interest, and the question arises as to how one should come up with a sample size when all the factors are taken into account. Krejcie and Morgan (1970) greatly simplified the size decision by providing a table that ensures a good decision model. Table 13.3 provides that generalized scientific guideline for sample size decisions. The interested student is advised to read Krejcie and Morgan (1970) as well as Cohen (1969) for decisions on sample size.

TABLE 13.3

Sample size for a given population size

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	180	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346

N	*S*	*N*	*S*	*N*	*S*
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10 000	370
150	108	750	254	15 000	375
160	113	800	260	20 000	377
170	118	850	265	30 000	379
180	123	900	269	40 000	380
190	127	950	274	50 000	381
200	132	1000	278	75 000	382
210	136	1100	285	1 000000	384

Sample size and Type II errors

Too large a sample size, (say, over 500) could become a problem inasmuch as we would then be prone to committing Type II errors. That is, we would accept the findings of our research, when in fact we should reject them. In other words, with too large a sample size, even weak relationships (say a correlation of 0.10 between two variables) might reach significance levels, and we would be inclined to believe that these significant relationships found in the sample were indeed true of the population, when in reality they may not be. Thus, neither too large nor too small sample sizes help research projects.

Statistical and practical significance

Another point to consider, even with the appropriate sample size, is whether statistical significance is more relevant than practical significance. For instance, a correlation of 0.25 may be statistically significant, but since this explains only about 6% of the variance (0.25^2), how meaningful is it in terms of practical utility?

Rules of thumb

Roscoe (1975) proposes the following rules of thumb for determining sample size:

1. Sample sizes larger than 30 and less than 500 are appropriate for most research.
2. Where samples are to be broken into subsamples (males/females, juniors/seniors, etc.), a minimum sample size of 30 for each category is necessary.
3. In multivariate research (including multiple regression analyses), the sample size should be several times (preferably ten times or more) as large as the number of variables in the study.
4. For simple experimental research with tight experimental controls (matched pairs, etc.), successful research is possible with samples as small as 10 to 20 in size.

Efficiency In Sampling

Efficiency in sampling is attained when, for a given level of precision (standard error), the sample size could be reduced, or for a given sample size (n), the level of precision could be increased. Some probability sampling designs are more efficient than others. The simple random sampling procedure is not always the most efficient plan to adopt; some other probability sampling designs are often more efficient. A stratified random sampling plan is often the most efficient, and a disproportionate stratified random sampling design has been shown to be more efficient than a proportionate sampling design in many cases. Cluster sampling is less efficient than simple random sampling because there is generally more homogeneity among the subjects in the clusters than is found in the elements in the population. Multistage cluster sampling is more efficient than single-stage cluster sampling when there is more heterogeneity found in the earlier stages. There is often a trade-off between time and cost efficiencies (as achieved in nonprobability sampling designs) and precision efficiencies (as achieved in many probability sampling plans). The choice of a sampling plan thus depends on the objectives of the research, as well as on the extent and nature of efficiency desired.

BOX 13.5

SAMPLING ISSUES IN ONLINE RESEARCH

When conducting online surveys, researchers often encounter problems with respect to sampling (Wright, 2005). Establishing a sampling frame when researching an online community presents a real challenge. Unlike membership-based organizations, many online communities, such as community bulletin boards and chat rooms, do not typically provide participant email addresses. Membership is based on common interests and little information is required when registering to use these communities, if registration is required at all (Andrews, Nonnecke, and Preece, 2003; Couper, 2000). Due to the *lack of an adequate sampling frame*, many online survey invitations are published in the form of a link on websites or in other media, which leads to non-probability samples and in many cases to sample selection bias. *Self-selection* bias is a major limitation of online survey research. In any given online community, there are individuals who are more likely than others to complete an online survey. The tendency of some individuals to respond to an invitation to participate in an online survey, while others ignore it, may lead to a systematic bias. Finally, the *response rates* of online surveys are generally very low. These sampling issues in online research often hinder researchers' ability to generalize their findings.

SAMPLING AS RELATED TO QUALITATIVE STUDIES

Sampling for qualitative research is as important as sampling for quantitative research. Qualitative sampling begins with precisely defining the *target population*. As a sampling technique, qualitative research generally uses *nonprobability sampling* as it does not aim to draw statistical inference. *Purposive sampling* is one technique that is often employed in qualitative investigation: subjects are selected on the basis of expertise in the subject that is being investigated. It is important that the subjects are chosen in such a way that they reflect the diversity of the population.

One form of purposive sampling is *theoretical sampling*, introduced by Glaser and Strauss (1967) in their work on grounded theory. The term **grounded theory** expresses the idea that theory will emerge from data through an iterative process that involves repeated sampling, collection of data, and analysis of data until "theoretical saturation" is reached. *Theoretical saturation* is reached when no new information about the subject emerges in repeated cases. Theoretical sampling may or may not begin with purposive sampling, but the sampling of additional subjects is directed by the emerging theoretical framework. According to Glaser, theoretical sampling takes place when "the analyst jointly collects, codes, and analyzes his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges" (1978, p. 36).

Because it is impossible to predict when theoretical saturation is reached, you cannot determine how many subjects will need to be sampled at the beginning of your study. Instead, the general rule in qualitative research is that you continue to sample until you are not getting any new information or are no longer gaining new insights. Note that the sample size will, therefore, at least partly, depend on the heterogeneity of the population.

BOX 13.6

SAMPLING IN CROSS-CULTURAL RESEARCH

Just as in instrument development and data collection, while engaging in cross-cultural research one has to be sensitive to the issue of selecting matched samples in the different countries. The nature and types of organizations studied, whether subjects are from rural or urban areas, and the types of sampling design used, should all be similar in the different countries to enable true comparisons.

MANAGERIAL IMPLICATIONS

Awareness of sampling designs and sample size helps managers to understand why a particular method of sampling is used by researchers. It also facilitates understanding of the cost implications of different designs, and the trade-off between precision and confidence vis-à-vis the costs. This enables managers to understand the risk they take in implementing changes based on the results of the research study. While reading research reports or journal articles, this knowledge also helps managers to assess the generalizability of the findings and analyze the implications of trying out the recommendations made therein in their own system.

SUMMARY

- **Learning objective 1: Define sampling, sample, population, element, sampling unit, and subject.**
  In learning how representative data can be collected, a few terms have to be understood. The population refers to the entire group of people, events, or things of interest that the researcher wishes to investigate. An element is a single member of the population. A sample is a subset of the population. The sampling unit is the element or set of elements that is available for selection in some stage of the sampling process. A subject is a single member of the sample, just as an element is a single member of the population.

- **Learning objective 2: Discuss statistical terms in sampling.**
  Sampling units provide the researcher with *responses*. When researchers examine the responses they get for their entire sample, they make use of *statistics*. The characteristics of the population are referred to as its *parameters*. When the properties of the population are not overrepresented or underrepresented in the sample, we have a representative sample.

- **Learning objective 3: Describe and discuss the sampling process.**
  Sampling is the *process* of selecting a sufficient number of the right elements from the population, so that a study of the sample and an understanding of its properties make it possible for the researcher to generalize such properties to the population elements. The major steps in sampling include: (1) defining the population; (2) determining the sample frame; (3) determining the sampling design; (4) determining the appropriate sample size; and (5) executing the sampling process.

- **Learning objective 4: Compare and contrast specific probability sampling designs.**
  In probability sampling, elements in the population have a known, nonzero chance of being chosen as subjects in the sample. Probability sampling can be either unrestricted (simple random sampling) or restricted (complex probability sampling) in nature.

- **Learning objective 5: Compare and contrast specific nonprobability sampling designs.**
  In nonprobability sampling designs, the elements in the population do not have any probabilities attached to their being chosen as sample subjects. This means that the findings from the study of the sample cannot be confidently generalized to the population. There are two main types of nonprobability sampling design: convenience sampling and purposive sampling.

- **Learning objective 6: Discuss precision and confidence and the trade-off between precision and confidence.**
  A reliable and valid sample enables the researcher to generalize the findings from the sample to the population under study. That is why sample statistics should be reliable estimates and reflect the population parameters as closely as possible. Precision and confidence are important issues in sampling because sample data are used to draw inferences about the population; one hopes to be pretty "on target." Precision and confidence are related to sample size: if one wants to maintain the original precision while increasing the confidence, or maintain the confidence level while increasing precision, or one wants to increase both the confidence and the precision, one needs a larger sample size.

- **Learning objective 7: Discuss how hypotheses can be tested with sample data.**
  Sample data can thus be used not only for estimating the population parameters, but also for testing hypotheses. We will have more to say about this in Chapter 15.

- **Learning objective 8: Discuss the factors to be taken into consideration for determining sample size and determine the sample size for any given research project.**
  It is a good idea to think through how much precision and confidence one really needs, before determining the sample size for the research project. Too large a sample size could become a problem inasmuch as we would then be prone to committing Type II errors. Efficiency in sampling is attained when, for a given level of precision (standard error), the sample size could be reduced, or for a given sample size (*n*), the level of precision could be increased.

- **Learning objective 9: Discuss sampling in qualitative research.**
  Qualitative sampling begins with precisely defining the *target population*. Qualitative research generally uses *nonprobability sampling* as it does not aim to draw statistical inference. *Purposive sampling* is one technique that is often employed in qualitative research. It is important that the subjects are chosen in such a way that

they reflect the diversity of the population. One form of purposive sampling is *theoretical sampling*. Because it is impossible to predict when theoretical saturation is reached, it is impossible to determine how many subjects will need to be sampled at the beginning of one's study.

- **Learning objective 10: Discuss the role of the manager in sampling.**
  Awareness of sampling designs and sample size decisions helps managers to understand why particular methods of sampling are used by researchers. In the next two chapters, we will see how the data gathered from a sample of respondents in the population are analyzed to test the hypotheses generated and find answers to the research questions. It facilitates understanding of the cost implications of different designs, and the trade-off between precision and confidence in relation to the costs. It enables managers to understand the risk they take in implementing changes based on the results of a research study. Finally, it helps managers to assess the generalizability of the findings of a study.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: Banks start image repair over financial crisis**.

DISCUSSION QUESTIONS

1. Identify the relevant population for the following research foci, and suggest the appropriate sampling design to investigate the issues, explaining *why* they are appropriate. Wherever necessary, identify the sampling frame as well.
   - **a.** A company wants to investigate the initial reactions of heavy soft-drink users to a new "all natural" soft drink.
   - **b.** A hospital administrator wants to find out if the single parents working in the hospital have a higher rate of absenteeism than parents who are not single.
   - **c.** A researcher would like to assess the extent of pilferage in the materials storage warehouses of manufacturing firms.
   - **d.** The director of human resources wants to investigate the relationship between drug abuse and dysfunctional behavior of blue-collar workers in a particular plant.
   - **e.** A marketer wants to generate some ideas on how women differ from men in acquiring product knowledge about cars.
2. **a.** Explain why cluster sampling is a probability sampling design.
   - **b.** What are the advantages and disadvantages of cluster sampling?
   - **c.** Describe a situation where you would consider the use of cluster sampling.

3. **a.** Explain what precision and confidence are and how they influence sample size.
   b. Discuss what is meant by the statement: "There is a trade-off between precision and confidence under certain conditions."
4. The use of a convenience sample used in organizational research is correct because all members share the same organizational stimuli and go through almost the same kinds of experience in their organizational life. Comment.
5. "Use of a sample of 5000 is not necessarily better than one of 500." How would you react to this statement?
6. Nonprobability sampling designs ought to be preferred to probability sampling designs in some cases. Explain with an example.
7. Because there seems to be a trade-off between accuracy and confidence for any given sample size, accuracy should always be considered more important than precision. Explain with reasons why you do or do not agree.
8. Overgeneralizations give rise to much confusion and other problems for researchers who try to replicate the findings. Explain what is meant by this.
9. Double sampling is probably the least used of all sampling designs in organizational research. Do you agree? Provide reasons for your answer.
10. Why do you think the sampling design should feature in a research proposal?

Now do Exercises 13.1, 13.2, 13.3, 13.4, 13.5, and 13.6.

For the situations presented in Exercises 13.1 to Exercise 13.6 below, indicate what would be the relevant population and the most appropriate sampling design. Make sure you discuss the reasons for your answers.

EXERCISE 13.1

A medical inspector wants to estimate the overall average monthly occupancy rates of the cancer wards in 80 different hospitals that are evenly located in the northwestern, southeastern, central, and southern suburbs of New York City.

EXERCISE 13.2

A magazine article suggested that "Consumers aged 35 to 44 will soon be the nation's biggest spenders, so advertisers must learn how to appeal to this over-the-thrill crowd." If this suggestion appeals to an apparel manufacturer, what should the sampling design be to assess the tastes of this group?

EXERCISE 13.3

The McArthur Co. produces special vacuum cleaners for conveniently cleaning the inside of cars. About a thousand of these, with stamped serial numbers, are produced every month and stored serially in a stockroom. Once a month an inspector does a quality control check on 50 of these. When he certifies them as to quality, the units are released from the stockroom for sale. The production and sales managers, however, are not satisfied with the quality control check since, quite often, many of the units sold are returned by customers because of various types of defect. What would be the most useful sampling plan to test the 50 units?

EXERCISE 13.4

A consultant had administered a questionnaire to some 285 employees using a simple random sampling procedure. As she looked at the responses, she suspected that two questions might not have been clear to the respondents. She would like to know if her suspicion is well-founded.

EXERCISE 13.5

The executive board of a relatively small university located in Europe wants to determine the attitude of their students toward various aspects of the university. The university, founded in 1928, is a fully accredited government-financed university with 11 000 students. The university specializes in the social sciences and humanities and has five faculties, six service departments, eight research centers, and two graduate schools. The executive board has asked you to come up with a sampling plan. Develop a sampling plan and pay attention to the following aspects: target population, the sampling frame, the sample technique, and the sample size.

EXERCISE 13.6

T-Mobile is a mobile network operator headquartered in Bonn, Germany. The company has enlisted your help as a consultant to develop and test a model on the determinants of subscriber churn in the German mobile telephone market. Develop a sampling plan and pay specific attention to the following aspects.

Define the target population. Discuss in as much detail as possible the sampling frame and the sampling design that you would use. Give reasons for your choice.

CHAPTER 14

Quantitative data analysis

LEARNING OBJECTIVES

After completing Chapter 14 you should be able to:

1. Demonstrate the ability to get data ready for quantitative analysis.
2. Describe the various processes by which one can get a feel for the data in a study.
3. Describe the means by which the reliability and validity of measures can be assessed.

INTRODUCTION

After quantitative data have been collected from a representative sample of the population, the next step is to analyze them to answer our research questions. However, before we can start analyzing the data, some preliminary steps need to be completed. These help to ensure that the data are accurate, complete, and suitable for further analysis. This chapter addresses these preliminary steps in detail. Subsequently, general guidelines are provided for calculating and displaying basic descriptive statistics.

The easiest way to illustrate data analysis is through a case. We will therefore introduce the Excelsior Enterprises case first.

EXAMPLE

Excelsior Enterprises is a medium-sized company, manufacturing and selling instruments and supplies needed by the health care industry, including blood pressure instruments, surgical instruments, dental accessories, and so on. The company, with a total of 360 employees working three shifts, is doing reasonably well but could do far better if it did not experience employee turnover at almost all levels and in all departments. The president of the company called in a research team to study the situation and to make recommendations on the turnover problem.

Since access to those who had left the company would be difficult, the research team suggested to the president that they talk to the current employees and, based on their input and a literature survey, try to get at the factors influencing employees' intentions to stay with, or leave, the company. Since past research has shown that intention to leave (ITL) is an excellent predictor of actual turnover, the president concurred.

The team first conducted an unstructured interview with about 50 employees at various levels and from different departments. Their broad statement was: "We are here to find out how you experience your work life. Tell us whatever you consider is important for you in your job, as issues relate to your work, the environment, the organization, supervision, and whatever else you think is relevant. If we get a good handle on the issues involved, we may be able to make appropriate recommendations to management to enhance the quality of your work life. We would just like to talk to you now, and administer a questionnaire later."

Each interview typically lasted about 45 minutes, and notes on the responses were written down by the team members. When the responses were tabulated, it became clear that the issues most frequently brought up by the respondents, in one form or another, related to three main areas: the job (employees said the jobs were dull or too complex; there was lack of freedom to do the job as one wanted to, etc.), perceived inequities (remarks such as "I put much more in my work than I get out of it"); and burnout (comments such as "there is so much work to be done that by the end of the day we are physically and emotionally exhausted"; "we feel the frequent need to take time off because of exhaustion"; etc.).

A literature survey confirmed that these variables were good predictors of intention to leave and subsequent turnover. In addition, job satisfaction was also found to be an important predictor of intention to leave. A theoretical framework was developed based on the interviews and the literature survey, and four hypotheses (stated later) were developed.

Next, a questionnaire was designed incorporating well-validated and reliable measures for job enrichment, perceived equity, burnout, job satisfaction, and intention to leave. Perceived equity was measured by five survey items: (1) "I invest more in my work than I get out of it"; (2) "I exert myself too much considering what I get back in return"; (3) "For the efforts I put into the organization, I get much in return" (reversed); (4) "If I take into account my dedication, the company ought to give me better training"; and (5) "In general, the benefits I receive from the organization outweigh the effort I put in it" (reversed). Job enrichment was measured on a four-item Likert scale: (1) "The job is quite simple and repetitive" (reversed); (2) "The job requires me to use a number of complex or higher-level skills"; (3) "The job requires a lot of cooperative work with other people"; and (4) "The job itself is not very significant or important in the broader scheme of things" (reversed). Participants responded to these items on a five-point scale, ranging from "I disagree completely" (1) to "I agree completely" (5). Burnout was measured with *The Burnout Measure Short Version* (*BMS*). The *BMS* includes ten items that measure levels of physical, emotional, and mental exhaustion of the individual. Respondents are asked to rate the frequency with which they experience each of the items appearing in the questionnaire (e.g., being tired or helpless) on a scale ranging from 1 ("never") to 5 ("always"). Job satisfaction was measured by a single-item rating of "satisfaction with your current job," using a five-point "not at all–very much" scale. Intention to leave was measured using two survey items: "With what level of certainty do you intend to leave this organization within the next year for another type of job?" (item 1) "for a similar type of job?" (item 2). Participants indicated on a four-point rating scale their level of certainty. Demographic variables such as age, education, gender, tenure, department, and work shift were also included in the questionnaire.

The questionnaire was administered personally to 174 employees who were chosen on a disproportionate stratified random sampling basis. The responses were entered into the computer. Thereafter, the data were submitted for analysis to test the following hypotheses, which were formulated by the researchers:

H_1: *Job enrichment has a negative effect on intention to leave.*

H_2: *Perceived equity has a negative effect on intention to leave.*

H_3: *Burnout has a positive effect on intention to leave.*

H_4: *Job satisfaction mediates the relationship between job enrichment, perceived equity, and burnout on intention to leave.*

It may be pertinent to point out here that the four hypotheses derived from the theoretical framework are particularly relevant for finding answers to the turnover issue. The results of testing the hypotheses will certainly offer insights into how much of the variance in intention to leave can be explained by the independent variables, and what corrective action, if any, needs to be taken.

GETTING THE DATA READY FOR ANALYSIS

After data are obtained through questionnaires, they need to be coded, keyed in, and edited. That is, a categorization scheme has to be set up before the data can be typed in. Then, outliers, inconsistencies, and blank responses, if any, have to be handled in some way. Each of these stages of data preparation is discussed below.

Coding and data entry

The first step in data preparation is data coding. **Data coding** involves assigning a number to the participants' responses so they can be entered into a database. In Chapter 9, we discussed the convenience of electronic surveys for collecting questionnaire data; such surveys facilitate the entry of the responses directly into the computer without manual keying in of the data. However, if, for whatever reason, this cannot be done, then it is perhaps a good idea to use a coding sheet first to transcribe the data from the questionnaire and then key in the data. This method, in contrast to flipping through each questionnaire for each item, avoids confusion, especially when there are many questions and a large number of questionnaires as well.

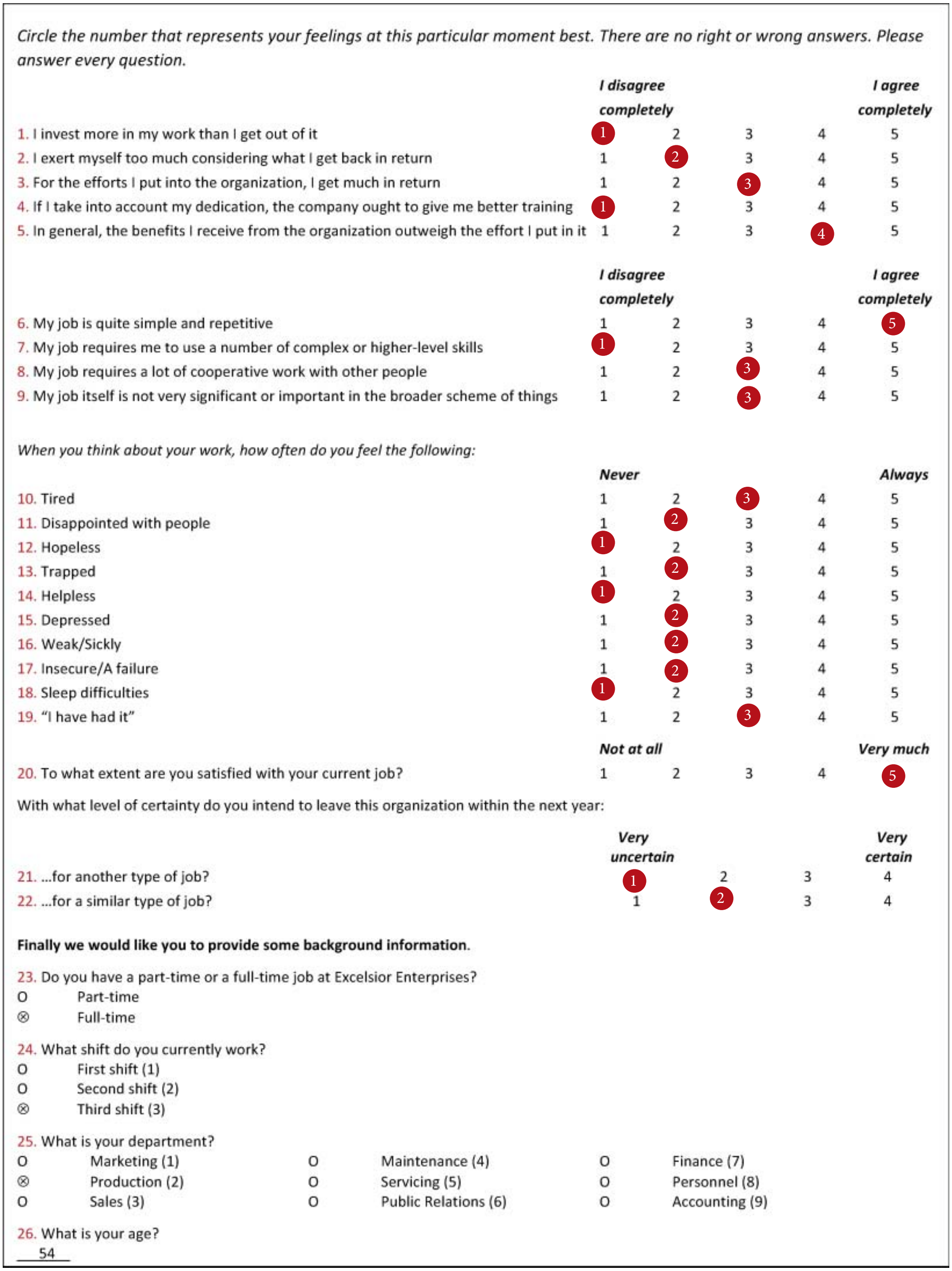
Coding the responses

In the Excelsior Enterprises questionnaire, we have 22 items measuring perceived equity, job enrichment, burnout, job satisfaction, and intention to leave, and six demographic variables, as shown in Figure 14.1, a sample questionnaire.

The responses of this particular employee (participant #1 in the data file) to the first 22 questions can be coded by using the actual number circled by the respondent (1, 2, 3, 1, 4, 5, 1, 3, 3, etc.). Coding the demographic variables is somewhat less obvious. For instance, tenure is a special case, because it is a two-category variable. It is possible to use a coding approach that assigns a 1 = part-time and a 2 = full-time. However, using 0 = part-time and 1 = full-time (this is called *dummy coding*) is by far the most popular and recommended approach because it makes our lives easier in the data analysis stage. Hence, we code tenure (full-time) with 1 for participant #1. Work shift (third shift) can be coded 3, department (production) 2, and age 54. Gender can be coded 0 (male) Finally, education (less than high school) can be coded 1.

At this stage you should also think about how you want to code nonresponses. Some researchers leave nonresponses blank, others assign a "9," a "99" or a "." All the approaches are fine, as long as you code all the nonresponses in the same way.

Human errors can occur while coding. At least 10% of the coded questionnaires should therefore be checked for coding accuracy. Their selection may follow a systematic sampling procedure. That is, every *n*th form coded could be verified for accuracy. If many errors are found in the sample, all items may have to be checked.



Circle the number that represents your feelings at this particular moment best. There are no right or wrong answers. Please answer every question.

	I disagree completely				***I agree completely***
1. I invest more in my work than I get out of it	[✓ 1]	2	3	4	5
2. I exert myself too much considering what I get back in return	1	[✓ 2]	3	4	5
3. For the efforts I put into the organization, I get much in return	1	2	[✓ 3]	4	5
4. If I take into account my dedication, the company ought to give me better training	[✓ 1]	2	3	4	5
5. In general, the benefits I receive from the organization outweigh the effort I put in it	1	2	3	[✓ 4]	5

	I disagree completely				***I agree completely***
6. My job is quite simple and repetitive	1	2	3	4	[✓ 5]
7. My job requires me to use a number of complex or higher-level skills	[✓ 1]	2	3	4	5
8. My job requires a lot of cooperative work with other people	1	2	[✓ 3]	4	5
9. My job itself is not very significant or important in the broader scheme of things	1	2	[✓ 3]	4	5

When you think about your work, how often do you feel the following:

	Never				***Always***
10. Tired	1	2	[✓ 3]	4	5
11. Disappointed with people	1	[✓ 2]	3	4	5
12. Hopeless	[✓ 1]	2	3	4	5
13. Trapped	1	[✓ 2]	3	4	5
14. Helpless	[✓ 1]	2	3	4	5
15. Depressed	1	[✓ 2]	3	4	5
16. Weak/Sickly	1	[✓ 2]	3	4	5
17. Insecure/A failure	1	[✓ 2]	3	4	5
18. Sleep difficulties	[✓ 1]	2	3	4	5
19. "I have had it"	1	2	[✓ 3]	4	5

	Not at all				***Very much***
20. To what extent are you satisfied with your current job?	1	2	3	4	[✓ 5]

With what level of certainty do you intend to leave this organization within the next year:

	Very uncertain			***Very certain***
21. ...for another type of job?	[✓ 1]	2	3	4
22. ...for a similar type of job?	1	[✓ 2]	3	4

Finally we would like you to provide some background information.

23. Do you have a part-time or a full-time job at Excelsior Enterprises?
○ Part-time
⊗ Full-time

24. What shift do you currently work?
○ First shift (1)
○ Second shift (2)
⊗ Third shift (3)

25. What is your department?
○ Marketing (1)
⊗ Production (2)
○ Sales (3)
○ Maintenance (4)
○ Servicing (5)
○ Public Relations (6)
○ Finance (7)
○ Personnel (8)
○ Accounting (9)

26. What is your age?
54

FIGURE 14.1

Sample questionnaire

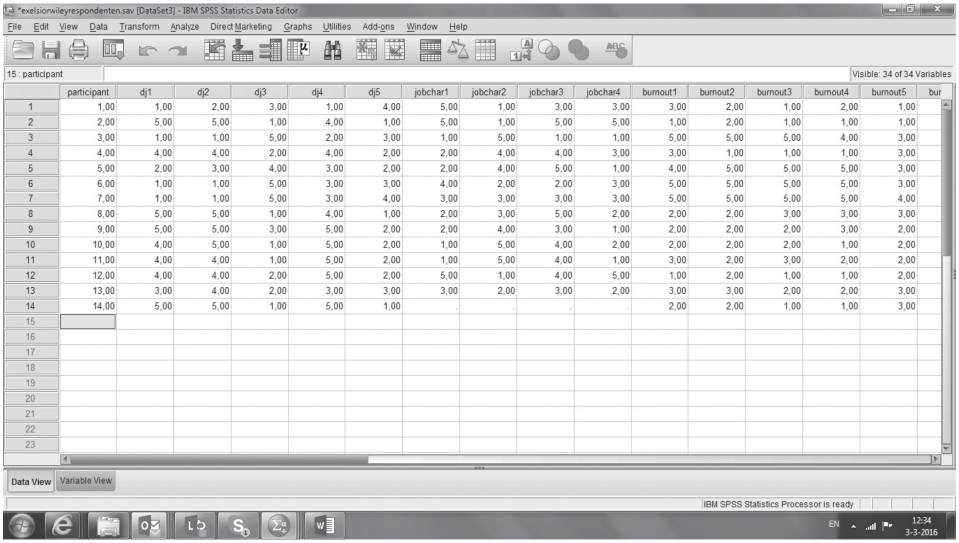
27. What is your gender
⊗ Male
O Female

28. What is the highest level of education you have completed?
⊗ Less than High School (1)
O High School/GED Equivalent (2)
O College Degree (3)
O Masters Degree (4)
O Doctoral Degree (5)

THIS WAS THE FINAL QUESTION OF THIS QUESTIONNAIRE.
THANK YOU VERY MUCH FOR YOUR COOPERATION!

FIGURE 14.1

(*Continued*)


*exelsiorwileyrespondenten.sav [DataSet3] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
15 : participant
Visible: 34 of 34 Variables
Data View
Variable View
IBM SPSS Statistics Processor is ready
EN
12:34
3-3-2016

	participant	dj1	dj2	dj3	dj4	dj5	jobchar1	jobchar2	jobchar3	jobchar4	burnout1	burnout2	burnout3	burnout4	burnout5	bur
1	1,00	1,00	2,00	3,00	1,00	4,00	5,00	1,00	3,00	3,00	3,00	2,00	1,00	2,00	1,00	
2	2,00	5,00	5,00	1,00	4,00	1,00	5,00	1,00	5,00	5,00	1,00	2,00	1,00	1,00	1,00	
3	3,00	1,00	1,00	5,00	2,00	3,00	1,00	5,00	1,00	1,00	5,00	5,00	5,00	4,00	3,00	
4	4,00	4,00	4,00	2,00	4,00	2,00	2,00	4,00	4,00	3,00	3,00	1,00	1,00	1,00	3,00	
5	5,00	2,00	3,00	4,00	3,00	2,00	2,00	4,00	5,00	1,00	4,00	5,00	5,00	5,00	3,00	
6	6,00	1,00	1,00	5,00	3,00	3,00	4,00	2,00	2,00	3,00	5,00	5,00	5,00	5,00	3,00	
7	7,00	1,00	1,00	5,00	3,00	4,00	3,00	3,00	3,00	3,00	5,00	5,00	5,00	5,00	4,00	
8	8,00	5,00	5,00	1,00	4,00	1,00	2,00	3,00	5,00	2,00	2,00	2,00	3,00	3,00	3,00	
9	9,00	5,00	5,00	3,00	5,00	2,00	2,00	4,00	3,00	1,00	2,00	2,00	2,00	3,00	2,00	
10	10,00	4,00	5,00	1,00	5,00	2,00	1,00	5,00	4,00	2,00	2,00	2,00	2,00	1,00	2,00	
11	11,00	4,00	4,00	1,00	5,00	2,00	1,00	5,00	4,00	1,00	3,00	2,00	3,00	2,00	2,00	
12	12,00	4,00	4,00	2,00	5,00	2,00	5,00	1,00	4,00	5,00	1,00	2,00	1,00	1,00	2,00	
13	13,00	3,00	4,00	2,00	3,00	3,00	3,00	2,00	3,00	2,00	3,00	3,00	2,00	2,00	3,00	
14	14,00	5,00	5,00	1,00	5,00	1,00	.	.	.	.	2,00	2,00	1,00	1,00	3,00	
15																
16																
17																
18																
19																
20																
21																
22																
23																

FIGURE 14.2

The SPSS Data Editor

Data entry

After responses have been coded, they can be entered into a database. Raw data can be entered through any software program. For instance, the SPSS Data Editor, which looks like a spreadsheet and is shown in Figure 14.2, can enter, edit, and view the contents of the data file.

Each row of the editor represents a case or observation (in this case a participant of our study – 174 in the Excelsior Enterprises study), and each column represents a *variable* (here variables are defined as the different items of information that you collect for your cases; there are thus 28 variables in the Excelsior Enterprises questionnaire).

It is important to always use the first column for identification purposes; assign a number to every questionnaire, write this number on the first page of the questionnaire, and enter this number in the first column of your data file. This allows you to compare the data in the data file with the answers of the participants, even after you have rearranged your data file.

Then, start entering the participants' responses into the data file.

Editing data

After the data are keyed in, they need to be edited. For instance, the blank responses, if any, have to be handled in some way, and inconsistent data have to be checked and followed up. **Data editing** deals with detecting and correcting illogical, inconsistent, or illegal data and omissions in the information returned by the participants of the study.

An example of an *illogical response* is an **outlier** response. An outlier is an observation that is substantially different from the other observations. An outlier is not always an error even though data errors (entry errors) are a likely source of outliers. Because outliers have a large impact on the research results they should be investigated carefully to make sure that they are correct. You can check the dispersion of nominal and/or ordinal variables by obtaining minimum and maximum values and frequency tables. This will quickly reveal the most obvious outliers. For interval and ratio data, visual aids (such as a scatterplot or a boxplot) are good methods to check for outliers.

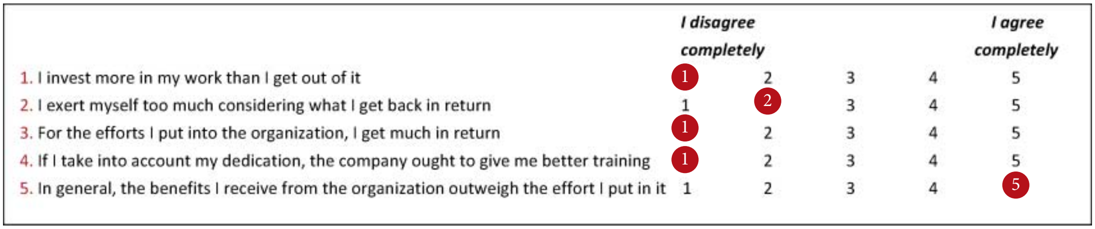
Inconsistent responses are responses that are not in harmony with other information. For instance, a participant in our study might have answered the perceived equity statements as in Figure 14.3. Note that all the answers of this employee indicate that the participant finds that the benefits she receives from the organization balance the efforts she puts into her job, except for the answer to the third statement. From the other four responses we might infer that the participant in all probability feels that, for the efforts she puts into the organization, she *does* get much in return and has made a mistake in responding to this particular statement. The response to this statement could then be edited by the researcher.

It is, however, possible that the respondent deliberately indicated that she does not get much in return for the efforts she puts into the organization. If such were to be the case, we would be introducing a bias by editing the data. Hence, great care has to be taken in dealing with inconsistent responses such as these. Whenever possible, it is desirable to follow up with the respondent to get the correct data, even though this is an expensive solution.

Illegal codes are values that are not specified in the coding instructions. For example, a code of "6" in question 1 (I invest more in my work than I get out of it) would be an illegal code. The best way to check for illegal codes is to have the computer produce a frequency distribution and check it for illegal codes.

Not all respondents answer every item in the questionnaire. *Omissions* may occur because respondents did not understand the question, did not know the answer, or were not willing to answer the question.

If a substantial number of questions – say, 25% of the items in the questionnaire – have been left unanswered, it may be a good idea to throw out the questionnaire and not include it in the data set for analysis. In this event, it is important to mention the number of returned but unused responses due to excessive missing data in the final report submitted to the sponsor of the study. If, however, only two or three items



	I disagree completely				*I agree completely*
1. I invest more in my work than I get out of it	[✓ 1]	2	3	4	5
2. I exert myself too much considering what I get back in return	1	[✓ 2]	3	4	5
3. For the efforts I put into the organization, I get much in return	[✓ 1]	2	3	4	5
4. If I take into account my dedication, the company ought to give me better training	[✓ 1]	2	3	4	5
5. In general, the benefits I receive from the organization outweigh the effort I put in it	1	2	3	4	[✓ 5]

FIGURE 14.3

Example of a possible inconsistent answer are left blank in a questionnaire with, say, 30 or more items, we need to decide how these blank responses are to be handled.

One way to handle a blank response is to ignore it when the analyses are done. This approach is possible in all statistical programs and is the default option in most of them. A disadvantage of this approach is that, of course, it will reduce the sample size, sometimes even to an inappropriate size, whenever that particular variable is involved in the analyses. Moreover, if the missing data are not missing completely at random, this method may bias the results of your study. For this reason, ignoring the blank responses is best suited to instances in which we have gathered a large amount of data, the number of missing data is relatively small, and relationships are so strong that they are not affected by the missing data (Hair, Anderson, Tatham & Black, 1995).

An alternative solution would be to look at the participant's pattern of responses to other questions and, from these answers, deduce a logical answer to the question for the missing response. A second alternative solution would be to assign to the item the mean value of the responses of all those who have responded to that particular item. In fact, there are many ways of handling blank responses (see Hair *et al.*, 1995), each of them having its own particular advantages and disadvantages.

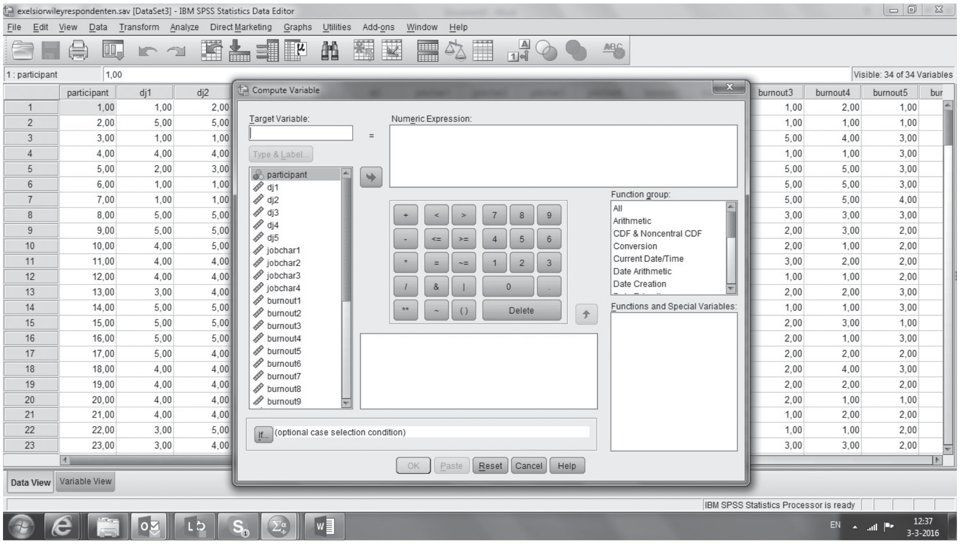
Note that if many of the respondents have answered "don't know" to a particular item or items, further investigation may well be worth while. The question might not have been clear or, for some reason, participants could have been reluctant or unable to answer the question.

Data transformation

Data transformation, a variation of data coding, is the process of changing the original numerical representation of a quantitative value to another value. Data are typically changed to avoid problems in the next stage of the data analysis process. For example, economists often use a logarithmic transformation so that the data are more evenly distributed. If, for instance, income data, which are often unevenly distributed, are reduced to their logarithmic value, the high incomes are brought closer to the lower end of the scale and provide a distribution closer to a normal curve.

Another type of data transformation is reverse scoring. Take, for instance, the perceived inequity measure of the Excelsior Enterprises case. Perceived inequity is measured by five survey items: (1) "I invest more in my work than I get out of it"; (2) "I exert myself too much considering what I get back in return"; (3) "For the efforts I put into the organization, I get much in return" (reversed); (4) "If I take into account my dedication, the organization ought to give me a better practical training"; and (5) "In general, the benefits I receive from the organization outweigh the effort I put in" (reversed). For the first, second, and fourth items, a score indicating high agreement would be negative, but for the third and fifth questions, a score indicating high agreement would be positive. To maintain consistency in the meaning of a response, the first, second, and fourth items have to be reverse scored (note that we are measuring equity and not inequity). In this case, a 5 ("I completely agree") would be transformed to a 1 ("I completely disagree"), a 4 to a 2, and so forth.

Data transformation is also necessary when several questions have been used to measure a single concept. In such cases, scores on the original questions have to be combined into a single score (but only *after* we have established that the interitem consistency is satisfactory (see Testing goodness of data, later on in this chapter). For instance, because five items have been used to measure the concept "perceived equity", a new "perceived equity" score has to be calculated from the scores on the five individual items (but only after items 1, 2, and 4 have been reverse coded). This involves calculating the summed score (per case/participant) and then dividing it by the number of items (five in this case). For example, our employee #1 has circled, respectively, 1, 2, 3, 1, and 4 on the five participation in decision-making questions; his (employee #1 is a man) scores on the items, once items 1, 2, and 4 have been reverse coded, are 5, 4, 3, 5, and 4. The combined score on perceived equity would be $5 + 4 + 3 + 5 + 4 = 21/5 = 4.2$). This combined score is included in a new column in SPSS. It is easy to compute the new variables, using the *Compute* dialog box, which opens when the *Transform* icon is chosen (Figure 14.4).


exelsiorwileyrespondenten.sav [DataSet3] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
1 : participant 1,00
Visible: 34 of 34 Variables
Compute Variable
Target Variable:
=
Numeric Expression:
Type & Label...
participant
dj1
dj2
dj3
dj4
dj5
jobchar1
jobchar2
jobchar3
jobchar4
burnout1
burnout2
burnout3
burnout4
burnout5
burnout6
burnout7
burnout8
burnout9
+ < > 7 8 9
- <= >= 4 5 6
* = ~= 1 2 3
/ & | 0 .
** ~ ( ) Delete
Function group:
All
Arithmetic
CDF & Noncentral CDF
Conversion
Current Date/Time
Date Arithmetic
Date Creation
Functions and Special Variables:
If... (optional case selection condition)
OK Paste Reset Cancel Help
Data View Variable View
IBM SPSS Statistics Processor is ready
EN
12:37
3-3-2016

	participant	dj1	dj2	burnout3	burnout4	burnout5
1	1,00	1,00	2,00	1,00	2,00	1,00
2	2,00	5,00	5,00	1,00	1,00	1,00
3	3,00	1,00	1,00	5,00	4,00	3,00
4	4,00	4,00	4,00	1,00	1,00	3,00
5	5,00	2,00	3,00	5,00	5,00	3,00
6	6,00	1,00	1,00	5,00	5,00	3,00
7	7,00	1,00	1,00	5,00	5,00	4,00
8	8,00	5,00	5,00	3,00	3,00	3,00
9	9,00	5,00	5,00	2,00	3,00	2,00
10	10,00	4,00	5,00	2,00	1,00	2,00
11	11,00	4,00	4,00	3,00	2,00	2,00
12	12,00	4,00	4,00	1,00	1,00	2,00
13	13,00	3,00	4,00	2,00	2,00	3,00
14	14,00	5,00	5,00	1,00	1,00	3,00
15	15,00	5,00	5,00	2,00	3,00	1,00
16	16,00	5,00	5,00	2,00	1,00	3,00
17	17,00	5,00	4,00	2,00	2,00	2,00
18	18,00	4,00	4,00	2,00	4,00	3,00
19	19,00	4,00	4,00	2,00	2,00	2,00
20	20,00	4,00	4,00	2,00	1,00	1,00
21	21,00	4,00	4,00	1,00	2,00	2,00
22	22,00	3,00	5,00	1,00	1,00	2,00
23	23,00	3,00	4,00	3,00	3,00	2,00

FIGURE 14.4

Transforming data with SPSS

Note that it is useful to set up a scheme for categorizing the responses such that the several items measuring a concept are all grouped together. If the questions measuring a concept are not contiguous but scattered over various parts of the questionnaire, care has to be taken to include all the items without any omission or wrong inclusion.

GETTING A FEEL FOR THE DATA

We can acquire a feel for the data by obtaining a visual summary or by checking the central tendency and the dispersion of a variable. We can also get to know our data by examining the relation between two variables. In Chapter 12, we explained that different statistical operations on variables are possible, depending on the level at which a variable is measured. Table 14.1 summarizes the relationship between scale type, data analysis, and methods of obtaining a visual summary for variables.

Table 14.1 shows that, depending on the scale of our measures, the mode, median, or mean, and the semi-interquartile range, standard deviation, or variance will give us a good idea of how the participants in our study have reacted to the items in the questionnaire. These statistics can be easily obtained, and will indicate whether the responses range satisfactorily over the scale. If the response to each individual item in a scale does not have a good spread (range) and shows very little variability, then the researcher may suspect that the particular question was probably not properly worded. Biases, if any, may also be detected if the respondents have tended to respond similarly to all items – that is, they have stuck to only certain points on the scale. Remember that if there is no variability in the data, then no variance can be explained! Getting a feel for the data is thus the necessary first step in all data analysis. Based on this initial feel, further detailed analyses may be undertaken to test the goodness of the data.

TABLE 14.1

Scale type, data analysis, and methods of obtaining a visual summary for variables

Scale	Examples	Measures of central tendency . . . *for a single variable*	Measures of dispersion . . . *for a single variable*	Visual summary . . . *for a single variable*	Measure of relation . . . *between variables*	Visual summary of relation . . . *between variables*
Nominal	Social security number, gender	Mode	—	Bar chart, pie chart	Contingency table (Cross-tab)	Stacked bars, Clustered bars
Ordinal	Satisfaction rating on a 5-point scale (1 = not satisfied at all; 5 = extremely satisfied)	Median	Semi-interquartile range	Bar chart, pie chart	Contingency table (Cross-tab)	Stacked bars, Clustered bars
Interval		Arithmetic mean	Minimum, maximum, standard deviation, variance, coefficient of variation	Histogram, scatterplot, box-and-whisker plot	Correlations	Scatterplots
Ratio	Age, Sales	Arithmetic or geometric mean	Minimum, maximum, standard deviation, variance, coefficient of variation	Histogram, scatterplot, box-and-whisker plot	Correlations	Scatterplots

Researchers go to great lengths to obtain the central tendency, the range, the dispersion, and other statistics for every single item measuring the dependent and independent variables, especially when the measures for a concept are newly developed.

Descriptive statistics for a single variable are provided by frequencies, measures of central tendency, and dispersion. These are now described.

Frequencies

Frequencies simply refer to the number of times various subcategories of a certain phenomenon occur, from which the percentage and the cumulative percentage of their occurrence can be easily calculated.

Excelsior Enterprises: frequencies The frequencies for the number of individuals in the various departments for the Excelsior Enterprises sample are shown in Output 14.1. It may be seen therefrom that the greatest number of individuals in the sample came from the production department (28.1%), followed by the sales department (25.3%). Only three individuals (1.7%) came from public relations, and five individuals each from the finance, maintenance, and accounting departments (2.9% from each). The low numbers in the sample in some of the departments are a function of the total population (very few members) in those departments.

From the frequencies obtained for the other variables (results not shown here) it was found that 79.9% of the respondents were men and 20.1% women; about 62% worked the first shift, 20% the second shift, and 18% the third shift. About 16% of the respondents worked part time and 84% full time. About 8% had less than a high school diploma, 39% a high school diploma, 32% a college degree, 20% a master's degree, and 1% had doctoral degrees.

We thus have a profile of the employees in this organization, which is useful for describing the sample in the "methods" section of the written report (see Chapter 17). Other instances where frequency distributions would be useful are when: (1) a marketing manager wants to know how many units (and what proportions or percentages) of each brand of coffee are sold in a particular region during a given period; (2) a tax consultant wishes to keep count of the number of times different sizes of firms (small, medium, large) are audited by the IRS; and (3) the financial analyst wants to keep track of the number of times the shares of manufacturing, industrial, and utility companies lose or gain more than ten points on the New York Stock Exchange over a six-month period.

Bar charts and pie charts

Frequencies can also be visually displayed as bar charts, histograms, or pie charts. Bar charts, histograms, and pie charts help us to understand our data.

Excelsior Enterprises: bar chart Figure 14.5 provides a graphic representation of the results listed in the table in Output 14.1.

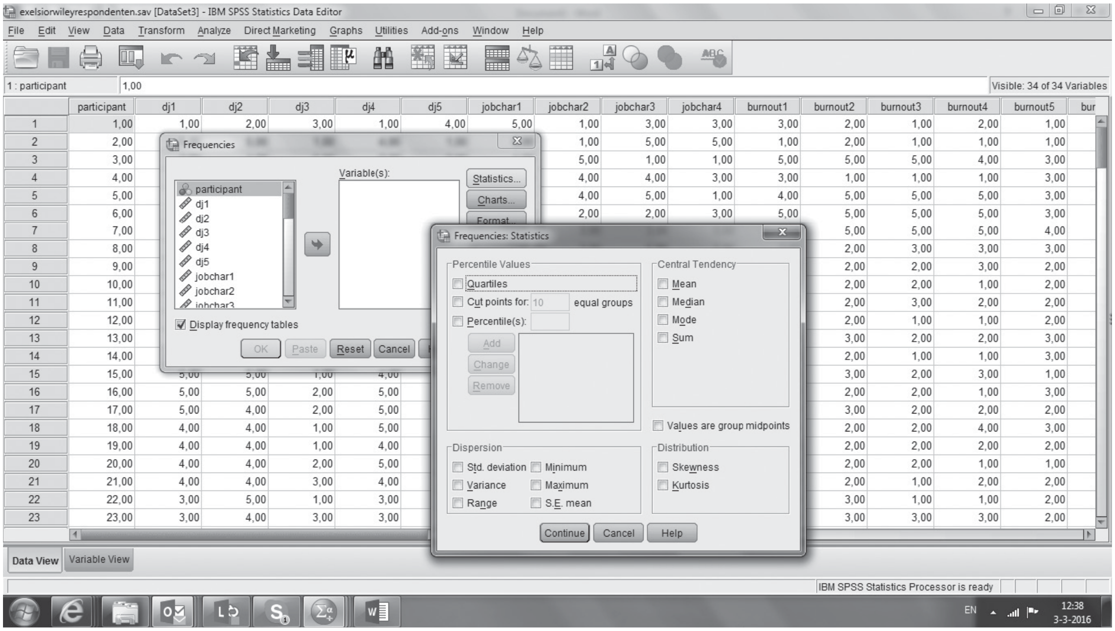
Frequency distributions, bar charts, histograms, and pie charts provide a great deal of basic information about the data. Measures of central tendency and dispersion will help us to further understand our data. These are discussed next.

OUTPUT 14.1

FREQUENCIES

From the menus, choose:
Analyze
  Descriptive Statistics
  Frequencies
  [Select the relevant variables]
Choose needed:
  Statistics . . .
  Charts . . .
  Format [for the order in which the results are to be displayed]

(*Continued*)


exelsiorwileyrespondenten.sav [DataSet3] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
1 : participant 1,00
Visible: 34 of 34 Variables
participant dj1 dj2 dj3 dj4 dj5 jobchar1 jobchar2 jobchar3 jobchar4 burnout1 burnout2 burnout3 burnout4 burnout5 bur
Frequencies
participant
dj1
dj2
dj3
dj4
dj5
jobchar1
jobchar2
jobchar3
Variable(s):
Statistics...
Charts...
Format...
☑ Display frequency tables
OK Paste Reset Cancel
Frequencies: Statistics
Percentile Values
☐ Quartiles
☐ Cut points for: 10 equal groups
☐ Percentile(s):
Add
Change
Remove
Central Tendency
☐ Mean
☐ Median
☐ Mode
☐ Sum
☐ Values are group midpoints
Dispersion
☐ Std. deviation ☐ Minimum
☐ Variance ☐ Maximum
☐ Range ☐ S.E. mean
Distribution
☐ Skewness
☐ Kurtosis
Continue Cancel Help
Data View Variable View
IBM SPSS Statistics Processor is ready
EN 12:38 3-3-2016

OUTPUT: RESPONDENT'S DEPARTMENT

	Frequency	Percent	Valid percent	Cumulative percent
Marketing	13	7.5	7.5	7.5
Production	49	28.1	28.1	35.6
Sales	44	25.3	25.3	60.9
Finance	5	2.9	2.9	63.8
Servicing	34	19.5	19.5	83.3
Maintenance	5	2.9	2.9	86.2
Personnel	16	9.2	9.2	95.4
Public Relations	3	1.7	1.7	97.1
Accounting	5	2.9	2.9	100.0
Total	174	100.0	100.0	100.0

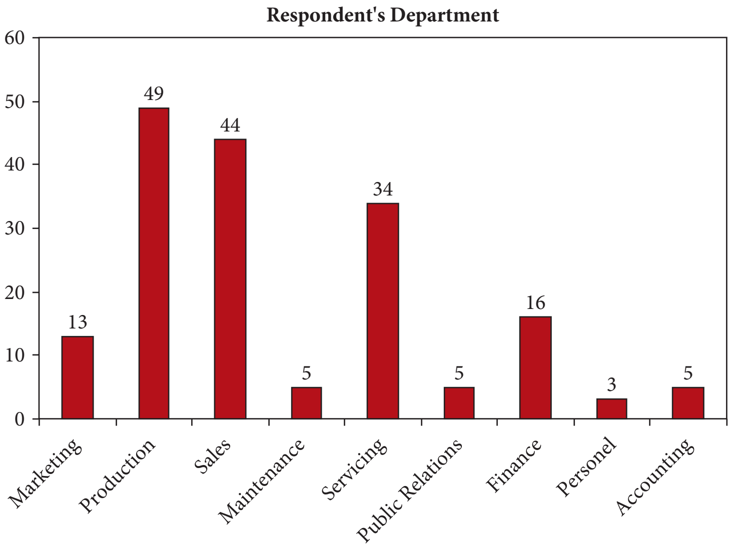


FIGURE 14.5

Bar chart of categories of employees

Measures of central tendency and dispersion

There are three **measures of central tendency:** the mean, the median, and the mode. **Measures of dispersion** include the range, the standard deviation, the variance (where the measure of central tendency is the mean), and the interquartile range (where the measure of central tendency is the median).

Measures of central tendency

The mean The **mean**, or the *average*, is a measure of central tendency that offers a general picture of the data without unnecessarily inundating one with each of the observations in a data set. For example, the production department might keep detailed records on how many units of a product are being produced each day. However, to estimate the raw materials inventory, all that the manager might want to know is how many units per month, *on average*, the department has been producing over the past six months. This measure of central tendency – that is, the *mean* – might offer the manager a good idea of the quantity of materials that need to be stocked.

The mean or average of a set of, say, ten observations, is the sum of the ten individual observations divided by ten (the total number of observations).

The median The **median** is the *central item* in a group of observations when they are arrayed in either an ascending or a descending order. Let us take an example to examine how the median is determined as a measure of central tendency.

The mode In some cases, a set of observations does not lend itself to a meaningful representation through either the mean or the median, but can be signified by the *most frequently occurring phenomenon*. For instance, in a department where there are 10 white women, 24 white men, 3 African American women,

EXAMPLE

Let's say the annual salaries of nine employees in a department are as follows: \$65 000, \$30 000, \$25 000, \$64 000, \$35 000, \$63 000, \$32 000, \$60 000, and \$61 000. The mean salary here works out to be about \$48 333, but the median is \$60 000. That is, when arrayed in ascending order, the figures will be as follows: \$25 000, \$30 000, \$32 000, \$35 000, \$60 000, \$61 000, \$63 000, \$64 000, \$65 000, and the figure in the middle is \$60 000. If there is an even number of employees, then the median will be the average of the middle two salaries.

and 2 Asian women, the most frequently occurring group – the **mode** – is the white men. Neither a mean nor a median is calculable or applicable in this case. There is also no way of indicating any measure of dispersion.

We have illustrated how the mean, median, and the mode can be useful measures of central tendency, based on the type of data we have. We will now examine dispersion.

Measures of dispersion

Apart from knowing that the measure of central tendency is the mean, median, or mode (depending on the type of available data), one would also like to know about the variability that exists in a set of observations. Like the measure of central tendency, the measure of dispersion is also unique to nominal and interval data.

Two sets of data might have the same mean, but the dispersions could be different. For example, if Company A sold 30, 40, and 50 units of a product during the months of April, May, and June, respectively, and Company B sold 10, 40, and 70 units during the same period, the average units sold per month by both companies is the same – 40 units – but the variability or the *dispersion* in the latter company is larger.

The three measurements of dispersion connected with the mean are the range, the variance, and the standard deviation, which are explained below.

Range **Range** refers to the extreme values in a set of observations. The range is between 30 and 50 for Company A (a dispersion of 20 units), while the range is between 10 and 70 units (a dispersion of 60 units) for Company B. Another more useful measure of dispersion is the variance.

Variance The **variance** is calculated by subtracting the mean from each of the observations in the data set, taking the square of this difference, and dividing the total of these by the number of observations. In the above example, the variance for each of the two companies is:

$$\text{Variance for Company A} = \frac{(30-40)^2 + (40-40)^2 + (50-40)^2}{3} = 66.7$$

$$\text{Variance for Company B} = \frac{(10-40)^2 + (40-40)^2 + (70-40)^2}{3} = 600$$

As we can see, the variance is much larger in Company B than Company A. This makes it more difficult for the manager of Company B to estimate how many goods to stock than it is for the manager of Company A. Thus, variance gives an indication of how dispersed the data in a data set are.

Standard deviation The **standard deviation**, which is another measure of dispersion for interval and ratio scaled data, offers an index of the spread of a distribution or the variability in the data. It is a very commonly used measure of dispersion, and is simply the square root of the variance. In the case of the above two companies, the standard deviation for Companies A and B would be $\sqrt{66.7}$ and $\sqrt{600}$ or 8.167 and 24.495, respectively.

The mean and standard deviation are the most common descriptive statistics for interval and ratio scaled data. The standard deviation, in conjunction with the mean, is a very useful tool because of the following statistical rules, in a normal distribution:

1. Practically all observations fall within three standard deviations of the average or the mean.
2. More than 90% of the observations are within two standard deviations of the mean.
3. More than half of the observations are within one standard deviation of the mean.

Other measures of dispersion When the *median* is the measure of central tendency, percentiles, deciles, and quartiles become meaningful. Just as the median divides the total realm of observations into two equal halves, the *quartile* divides it into four equal parts, the *decile* into ten, and the *percentile* into 100 equal parts. The percentile is useful when huge masses of data, such as the GRE or GMAT scores, are handled. When the area of observations is divided into 100 equal parts, there are 99 percentile points. Any given score has a probability of 0.01 that it will fall in any one of those points. If John's score is in the 16th percentile, it indicates that 84% of those who took the exam scored better than he did, while 15% did worse.

Oftentimes we are interested in knowing where we stand in comparison to others – are we in the middle, in the upper 10 or 25%, or in the lower 20 or 25%, or where? For instance, if in a company-administered test, Mr Chou scores 78 out of a total of 100 points, he may be unhappy if he is in the bottom 10% among his colleagues (the test-takers), but may be reasonably pleased if he is in the top 10%, despite the fact that his score remains the same. His standing in relation to the others can be determined by the central tendency median and the percentile he falls in.

The measure of dispersion for the median, the **interquartile range**, consists of the middle 50% of the observations (i.e., observations excluding the bottom and top 25% quartiles). The interquartile range is very useful when comparisons are to be made among several groups. For instance, telephone companies can compare long-distance charges of customers in several areas by taking samples of customer bills from each of the cities to be compared. By plotting the first and third quartiles and comparing the median and the spread, they can get a good idea of where billings tend to be highest, to what extent customers vary in the frequency of use of long-distance calls, and so on. This is done by creating a box-and-whisker plot for each area. The box-and-whisker plot is a graphic device that portrays central tendency, percentiles, and variability. A box is drawn, extending from the first to the third quartile, and lines are drawn from either side of the box to the extreme scores, as shown in Figure 14.6(a). Figure 14.6(b) has the median represented by a dot within each box. Side-by-side comparisons of the various plots clearly indicate the highest value, the range, and the spread for each area or city. For a fuller discussion on this, refer to Salvia (1990).

In sum, we have illustrated how the mean, median, and the mode can be useful measures of central tendency, depending on the type of available data. Likewise, we have shown how the standard deviation (and variance, which is the square of standard deviation), and the interquartile range are useful measures of dispersion. Obviously, there is no measure of dispersion associated with the mode.

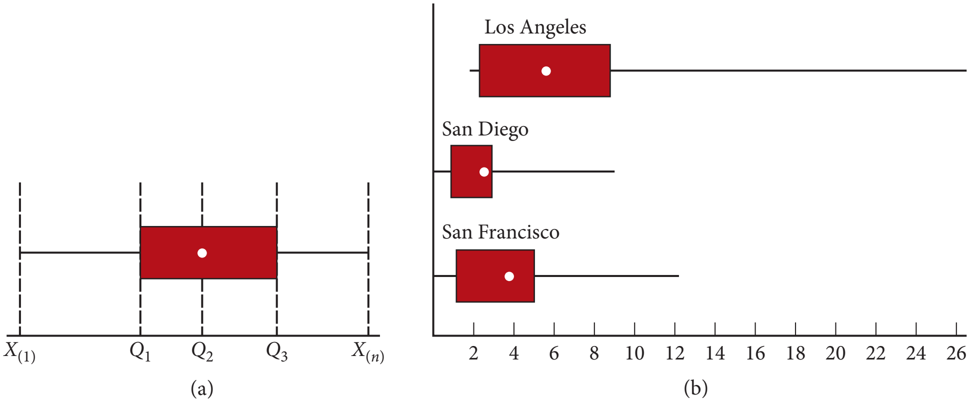


FIGURE 14.6

(a) Box-and-whisker plot; (b) comparison of telephone bills in three cities

TABLE 14.2

Contingency table of skin color and job type

Skin color	White collar	Blue collar	Total
White	30	5	35
Nonwhite	2	18	20
Total	32	23	55

Relationships between variables

In a research project that includes several variables, beyond knowing the descriptive statistics of the variables, we would often like to know how one variable is related to another. That is, we would like to see the nature, direction, and significance of the *bivariate* relationships of the variables used in the study (i.e., the relationship between any two variables among the variables tapped in the study).

Nonparametric tests are available to assess the relationship between variables measured on a nominal or an ordinal scale. Spearman's rank correlation and Kendall's rank correlation are used to examine relationships between two ordinal variables. A **correlation matrix** is used to examine relationships between interval and/or ratio variables.

Relationship between two nominal variables: χ^2 test

We might sometimes want to know if there is a relationship between two nominal variables or whether they are independent of each other. As examples: (1) Is viewing a television advertisement of a product (yes/no) related to buying that product by individuals (buy/don't buy)? (2) Is the type of job done by individuals (white-collar job/blue-collar job) a function of the color of their skin (white/nonwhite)? Such comparisons are possible by organizing data by groups or categories and seeing if there are any statistically significant relationships. For example, we might collect data from a sample of 55 individuals whose color of skin and nature of jobs, culled from a frequency count, might be illustrated as in Table 14.2 in a two-by-two contingency table. Just by looking at Table 14.2, a clear pattern seems to emerge that those who are white hold white-collar jobs. Only a few of the nonwhites hold white-collar jobs. Thus, there does seem to be a relationship between the color of the skin and the type of job handled; the two do not seem to be independent. This can be statistically confirmed by the **chi-square** (χ^2) **test** – a nonparametric test – which indicates whether or not the observed pattern is due to chance. As we know, nonparametric tests are used when normality of distributions cannot be assumed as in nominal or ordinal data. The χ^2 test compares the expected frequency (based on probability) and the observed frequency, and the χ^2 statistic is obtained by the formula:

$$\chi^2 = \sum \frac{(Oi - Ei)^2}{Ei}$$

where χ^2 is the chi-square statistic; Oi is the observed frequency of the ith cell; and Ei is the expected frequency. The χ^2 statistic with its level of significance can be obtained for any set of nominal data through computer analysis.

Thus, in testing for differences in relationships among nominally scaled variables, the χ^2 (chi-square) statistic comes in handy. The null hypothesis would be set to state that there is no significant relationship between two variables (color of skin and nature of the job, in the above example), and the alternate hypothesis would state that there is a significant relationship.

The chi-square statistic is associated with the degrees of freedom (df), which denote whether or not a significant relationship exists between two nominal variables. The number of degrees of freedom is one less than the number of cells in the columns and rows. If there are four cells (two in a column and two in a row), then the number of degrees of freedom would be 1: $[(2 - 1) \times (2 - 1)]$. The chi-square statistic for various df is provided in Table III in the statistical tables toward the end of the book.

The χ^2 statistic can also be used for multiple levels of two nominal variables. For instance, one might be interested to know if four groups of employees – production, sales, marketing, and R&D personnel – react to a policy in four different ways (i.e., with no interest at all, with mild interest, moderate interest, and intense interest). Here, the χ^2 value for the test of independence is generated by cross-tabulating the data in 16 cells – that is, classifying the data in terms of the four groups of employees and the four categories of interest. The degrees of freedom here will be 9: $[(4 - 1) \times (4 - 1)]$.

The χ^2 test of significance thus helps us to see whether or not two nominal variables are related. Besides the χ^2 test, other tests, such as the *Fisher exact probability test* and the *Cochran Q test* are used to determine the relationship between two nominally scaled variables.

Correlations

A Pearson correlation matrix will indicate the direction, strength, and significance of the bivariate relationships among all the variables that were measured at an interval or ratio level. The correlation is derived by assessing the variations in one variable as another variable also varies. For the sake of simplicity, let us say we have collected data on two variables – price and sales – for two different products. The volume of sales at every price level can be plotted for each product, as shown in the scatter diagrams in Figure 14.7(a) and 14.7(b).

Figure 14.7 (b) indicates a discernible pattern of how the two factors vary simultaneously (the trend of the scatter is that of a downward straight line), whereas Figure 14.7 (a) does not. Looking at the scatter diagram in Figure 14.7 (b), it would seem there is a direct negative correlation between price and sales for this product. That is, as the price increases, sales of the product drop consistently. Figure 14.7 (a) suggests no interpretable pattern for the other product.

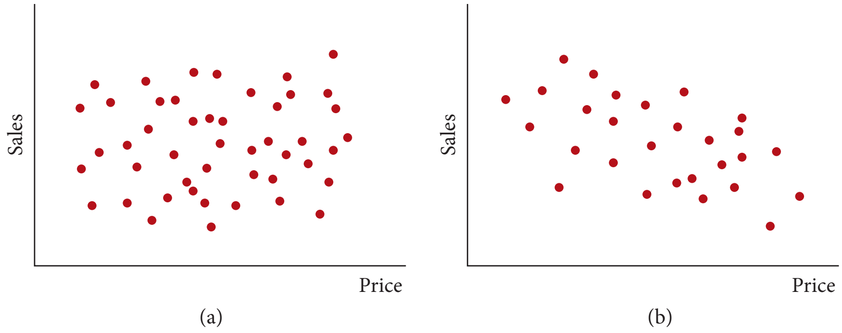


FIGURE 14.7

(a) Scatter diagram with no discernible pattern; (b) scatter diagram indicating a downward or negative slope

A correlation coefficient that indicates the strength and direction of the relationship can be computed by applying a formula that takes into consideration the two sets of figures – in this case, different sales volumes at different prices.

Theoretically, there could be a perfect positive correlation between two variables, which is represented by 1.0 (plus 1), or a perfect negative correlation which would be −1.0 (minus 1). However, neither of these will be found in reality when assessing correlations between any two variables expected to be different from each other.

While the correlation could range between −1.0 and +1.0, we need to know if any correlation found between two variables is significant or not (i.e., if it has occurred solely by chance or if there is a high probability of its actual existence). As we know, a significance of $p = 0.05$ is the generally accepted conventional level in social science research. This indicates that 95 times out of 100, we can be sure that there is a true or significant correlation between the two variables, and there is only a 5% chance that the relationship does not truly exist. If there is a correlation of 0.56 (denoted as $r = 0.56$) between two variables A and B, with $p < 0.01$, then we know that there is a positive relationship between the two variables and the probability of this not being true is 1% or less. That is, over 99% of the time we would expect this correlation to exist. The correlation of 0.56 also indicates that the variables explain the variance in one another to the extent of 31.4% (0.56^2).

We do not know which variable *causes* which, but we do know that the two variables are associated with each other. Thus, a hypothesis that postulates a significant positive (or negative) relationship between two variables can be tested by examining the correlation between the two.

The Pearson correlation coefficient is appropriate for interval- and ratio-scaled variables, and the Spearman Rank or the Kendall's tau coefficients are appropriate when variables are measured on an ordinal scale. Any bivariate correlation can be obtained by clicking the relevant menu, identifying the variables, and seeking the appropriate parametric or nonparametric statistics.

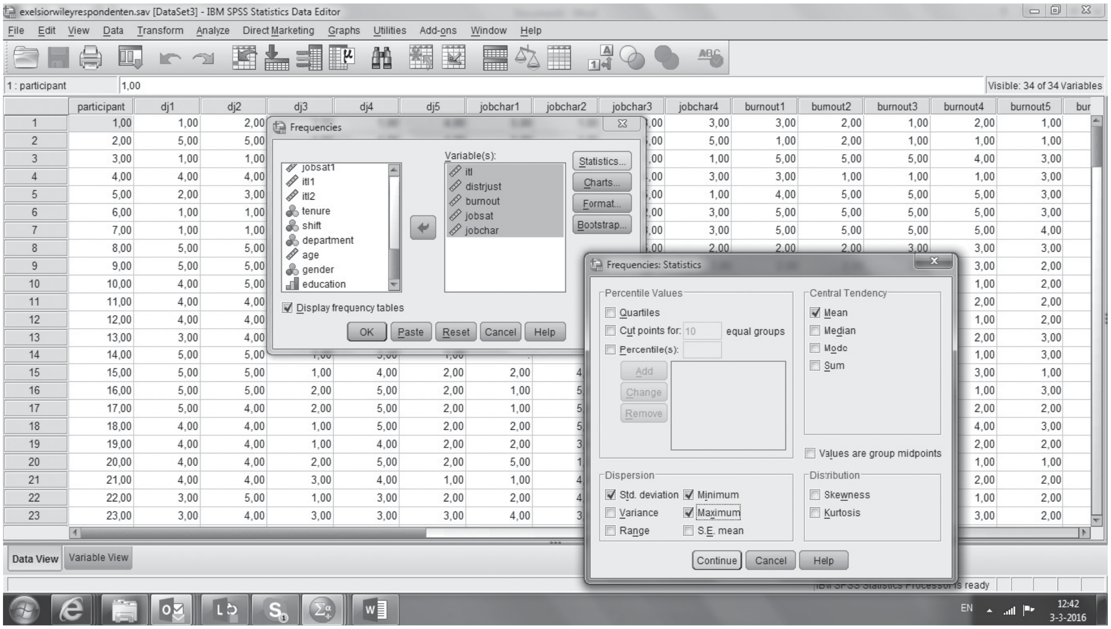
EXCELSIOR ENTERPRISES: DESCRIPTIVE STATISTICS PART 1

Descriptive statistics such as maximum, minimum, means, standard deviations, and variance were obtained for the interval-scaled items of the Excelsior Enterprises study. The procedure is shown in Output 14.2.

OUTPUT 14.2

DESCRIPTIVE STATISTICS: CENTRAL TENDENCIES AND DISPERSIONS

From the menus, choose:
Analyze
    Descriptive Statistics
    Descriptives
    [Select the variables]
    Statistics . . .
    [Choose the relevant statistics needed]


exelsiorwileyrespondenten.sav [DataSet3] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
1 : participant 1,00
Visible: 34 of 34 Variables
Data View Variable View
IBM SPSS Statistics Processor is ready
EN 12:42 3-3-2016

Frequencies
Variable(s): itl, distrjust, burnout, jobsat, jobchar
☑ Display frequency tables
OK Paste Reset Cancel Help

Frequencies: Statistics
Percentile Values
☐ Quartiles
☐ Cut points for: 10 equal groups
☐ Percentile(s):
Central Tendency
☑ Mean
☐ Median
☐ Mode
☐ Sum
☐ Values are group midpoints
Dispersion
☑ Std. deviation ☑ Minimum
☐ Variance ☑ Maximum
☐ Range ☐ S.E. mean
Distribution
☐ Skewness
☐ Kurtosis
Continue Cancel Help

Output

	pe1	pe2	pe3	pe4	pe5	jobchar1	jobchar2	jobchar3	jobchar4	burnout1	burnout2
N valid	174	174	174	171	171	172	173	173	173	171	171
N missing	0	0	0	3	3	2	1	1	1	3	3
Mean	2.385	2.270	2.523	2.491	2.552	3.526	3.428	3.549	3.462	2.468	2.444
Std deviation	1.023	0.980	1.126	0.916	0.999	1.097	1.035	1.097	1.081	1.238	1.041
Variance	1.047	0.961	1.268	0.840	0.997	1.204	1.072	1.203	1.169	1.533	1.084
Minimum	1	1	1	1	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	6	5	5	5	5	5

	burnout3	burnout4	burnout5	burnout6	burnout7	burnout8	burnout9	burnout10	job sat	itl1	itl2
N valid	171	171	173	173	173	173	173	174	173	174	174
N missing	3	3	1	1	1	1	1	0	1	0	0
Mean	2.462	2.532	2.734	2.665	2.584	2.688	2.798	2.270	2.931	2.569	2.615
Std deviation	1.144	1.356	1.028	1.064	1.146	1.129	0.988	1.021	1.169	0.828	0.903
Variance	1.309	1.356	1.057	1.131	1.314	1.274	0.976	1.042	1.367	0.686	0.816
Minimum	1	1	1	1	1	1	1	1	1	1	1
Maximum	6	5	5	5	5	5	5	4	5	4	5

The results presented in the table in Output 14.2 indicate that:

- there are missing observations for every item except for the items pe1, pe2, pe3, burnout10, itl1, and itl2;
- there are illegal codes for items jobchar1 (a 6 has been entered in at least one cell), burnout3 (again, a 6 has been entered in at least one cell), and itl2 (a 5 has been entered in at least one cell);
- the responses to each individual item have a good spread.

Appropriate actions were taken to correct the illegal entries. A further inspection of the missing data revealed that every participant answered either all or the vast majority of the questions. Therefore, no questionnaires were thrown out. Missing data will be ignored during subsequent analyses.

From here, we can proceed with further detailed analyses to test the goodness of our data.

TESTING THE GOODNESS OF MEASURES

The reliability and validity of the measures can now be tested.

Reliability

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Reliability**.

As discussed in Chapter 12, the reliability of a measure is established by testing for both consistency and stability. Consistency indicates how well the items measuring a concept hang together as a set. Cronbach's alpha is a reliability coefficient that indicates how well the items in a set are positively correlated to one another. Cronbach's alpha is computed in terms of the average intercorrelations among the items measuring the concept. The closer Cronbach's alpha is to 1, the higher the internal consistency reliability.

Another measure of consistency reliability used in specific situations is the split-half reliability coefficient. Since this reflects the correlations between two halves of a set of items, the coefficients obtained will vary depending on how the scale is split. Sometimes split-half reliability is obtained to test for consistency when more than one scale, dimension, or factor, is assessed. The items across each of the dimensions or factors are split, based on some predetermined logic (Campbell, 1976). In almost every case, Cronbach's alpha is an adequate test of internal consistency reliability. You will see later in this chapter how Cronbach's alpha is obtained through computer analysis.

As discussed in Chapter 12, the stability of a measure can be assessed through parallel form reliability and test–retest reliability. When a high correlation between two similar forms of a measure (see Chapter 12) is obtained, parallel form reliability is established. Test–retest reliability can be established by computing the correlation between the same tests administered at two different time periods.

Excelsior Enterprises: checking the reliability of the multi-item measures

Because perceived equity, burnout, job enrichment, and intention to leave were measured with multi-item scales, the consistency of the respondents' answers to the scale items has to be tested for each measure. In Chapter 12, we explained that Cronbach's alpha is a popular test of inter-item consistency. Table 14.3 provides an overview of Cronbach's alpha for the four variables. This table shows that the alphas were all well above 0.60.

In general, reliabilities less than 0.60 are considered to be poor, those in the 0.70 range, acceptable, and those over 0.80 good. Thus, the internal consistency reliability of the measures used in this study can be considered to be acceptable for the intention to leave measure and good for the other measures.

It is important to note that all the negatively worded items in the questionnaire should first be reversed before the items are submitted for reliability tests. Unless all the items measuring a variable are in the same direction, the reliabilities obtained will be incorrect.

A sample of the result obtained for the Cronbach's alpha test for job enrichment, together with instructions on how it is obtained, is shown in Output 14.3.

The reliability of the job enrichment measure is presented in the first table in Output 14.3. The second table provides an overview of the alphas if we take one of the items out of the measure. For instance, it is shown that if the first item (Jobchar1) is taken out, Cronbach's alpha of the new three-item measure will be 0.777. This means that the alpha will go down if we take item 1 out of our measure. Likewise, if we take out item 2, our alpha will go down and become 0.788. Note that even if our alpha would increase if we would take out one of the items, we would not take it out for two reasons. First, our alpha is above 0.7 so we do not have to take any remedial actions. Second, if we would take one of the items out, the *validity* of our measure would probably decrease. The items (all of them) were included in the original measure for a reason!

TABLE 14.3

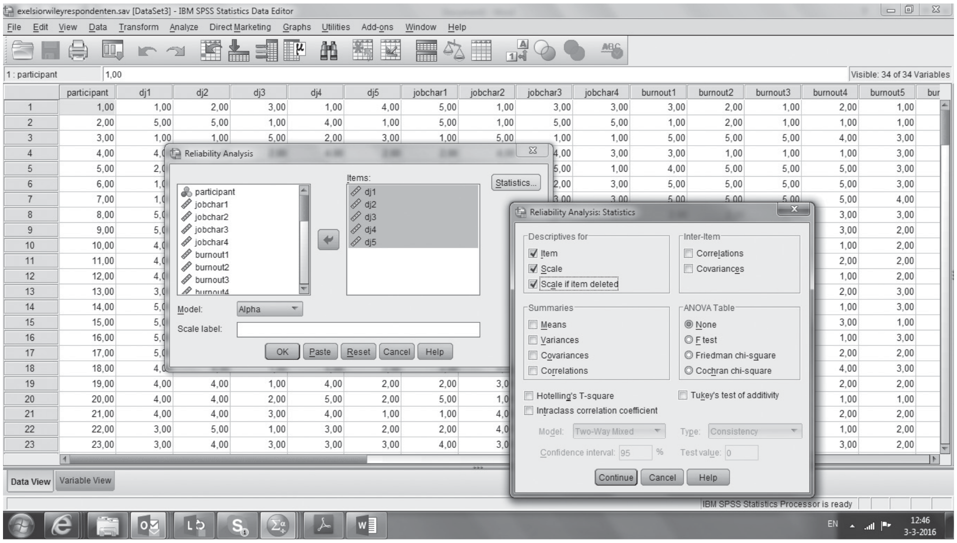
Reliability of the Excelsior Enterprises measures

Variable	Number of items	Cronbach's alpha
Perceived equity	5	0.882
Job enrichment	4	0.844
Burnout	10	0.813
Intention to leave	2	0.749

OUTPUT 14.3

RELIABILITY ANALYSIS

From the menus, choose:
Analyze
Scale
Reliability Analysis . . .
[Select the variables constituting the scale]
Choose *Model Alpha* [this is the default option]
Click on *Statistics*.
Select *Scale* if item deleted under *Descriptives*


exelsiorwileyrespondenten.sav [DataSet3] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
1 : participant 1,00
Visible: 34 of 34 Variables
Data View Variable View
IBM SPSS Statistics Processor is ready
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Reliability Analysis
Variables: participant, jobchar1, jobchar2, jobchar3, jobchar4, burnout1, burnout2, burnout3, burnout4
Items: dj1, dj2, dj3, dj4, dj5
Model: Alpha
Scale label:
OK Paste Reset Cancel Help

Reliability Analysis: Statistics
Descriptives for: ☑ Item ☑ Scale ☑ Scale if item deleted
Inter-Item: ☐ Correlations ☐ Covariances
Summaries: ☐ Means ☐ Variances ☐ Covariances ☐ Correlations
ANOVA Table: ● None ○ F test ○ Friedman chi-square ○ Cochran chi-square
☐ Hotelling's T-square ☐ Tukey's test of additivity
☐ Intraclass correlation coefficient
Model: Two-Way Mixed Type: Consistency
Confidence interval: 95 % Test value: 0
Continue Cancel Help

Output

Reliability statistics	
Cronbach's alpha	**Number of items**
0.844	4

Item-total statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total variation	Cronbach's alpha if item deleted
Jobchar1	10,4393	7,143	,735	,777
Jobchar2	10,5318	7,483	,714	,788
Jobchar3	10,4104	7,639	,620	,828
Jobchar4	10,4971	7,554	,652	,814

If, however, our Cronbach's alpha was too low (under 0.60) then we could use this table to find out which of the items would have to be removed from our measure to increase the inter-item consistency. Note that, usually, taking out an item, although improving the reliability of our measure, affects the validity of our measure in a negative way.

Now that we have established that the inter-item consistency is satisfactory for perceived equity, job enrichment, burnout, and intention to leave, the scores on the original questions can be combined into a single score. For instance, a new "perceived equity" score can be calculated from the scores on the five individual "perceived equity" items (but only after items 1, 2, and 4 have been reverse coded). Likewise, a new "job enrichment" score can be calculated from the scores on the four individual "job enrichment" items, and so on. We have already explained that this involves calculating the summed score (per case/participant) and then dividing it by the number of items.

Validity

Factorial validity can be established by submitting the data for factor analysis. The results of factor analysis (a multivariate technique) will confirm whether or not the theorized dimensions emerge. Recall from Chapter 11 that measures are developed by first delineating the dimensions so as to operationalize the concept. Factor analysis reveals whether the dimensions are indeed tapped by the items in the measure, as theorized. **Criterion-related validity** can be established by testing for the power of the measure to differentiate individuals who are known to be different (refer to discussions regarding concurrent and predictive validity in Chapter 12). **Convergent validity** can be established when there is a high degree of correlation between two different sources responding to the same measure (e.g., both supervisors and subordinates respond similarly to a perceived reward system measure administered to them). **Discriminant validity** can be established when two distinctly different concepts are not correlated to each other (e.g., courage and honesty; leadership and motivation; attitudes and behavior). Convergent and discriminant validity can be established through the multitrait multimethod matrix, a full discussion of which is beyond the scope of this book. The student interested in knowing more about factor analysis and the multitrait multimethod matrix can refer to books on those subjects. When well-validated measures are used, there is no need, of course, to establish their validity again for each study. The reliability of the items can, however, be tested.

EXCELSIOR ENTERPRISES: DESCRIPTIVE STATISTICS PART 2

Once the new scores for perceived equity, job enrichment, burnout, and intention to leave have been calculated, we are ready to further analyze the data. Descriptive statistics such as maximum, minimum, means, standard deviations, and variance can now be obtained for the multi-item, interval-scaled independent and dependent variables. What's more, a correlation matrix can also be obtained to examine how the variables in our model are related to each other.

This will help us to answer important questions such as:

- *How big is the problem*? In other words, to what extent are the employees of Excelsior Enterprises inclined to leave? What is the average inclination to leave?
- *What is the nature of the problem?* Compare, for instance, the histograms provided in Figure 14.8. The average ITL is the same in both cases. However, the graphs show us that in the first hypothetical histogram ITL is "fairly normally" distributed.[1] In the second hypothetical histogram, the distribution is clearly not normal. In fact, it looks bimodal (with two peaks indicative of two modes). The first distribution suggests that most of the respondents are neither bent on leaving nor staying. The bimodal distribution, on the other hand, suggests that one group of employees is not inclined to leave at all, whereas another group is determined to leave the organization.[2]

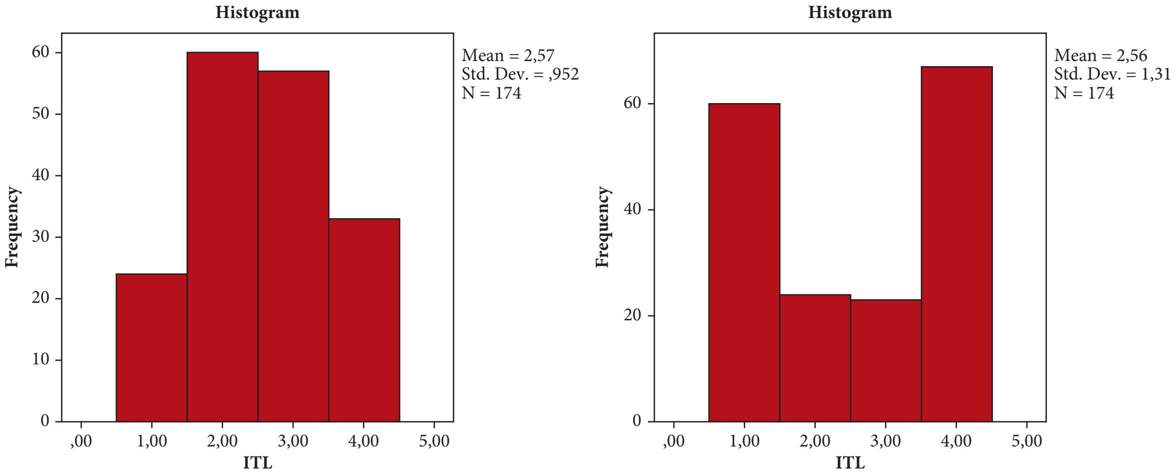

FIGURE 14.8

Two hypothetical histograms of "intention to leave"

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[1] Note that there are objective tests to decide whether or not a distribution is normal, for instance the Kolmogorov-Smirnov test and the Shapiro-Wilk test.

[2] "Normally distributed data" is one of the assumptions of *parametric data*; this assumption is unmistakably violated in the second histogram. An excellent discussion on the assumptions of parametric data and on what to do if the assumptions are violated is provided by Andy Field in his book *Discovering Statistics Using SPSS* (Field, 2009).

Descriptive statistics will also help us to answer the following questions:

- Are the employees satisfied with their jobs?
- What are the employees' perceptions on job enrichment?
- How many employees have which degrees of burnout?
- Is there much variance in the extent to which employees perceive the relationship with the company as equitable?
- What are the relationships between perceived equity, burnout, job enrichment, job satisfaction, and intention to leave?

The answers to these questions will help us (together with the results of our hypotheses tests) to make informed decisions on how we can best solve the problem.

Descriptive statistics such as maximum, minimum, means, standard deviations, and variance were obtained for the interval-scaled independent and dependent variables in the Excelsior Enterprises study. The results are shown in Table 14.4. It may be mentioned that all variables except ITL were tapped on a five-point scale. ITL was measured on a four-point scale.

From the results, it may be seen that the mean of 2.59 on a four-point scale for ITL indicates that Excelsior Enterprises has a problem with regard to turnover. The minimum of 1 reveals that there are some employees who do not intend to leave at all, and the maximum of 4 reveals that some are seriously considering leaving. Job satisfaction is about average (2.91 on a five-point scale). The mean on perceived equity is rather low (2.44 on a five-point scale), as is the mean on experienced burnout (2.57). Finally, the job is perceived as somewhat enriched (3.49). Table 14.4 also points out that the variance for all the variables is rather high, indicating that participants' answers are not always very close to the mean on all the variables.

Table 14.5 provides a more detailed account of employees' intentions to leave. This table shows that a large group of employees seriously considers leaving Excelsior Enterprises! Testing our hypotheses will improve our understanding of *why* employees consider leaving Excelsior Enterprises and will provide us with useful tools to reduce employees' intentions to leave the company.

The Pearson correlation matrix obtained for the five interval-scaled variables is shown in Table 14.6. From the results, we see that the intention to leave is, as would be expected, significantly negatively correlated to job satisfaction, perceived equity, and job enrichment. That is, the intention to leave is low if job satisfaction and equitable treatment are experienced, and the job is enriched. However, when individuals experience burnout (physical and emotional exhaustion), their intention to leave does not increase (this relationship is not significant;

TABLE 14.4

Descriptive statistics for independent and dependent variables

	N	Minimum	Maximum	Mean	Std deviation	Variance
ITL	174	1.00	4.00	2.589	0.769	0.592
Job satisfaction	173	1.00	5.00	2.931	1.169	1.367
Perceived equity	174	1.00	4.60	2.444	0.883	0.694
Burnout	174	1.20	4.60	2.566	0.681	0.463
Jobchar	173	1.00	5.00	3.491	0.888	0.789

TABLE 14.5

Frequency table intention to leave

	Frequency	Percentage	Valid percentage	Cumulative percentage
1.00	9	5.2	5.2	5.2
1.50	16	9.2	9.2	14.4
2.00	33	19.0	19.0	33.3
2.50	40	23.0	23.0	56.3
3.00	39	22.4	22.4	78.7
3.50	27	15.5	15.5	94.3
4.00	10	5.7	5.7	100.0
Total	174	100.0	100.0	

TABLE 14.6

Correlations between independent and dependent variables

	Intention to leave	Job satisfaction	Perceived equity	Burnout	Job enrichment
Intention to leave	1	−0.703	−0.384	0.037	−0.426
Sig. (two-tailed)		0.000	0.000	0.629	0.000
N	174	173	174	174	173
Job satisfaction	−0.703	1	.280	−0.242	0.268
Sig. (two-tailed)	0.000		0.000	0.001	0.000
N	173	173	173	173	172
Perceived equity	−0.384	0.280	1	0.089	0.272
Sig. (two-tailed)	0.000	0.000		0.241	0.000
N	174	173	174	174	173
Burnout	0.037	−0.242	0.089	1	0.028
Sig. (two-tailed)	0.629	0.000	0.241		0.719
N	174	173	174	174	173
Job enrichment	−0.426	0.268	0.272	0.028	1
Sig. (two-tailed)	0.000	0.000	0.000	0.719	
N	173	172	173	173	173

we will have more to say about this in the next chapter). Job satisfaction is positively correlated to perceived equity and an enriched job and negatively correlated to burnout and ITL. These correlations are all in the expected direction. It is important to note that the correlations between the independent variables does not exceed 0.272 for this sample. This is an important finding, because if correlations between the *independent variables* were very high (say, 0.75 and above), we might run into a *collinearity* problem in our regression analysis.

After we have obtained descriptive statistics for the variables in our study, we can test our hypotheses. Hypothesis testing is discussed in the next chapter.

SUMMARY

- **Learning objective 1: Demonstrate the ability to get data ready for quantitative analysis.**
  After quantitative data have been collected, the next step is to analyze them to answer the research questions. However, before the data can be analyzed, they need to be coded, keyed in, and edited. A categorization scheme has to be set up before the data can be typed in. Then, outliers, inconsistencies, and blank responses, if any, have to be handled in some way. Data transformation, the next step, is a variation of data coding; it is the process of changing the original numerical representation of a quantitative value to another value. Data are typically changed to avoid problems in the next stage of the data analysis process. Data transformation is also necessary when several questions have been used to measure a single concept.

- **Learning objective 2: Describe the various processes by which one can get a feel for the data in a study.**
  The researcher can acquire a feel for the data by obtaining a visual summary or by checking the central tendency and the dispersion of a variable. One can also get to know the data by examining the relation between two variables.

- **Learning objective 3: Describe the means by which the reliability and validity of measures can be assessed.**
  The reliability of a measure is established by testing for both consistency and stability. Consistency indicates how well the items measuring a concept hang together as a set. Cronbach's alpha is a reliability coefficient that indicates how well the items in a set are correlated to one another. Another measure of consistency reliability used in specific situations is the split-half reliability coefficient. Factorial validity can be established by submitting the data for factor analysis. Criterion-related validity can be established by testing for the power of the measure to differentiate individuals who are known to be different. Convergent validity can be established when there is a high degree of correlation between two different sources responding to the same measure. Discriminant validity can be established when two distinctly different concepts are not correlated to each other.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: The Doughnut Dilemma**.

DISCUSSION QUESTIONS

1. What activities are involved in getting the data ready for analysis?
2. What does coding the data involve?
3. Data editing deals with detecting and correcting illogical, inconsistent, or illegal data in the information returned by the participants of the study. Explain the difference between illogical, inconsistent, and illegal data.
4. How would you deal with missing data?
5. What is reverse scoring and when is reverse scoring necessary?
6. There are three measures of central tendency: the mean, the median, and the mode. Measures of dispersion include the range, the standard deviation, and the variance (where the measure of central tendency is the mean), and the interquartile range (where the measure of central tendency is the median). Describe these measures and explain which of these measures you would use to provide an overview of (a) nominal, (b) ordinal, and (c) interval data?
7. A researcher wants to provide an overview of the gender of the respondents in his sample. The gender is measured like this: What is your gender? ☐ Male ☐ Female. What is the best way to provide an overview of the gender of the respondents?
8. Consider the following reliability analysis for the variable customer differentiation. What could you conclude from it?

Reliability analysis-scale (alpha)

Item-total statistics

	Scale	**Scale**	**Corrected**	
	Mean if item deleted	Variance if item deleted	Item-total correlation	Alpha if item deleted
CUSDIF1	10.0405	5.4733	0.2437	0.7454
CUSDIF2	9.7432	5.0176	0.5047	0.3293
CUSDIF3	9.6486	5.3754	0.4849	0.3722

Reliability coefficients

N of Cases = 111.0 *N* of Items = 3

Alpha = 0.5878

EXERCISE 14.4

The following data are available:

Respondent	Age	Exam mark	Paper mark	Sex	Year in college	IQ
1	21	87	83	M	2	80
2	19	83	80	M	1	100
3	23	85	86	M	4	98
4	21	81	75	F	1	76
5	21	81	75	F	3	82
6	20	67	68	F	3	99
7	26	75	88	F	2	120
8	24	92	78	F	4	115
9	26	78	92	M	4	126
10	30	89	95	F	3	129
11	21	72	80	F	1	86
12	19	81	65	M	2	80
13	17	75	77	M	1	70
14	19	76	85	F	1	99
15	35	80	83	F	3	99
16	27	75	60	F	2	60
17	21	85	80	M	3	89
18	27	79	75	M	4	70
19	21	90	93	F	3	140
20	22	97	95	M	3	165
21	21	90	82	M	2	115
22	19	87	86	F	3	119
23	32	95	90	M	2	120
24	19	68	57	F	3	89

Note: Maximum exam mark = 100, Maximum paper mark = 100, Sex: M = male, F = female, Year in college: 1 = Freshman; 2 = Sophomore; 3 = Junior; 4 = Senior.

1. Data handling
   - **a.** Enter the data in SPSS. Save the file to your USB flashdrive. Name the file "resmethassignment1."
   - **b.** Provide appropriate variable labels, value labels, and scaling indications to the variables.
2. Descriptives
   - **a.** Use Analyze, Descriptive statistics, Descriptives to summarize metric variables.
   - **b.** Use Analyze, Descriptive statistics, Frequencies to summarize nonmetric variables.

c. Create a pie-chart for Year in college.

d. Create a histogram for IQ and include the normal distribution.

e. Make a scatter plot with IQ on the x-axis and exam grade on the y-axis. What do you conclude?

f. Recode the sex variable such that it is 1 for females and 0 for males.

g. Make a scatter plot with sex on the x-axis and IQ on the y-axis. What do you conclude?

h. Compute the mean IQ for males and for females. Conclusion?

i. Create a new dummy variable, IQdum, which is 1 if the IQ is larger than or equal to 100, and 0 otherwise.

CHAPTER 15

Quantitative data analysis: Hypothesis testing

LEARNING OBJECTIVES

After completing Chapter 15, you should be able to:

1. Discuss type I errors, type II errors, and statistical power.
2. Test hypotheses using the appropriate statistical technique.
3. Describe data warehousing, data mining, and operations research.
4. Describe useful software packages for quantitative data analysis.

INTRODUCTION

In Chapter 5 we discussed the steps to be followed in hypothesis development and testing. These steps are:

1. State the null and the alternate hypotheses.
2. Determine the level of significance desired ($p = 0.05$, or more, or less).
3. Choose the appropriate statistical test depending on the type of scales that have been used (nominal, ordinal, interval, or ratio).
4. See if the output results from computer analysis indicate that the significance level is met. When the resultant value is larger than the critical value, the null hypothesis is rejected, and the alternate accepted. If the calculated value is less than the critical value, the null hypothesis is accepted and the alternate hypothesis rejected.

In this chapter we will discuss hypothesis testing. First, we will pay attention to type I errors, type II errors, and statistical power. Then, we will discuss various univariate and bivariate statistical tests that can be used to test hypotheses. Finally, we will come back to the Excelsior Enterprises case and test the hypotheses that were developed in the previous chapter.

TYPE I ERRORS, TYPE II ERRORS, AND STATISTICAL POWER

In Chapter 5 we explained that the hypothetico-deductive method requires hypotheses to be falsifiable. For this reason, null hypotheses are developed. These null hypotheses (H_0) are thus set up to be rejected in order to support the alternate hypothesis, termed H_A.

The null hypothesis is presumed true until statistical evidence, in the form of a hypothesis test, indicates otherwise. The required statistical evidence is provided by **inferential statistics**, such as regression analysis or MANOVA. Inferential statistics help us to draw conclusions (or to make inferences) *about the population* from a sample.

The purpose of hypothesis testing is to determine *accurately* if the null hypothesis can be rejected in favor of the alternate hypothesis. Based on the sample data the researcher can reject the null hypothesis (and therefore accept the alternate hypothesis) *with a certain degree of confidence*: there is always a risk that the inference that is drawn about the population is incorrect.

There are two kinds of errors (or two ways in which a conclusion can be incorrect), classified as type I errors and type II errors. A **type I error**, also referred to as alpha (α), is the probability of rejecting the null hypothesis when it is actually true. In the Excelsior Enterprises example introduced in Chapter 14, a type I error would occur if we concluded, based on the data, that burnout affects intention to leave when, in fact, it does not. The probability of type I error, also known as the *significance level*, is determined by the researcher. Typical significance levels in business research are 5% (<0.05) and 1% (<0.01).

A **type II error**, also referred to as beta (β), is the probability of failing to reject the null hypothesis given that the alternate hypothesis is actually true; e.g., concluding, based on the data, that burnout does not affect intention to leave when, in fact, it does. The probability of type II error is inversely related to the probability of type I error: the smaller the risk of one of these types of error, the higher the risk of the other type of error.

A third important concept in hypothesis testing is statistical power ($1 - \beta$). **Statistical power**, or just power, is the probability of correctly rejecting the null hypothesis. In other words, power is the probability that statistical significance will be indicated if it is present.

Statistical power depends on:

1. Alpha (α): the statistical significance criterion used in the test. If alpha moves closer to zero (for instance, if alpha moves from 5% to 1%), then the probability of finding an effect when there is an effect decreases. This implies that the lower the α (i.e., the closer α moves to zero) the lower the power; the higher the alpha, the higher the power.
2. Effect size: the effect size is the size of a difference or the strength of a relationship *in the population*: a large difference (or a strong relationship) in the population is more likely to be found than a small difference (similarity, relationship).
3. The size of the sample: at a given level of alpha, increased sample sizes produce more power, because increased sample sizes lead to more accurate parameter estimates. Thus, increased sample sizes lead to a higher probability of finding what we were looking for. However, increasing the sample size can also lead to too much power, because even very small effects will be found to be statistically significant.

Along these lines, there are four interrelated components that affect the inferences you might draw from a statistical test in a research project: the power of the test, the alpha, the effect size, and the sample size. Given the values for any three of these components, it is thus possible to calculate the value of the fourth. Generally, it is recommended to establish the power, the alpha, and the required precision (effect size) of a test first, and then, based on the values of these components, determine an appropriate sample size.

BOX 15.1

The focus of business research is usually on type I error. However, power (e.g., to determine an appropriate sample size) and, in some situations, type II error (e.g., if you are testing the effect of a new drug) must also be given serious consideration.

CHOOSING THE APPROPRIATE STATISTICAL TECHNIQUE

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Choosing the appropriate statistical technique**.

After you have selected an acceptable level of statistical significance to test your hypotheses, the next step is to decide on the appropriate method to test the hypotheses. The choice of the appropriate statistical technique largely depends on the number of (independent and dependent) variables you are examining and the scale of measurement (metric or nonmetric) of your variable(s). Other aspects that play a role are whether the assumptions of parametric tests are met and the size of your sample.

Univariate statistical techniques are used when you want to examine two-variable relationships. For instance, if you want to examine the effect of gender on the number of candy bars that students eat per week, univariate statistics are appropriate. If, on the other hand, you are interested in the relationships between many variables, such as in the Excelsior Enterprises case, *multivariate statistical techniques* are required. The appropriate univariate or multivariate test largely depends on the measurement scale you have used, as Figure 15.1 illustrates.

Chi-square analysis was discussed in the previous chapter. This chapter will discuss the other techniques listed in Figure 15.1. Note that some techniques are discussed more elaborately than others. A detailed discussion of all these techniques is beyond the scope of this book.

Testing a hypothesis about a single mean

The **one sample *t*-test** is used to test the hypothesis that the mean of the *population* from which a sample is drawn is equal to a comparison standard. Assume that you have read that the average student studies 32 hours a week. From what you have observed so far, you think that students from your university (the population from which your sample will be drawn) study more. Therefore, you ask 20 class mates how long they study in an average week. The average study time per week turns out to be 36.2 hours, 4 hours and 12 minutes more than the study time of students in general. The question is: is this a coincidence?

In the above example, the *sample* of students from your university differs from the typical student. What you want to know, however, is whether your fellow students come from a different population than the rest of the students. In other words, did you select a group of motivated students by chance? Or is there a "true" difference between students from your university and students in general?

In this example the null hypothesis is:

H_0: *The number of study hours of students from our university is equal to the number of study hours of students in general.*

Univariate techniques:

Testing a hypothesis on a single mean:
Metric data: One sample t-test
Nonmetric data: Chi-square

Testing hypotheses about two related means
Independent samples
Metric data: Independent samples t-test
Nonmetric data: Chi-square
Mann–Whitney U-test
Related samples
Metric data Paired samples t-test
Nonmetric data: Chi-square
Wilcoxon
McNemar

Testing hypotheses about several means
Metric data: One-way analysis of variance
Nonmetric data: Chi-square

Multivariate techniques:

One metric dependent variable
Analysis of variance and covariance
Multiple regression analysis
Conjoint analysis
One nonmetric dependent variable
Discriminant analysis
Logistic regression
More than one metric dependent variable
Multivariate analysis of variance
Canonical correlation

FIGURE 15.1

Overview of univariate and multivariate statistical techniques

The alternate hypothesis is:

H_1: *The number of study hours of students from our university differs from the number of study hours of students in general.*

The way to decide whether there is a significant difference between students from your university and students in general depends on three aspects: the value of the sample mean (36.2 hours); the value of the comparison standard (32 hours); and the degree of uncertainty concerning how well the sample mean represents the population mean (the standard error of the sample mean).

Along these lines, the following formula is used to compute the t-value:

$$t_{n-1} = \frac{X - \mu}{s/\sqrt{n}}$$

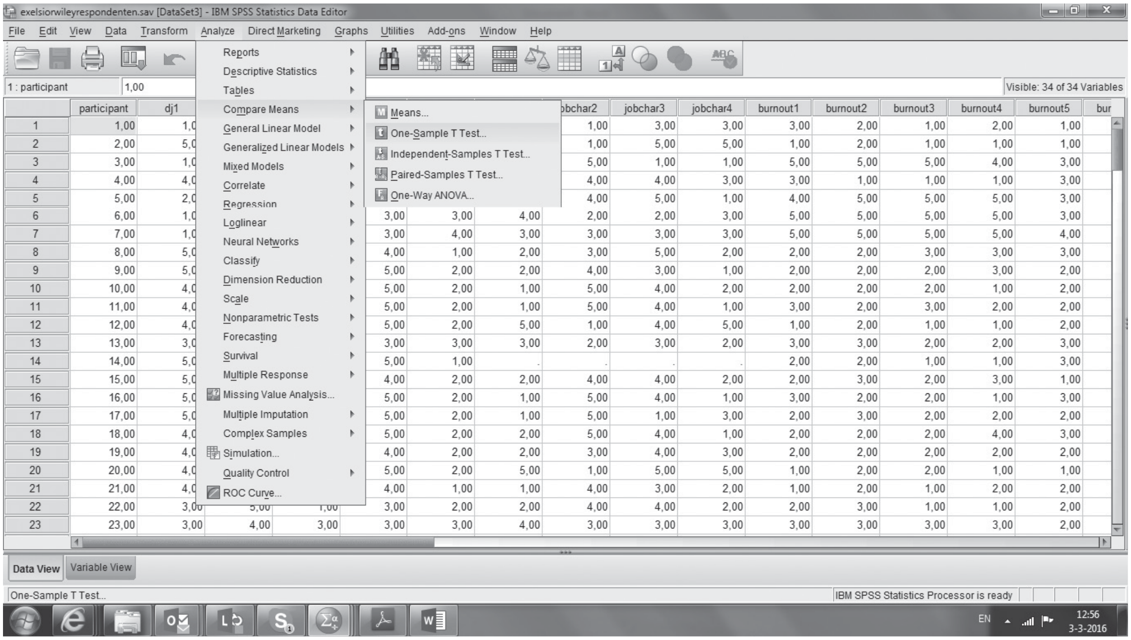
Assume that the observed standard deviation is 8. Hence, the t-statistic becomes:

$$t = \frac{36.2 - 32}{8/\sqrt{20}} = 2.438$$

BOX 15.2

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Compare Means, then One-Sample T Test. Move the dependent variable into the "Test Variable(s)" box. Type in the value you wish to compare your sample to in the box called "Test Value."


exelsiorwileyrespondenten.sav [DataSet3] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Reports
Descriptive Statistics
Tables
Compare Means
General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Simulation...
Quality Control
ROC Curve...
Means...
One-Sample T Test...
Independent-Samples T Test...
Paired-Samples T Test...
One-Way ANOVA...
Data View
Variable View
EN
12:56
3-3-2016

1 : participant 1,00

Visible: 34 of 34 Variables

	participant	dj1						bchar2	jobchar3	jobchar4	burnout1	burnout2	burnout3	burnout4	burnout5
1	1,00	1,0						1,00	3,00	3,00	3,00	2,00	1,00	2,00	1,00
2	2,00	5,0						1,00	5,00	5,00	1,00	2,00	1,00	1,00	1,00
3	3,00	1,0						5,00	1,00	1,00	5,00	5,00	5,00	4,00	3,00
4	4,00	4,0						4,00	4,00	3,00	3,00	1,00	1,00	1,00	3,00
5	5,00	2,0						4,00	5,00	1,00	4,00	5,00	5,00	5,00	3,00
6	6,00	1,0			3,00	3,00	4,00	2,00	2,00	3,00	5,00	5,00	5,00	5,00	3,00
7	7,00	1,0			3,00	4,00	3,00	3,00	3,00	3,00	5,00	5,00	5,00	5,00	4,00
8	8,00	5,0			4,00	1,00	2,00	3,00	5,00	2,00	2,00	2,00	3,00	3,00	3,00
9	9,00	5,0			5,00	2,00	2,00	4,00	3,00	1,00	2,00	2,00	2,00	3,00	2,00
10	10,00	4,0			5,00	2,00	1,00	5,00	4,00	2,00	2,00	2,00	2,00	1,00	2,00
11	11,00	4,0			5,00	2,00	1,00	5,00	4,00	1,00	3,00	2,00	3,00	2,00	2,00
12	12,00	4,0			5,00	2,00	5,00	1,00	4,00	5,00	1,00	2,00	1,00	1,00	2,00
13	13,00	3,0			3,00	3,00	3,00	2,00	3,00	2,00	3,00	3,00	2,00	2,00	3,00
14	14,00	5,0			5,00	1,00	.	.	.	.	2,00	2,00	1,00	1,00	3,00
15	15,00	5,0			4,00	2,00	2,00	4,00	4,00	2,00	2,00	3,00	2,00	3,00	1,00
16	16,00	5,0			5,00	2,00	1,00	5,00	4,00	1,00	3,00	2,00	2,00	1,00	3,00
17	17,00	5,0			5,00	2,00	1,00	5,00	1,00	3,00	2,00	3,00	2,00	2,00	2,00
18	18,00	4,0			5,00	2,00	2,00	5,00	4,00	1,00	2,00	2,00	2,00	4,00	3,00
19	19,00	4,0			4,00	2,00	2,00	3,00	4,00	3,00	2,00	2,00	2,00	2,00	2,00
20	20,00	4,0			5,00	2,00	5,00	1,00	5,00	5,00	1,00	2,00	2,00	1,00	1,00
21	21,00	4,0			4,00	1,00	1,00	4,00	3,00	2,00	1,00	2,00	1,00	2,00	2,00
22	22,00	3,00	5,00	1,00	3,00	2,00	2,00	4,00	4,00	2,00	2,00	3,00	1,00	1,00	2,00
23	23,00	3,00	4,00	3,00	3,00	3,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00

One-Sample T Test...

IBM SPSS Statistics Processor is ready

Having calculated the t-statistic, we can now compare the t-value with a standard table of t-values with $n-1$ degrees of freedom to determine whether the t-statistic reaches the threshold of statistical significance. When the t-statistic is larger than the appropriate table value, the null hypothesis (no significant difference) is rejected.

Our t-statistic (2.438) is larger than the appropriate table value (1.729). This means that the difference between 36.2 and 32 is statistically significant. The null hypothesis must thus be rejected: there is a significant difference in study time between students from our university and students in general.

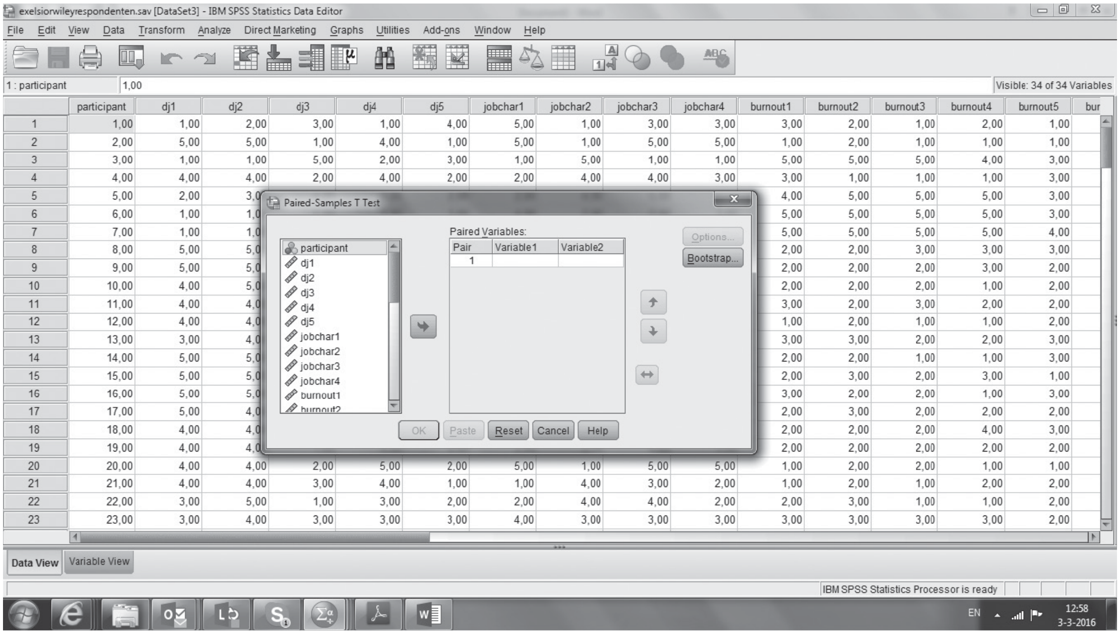
Testing hypotheses about two related means

We can also do a **(paired samples) *t*-test** to examine the differences in the same group before and after a treatment. For example, would a group of employees perform better *after* undergoing training than they did *before?*

BOX 15.3

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Compare Means, then Paired-Samples T Test. Move each of the two variables whose means you want to compare to the "Paired Variables" list.


exelsiorwileyrespondenten.sav [DataSet3] - IBM SPSS Statistics Data Editor
File
Edit
View
Data
Transform
Analyze
Direct Marketing
Graphs
Utilities
Add-ons
Window
Help
Paired-Samples T Test
participant
dj1
dj2
dj3
dj4
dj5
jobchar1
jobchar2
jobchar3
jobchar4
burnout1
burnout2
Options...
Bootstrap...
OK
Paste
Reset
Cancel
Help
Data View
Variable View
IBM SPSS Statistics Processor is ready
EN
12:58
3-3-2016

1 : participant 1,00

Visible: 34 of 34 Variables

Paired Variables:

Pair	Variable1	Variable2
1		

	participant	dj1	dj2	dj3	dj4	dj5	jobchar1	jobchar2	jobchar3	jobchar4	burnout1	burnout2	burnout3	burnout4	burnout5	bur
1	1,00	1,00	2,00	3,00	1,00	4,00	5,00	1,00	3,00	3,00	3,00	2,00	1,00	2,00	1,00	
2	2,00	5,00	5,00	1,00	4,00	1,00	5,00	1,00	5,00	5,00	1,00	2,00	1,00	1,00	1,00	
3	3,00	1,00	1,00	5,00	2,00	3,00	1,00	5,00	1,00	1,00	5,00	5,00	5,00	4,00	3,00	
4	4,00	4,00	4,00	2,00	4,00	2,00	2,00	4,00	4,00	3,00	3,00	1,00	1,00	1,00	3,00	
5	5,00	2,00	3,0								4,00	5,00	5,00	5,00	3,00	
6	6,00	1,00	1,0								5,00	5,00	5,00	5,00	3,00	
7	7,00	1,00	1,0								5,00	5,00	5,00	5,00	4,00	
8	8,00	5,00	5,0								2,00	2,00	3,00	3,00	3,00	
9	9,00	5,00	5,0								2,00	2,00	2,00	3,00	2,00	
10	10,00	4,00	5,0								2,00	2,00	2,00	1,00	2,00	
11	11,00	4,00	4,0								3,00	2,00	3,00	2,00	2,00	
12	12,00	4,00	4,0								1,00	2,00	1,00	1,00	2,00	
13	13,00	3,00	4,0								3,00	3,00	2,00	2,00	3,00	
14	14,00	5,00	5,0								2,00	2,00	1,00	1,00	3,00	
15	15,00	5,00	5,0								2,00	3,00	2,00	3,00	1,00	
16	16,00	5,00	5,0								3,00	2,00	2,00	1,00	3,00	
17	17,00	5,00	4,0								2,00	3,00	2,00	2,00	2,00	
18	18,00	4,00	4,0								2,00	2,00	2,00	4,00	3,00	
19	19,00	4,00	4,0								2,00	2,00	2,00	2,00	2,00	
20	20,00	4,00	4,00	2,00	5,00	2,00	5,00	1,00	5,00	5,00	1,00	2,00	2,00	1,00	1,00	
21	21,00	4,00	4,00	3,00	4,00	1,00	1,00	4,00	3,00	2,00	1,00	2,00	1,00	2,00	2,00	
22	22,00	3,00	5,00	1,00	3,00	2,00	2,00	4,00	4,00	2,00	2,00	3,00	1,00	1,00	2,00	
23	23,00	3,00	4,00	3,00	3,00	3,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00	

In this case, there would be two observations for each employee, one before the training and one after the training. We would use a paired samples t-test to test the null hypothesis that the average of the differences between the before and after measure is zero.

EXAMPLE

A university professor was interested in the effect of her teaching program on the performance of her students. For this reason, ten students were given a math test in the first week of the semester and their scores were recorded. Subsequently, the students were given an equivalent test during the last week of the semester. The professor now wants to know whether the students' math scores have increased.

Table 15.1 depicts the scores of students on the math test in the first and in the last week of the semester.

To find out if there is a significant difference in math scores we need a test statistic. The test statistic is the average difference/$s_{\text{difference}}/\sqrt{n}$.

In this example we get: $22.5/13.79412/\sqrt{10}$.

Having calculated the t-statistic, we can now compare the t-value with a standard table of t-values with $n-1$ degrees of freedom to determine whether the t-statistic reaches the threshold of statistical significance. Again, when the t-statistic is larger than the appropriate table value, the null hypothesis (no significant difference) is rejected.

Our t-statistic is larger than the appropriate table value (1.83). This means that the difference between 70 and 57.5 is statistically significant. The null hypothesis must thus be rejected: there is a significant increase in math score.

TABLE 15.1

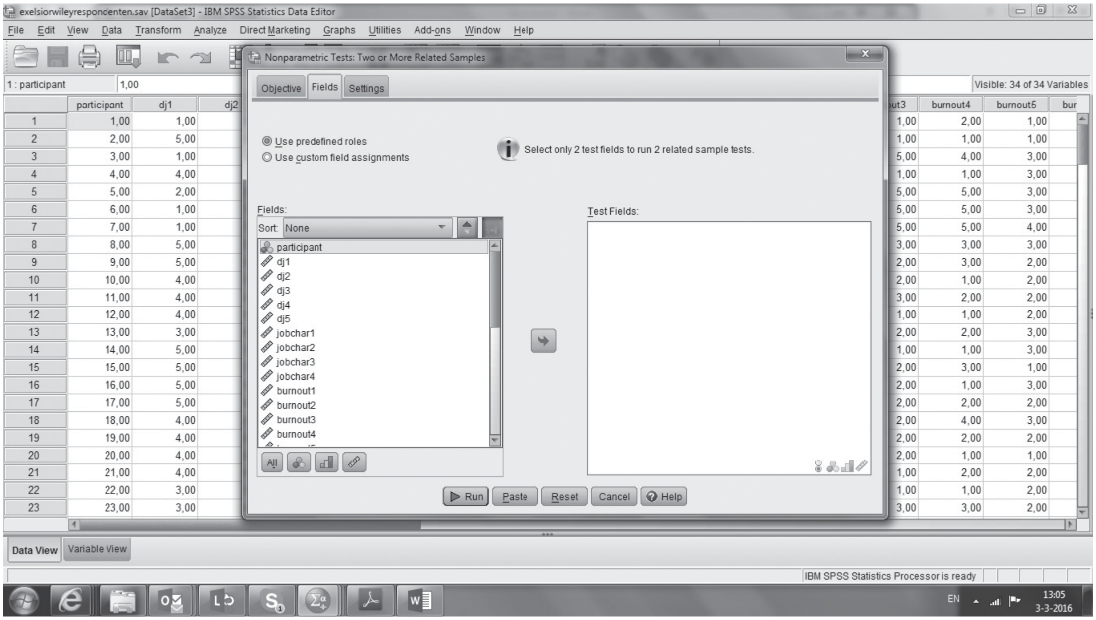
Math scores of ten students in the first and last week of the semester

	Math scores		
Student	**Score first week**	**Score last week**	**Difference**
1	55	75	+20
2	65	80	+15
3	70	75	+5
4	55	60	+5
5	40	45	+5
6	60	55	−5
7	80	75	−5
8	35	70	+35
9	55	75	+20
10	60	90	+30
Average score	57.5	70	22.5

BOX 15.4

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Nonparametric Tests, then Related Samples. Choose 'Automatically compare observed data to hypothesized' as the objective of your analysis, 'Wilcoxon matched-pair signed-rank (2 samples)', under 'Settings' and move the variables you want to compare into the 'Test Fields' box.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File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Nonparametric Tests: Two or More Related Samples
Objective Fields Settings
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1 : participant 1,00

Visible: 34 of 34 Variables

● Use predefined roles
○ Use custom field assignments

Select only 2 test fields to run 2 related sample tests.

Fields:
Sort: None
participant
dj1
dj2
dj3
dj4
dj5
jobchar1
jobchar2
jobchar3
jobchar4
burnout1
burnout2
burnout3
burnout4

Test Fields:

	participant	dj1	dj2	ut3	burnout4	burnout5	bur
1	1,00	1,00		1,00	2,00	1,00	
2	2,00	5,00		1,00	1,00	1,00	
3	3,00	1,00		5,00	4,00	3,00	
4	4,00	4,00		1,00	1,00	3,00	
5	5,00	2,00		5,00	5,00	3,00	
6	6,00	1,00		5,00	5,00	3,00	
7	7,00	1,00		5,00	5,00	4,00	
8	8,00	5,00		3,00	3,00	3,00	
9	9,00	5,00		2,00	3,00	2,00	
10	10,00	4,00		2,00	1,00	2,00	
11	11,00	4,00		3,00	2,00	2,00	
12	12,00	4,00		1,00	1,00	2,00	
13	13,00	3,00		2,00	2,00	3,00	
14	14,00	5,00		1,00	1,00	3,00	
15	15,00	5,00		2,00	3,00	1,00	
16	16,00	5,00		2,00	1,00	3,00	
17	17,00	5,00		2,00	2,00	2,00	
18	18,00	4,00		2,00	4,00	3,00	
19	19,00	4,00		2,00	2,00	2,00	
20	20,00	4,00		2,00	1,00	1,00	
21	21,00	4,00		1,00	2,00	2,00	
22	22,00	3,00		1,00	1,00	2,00	
23	23,00	3,00		3,00	3,00	2,00	

The **Wilcoxon signed-rank test** is a nonparametric test for examining significant differences between two related samples or repeated measurements on a single sample. It is used as an alternative to a paired samples *t*-test when the population cannot be assumed to be normally distributed.

McNemar's test is a nonparametric method used on nominal data. It assesses the significance of the difference between two dependent samples when the variable of interest is dichotomous. It is used primarily in before–after studies to test for an experimental effect.

In the following example, a researcher wants to determine whether the use of a new training method (called CARE) has an effect on the performance of athletes. Counts of individual athletes are given in Table 15.2. The performance (average/good) before the treatment (the new training method) is given in the columns (244 athletes delivered an average performance before they trained with the CARE method, whereas 134 athletes delivered a good performance before they adopted this method). You can find the performance after the treatment (average/good) in the rows (190 athletes delivered an average performance after using the new training method, while the number of athletes that delivered a good performance increased to 188).

TABLE 15.2

Performance of athletes before and after new training method

		Before		
		average	**good**	**totals**
After	average	112	78	190
	good	132	56	188
	totals	244	134	378

TABLE 15.3

A more abstract representation of Table 15.2

		Before		
		average	**good**	**totals**
After	average	a	b	$a + b$
	good	c	d	$c + d$
	totals	$a + c$	$b + d$	n

The cells of Table 15.2 can be represented by the letters a, b, c, and d. The totals across rows and columns are marginal totals ($a + b$, $c + d$, $a + c$, and $b + d$). The grand total is represented by n, as shown in Table 15.3.

McNemar's test is a rather straightforward technique to test marginal homogeneity. *Marginal homogeneity* refers to equality (or the lack of a significant difference) between one or more of the marginal row totals and the corresponding marginal column totals. In this example, marginal homogeneity implies that the row totals are equal to the corresponding column totals, or

$$a + b = a + c$$
$$c + d = b + d$$

Marginal homogeneity would mean there was no effect of the treatment. In this case it would mean that the new training method would not affect the performance of athletes.

The McNemar test uses the χ^2 distribution, based on the formula: $(|b - c| - 1)^2/(b + c)$. χ^2 is a statistic with 1 degree of freedom [(# rows − 1) × (# columns −1)]. The marginal frequencies are *not* homogeneous if the χ^2 result is significant at $p < 0.05$.

The χ^2 value in this example is:

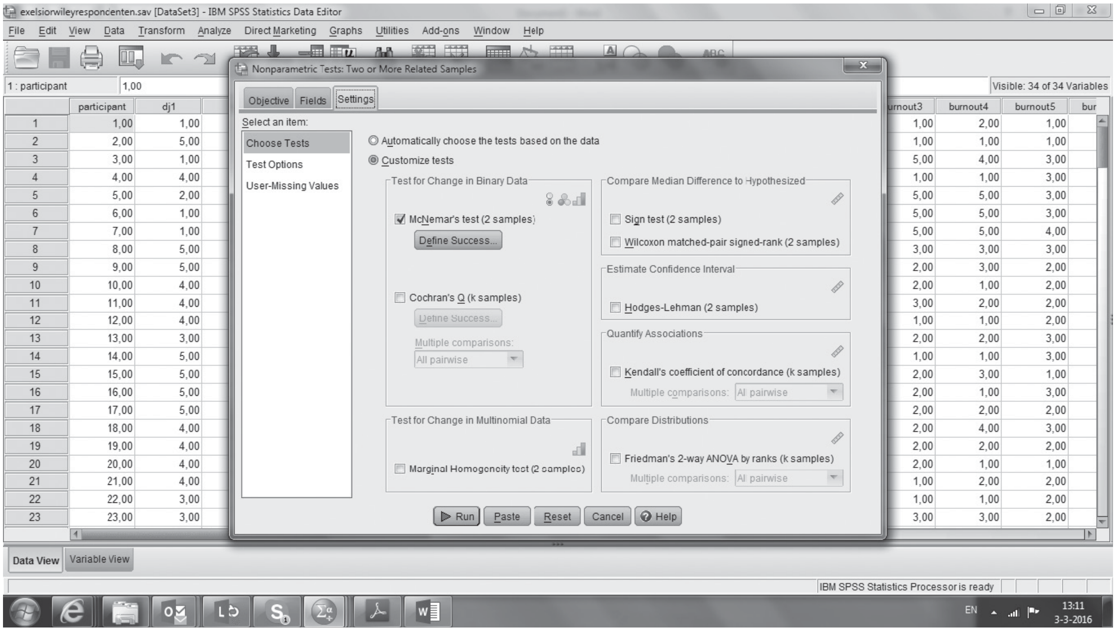
$$(|78 - 132| - 1)^2)/(78 + 132) = 53^2/210 = 13.376$$

The table of the distribution of chi-square, with 1 degree of freedom, reveals that the difference between samples is significant at the 0.05 level: the critical value of chi-square is 3.841. Since 13.376 computed for the example above exceeds this value, the difference between samples is significant. Hence, we can conclude that the new training method has a positive effect on the performance of athletes.

BOX 15.5

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Nonparametric Tests, then Related Samples. Choose 'Automatically compare observed data to hypothesized' as the objective of your analysis, 'McNedmar's test (2 samples)', under 'Settings' and move the variables you want to compare into the 'Test Fields' box.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File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Nonparametric Tests: Two or More Related Samples
Objective Fields Settings
Select an item:
Choose Tests
Test Options
User-Missing Values
Run Paste Reset Cancel Help
Data View Variable View
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Visible: 34 of 34 Variables

	participant	dj1	urnout3	burnout4	burnout5	bur
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2	2,00	5,00	1,00	1,00	1,00	
3	3,00	1,00	5,00	4,00	3,00	
4	4,00	4,00	1,00	1,00	3,00	
5	5,00	2,00	5,00	5,00	3,00	
6	6,00	1,00	5,00	5,00	3,00	
7	7,00	1,00	5,00	5,00	4,00	
8	8,00	5,00	3,00	3,00	3,00	
9	9,00	5,00	2,00	3,00	2,00	
10	10,00	4,00	2,00	1,00	2,00	
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18	18,00	4,00	2,00	4,00	3,00	
19	19,00	4,00	2,00	2,00	2,00	
20	20,00	4,00	2,00	1,00	1,00	
21	21,00	4,00	1,00	2,00	2,00	
22	22,00	3,00	1,00	1,00	2,00	
23	23,00	3,00	3,00	3,00	2,00	

○ Automatically choose the tests based on the data
● Customize tests

Test for Change in Binary Data
☑ McNemar's test (2 samples)
Define Success...
☐ Cochran's Q (k samples)
Define Success...
Multiple comparisons: All pairwise

Test for Change in Multinomial Data
☐ Marginal Homogeneity test (2 samples)

Compare Median Difference to Hypothesized
☐ Sign test (2 samples)
☐ Wilcoxon matched-pair signed-rank (2 samples)

Estimate Confidence Interval
☐ Hodges-Lehman (2 samples)

Quantify Associations
☐ Kendall's coefficient of concordance (k samples)
Multiple comparisons: All pairwise

Compare Distributions
☐ Friedman's 2-way ANOVA by ranks (k samples)
Multiple comparisons: All pairwise

Note that if b and/or c are small ($b + c < 20$) then χ^2 is not approximated by the chi-square distribution. Instead a *sign test* should be used.

Testing hypotheses about two unrelated means

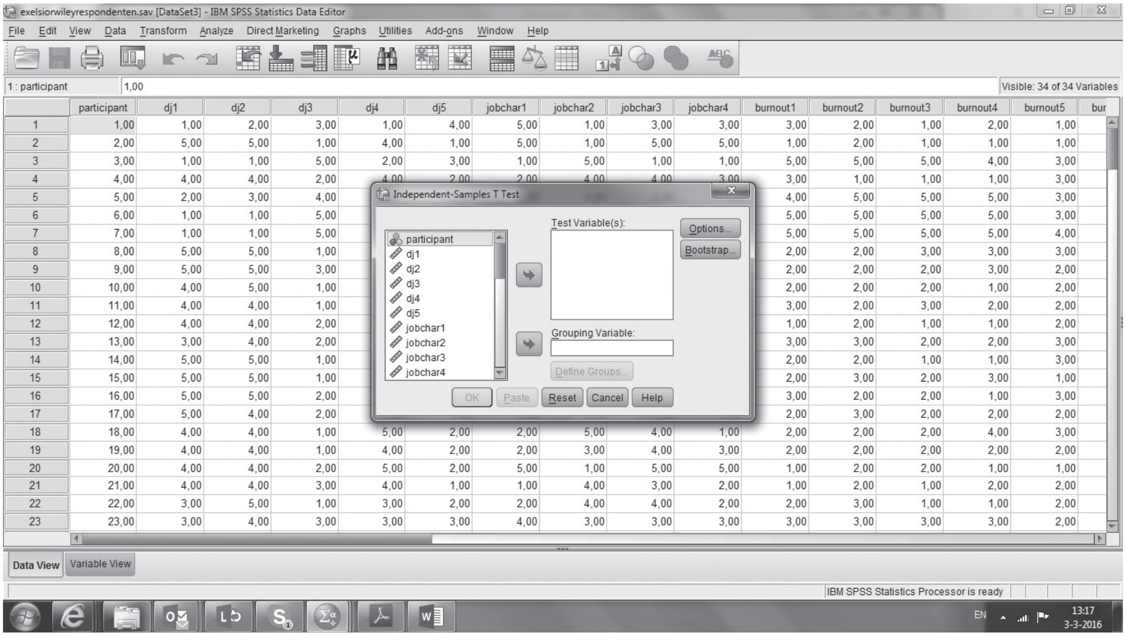
There are many instances when we are interested to know whether two groups are different from each other on a particular interval-scaled or ratio-scaled variable of interest. For example, would men and women press their case for the introduction of flextime at the workplace to the same extent, or would their needs be different? Do MBAs perform better in organizational settings than business students with only a bachelor's degree? Do individuals in urban areas have a different investment pattern for their savings than those in semi-urban areas? Do CPAs perform better than non-CPAs in accounting tasks? To find answers to such questions, an

independent samples *t*-test is carried out to see if there are any significant differences in the means for two groups in the variable of interest. That is, a **nominal** variable that is split into two subgroups (e.g., smokers and nonsmokers; employees in the marketing department and those in the accounting department; younger and older employees) is tested to see if there is a significant mean difference between the two split groups on a dependent variable, which is measured on an **interval** or **ratio scale** (for instance, extent of wellbeing; pay; or comprehension level).

BOX 15.6

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Compare Means, then Independent Samples T Test. Move the dependent variable into the "Test Variable(s)" box. Move the independent variable (i.e., the variable whose values define the two groups) into the "Grouping Variable" box. Click "Define Groups" and specify how the groups are defined (for instance 0 and 1 or 1 and 2).



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1 : participant 1,00

Visible: 34 of 34 Variables

	participant	dj1	dj2	dj3	dj4	dj5	jobchar1	jobchar2	jobchar3	jobchar4	burnout1	burnout2	burnout3	burnout4	burnout5
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2	2,00	5,00	5,00	1,00	4,00	1,00	5,00	1,00	5,00	5,00	1,00	2,00	1,00	1,00	1,00
3	3,00	1,00	1,00	5,00	2,00	3,00	1,00	5,00	1,00	1,00	5,00	5,00	5,00	4,00	3,00
4	4,00	4,00	4,00	2,00	4,00	2,00	2,00	4,00	4,00	3,00	3,00	1,00	1,00	1,00	3,00
5	5,00	2,00	3,00	4,00							4,00	5,00	5,00	5,00	3,00
6	6,00	1,00	1,00	5,00							5,00	5,00	5,00	5,00	3,00
7	7,00	1,00	1,00	5,00							5,00	5,00	5,00	5,00	4,00
8	8,00	5,00	5,00	1,00							2,00	2,00	3,00	3,00	3,00
9	9,00	5,00	5,00	3,00							2,00	2,00	2,00	3,00	2,00
10	10,00	4,00	5,00	1,00							2,00	2,00	2,00	1,00	2,00
11	11,00	4,00	4,00	1,00							3,00	2,00	3,00	2,00	2,00
12	12,00	4,00	4,00	2,00							1,00	2,00	1,00	1,00	2,00
13	13,00	3,00	4,00	2,00							3,00	3,00	2,00	2,00	3,00
14	14,00	5,00	5,00	1,00							2,00	2,00	1,00	1,00	3,00
15	15,00	5,00	5,00	1,00							2,00	3,00	2,00	3,00	1,00
16	16,00	5,00	5,00	2,00							3,00	2,00	2,00	1,00	3,00
17	17,00	5,00	4,00	2,00							2,00	3,00	2,00	2,00	2,00
18	18,00	4,00	4,00	1,00	5,00	2,00	2,00	5,00	4,00	1,00	2,00	2,00	2,00	4,00	3,00
19	19,00	4,00	4,00	1,00	4,00	2,00	2,00	3,00	4,00	3,00	2,00	2,00	2,00	2,00	2,00
20	20,00	4,00	4,00	2,00	5,00	2,00	5,00	1,00	5,00	5,00	1,00	2,00	2,00	1,00	1,00
21	21,00	4,00	4,00	3,00	4,00	1,00	1,00	4,00	3,00	2,00	1,00	2,00	1,00	2,00	2,00
22	22,00	3,00	5,00	1,00	3,00	2,00	2,00	4,00	4,00	2,00	2,00	3,00	1,00	1,00	2,00
23	23,00	3,00	4,00	3,00	3,00	3,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00

Independent-Samples T Test

participant
dj1
dj2
dj3
dj4
dj5
jobchar1
jobchar2
jobchar3
jobchar4

Test Variable(s):

Grouping Variable:

IBM SPSS Statistics Processor is ready

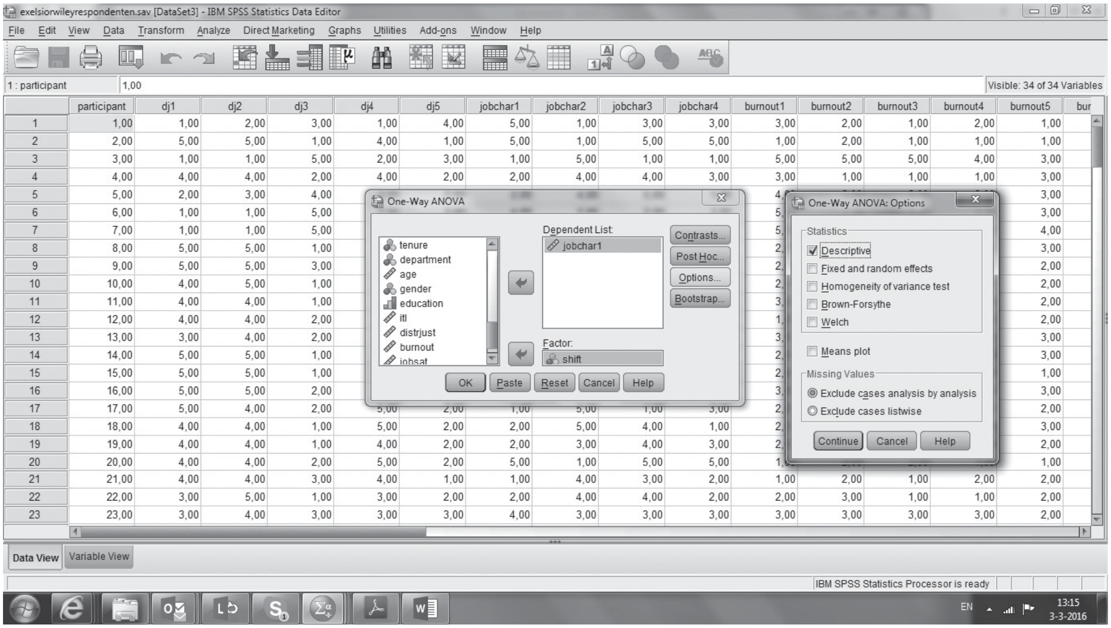
Testing hypotheses about several means

Whereas the (independent samples) *t*-test indicates whether or not there is a significant mean difference in a dependent variable between two groups, an analysis of variance (**ANOVA**) helps to examine the significant mean differences among more than two groups on an interval or ratio-scaled dependent variable. For example, is there a significant difference in the amount of sales by the following four groups of salespersons: those who are sent to training schools; those who are given on-the-job training during field trips; those who have been tutored by the sales manager; and those who have had none of the above? Or is the rate of promotion significantly different for those who have assigned mentors, choose their own mentors, and have no mentors in the organizational system?

BOX 15.7

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Compare Means, then One-Way ANOVA. Move the dependent variable into the "Dependent List". Move the Independent variable (i.e., the variable whose values define the groups) into the "Factor" box. Click OK.


exelsiorwileyrespondenten.sav [DataSet3] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
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Visible: 34 of 34 Variables
One-Way ANOVA
tenure
department
age
gender
education
itl
distrjust
burnout
jobsat
Contrasts...
Post Hoc...
Options...
Bootstrap...
OK Paste Reset Cancel Help
One-Way ANOVA: Options
Statistics
Missing Values
Continue Cancel Help
Data View Variable View
IBM SPSS Statistics Processor is ready

One-Way ANOVA

Dependent List: jobchar1

Factor: shift

One-Way ANOVA: Options

Statistics

- ☑ Descriptive
- ☐ Fixed and random effects
- ☐ Homogeneity of variance test
- ☐ Brown-Forsythe
- ☐ Welch

☐ Means plot

Missing Values

- ● Exclude cases analysis by analysis
- ○ Exclude cases listwise

The results of ANOVA show whether or not the means of the various groups are significantly different from one another, as indicated by the *F* statistic. The *F* statistic shows whether two sample variances differ from each other or are from the same population. The *F* distribution is a probability distribution of sample variances and the family of distributions changes with changes in the sample size. Details of the *F* statistic may be seen in Table IV in the statistical tables toward the end of the book.

When significant mean differences among the groups are indicated by the *F* statistic, there is no way of knowing from the ANOVA results alone where they lie; that is, whether the significant difference is between Groups A and B, or between B and C, or A and C, and so on. It is therefore unwise to use multiple *t*-tests, taking two groups at a time, because the greater the number of *t*-tests done, the lower the confidence we can place on results. For example, three *t*-tests done simultaneously decrease the confidence level from 95% to 86% $(0.95)^3$. However, several tests, such as Scheffe's test, Duncan Multiple Range test, Tukey's test, and Student–Newman–Keul's test are available and can be used, as appropriate, to detect where exactly the mean differences lie.

Regression analysis

Simple **regression analysis** is used in a situation where one independent variable is hypothesized to affect one dependent variable. For instance, assume that we propose that the propensity to buy a product depends only on the perceived quality of that product.[1] In this case we would have to gather information on perceived quality and propensity to buy a product. We could then plot the data to obtain some first ideas on the relationship between these variables.

From Figure 15.2 we can see that there is a linear relationship between perceived quality and propensity to buy the product. We can model this linear relationship by a *least squares function*.

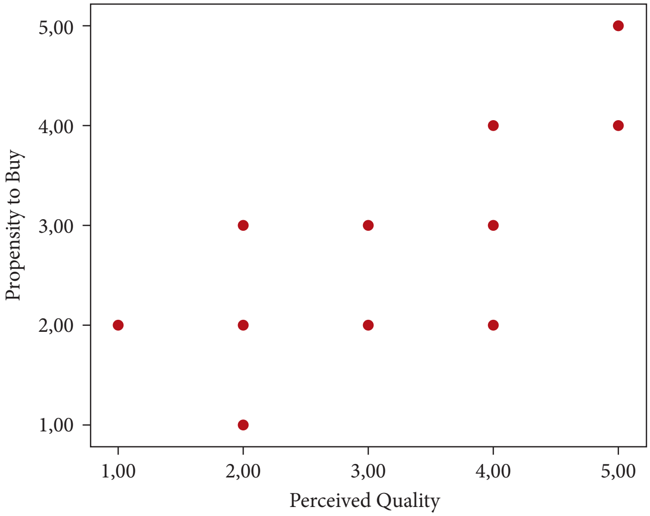

FIGURE 15.2

Scatter plot of perceived quality versus propensity to buy

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[1] In reality, any effort to model the effect of perceived quality on propensity to buy a product without careful attention to other factors that affect propensity to buy would cause a serious statistical problem ("omitted variables bias").

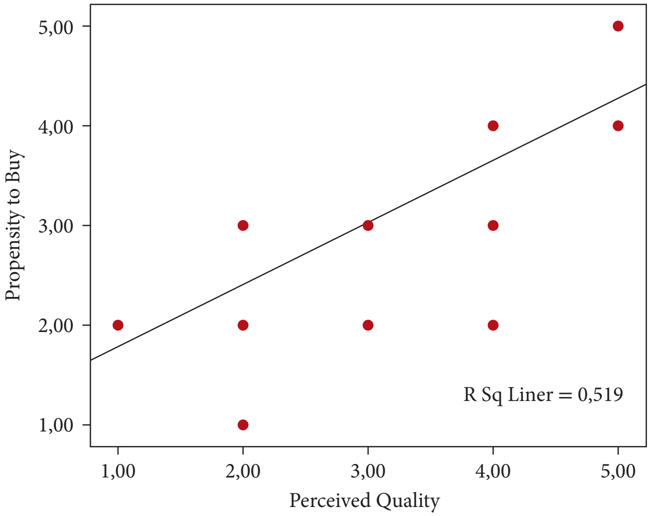


FIGURE 15.3

Regression of propensity to buy on perceived quality

A simple linear regression equation represents a straight line. Indeed, to summarize the relationship between perceived quality and propensity to buy, we can draw a straight line through the data points, as in Figure 15.3.

We can also express this relationship in an equation:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \varepsilon_i$$

The parameters β_0 and β_1 are called regression coefficients. They are the intercept (β_0) and the slope (β_1) of the straight line relating propensity to buy (Y) to perceived quality (X_1). The slope can be interpreted as the number of units by which propensity to buy would increase if perceived quality increased by a unit. The error term denotes the error in prediction or the difference between the estimated propensity to buy and the actual propensity to buy.

In this example the intercept (β_0) was not significant whereas the slope (β_1) was. The unstandardized regression coefficient β_1 was 0.832. Recall that the unstandardized regression coefficient represents the amount of change in the dependent variable (propensity to buy in this case) for a one-unit change in the independent variable (perceived quality). Hence, the regression coefficient β_1 indicates that the propensity to buy increases by 0.832 (on a five-point scale) for a one unit change in perceived quality. In other words, the propensity to buy for consumer A, who appraises perceived quality with a 4 (on a five-point scale) is *estimated* to be 0.832 units higher (on a five-point scale) than the propensity to buy for consumer B, who appraised perceived quality with a 3 (on a five-point scale).

The coefficient of determination, R^2, provides information about the goodness of fit of the regression model: it is a statistical measure of how well the regression line approximates the real data points. R^2 is the percentage of variance in the dependent variable that is explained by the variation in the independent variable. If R^2 is 1, the regression model using perceived quality perfectly predicts propensity to buy. In other words, the regression model fits the data perfectly. On the other hand, if R^2 is 0, none of the variation in propensity to buy can be attributed to the independent variable, perceived quality. In this case, the R^2 for the model is 0.519. This means that almost 52% of the variation in propensity to buy is explained by variation in perceived quality.

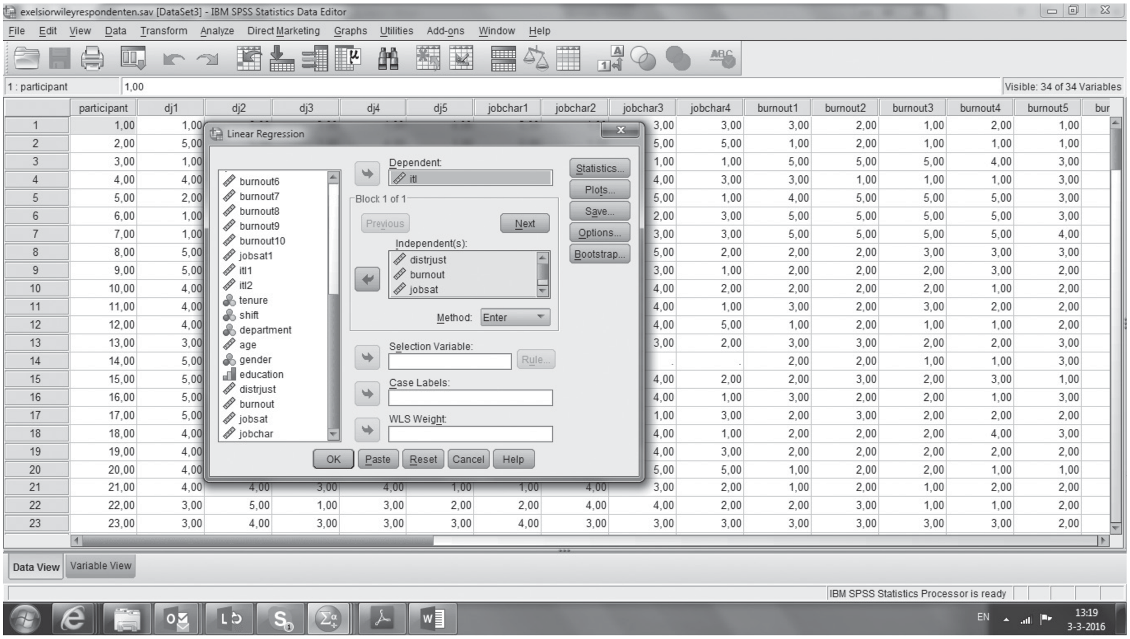
The basic idea of **multiple regression analysis** is similar to that of simple regression analysis. Only in this case, we use more than one independent variable to explain variance in the dependent variable. Multiple regression analysis is a multivariate technique that is used very often in business research. The starting point of multiple regression analysis is, of course, the conceptual model (and the hypotheses derived from that model) that the researcher has developed in an earlier stage of the research process.

Multiple regression analysis provides a means of objectively assessing the degree and the character of the relationship between the independent variables and the dependent variable: the regression coefficients indicate the relative importance of each of the independent variables in the prediction of the dependent variable. For example, suppose that a researcher believes that the variance in performance can be explained by four independent variables, *A*, *B*, *C*, and *D* (say, pay, task difficulty, supervisory support, and organizational culture). When these variables are jointly regressed against the dependent variable in an effort to explain the variance in it, the sizes of the individual regression coefficients indicate how much an increase of one unit in the independent variable would affect the dependent variable, assuming that all the other independent variables remain unchanged. What's more, the individual correlations between the independent variables and the dependent variable collapse

BOX 15.8

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Regression, then Linear. Move the dependent variable into the "Dependent" box. Move the independent variables into the "Independent(s)" list and click OK.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File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Linear Regression
Statistics...
Plots...
Save...
Options...
Bootstrap...
OK Paste Reset Cancel Help
Data View Variable View
IBM SPSS Statistics Processor is ready

Dependent: itl

Block 1 of 1

Independent(s): distrjust, burnout, jobsat

Method: Enter

into what is called a *multiple r* or multiple correlation coefficient. The square of multiple r, R-square, or R^2 as it is commonly known, is the amount of variance explained in the dependent variable by the predictors.

Standardized regression coefficients

Standardized regression coefficients (or beta coefficients) are the estimates resulting from a multiple regression analysis performed on variables that have been standardized (a process whereby the variables are transformed into variables with a mean of 0 and a standard deviation of 1). This is usually done to allow the researcher to compare the relative effects of independent variables on the dependent variable, when the independent variables are measured in different units of measurement (e.g., income measured in dollars and household size measured in number of individuals).

Regression with dummy variables

A **dummy variable** is a variable that has two or more distinct levels, which are coded 0 or 1. Dummy variables allow us to use nominal or ordinal variables as independent variables to explain, understand, or predict the dependent variable.

Suppose that we are interested in the relationship between work shift and job satisfaction. In this case, the variable "work shift," which has three categories (see the Excelsior Enterprises case), would have to be coded in terms of two dummy variables, since one of the three categories should serve as the reference category. This might be done as shown in Table 15.4. Note that the third shift serves as the reference category.

Next, the dummy variables D_1 and D_2 have to be included in a regression model. This would look like this:

$$Y_i = \beta_0 + \beta_1 D_{1i} + \beta_{2i} D_{2i} + \varepsilon_i$$

In this example workers from the third shift have been selected as the reference category. For this reason, this category has not been included in the regression equation. For workers in the third shift, D_1 and D_2 assume a value of 0, and the regression equation thus becomes:

$$Y_i = \beta_0 + \varepsilon_i$$

For workers in the first shift the equation becomes:

$$Y_i = \beta_0 + \beta_1 D_{1i} + \varepsilon_i$$

TABLE 15.4

Recoding work shift into dummy codes

Work shift	Original code	Dummy D_1	Dummy D_2
First shift	1	1	0
Second shift	2	0	1
Third shift	3	0	0

The coefficient β_1 is the difference in predicted job satisfaction for workers in the first shift, as compared to workers in the third shift. The coefficient β_2 has the same interpretation. Note that any of the three shifts could have been used as a reference category.

Now do Exercises 15.1 and 15.2.

EXERCISE 15.1

Provide the equation for workers in the second shift.

EXERCISE 15.2

Use the data of the Excelsior Enterprises case to estimate the effect of work shift on job satisfaction.

Multicollinearity

Multicollinearity is an often encountered statistical phenomenon in which two or more independent variables in a multiple regression model are highly correlated. In its most severe case (if the correlation between two independent variables is equal to 1 or −1) multicollinearity makes the estimation of the regression coefficients impossible. In all other cases it makes the estimates of the regression coefficients unreliable.

The simplest and most obvious way to detect multicollinearity is to check the correlation matrix for the independent variables. The presence of high correlations (most people consider correlations of 0.70 and above high) is a first sign of sizeable multicollinearity. However, when multicollinearity is the result of complex relationships among several independent variables, it may not be revealed by this approach. More common measures for identifying multicollinearity are therefore the *tolerance value* and the *variance inflation factor* (*VIF* – the inverse of the tolerance value). Box 15.9 explains how you can produce tolerance and VIF values using SPSS. These measures indicate the degree to which one independent variable is explained by the other independent variables. A common cutoff value is a tolerance value of 0.10, which corresponds to a VIF of 10.

Note that multicollinearity is *not* a serious problem if the purpose of the study is to predict or forecast future values of the dependent variable, because even though the estimations of the regression coefficients may be unstable, multicollinearity does not affect the reliability of the forecast. However, if the objective of the study is to reliably estimate the individual regression coefficients, multicollinearity is a problem. In this case, we may use one or more of the following methods to reduce it:

- Reduce the set of independent variables to a set that are not collinear (but note that this may lead to omitted variable bias, which is also a serious problem).
- Use more sophisticated ways to analyze the data, such as ridge regression.
- Create a new variable that is a composite of the highly correlated variables.

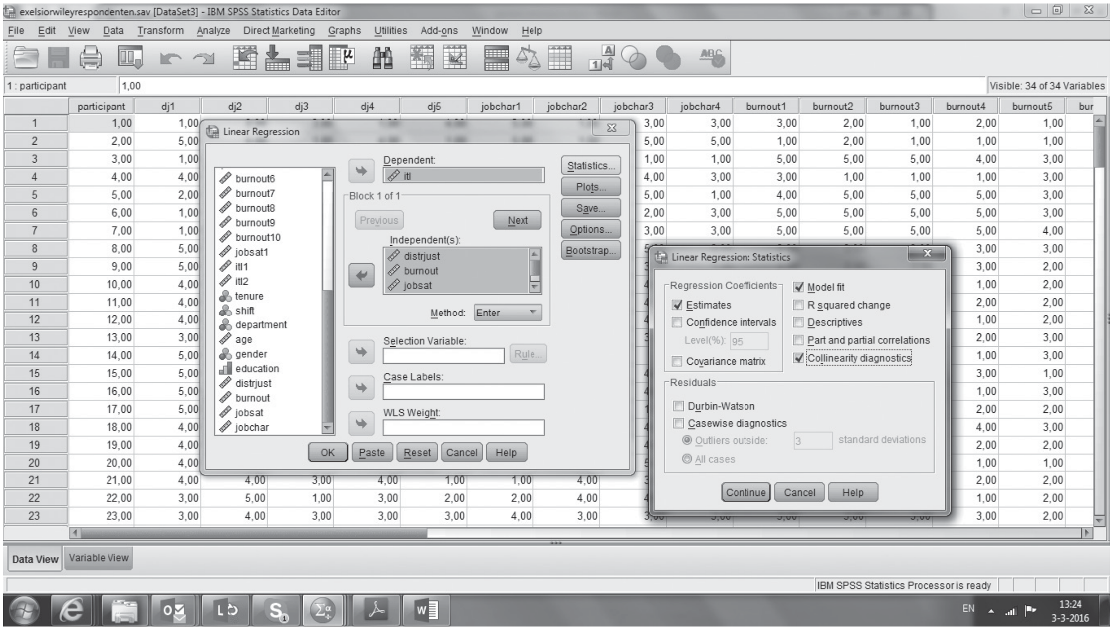
Testing moderation using regression analysis: interaction effects

Earlier in this book we described a moderating variable as a variable that modifies the original relationship between an independent variable and the dependent variable. This means that the effect of one variable (X_1) on

BOX 15.9

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Regression, then Linear. Move the dependent variable into the "Dependent" box. Move the independent variables into the "Independent(s)" list. Select "Statistics" by clicking the button on the right-hand side. Select "Collinearity diagnostics" and click continue. Then click OK.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File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Visible: 34 of 34 Variables
Linear Regression
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Linear Regression: Statistics
Continue Cancel Help
Data View Variable View
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Dependent: itl

Block 1 of 1

Independent(s): distrjust, burnout, jobsat

Method: Enter

Regression Coefficients: ☑ Estimates ☐ Confidence intervals Level(%): 95 ☐ Covariance matrix

☑ Model fit ☐ R squared change ☐ Descriptives ☐ Part and partial correlations ☑ Collinearity diagnostics

Residuals: ☐ Durbin-Watson ☐ Casewise diagnostics ● Outliers outside: 3 standard deviations ○ All cases

Y depends on the value of another variable, the moderating variable (X_2). Such *interactions* are included as *the product* of two variables in a regression model.

Suppose that we have developed the following hypothesis:

H_1: *The students' judgment of the university's library is affected by the students' judgment of the computers in the library.*

Now suppose that we also believe that, even though this relationship will hold for all students, it will be nonetheless contingent on laptop ownership. That is, we believe that the relationship between the judgment of computers in the library and the judgment of the library is affected by laptop ownership (indeed laptop ownership is a *dummy variable*). Therefore, we hypothesize that:

H_2: *The relationship between the judgment of the library and judgment of computers in the library is moderated by laptop ownership.*

The relationship between the judgment of the library and judgment of computers in the library can be modeled as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \varepsilon_i \tag{1}$$

We have also hypothesized that the effect of X_1 on Y depends on X_2. This can be modeled as follows:

$$\beta_1 = \gamma_0 + \gamma_1 X_{2i} \tag{2}$$

Adding the second equation into the first one leads to the following model:

$$Y_i = \beta_0 + \gamma_0 X_{1i} + \gamma_1 \left(X_{1i} \cdot X_{2i} \right) + \varepsilon_i \tag{3}$$

This last model states that the slope of the relationship between the independent variable (judgment of computers in the library: X_1) and the dependent variable (judgment of the library: Y) varies according to the level of the moderating variable (laptop possession: X_2). In other words, the relationship between the independent and the dependent variable is a function of variable X_2.

Although this model allows us to test moderation, the following model is better (because it also helps us to account for differences in starting level between laptop owners and students who do not own a laptop):

$$Y_i = \beta_0 + \gamma_0 X_{1i} + \gamma_1 \left(X_{1i} \cdot X_{2i} \right) + \gamma_2 X_{2i} + \varepsilon_i \tag{4}$$

Because model (4) includes a direct effect of X_2 on Y, it allows us to differentiate between *pure moderation* and *quasi moderation* (compare Sharma, Durand & Gur-Arie, 1981), as explained next.

If $\gamma_1 = 0$ and $\gamma_2 \neq 0$, X_2 is not a moderator but simply an independent predictor variable. If $\gamma_1 \neq 0$, X_2 is a moderator. Model (4) allows us to differentiate between pure moderators and quasi moderators as follows: if $\gamma_1 \neq 0$ and $\gamma_2 = 0$, X_2 is a pure moderator. That is, X_2 moderates the relationship between X_1 and Y, but it has no direct effect on Y. In other words, in this case the *effect* of judgment of computers in the library on judgment of the library is different for the two groups (the line representing this relationship has a different slope); the starting level is the same however (there are no differences in the intercept). If $\gamma_1 \neq 0$ and $\gamma_2 \neq 0$, X_2 is a quasi moderator. That is, X_2 moderates the relationship between X_1 and Y, but it also has a direct effect on Y (different slope and different intercept).

Suppose that data analysis leads to the following model:

$$\hat{Y}_i = 4.3 + 0.4 X_{1i} - 0.01 X_{2i} - 0.2 (X_{1i} \cdot X_{2i}) \tag{5}$$

where $\beta_0 \neq 0, \gamma_0 \neq 0, \gamma_1 \neq 0$, and $\gamma_2 = 0$.

Based on the results we can conclude that: (1) the judgment of computers in the library has a positive effect on the judgment of the library and (2) that this effect is moderated by laptop possession: if a student has no laptop $\left(X_{2i} = 0 \right)\left(X_{2i} = 0 \right)$ the *marginal* effect is 0.4; if the student has a laptop $\left(X_{2i} = 1 \right)\left(X_{2i} = 1 \right)$ the *marginal* effect is 0.2. Thus, laptop possession has a negative moderating effect.

Now do Exercises 15.3, 15.4, and 15.5.

EXERCISE 15.3

Why could it be important to differentiate between quasi moderators and pure moderators?

EXERCISE 15.4

Is laptop possession a pure moderator or a quasi moderator? Explain.

EXERCISE 15.5

Provide a logical explanation for the negative moderating effect of laptop possession.

The previous example shows that dummy variables can be used to allow the effect of one independent variable on the dependent variable to change depending on the value of the dummy variable. It is, of course, also possible to include metric variables as moderators in a model. In such cases, the procedure to test moderation is exactly the same as in the previous example.

In this section, we have explained how moderation can be tested with regression analysis. Note that it is also possible to test mediation with regression analysis. We will explain this later on in this chapter using the Excelsior Enterprises data.

Other multivariate tests and analyses

We will now briefly describe five other multivariate techniques: discriminant analysis, logistic regression, conjoint analysis, multivariate analysis of variance (MANOVA), and canonical correlations.

Discriminant analysis

Discriminant analysis (Box 15.10) helps to identify the independent variables that discriminate a nominally scaled dependent variable of interest – say, those who are high on a variable from those who are low on it. The linear combination of independent variables indicates the discriminating function showing the large difference that exists in the two group means. In other words, the independent variables measured on an interval or ratio scale discriminate the groups of interest to the study.

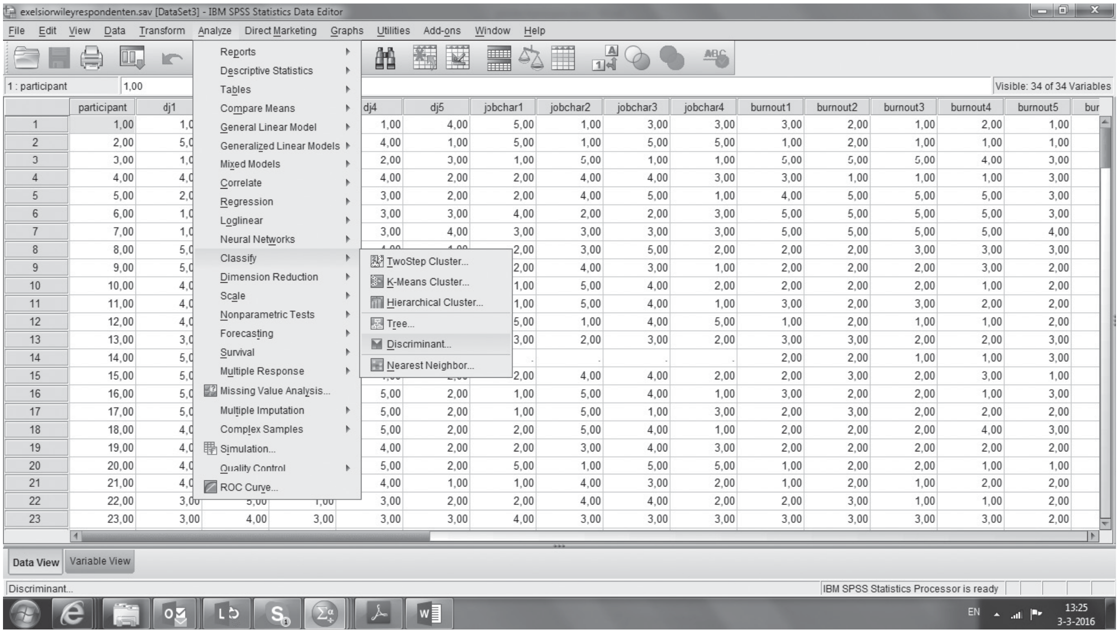
Logistic regression

Logistic regression (Box 15.11) is also used when the dependent variable is nonmetric. However, when the dependent variable has only two groups, logistic regression is often preferred because it does not face the strict assumptions that discriminant analysis faces and because it is very similar to regression analysis. Although

BOX 15.10

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Classify, then Discriminant. Move the dependent variable into the "Grouping" box. Move the independent variables into the "Independent(s)" list and click OK.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General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Simulation...
Quality Control
ROC Curve...
TwoStep Cluster...
K-Means Cluster...
Hierarchical Cluster...
Tree...
Discriminant...
Nearest Neighbor...
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Discriminant...
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1 : participant 1,00

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7	7,00	1,0			3,00	4,00	3,00	3,00	3,00	3,00	5,00	5,00	5,00	5,00	4,00
8	8,00	5,0					2,00	3,00	5,00	2,00	2,00	2,00	3,00	3,00	3,00
9	9,00	5,0					2,00	4,00	3,00	1,00	2,00	2,00	2,00	3,00	2,00
10	10,00	4,0					1,00	5,00	4,00	2,00	2,00	2,00	2,00	1,00	2,00
11	11,00	4,0					1,00	5,00	4,00	1,00	3,00	2,00	3,00	2,00	2,00
12	12,00	4,0					5,00	1,00	4,00	5,00	1,00	2,00	1,00	1,00	2,00
13	13,00	3,0					3,00	2,00	3,00	2,00	3,00	3,00	2,00	2,00	3,00
14	14,00	5,0					.	.	.	.	2,00	2,00	1,00	1,00	3,00
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20	20,00	4,0			5,00	2,00	5,00	1,00	5,00	5,00	1,00	2,00	2,00	1,00	1,00
21	21,00	4,0			4,00	1,00	1,00	4,00	3,00	2,00	1,00	2,00	1,00	2,00	2,00
22	22,00	3,00	5,00	1,00	3,00	2,00	2,00	4,00	4,00	2,00	2,00	3,00	1,00	1,00	2,00
23	23,00	3,00	4,00	3,00	3,00	3,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00

regression analysis and logistic regression analysis are very different from a statistical point of view, they are very much alike from a practical viewpoint. Both methods produce prediction equations and in both cases the regression coefficients measure the predictive capability of the independent variables. Thus, logistic regression allows the researcher to predict a discrete outcome, such as "will purchase the product/will not purchase the product," from a set of variables that may be continuous, discrete, or dichotomous.

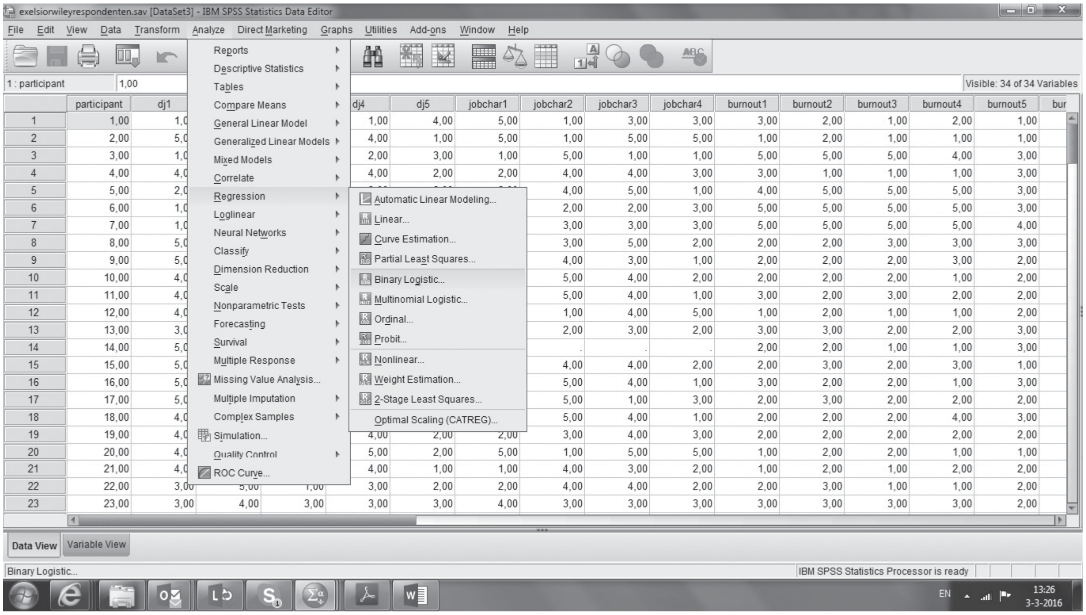
Conjoint analysis

Conjoint analysis is a statistical technique that is used in many fields including marketing, product management, and operations research. Conjoint analysis requires participants to make a series of trade-offs. In marketing, conjoint analysis is used to understand how consumers develop preferences for products or services. Conjoint analysis is built on the idea that consumers evaluate the value of a product or service by combining the value that is provided by each attribute. An attribute is a general feature of a product or service, such as price, product quality, or delivery speed. Each attribute has specific levels. For instance, for the attribute "price," levels might be €249,

BOX 15.11

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose Regression, then Binary Logistic. Move the dependent variable into the "Dependent" box. Move the independent variables into the "Covariate(s)" list and click OK.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Generalized Linear Models
Mixed Models
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Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Simulation...
Quality Control
ROC Curve...
Automatic Linear Modeling...
Linear...
Curve Estimation...
Partial Least Squares...
Binary Logistic...
Multinomial Logistic...
Ordinal...
Probit...
Nonlinear...
Weight Estimation...
2-Stage Least Squares...
Optimal Scaling (CATREG)...
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Visible: 34 of 34 Variables
Data View
Variable View
Binary Logistic...
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18	18,00				5,00	4,00	1,00	2,00	2,00	2,00	4,00	3,00
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22	22,00	3,00	2,00	2,00	4,00	4,00	2,00	2,00	3,00	1,00	1,00	2,00
23	23,00	3,00	3,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00

€279, and €319. Along these lines, we might describe a mobile phone using the attributes "memory," "battery life," "camera," and "price". A specific mobile phone would be described as follows: memory, 12 GB; battery life, 24 hours; camera 8 megapixels; and price €249.

Conjoint analysis takes these attribute and level descriptions of products and services and uses them by asking participants to make a series of choices between different products. For instance:

Would you choose phone X or phone Y?

	Phone X	**Phone Y**
Memory	12 GB	16 GB
Battery life	24 hours	12 hours
Camera	8 megapixels	16 megapixels
Price	€249	€319

By asking for enough choices, it is possible to establish how important each of the levels is relative to the others; this is known as the utility of the level. Conjoint analysis is traditionally carried out with some form of multiple regression analysis. More recently, the use of hierarchical Bayesian analysis has become widespread to develop models of individual consumer decision-making behavior.

Two-way ANOVA

Two-way ANOVA can be used to examine the effect of two nonmetric independent variables on a single metric dependent variable. Note that, in this context, an independent variable is often referred to as a factor and this is why a design that aims to examine the effect of two nonmetric independent variables on a single metric dependent variable is often called a *factorial design*. The factorial design is very popular in the social sciences. Two-way ANOVA enables us to examine main effects (the effects of the independent variables on the dependent variable) but also interaction effects that exist between the independent variables (or factors). An interaction effect exists when the effect of one independent variable (or one factor) on the dependent variable depends on the level of the other independent variable (factor).

MANOVA

MANOVA is similar to ANOVA, with the difference that ANOVA tests the mean differences of more than two groups on *one* dependent variable, whereas MANOVA tests mean differences among groups across *several* dependent variables simultaneously, by using sums of squares and cross-product matrices. Just as multiple t-tests would bias the results (as explained earlier), multiple ANOVA tests, using one dependent variable at a time, would also bias the results, since the dependent variables are likely to be interrelated. MANOVA circumvents this bias by simultaneously testing all the dependent variables, cancelling out the effects of any intercorrelations among them.

In MANOVA tests (Box 15.12), the independent variable is measured on a nominal scale and the dependent variables on an interval or ratio scale.

The null hypothesis tested by MANOVA is:

$$H_0: \mu_1 = \mu_2 = \mu_3 = \ldots \mu_n$$

The alternate hypothesis is:

$$H_A: \mu_1 \neq \mu_2 \neq \mu_3 \neq \ldots \mu_n$$

Canonical correlation

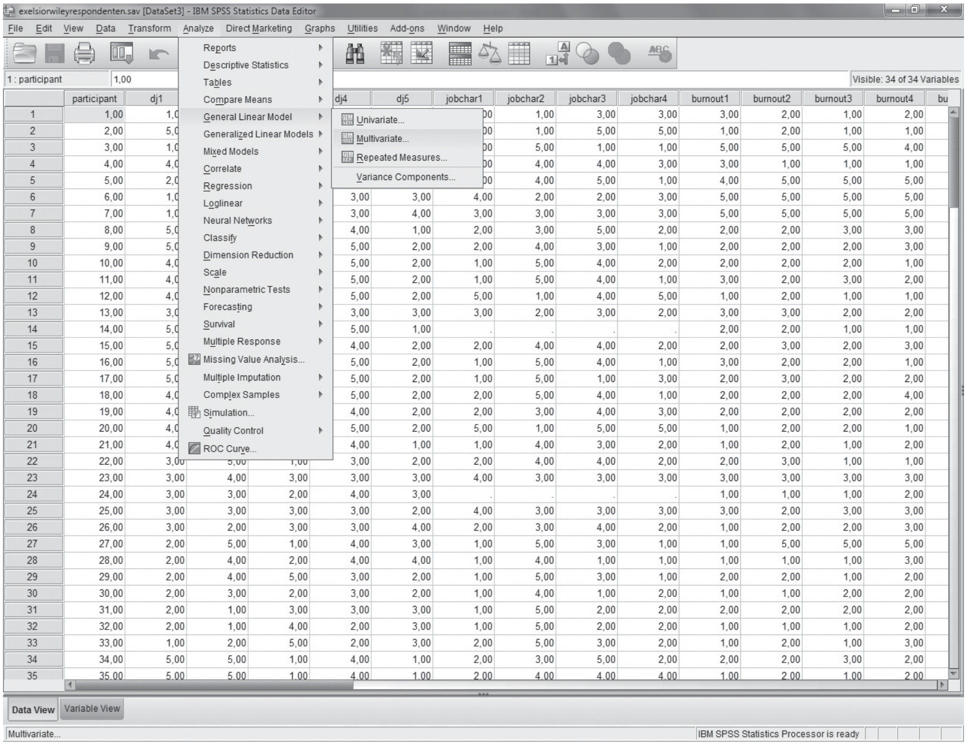
Canonical correlation examines the relationship between two or more dependent variables and several independent variables; for example, the correlation between a set of job behaviors (such as engrossment in work, timely completion of work, and number of absences) and their influence on a set of performance factors (such as quality of work, the output, and rate of rejects). The focus here is on delineating the job behavior profiles associated with performance that result in high-quality production.

In sum, several univariate, bivariate, and multivariate techniques are available to analyze sample data. Using these techniques allows us to generalize the results obtained from the sample to the population at large. It is, of course, very important to use the correct statistical technique to test the hypotheses of your study. We have explained earlier in this chapter that the choice of the appropriate statistical technique depends on the number of variables you are examining, on the scale of measurement of your variable(s), on whether the assumptions of **parametric tests** are met, and on the size of your sample.

BOX 15.12

HOW DOES THIS WORK IN SPSS?

Under the Analyze menu, choose General Linear Model, then Multivariate. Move the dependent variables into the "Dependent" box. Move the independent variables into the "Fixed Factor(s)" list. Select any of the dialog boxes by clicking the buttons on the right-hand side.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Direct Marketing
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Add-ons
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Compare Means
General Linear Model
Generalized Linear Models
Mixed Models
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Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Simulation...
Quality Control
ROC Curve...
Univariate...
Multivariate...
Repeated Measures...
Variance Components...
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Visible: 34 of 34 Variables
Data View
Variable View
Multivariate...
IBM SPSS Statistics Processor is ready

	participant	dj1			dj4	dj5	jobchar1	jobchar2	jobchar3	jobchar4	burnout1	burnout2	burnout3	burnout4	bu
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3	3,00	1,0					00	5,00	1,00	1,00	5,00	5,00	5,00	4,00	
4	4,00	4,0					00	4,00	4,00	3,00	3,00	1,00	1,00	1,00	
5	5,00	2,0					00	4,00	5,00	1,00	4,00	5,00	5,00	5,00	
6	6,00	1,0			3,00	3,00	4,00	2,00	2,00	3,00	5,00	5,00	5,00	5,00	
7	7,00	1,0			3,00	4,00	3,00	3,00	3,00	3,00	5,00	5,00	5,00	5,00	
8	8,00	5,0			4,00	1,00	2,00	3,00	5,00	2,00	2,00	2,00	3,00	3,00	
9	9,00	5,0			5,00	2,00	2,00	4,00	3,00	1,00	2,00	2,00	2,00	3,00	
10	10,00	4,0			5,00	2,00	1,00	5,00	4,00	2,00	2,00	2,00	2,00	1,00	
11	11,00	4,0			5,00	2,00	1,00	5,00	4,00	1,00	3,00	2,00	3,00	2,00	
12	12,00	4,0			5,00	2,00	5,00	1,00	4,00	5,00	1,00	2,00	1,00	1,00	
13	13,00	3,0			3,00	3,00	3,00	2,00	3,00	2,00	3,00	3,00	2,00	2,00	
14	14,00	5,0			5,00	1,00	.	.	.	.	2,00	2,00	1,00	1,00	
15	15,00	5,0			4,00	2,00	2,00	4,00	4,00	2,00	2,00	3,00	2,00	3,00	
16	16,00	5,0			5,00	2,00	1,00	5,00	4,00	1,00	3,00	2,00	2,00	1,00	
17	17,00	5,0			5,00	2,00	1,00	5,00	1,00	3,00	2,00	3,00	2,00	2,00	
18	18,00	4,0			5,00	2,00	2,00	5,00	4,00	1,00	2,00	2,00	2,00	4,00	
19	19,00	4,0			4,00	2,00	2,00	3,00	4,00	3,00	2,00	2,00	2,00	2,00	
20	20,00	4,0			5,00	2,00	5,00	1,00	5,00	5,00	1,00	2,00	2,00	1,00	
21	21,00	4,0			4,00	1,00	1,00	4,00	3,00	2,00	1,00	2,00	1,00	2,00	
22	22,00	3,00	5,00	1,00	3,00	2,00	2,00	4,00	4,00	2,00	2,00	3,00	1,00	1,00	
23	23,00	3,00	4,00	3,00	3,00	3,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	
24	24,00	3,00	3,00	2,00	4,00	3,00	.	.	.	.	1,00	1,00	1,00	2,00	
25	25,00	3,00	3,00	3,00	3,00	2,00	4,00	3,00	3,00	3,00	3,00	2,00	3,00	3,00	
26	26,00	3,00	2,00	3,00	3,00	4,00	2,00	3,00	4,00	2,00	1,00	2,00	2,00	3,00	
27	27,00	2,00	5,00	1,00	4,00	3,00	1,00	5,00	3,00	1,00	1,00	5,00	5,00	5,00	
28	28,00	2,00	4,00	2,00	4,00	4,00	1,00	4,00	1,00	1,00	1,00	1,00	1,00	3,00	
29	29,00	2,00	4,00	5,00	3,00	2,00	1,00	5,00	3,00	1,00	2,00	2,00	1,00	2,00	
30	30,00	2,00	3,00	2,00	3,00	2,00	1,00	4,00	1,00	2,00	1,00	1,00	2,00	2,00	
31	31,00	2,00	1,00	3,00	3,00	3,00	1,00	5,00	2,00	2,00	2,00	2,00	2,00	2,00	
32	32,00	2,00	1,00	4,00	2,00	3,00	1,00	5,00	2,00	2,00	1,00	1,00	1,00	2,00	
33	33,00	1,00	2,00	5,00	2,00	3,00	2,00	5,00	3,00	2,00	1,00	2,00	1,00	3,00	
34	34,00	5,00	5,00	1,00	4,00	1,00	2,00	3,00	5,00	2,00	2,00	2,00	3,00	2,00	
35	35,00	5,00	5,00	1,00	4,00	1,00	2,00	4,00	4,00	4,00	1,00	2,00	1,00	2,00	

EXCELSIOR ENTERPRISES: HYPOTHESIS TESTING

The following hypotheses were generated for this study, as stated earlier:

H_1: *Job enrichment has a negative effect on intention to leave.*
H_2: *Perceived equity has a negative effect on intention to leave.*
H_3: *Burnout has a positive effect on intention to leave.*
H_4: *Job satisfaction mediates the relationship between job enrichment, perceived equity, and burnout on intention to leave.*

These hypotheses call for the use of mediated regression analysis (all the variables are measured at an interval level). The results of these tests and their interpretation are discussed below.

To test the hypothesis that job satisfaction mediates the effect of perceived justice, burnout, and job enrichment on employees' intentions to leave three regression models were estimated, following Baron and Kenny (1986): model 1, regressing job satisfaction on perceived justice, burnout, and job enrichment; model 2, regressing intention to leave on perceived justice, burnout, and job enrichment; and model 3, regressing employees' intentions to leave on perceived justice, burnout, job enrichment, and job satisfaction. Separate coefficients for each equation were estimated and tested. To establish mediation the following conditions must hold: perceived justice, burnout, and job enrichment must affect job satisfaction in model 1; perceived justice, burnout, and job enrichment must be shown to have an impact on employees' intention to leave in model 2; and job satisfaction must affect employees' intention to leave in model 3 (while controlling for perceived justice, burnout, and job enrichment). If these conditions all hold in the predicted direction, then the effect of perceived justice, burnout, and job enrichment must be less in model 3 than in model 2. *Perfect mediation* holds if perceived justice, burnout, and job enrichment have no effect on intention to leave (in other words, the effect of these variables on intention to leave is no longer significant) when the effect of job satisfaction is controlled for (model 3); *partial mediation* is established if perceived justice, burnout, and job enrichment still affect intention to leave in model 3.

The *R*-square of the first regression model (model 1) was 0.172 and the model was statistically significant. In this model perceived equity, burnout and job enrichment were all significant predictors of job satisfaction. The *R*-square of the second regression model (model 2) was 0.264 and this model was also statistically significant. Model 2, as depicted in Table 15.5 indicated that perceived equity and job enrichment affected employees' intention to leave, whereas burnout did not.

TABLE 15.5

Mediation analysis

Step 1 model, with job satisfaction as the dependent variable		
	Coefficient	*p*-value
Constant	2.329	0.000
Perceived equity	0.343	0.001
Burnout	−0.454	0.000
Job enrichment	0.269	0.005
Model fit = 0.172		
Step 2 model, with intention to leave (ITL) as the dependent variable		
	Coefficient	*p*-value
Constant	4.094	0.000
Perceived equity	−0.270	0.000
Burnout	0.075	0.315
Job enrichment	−0.299	0.000
Model fit = 0.264		
Step 3 model, including job satisfaction as an independent variable and with ITL as the dependent variable		
	Coefficient	*p*-value
Constant	5.019	0.000
Perceived equity	−0.131	0.009
Burnout	−0.103	0.089
Job enrichment	−0.187	0.000
Job satisfaction	−0.408	0.000
Model fit = 0.577		

Note: Parameters are unstandardized regression weights, with significance levels of *t*-values. Two-sided tests. *N* = 174.

The R-square of the last model (model 3) was 0.577 and again the model was statistically significant. In this model, job satisfaction was a significant predictor of intention to leave. Perceived equity and job enrichment were significant predictors of intention to leave when job satisfaction was controlled for. The effect of perceived equity and job enrichment on intention to leave was less in the third model than in the second model. Thus, all conditions for *partial* mediation were met for perceived equity and job enrichment.

Follow-up analyses were performed to test for the indirect effect of perceived equity and job enrichment on intention to leave via job satisfaction. Baron and Kenny (1986) provide an approximate significance test for the *indirect* effect of perceived justices and burnout on employees' intentions. The path from, respectively, perceived equity and job enrichment to job satisfaction is denoted a and its standard error s_a; the path from job satisfaction to intention to leave is denoted b and its standard error s_b. The product ab is the estimate of the indirect effect of perceived equity and job enrichment on employees' intentions to leave. The standard error of ab is:

$$SE_{ab} = \sqrt{b^2 s_a^2 + a^2 s_b^2 + s_a^2 s_b^2}$$

The ratio ab / SE_{ab} can be interpreted as a z statistic. Indirect effects of perceived equity (-3.246, $p < 0.01$) and burnout (-2.743, $p < 0.01$) were both significant.

BOX 15.13

RESEARCH REALITY

A method of testing mediation and moderation that is becoming more and more popular is *bootstrapping* (Bullock, Green & Ha, 2010; Preacher, Rucker & Hayes, 2007; Shrout & Bolger, 2002). Bootstrapping is a statistical method based on building a sampling distribution for a statistic by resampling from the data at hand. A big advantage of bootstrapping is that no assumptions about the shape of the sampling distribution of the statistic are necessary when conducting inferential tests. Two software packages that are often used to bootstrap are Mplus and AMOS.

Overall interpretation and recommendations to the president

From the results of the hypothesis tests, it is clear that perceived equity and job enrichment affect employees' intentions to leave through job satisfaction. From the descriptive results, we have already seen that the mean on perceived equity is rather low (2.44 on a five-point scale). The mean of job enrichment is clearly higher (3.49 on a five-point scale), but it is still below the standards of the company. Hence, if retention of employees is a top priority for the president, it is important to formulate policies and practices that help to enhance equity perceptions and to redesign jobs in such a way that they are more challenging to the employees. Whatever is done to improve employees' perceptions of equity and to enrich the jobs of employees will improve job satisfaction and thus help employees to think less about leaving and induce them to stay.

The president would therefore be well advised to rectify inequities in the system, if they really exist, or to clear misperceptions of inequities if this is actually the case.

To enrich jobs of employees, the president may want to keep the following goals in mind:

- Reduce repetitive work.
- Increase the employee's feelings of recognition and achievement.

- Provide opportunities for employee advancement (promotions into jobs requiring more skills).
- Provide opportunities for employee growth (an increase in skills and knowledge without a job promotion).

The fact that only 57.7% of the variance in "intention to leave" was explained by the four independent variables considered in this study still leaves more than 40% unexplained. In other words, there are other additional variables that are important in explaining ITL that have not been considered in this study. Further research might be necessary to explain more of the variance in ITL, if the president wishes to pursue the matter further.

Now do Exercises 15.6, 15.7, and 15.8.

EXERCISE 15.6

Discuss: what do the unstandardized coefficients and their *p*-values in the first model imply? In other words, what happens to job satisfaction if perceived justice, burnout, and job enrichment change by one unit?

EXERCISE 15.7

Provide the tolerance values and the variance inflation factors for all the independent variables in model 1. Discuss: do we have a multicollinearity problem?

EXERCISE 15.8

Does work shift moderate the relationship between job satisfaction and intention to leave for Excelsior Enterprises employees?

We have now seen how different hypotheses can be tested by applying the appropriate statistical tests in data analysis. Based on the interpretation of the results, the research report is then written, making necessary recommendations and discussing the pros and cons of each, together with cost–benefit analysis.

DATA WAREHOUSING, DATA MINING, AND OPERATIONS RESEARCH

Data warehousing and data mining are aspects of information systems. Most companies are now aware of the benefits of creating a **data warehouse** that serves as the central repository of all data collected from disparate sources, including those pertaining to the company's finance, manufacturing, sales, and the like. The data warehouse is usually built from data collected through the different departments of the enterprise and can be accessed through various online analytical processing (OLAP) tools to support decision making. Data warehousing can be described as the process of extracting, transferring, and integrating data spread across multiple external databases and even operating systems, with a view to facilitating analysis and decision making.

Complementary to the functions of data warehousing, many companies resort to data mining as a strategic tool for reaching new levels of business intelligence. Using algorithms to analyze data in a meaningful way, **data**

mining more effectively leverages the data warehouse by identifying hidden relations and patterns in the data stored in it. For instance, data mining makes it possible to trace retail sales patterns by ZIP code and the time of day of the purchases, so that optimal stocking of items becomes possible. Such "mined" data pertaining to the vital areas of the organization can be easily accessed and used for different purposes. For example, staffing for different times of the day can be planned, as can the number of check-out counters that need to be kept open in retail stores, to ensure efficiency as well as effectiveness. We can see that data mining helps to clarify the underlying patterns in different business activities, which in turn facilitates decision making.

Operations research (OR) or *management science* (MS) is another sophisticated tool used to simplify and thus clarify certain types of complex problem that lend themselves to quantification. OR uses higher mathematics and statistics to identify, analyze, and ultimately solve intricate problems of great complexity faced by the manager. It provides an additional tool to the manager by using quantification to supplement personal judgment. Areas of problem solving that easily lend themselves to OR include those relating to inventory, queuing, sequencing, routing, and search and replacement. OR helps to minimize costs and increase efficiency by resorting to *decision trees*, *linear programming*, *network analysis*, and *mathematical models*.

Other information systems such as *management information systems* (*MIS*), *decision support systems*, *executive information systems*, and *expert systems* are good decision-making aids, but not necessarily involved with data collection and analyses in the strict sense.

In sum, a good information system collects, mines, and provides a wide range of pertinent information relating to aspects of both the external and internal environments of the organization. By using the wide variety of tools and techniques available for solving problems of differing magnitude, executives, managers, and others entrusted with responsibility for results at various levels of the organization can find solutions to various concerns merely by securing access to the data available in the system and analyzing them.

It should be ensured that the data in the information system are error-free and are frequently updated. After all, decision making can only be as good as the data made available to managers.

SOME SOFTWARE PACKAGES USEFUL FOR DATA ANALYSIS

There is a wide variety of analytical software that may help you to analyze your data. Based on your specific needs, your research problem, and/or your conceptual model, you might consider the following software packages:

- **LISREL**: from Scientific Software International;
- **MATLAB®**: from the MathWorks, Inc.;
- **Mplus**: developed by Linda and Bengt Muthén;
- **Qualtrics**: a private research software company;
- **SAS/STAT**: from SAS Institute;
- **SPSS**: from SPSS Inc.;
- **SPSS AMOS**: from SPSS Inc.;
- **Stata**: from Stata Corporation.

LISREL is designed to estimate and test structural equation models. Structural equation models are complex, statistical models of linear relationships among latent (unobserved) variables and manifest (observed) variables. You can also use LISREL to carry out exploratory factor analysis and confirmatory factor analysis.

MATLAB is a computer program that was originally designed to simplify the implementation of numerical linear algebra routines. It is used to implement numerical algorithms for a wide range of applications.

Mplus is a statistical modeling program that offers researchers a wide choice of models, estimators, and algorithms. Mplus allows the analysis of a wide variety of data such as cross-sectional and longitudinal data, single-level and multilevel data, and data that come from different populations with either observed or unobserved heterogeneity. In addition, Mplus has extensive capabilities for Monte Carlo simulation studies.

Qualtrics was founded in 2002. The program allows users to do many kinds of online data collection and data analysis, employee evaluations, website feedback, marketing research, and customer satisfaction and loyalty research.

SAS is an integrated system of software products, capable of performing a broad range of statistical analyses such as descriptive statistics, multivariate techniques, and time series analyses. Because of its capabilities, it is used in many disciplines, including medical sciences, biological sciences, social sciences, and education.

SPSS (Statistical Package for the Social Sciences) is a data management and analysis program designed to do statistical data analysis, including descriptive statistics such as plots, frequencies, charts, and lists, as well as sophisticated inferential and multivariate statistical procedures like analysis of variance (ANOVA), factor analysis, cluster analysis, and categorical data analysis.

SPSS AMOS is designed to estimate and test structural equation models.

Stata is a general purpose statistical software package that supports various statistical and econometric methods, graphics, and enhanced features for data manipulation, programming, and matrix manipulation.

SUMMARY

- **Learning objective 1: Discuss type I errors, type II errors, and statistical power.**
  The null hypothesis is presumed true until statistical evidence, in the form of a hypothesis test, indicates otherwise. The required statistical evidence is provided by inferential statistics. There are two kinds of errors (two ways in which a conclusion can be incorrect), classified as type I errors and type II errors. A type I error, also referred to as alpha (α), is the probability of rejecting the null hypothesis when it is actually true. A type II error, also referred to as beta (β), is the probability of failing to reject the null hypothesis given that the alternate hypothesis is actually true. A third important concept in hypothesis testing is statistical power ($1 - \beta$). Statistical power is the probability of correctly rejecting the null hypothesis. In other words, power is the probability that statistical significance will be indicated if it is present.

- **Learning objective 2: Test hypotheses using the appropriate statistical technique.**
  After the researcher has selected an acceptable level of statistical significance to test the hypotheses, the next step is to decide on the appropriate method to test them. The choice of the appropriate statistical technique largely depends on the number of (independent and dependent) variables and the scale of measurement (metric or nonmetric) of these variables. Other aspects that play a role are whether the assumptions of parametric tests are met and the size of the sample.

- **Learning objective 3: Describe data warehousing, data mining, and operations research.**
  A good information system collects, mines, and provides a wide range of information relating to aspects of both the external and internal environments of the organization. By using tools and techniques available for solving problems of differing magnitude, organizations may find solutions to various concerns merely by securing access to the data available in the system and analyzing them.

- **Learning objective 4: Describe useful software packages for quantitative data analysis.**
  There is a wide variety of analytical software that may help researchers to analyze their data. Based on one's specific needs, the research problem, and/or the conceptual model, one might consider software packages such as LISREL, MATLAB, Qualtrics, or SPSS, to name a few.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: Perceptions of Organizational Attractiveness**.

DISCUSSION QUESTIONS

1. What kinds of biases do you think could be minimized or avoided during the data analysis stage of research?
2. When we collect data on the effects of treatment in experimental designs, which statistical test is most appropriate to test the treatment effects?
3. A tax consultant wonders whether he should be more selective about the class of clients he serves so as to maximize his income. He usually deals with four categories of clients: the very rich, rich, upper middle class, and middle class. He has records of each and every client served, the taxes paid by them, and how much he has charged them. Since many particulars in respect of the clients vary (number of dependants, business deductibles, etc.), irrespective of the category they belong to, he would like an appropriate analysis to be done to see which among the four categories of clientele he should choose to continue to serve in the future. *What kind of analysis should be done in this case and why?*
4. What is bootstrapping and why do you think that this method is becoming more and more popular as a method of testing for moderation and mediation?

Now do Exercises 15.9, 15.10, and 15.11.

EXERCISE 15.9

Open the file “resmethassignment1” (you created this file doing the exercise from the previous chapter). Answer the following questions.

- **a.** Is the exam grade significantly larger than 75?
- **b.** Are there significant differences in the exam grade for men and women?
- **c.** Is there a significant difference between the exam grade and the paper grade?
- **d.** Are there significant differences in the paper grade for the four year groups?
- **e.** Is the sample representative for the IQ level, for which it is known that 50% of the population has an IQ below 100, and 50% has an IQ of 100 or higher?
- **f.** Obtain a correlation matrix for all relevant variables and discuss the results.
- **g.** Do a multiple regression analysis to explain the variance in paper grades using the independent variables of age, sex (dummy coded), and IQ, and interpret the results.

EXERCISE 15.10

Tables 15.A to 15.D below summarize the results of data analyses of research conducted in a sales organization that operates in 50 different cities of the country and employs a total sales force of about 500. The number of salespersons sampled for the study was 150.

- **a.** Interpret the information contained in each of the tables in as much detail as possible.
- **b.** Summarize the results for the CEO of the company.
- **c.** Make recommendations based on your interpretation of the results.

TABLE 15.A

Means, standard deviations, minimum, and maximum

Variable	Mean	Std. deviation	Minimum	Maximum
Sales (in 1000s of $)	75.1	8.6	45.2	97.3
No of salespersons	25	6	5	50
Population (in 100s)	5.1	0.8	2.78	7.12
Per capita income (in 1000s of $)	20.3	20.1	10.1	75.9
Advertising (in 1000s of $)	10.3	5.2	6.1	15.7

TABLE 15.B

Correlations among the variables

	Sales	Salespersons	Population	Income	Ad. expenditure
Sales	1.0				
No. of salespersons	0.76	1.0			
Population	0.62	0.06	1.0		
Income	0.56	0.21	0.11	1.0	
Ad. expenditure	0.68	0.16	0.36	0.23	1.0

All figures above 0.15 are significant at $p = 0.05$.
All figures above 0.35 are significant at $p \leq 0.001$.

TABLE 15.C

Results of one-way ANOVA: sales by level of education

Source of variation	Sums of squares	df	Mean squares	*F*	Significance of *F*
Between groups	50.7	4	12.7	3.6	0.01
Within groups	501.8	145	3.5		
Total	552.5	150			

TABLE 15.D

Results of regression analysis

Multiple *R*	0.65924		
R-square	0.43459		
Adjusted *R*-square	0.35225		
Standard error	0.41173		
df	(5.144)		
F	5.278		
Sig.	0.000		
Variable	Beta	*t*	Sig. *t*
Training of salespersons	0.28	2.768	0.0092
No. of salespersons	0.34	3.55	0.00001
Population	0.09	0.97	0.467
Per capita income	0.12	1.200	0.089
Advertisement	0.47	4.54	0.00001

EXERCISE 15.11

Visit David Kenny's website (http://davidakenny.net/cm/mediate.htm) and search for a link to SPSS and SAS macros that can be downloaded for tests of indirect effects.

CHAPTER 16

Qualitative data analysis

LEARNING OBJECTIVES

After completing Chapter 16 you should be able to:

1. Discuss three important steps in qualitative data analysis: data reduction, data display, and drawing conclusions.
2. Discuss how reliability and validity have a different meaning in qualitative research in comparison to quantitative research and explain how reliability and validity are achieved in qualitative research.
3. Compare and contrast content analysis, narrative analysis, and analytic induction.
4. Describe the characteristics of big data and explain why big data holds many promises for organizations and managers.

INTRODUCTION

Qualitative data are data in the form of words. Examples of qualitative data are interview notes, transcripts of focus groups, answers to open-ended questions, transcriptions of video recordings, accounts of experiences with a product on the Internet, news articles, and the like. Qualitative data can come from a wide variety of primary sources and/or secondary sources, such as individuals, focus groups, company records, government publications, and the Internet. The analysis of qualitative data is aimed at making valid inferences from the often overwhelming amount of collected data.

THREE IMPORTANT STEPS IN QUALITATIVE DATA ANALYSIS

The analysis of qualitative data is not easy. The problem is that, in comparison with quantitative data analysis, there are relatively few well-established and commonly accepted rules and guidelines for analyzing qualitative data. Over the years, however, some general approaches for the analysis of qualitative data have been developed. The approach discussed in this chapter is largely based on work of Miles and Huberman (1994). According to

BOX 16.1

THE INTERNET AS A SOURCE OF TEXTUAL INFORMATION

Earlier in this book we explained that you can search the Internet for books, journals articles, conference proceedings, company publications, and the like. However, the Internet is more than a mere source of documents; it is also a rich source of textual information for qualitative research. For instance, there are many *social networks* on the Internet structured around products and services such as computer games, mobile telephones, movies, books, and music. Through an analysis of these social networks researchers may learn a lot about the needs of consumers, about the amount of time consumers spend in group communication, or about the social network that underlies the virtual community. In this way, social networks on the Internet may provide researchers and marketing and business strategists with valuable, strategic information.

The possibilities for qualitative research on the Internet are unlimited, as the following example illustrates. In an effort to find out what motivates consumers to construct *protest websites*, Ward and Ostrom (2006) examined and analyzed protest websites. A content analysis revealed that consumers construct complaint websites to demonstrate their power, to influence others, and to gain revenge on the organization that betrayed them. This example illustrates how the Internet can be a valuable source of rich, authentic qualitative information. With increasing usage of the Internet, it will undoubtedly become even more important as a source of qualitative and quantitative information.

them, there are generally three steps in qualitative data analysis: data reduction, data display, and the drawing of conclusions.

The first step in qualitative data analysis is concerned with data reduction. **Data reduction** refers to the process of selecting, coding, and categorizing the data. **Data display** refers to ways of presenting the data. A selection of quotes, a matrix, a graph, or a chart illustrating patterns in the data may help the researcher (and eventually the reader) to understand the data. In this way, data displays may help you to draw conclusions based on patterns in the reduced set of data.

Having identified these general stages, it should be noted that qualitative data analysis is not a step-by-step, linear process but rather a continuous and iterative process. For instance, **data coding** may help you simultaneously to develop ideas on how the data may be displayed, as well as to draw some preliminary conclusions. In turn, preliminary conclusions may feed back into the way the raw data are coded, categorized, and displayed.

EXAMPLE

Qualitative research may involve the repeated sampling, collection, and analysis of data. As a result, qualitative data analysis may already start after some of the data have been collected.

This chapter will discuss the three important steps in qualitative data analysis – data reduction, data display, and drawing and verifying conclusions – in some detail. To illustrate these steps in qualitative data analysis, we will introduce a case. We will use the case, by means of boxes throughout the chapter, to illustrate key parts of the qualitative research process.

Data reduction

Visit the companion website at **www.wiley.com/college/sekaran** for **Author Video: Data reduction**.

Qualitative data collection produces large amounts of data. The first step in data analysis is therefore the reduction of data through coding and categorization. **Coding** is the analytic process through which the qualitative data that you have gathered are reduced, rearranged, and integrated to form theory. The purpose of coding is to help you to draw meaningful conclusions about the data. *Codes* are labels given to units of text which are later grouped and turned into categories. Coding is often an iterative process; you may have to return to your data repeatedly to increase your understanding of the data (i.e., to be able to recognize patterns in the data, to discover connections between the data, and to organize the data into coherent categories).

CASE

INSTIGATIONS OF CUSTOMER ANGER

INTRODUCTION

Suppose that you are in a fashion shop and that you have just found a clothing item that you like. You go to the counter to pay for the item. At the counter you find a shop assistant who is talking to a friend on her mobile phone. You have to wait. You wait for a couple of minutes, but the shop assistant is in no hurry to finish the call.

This event may make you angry. Waiting for service is a common cause of anger: the longer the delay, the angrier customers tend to be (Taylor, 1994).

RESEARCH OBJECTIVE

Prior research in marketing has applied appraisal theory to understand why anger is experienced in such situations (e.g., Folkes, Koletsky & Graham, 1987; Nyer, 1997; Taylor, 1994). Appraisal refers to the process of judging the significance of an event for personal well-being. The basic premise of appraisal theory is that emotions are related to the interpretations that people have about events: people may differ in the specific appraisals that are elicited by a particular event (for instance, waiting for service), but the same patterns of appraisal give rise to the same emotions. Most appraisal theories see appraisals as being a cause of emotions (Parrott, 2001). Along these lines, appraisal theory has been used to understand why anger is experienced in service settings.

Although appraisal theory provides useful insights into the role of cognition in emotional service encounters, recent research suggests that, although they are clearly associated with anger, none of the aforementioned appraisals is a necessary or sufficient condition for anger to arise (Kuppens, VanMechelen, Smits & DeBoeck, 2003; Smith & Ellsworth, 1987). What's more, for the specific purpose of avoiding customer anger, appraisal theory is too abstract to be diagnostic for services management. That is, service firm management may benefit more from a classification of incidents that are considered to be unfair (for instance, waiting for service and core service failures), than from the finding that unfair events are generally associated with customer anger.

In other words, to be able to avoid customer anger, it is crucial that service firm management knows what specific precipitating events typically elicit this emotion in customers. After all, it is easier to manage such events than the appraisals that may or may not be associated with these particular events.

Therefore, this study investigates events that typically instigate customer anger in services. This study builds on a rich tradition of research in psychology that has specified typical instigations of anger in everyday life. In addition, it builds on research in marketing that has identified and classified service failures, retail failures, and behaviors of service firms that cause customers to switch services (Bitner, Booms & Tetreault, 1990; Keaveney, 1995; Kelley, Hoffman & Davis, 1993).

METHOD

Procedure. Following related research in marketing, the critical incident technique (CIT) was used to identify critical behaviors of service providers that instigate customer anger (e.g., Bitner, Booms & Tetreault, 1990; Keaveney, 1995; Kelley, Hoffman & Davis, 1993; Mangold, Miller & Brockway, 1999). Critical incidents were collected by 30 trained research assistants, who were instructed to collect 30 critical incidents each. In order to obtain a sample representative of customers of service organizations, they were instructed to collect data from a wide variety of people. Participants were asked to record their critical incidents on a standardized form in the presence of the interviewer. This has several advantages, such as availability of the interviewer to answer questions and to provide explanations.

Questionnaire. Participants were asked to record their answers on a standardized questionnaire, which was modeled after previous applications of CIT in services (e.g., Keaveney, 1995; Kelley, Hoffman & Davis, 1993). The questionnaire began by asking participants to indicate which of 30 different services they had purchased during the previous six-month period. Next, participants were asked to recall the last negative incident with a service provider that made them feel angry. They were asked to describe the incident in detail by means of open-ended questions. The open-ended questions were "What service are you thinking about?", "Please tell us, in your own words, what happened. Why did you get angry?", and "Try to tell us exactly what happened: where you were, what happened, what the service provider did, how you felt, what you said, and so forth."

*Sample***.** Critical incidents were defined as events, combinations of events, or series of events between a customer and a service provider that caused customer anger. The interviewers collected 859 incidents. The participants (452 males, 407 females) represented a cross-section of the population. Their ages ranged between 16 and 87 with a mean age of 37.4. Approximately 2% of the participants had less than a completed high school education, whereas 45.1% had at least a bachelor's degree. The reported incidents covered more than 40 different service businesses, including banking and insurance, personal transportation (by airplane, bus, ferry, taxi, or train), hospitals, physicians, and dentists, repair and utility services, (local) government and the police, (virtual) stores, education and child care, entertainment, hospitality, restaurants, telecommunication companies, health clubs, contracting firms, hairdressers, real-estate agents, driving schools, rental companies, and travel agencies. On average, the negative events that participants reported had happened 18 weeks earlier.

Coding begins with selecting the coding unit. Indeed, qualitative data can be analyzed at many levels. Examples of coding units include words, sentences, paragraphs, and themes. The smallest unit that is generally used is the word. A larger, and often more useful, unit of content analysis is the theme: "a single assertion about a subject" (Kassarjian, 1977, p. 12). When you are using the theme as a coding unit, you are primarily looking for the expression of an idea (Minichiello, Aroni, Timewell & Alexander, 1990). Thus, you might assign a code to a text unit of any size, as long as that unit of text represents a single theme or issue. Consider, for instance, the following critical incident:

> ***After the meal I asked for the check. The waitress nodded and I expected to get the check. After three cigarettes there was still no check. I looked around and saw that the waitress was having a lively conversation with the bartender.***

This critical incident contains two themes:

1. The waitress does not provide service at the time she promises to: "The waitress nodded and I expected to get the check. After three cigarettes there was still no check."
2. The waitress pays little attention to the customer: she is not late because she is very busy; instead of bringing the check, she is engaged in a lively conversation with the bartender.

Accordingly, the aforementioned critical incident was coded as: "delivery promises" (that were broken) and "personal attention" (that was not provided).

This example illustrates how the codes "delivery promises" and "personal attention" help to reduce the data to a more manageable amount. Note that proper coding not only involves reducing the data but also making sure that no relevant data are eliminated. Hence, it is important that the codes "delivery promises" and "personal attention" capture the meaning of the coded unit of text.

BOX 16.2

DATA ANALYSIS

Unit of analysis Since the term "critical incident" can refer to either the overall story of a participant or to discrete behaviors contained within this story, the first step in data analysis is to determine the appropriate unit of analysis (Kassarjian, 1977). In this study, *critical behavior* was chosen as the unit of analysis. For this reason, 600 critical incidents were coded into 886 critical behaviors. For instance, a critical incident in which a service provider does not provide prompt service and treats a customer in a rude manner was coded as containing two critical behaviors ("unresponsiveness" and "insulting behavior").

Categorization is the process of organizing, arranging, and classifying coding units. Codes and categories can be developed both inductively and deductively. In situations where there is no theory available, you must generate codes and categories inductively from the data. In its extreme form, this is what has been called **grounded theory** (see Chapter 6).

In many situations, however, you will have a preliminary theory on which you can base your codes and categories. In these situations you can construct an initial list of codes and categories from the theory, and, if necessary, change or refine these during the research process as new codes and categories emerge inductively (Miles & Huberman, 1994). The benefit of the adoption of existing codes and categories is that you are able to build on and/or expand prevailing knowledge.

BOX 16.3

DATA ANALYSIS

Categorization Qualitative data analysis was used to examine the data (Kassarjian, 1977). As a first step, two judges coded critical incidents into critical behaviors. Next, (sub)categories were developed based on these critical behaviors. Two judges (A and B) independently developed mutually exclusive and exhaustive categories and subcategories for responses 1 to 400 (587 critical behaviors). Two other trained judges (C and D) independently sorted the critical behaviors into the categories provided by judges A and B. Finally, a fifth, independent judge (E) carried out a final sort.

As you begin to organize your data into categories and subcategories you will begin to notice patterns and relationships between the data. Note that your list of categories and subcategories may change during the process of analyzing the data. For instance, new categories may have to be identified, definitions of categories may have to be changed, and categories may have to be broken into subcategories. This is all part of the iterative process of qualitative data analysis.

BOX 16.4

RESULTS

Categories Participants reported a wide range of critical behaviors that made them angry. Some of these behaviors were closely related to the *outcome* of the service process (e.g., "My suitcase was heavily damaged"). Other behaviors were related to *service delivery* (e.g., "For three days in a row I tried to make an appointment [. . .] via the telephone. The line was always busy") or *interpersonal relationships* (e.g., "She did not stir a finger. She was definitely not intending to help me"). Finally, customers got angry because of *inadequate responses to service failures* (e.g., "He did not even apologize" or "He refused to give me back my money"). These four specific behavior types represent the four overarching categories of events that instigate customer anger.

Two of these categories were further separated into, respectively, three categories representing service delivery or procedural failures ("unreliability," "inaccessibility," and "company policies") and two categories representing interpersonal relationships or interactional failures ("insensitive behavior" and "impolite behavior"). The main reason for this was that the categories "procedural failures" and "interactional failures" would otherwise be too heterogeneous with respect to their composition and, more importantly, with respect to ways of avoiding or dealing with these failures. For instance, avoiding anger in response to unreliability (not performing in accordance with agreements) will most likely call for a different – and maybe even opposite – approach than avoiding anger in response to company policies (performing in accordance with company rules and procedures), even though these failures are both procedural; that is, related to service delivery.

Sometimes you may want to capture the number of times a particular theme or event occurs, or how many respondents bring up certain themes or events. Quantification of your qualitative data may provide you with a rough idea about the (relative) importance of the categories and subcategories.

BOX 16.5

Table 16.1 indicates that "price agreements that were broken" (category "unreliability", subcategory "pricing") was mentioned 12 times as a cause of anger. Hence, broken price agreements represent 1.35% of the total number of critical behaviors (886) and 2% of the total number of the reported critical incidents (600). The sixth column indicates that nine participants mentioned broken price agreements as the sole cause of their anger, whereas three participants mentioned at least one additional critical behavior (column 7).

TABLE 16.1

Instigations of anger in service consumption settings

(Sub)category	(Sub)category definition	No. of behaviors	No. of behaviors in % of behaviors	No. of behaviors in % of incidents	No. of behaviors in single-factor incidents	No. of behaviors in multi-factor incidents	Example(s)
Procedural failures							
Unreliability	*Service firm does not perform the service dependably.*	*156*	*17.61*	*26.00*	*73*	*83*	
Delivery promises	Service provider does not provide services at the time it promises to do so.	104	11.74	17.33	42	62	Wait for appointment with dentist, physician, or hairdresser, or on a plane, train, or taxi.
Service provision	Service provider does not provide the service that was agreed upon.	40	4.52	6.67	22	18	Client receives different car than agreed upon with car rental company or different apartment than agreed upon with travel agent. Bicycle repairers, car mechanics, or building contractors carry out different work than agreed upon or work that was not agreed upon with their clients.
Pricing	Price agreements are broken.	12	1.35	2.00	9	3	“After a party we called a cab. We were with a party of five. A van would take us home for a fixed, low price. However, upon arrival, the driver asked the regular clock price.”

Inaccessibility	*Customers experience difficulties with engaging in the service process.*	*47*	*5.30*	*7.83*	*17*	*30*	
Communicative inaccessibility	Inaccessibility via telephone, fax, e-mail, and/or the Internet.	26	2.93	4.33	9	17	"For three days in a row I tried to make an appointment with my physician via the telephone. The line was always busy."
Physical inaccessibility of service elements	Customers experience difficulties with accessing a certain element or part of the service.	12	1.35	2.00	4	8	Check-in counter of an airline company, cash-point of a supermarket, service desk of a holiday resort, or baggage claim at an airport.
Physical inaccessibility of service provider	Difficult physical accessibility of service provider because of inconvenient locations or opening hours.	9	1.02	1.50	4	5	"It was three o'clock on a Saturday afternoon and the dry cleaner was already closed."
Company policies	*Service provider's rules and procedures or the execution of rules and procedures by service staff is perceived to be unfair.*	*76*	*8.57*	*12.67*	*45*	*31*	
Rules and procedures	Inefficient, ill-timed, and unclear rules and procedures.	66	7.45	11.00	38	28	"It turned out that the [Cystic Fibrosis] foundation used unfair procedures for assigning families with cystic fibrosis to vacations. For example, some families were invited for years in a row even though this is not allowed."

(*continued*)

TABLE 16.1

(Continued)

(Sub)category	(Sub)category definition	No. of behaviors	No. of behaviors in % of behaviors	No. of behaviors in % of incidents	No. of behaviors in single-factor incidents	No. of behaviors in multi-factor incidents	Example(s)
							"Only two days before our wedding my wife was ordered to leave the country by the immigration office." "I went to the local administration to report a change of address. At the same time I wanted to apply for a parking license. In that case you must draw a number for the change of address first and later on you must draw a second number for the parking license. I got angry and asked why on earth that was necessary."
Inflexible service staff	Service staff does not adapt rules and procedures to reflect individual circumstances of customer.	10	1.12	1.67	7	3	"It was an exceptionally hot day. The second-class compartments of the train were overcrowded. To avoid the bad atmosphere I went to a first-class compartment. When the guard came he sent us away. At that moment I flew into a rage."

Interactional failures							
Impolite behavior	*Service provider behaves rudely.*	*84*	*9.48*	*14.00*	*46*	*38*	
Insulting behavior	Service provider is behaving offensively.	32	3.61	5.33	15	17	“The physician was getting fluid out of my knee. This was rather painful, so I told him that it hurt. He directly stopped even though there was some fluid left. When I asked him why he had stopped he said ‘because you are such a moaner’. That’s no way to treat people.”
Not taking client seriously	Service provider does not take client seriously.	28	3.16	4.67	15	13	“For some time I was hearing strange noises when I was driving my car. Again and again they [garage] fobbed me off with ‘Yes, dear . . .’ and ‘Yes, love . . .’ Eventually they had to replace the engine.”
Dishonesty	Service provider tries to earn money in an improper manner.	16	1.81	2.67	10	6	“After we went to the theater, we took a cab. The driver made a huge detour. I was mad because this was a plain rip-off.”
Discrimination	Person or group is treated unfairly, usually because of prejudice about race, ethnic group, age group, or gender.	8	0.90	1.33	6	2	“I was refused access to the bar because of my race, even though I was immaculately dressed. They literally told me that they did not care for my kind of people.”

(*continued*)

TABLE 16.1

(Continued)

(Sub)category	(Sub)category definition	No. of behaviors	No. of behaviors in % of behaviors	No. of behaviors in % of incidents	No. of behaviors in single-factor incidents	No. of behaviors in multi-factor incidents	Example(s)
Insensitive behavior	*Service provider does not make an effort to appreciate the customer's needs and/or pays little attention to customers or their belongings.*	*195*	*22.01*	*32.50*	*76*	*119*	
Unresponsiveness	Unresponsive staff does not provide prompt service to customers or does not respond to customers' requests at all.	80	9.03	13.33	33	47	"I went to a cash desk [of a drugstore] but the salesperson walked away. At another cash desk two persons were helping one client. One of them looked at me but did not show any intention to help me. It took forever before I was finally served." "I asked a girl to help me find the right size [clothes] for my grandson. She did not stir a finger. She was definitely not intending to help me."
Incomplete/incorrect information	Service provider withholds information from client or provides incomplete, imprecise, or incorrect information.	61	6.88	10.17	21	40	"Our plane was not there. I got mad because they did not tell us why not or what to do."

Inaccuracy with personal data	Service provider handles personal information of client rather carelessly.	16	1.81	2.67	5	11	“I was looking for a summer job and signed up at an employment agency. When I asked them about the state of affairs a couple of weeks later, I found out that I had not been signed up yet. They told me that they had lost my application form.”
Personal attention	Service provider pays little attention to the customer.	15	1.69	2.50	8	7	“After the meal I asked for the check. The waitress nodded and I expected to get the check. After three cigarettes there was still no check. I looked around and saw that the waitress was having a lively conversation with the bartender.”
Impersonal treatment	Service provider does not provide tailor-made solutions.	9	1.02	1.50	3	6	“I got angry because she [hairdresser] did not cut my hair the way I had asked her to . . .” “The mortgage counselor was very dominant during the conversation. My own point of view was not sufficiently addressed.”
Inconvenience	Customer ends up in inconvenient or uncomfortable situation, often leading to physical distress.	8	0.90	1.33	2	6	“After landing [airplane], we had to stay in our seats for 1.5 hours. It was very uncomfortable”.

(*continued*)

TABLE 16.1

(Continued)

(Sub)category	(Sub)category definition	No. of behaviors	No. of behaviors in % of behaviors	No. of behaviors in % of incidents	No. of behaviors in single-factor incidents	No. of behaviors in multi-factor incidents	Example(s)
Privacy matters	Service provider invades or disregards a person's privacy.	3	0.34	0.50	2	1	"The welfare worker left the door open during our private conversation."
Irresponsible behavior	Service staff behaves irresponsibly.	3	0.34	0.50	2	1	"The schoolteacher let my very young children walk to their homes on their own when I was a little late to pick them up."
Outcome failures	*Quality of core service itself.*	*191*	*21.56*	*31.84*	*76*	*115*	
Service mistakes	Small or big mistakes, which may cause damage to the customer or belongings of the customer.	115	12.98	18.50	47	68	"The waitress brought the wrong meal." "The physician prescribed the wrong medicine." "As a consequence of the operation I will not be able to ever walk again." "My suitcase was heavily damaged."

Defective tangibles	Inoperative, broken, badly prepared, or unsatisfactory tangibles.	35	3.95	5.83	6	29	“My cash card was not working.” “After three weeks the coffee machine [bought in shop] broke down.” “The food was cold.” “We booked a very expensive holiday. However, the hotel was an old, dirty, run-down slum, with holes in the carpeting. The swimming pool was unpainted and 95 centimeters deep. The dining room looked like a stable.”
Billing errors	Customers are mischarged for services.	25	2.82	4.17	10	15	
High prices	Service provider's prices are considered to be too high relative to an internal reference price or relative to prices of competitors.	16	1.81	2.67	13	3	“I ordered two drinks at the bar. I had to pay €12. That is really an absurd price!” “The price of the DVD-player was €1250. At another store it was only €900.”
Inadequate responses to service failures		*137*	*15.46*	*22.83*	*10*	*127*	

(*continued*)

TABLE 16.1

(Continued)

(Sub)category	(Sub)category definition	No. of behaviors	No. of behaviors in % of behaviors	No. of behaviors in % of incidents	No. of behaviors in single-factor incidents	No. of behaviors in multi-factor incidents	Example(s)
Interactional unfairness	Service employees' interpersonal behavior during the service recovery.	80	9.03	13.33	4	76	“He [waiter] did not even apologize.”
Outcome unfairness	The outcome of the service recovery.	37	4.17	6.17	5	32	“I did not receive the newspaper. I called them on the phone and they promised that I would receive the newspaper that same day. Nothing happened.” “He [hairdresser] refused to give me back my money.”
Procedural unfairness	The perceived fairness of the service recovery process.	20	2.26	3.33	1	19	“Recently I bought a house. After moving in I noticed that the bathroom tap was defective. The contractor admitted that it was the firm's responsibility. However, it took forever before they took action. Only after the chief executive of the company intervened did they cover the expenses.”

Data display

According to Miles and Huberman (1994), data display is the second major activity that you should go through when analyzing your qualitative data. **Data display** involves taking your reduced data and displaying them in an organized, condensed manner. Along these lines, charts, matrices, diagrams, graphs, frequently mentioned phrases, and/or drawings may help you to organize the data and to discover patterns and relationships in the data so that the drawing of conclusions is eventually facilitated.

In our example, a matrix was considered to be the appropriate display to bring together the qualitative data. The selected data display technique may depend on researcher preference, the type of data set, and the purpose of the display. A matrix is, by and large, descriptive in nature, as the aforementioned example illustrates. Other displays, such as networks or diagrams, allow you to present causal relationships between concepts in your data.

BOX 16.6

DATA ANALYSIS

In our study into events that typically elicit customer anger in service consumption settings, we developed a matrix to organize and arrange the qualitative data. This allowed us to extract higher order themes from the data: we were able to combine the 28 subcategories into seven categories and four "super-categories." The seven categories were "unreliability," "inaccessibility," and "company policies" (procedural failures); "insensitive behaviour" and "impolite behavior" (interactional failures); "outcome failures"; and "inadequate responses to service failures." These categories and subcategories are defined in the second column of Table 16.1. The eighth column provides typical examples of critical behavior per subcategory.

Table 16.1 illustrates how data display organizes qualitative information in a way that helps you to draw conclusions. Categories and corresponding subcategories of events that typically instigate anger are presented in column 1 and defined in column 2. Column 3 provides information on how many times specific themes were mentioned by the participants. Column 4 provides information about how many times a specific theme was mentioned as a percentage of the total number of themes (885). Column 5 contains the percentage of participants that mentioned a specific category or subcategory. Columns 6 and 7 provide an overview of the distribution of incidents over one- or multifactor incidents. Column 8 provides (verbatim) examples of critical behaviors, attitudes, and manners of service providers.

Drawing conclusions

Conclusion drawing is the "final" analytical activity in the process of qualitative data analysis. It is the essence of data analysis; it is at this point where you answer your research questions by determining what identified themes stand for, by thinking about explanations for observed patterns and relationships, or by making contrasts and comparisons.

BOX 16.7

DISCUSSION

The identification of precipitating events of anger is critical to understanding this emotion. What's more, for service firm management, it is important to understand what critical behaviors from their side typically elicit anger in customers. For this reason, this exploratory study investigated precipitating events of customer anger in services.

The results of this study provide an adequate, unambiguous representation of precipitating events of customer anger and expand existing (appraisal) theories of antecedents of customer anger. Specifically, seven event categories were found to instigate anger, including unreliability, inaccessibility, and company policies (the procedural failures), insensitive behavior and impolite behavior (the interactional failures), outcome failures, and inadequate responses to service failures. Each of these events was found to be a sufficient cause of customer anger. However, the compound incidents that were reported by the participants in this study suggest that critical behaviors of service providers may also interact in their effects on customer anger.

The foregoing findings imply certain extensions to service marketing research. Researchers have previously examined the effects of core service failures and waiting for service on anger. However, this study shows that the antecedents of anger are not limited to these two factors. For service firm management, the seven categories suggest areas in which managers might take action to prevent customer anger. For example, the finding that inaccessibility of services causes customers to get angry suggests that service providers may benefit from being easily accessible for consumers. The finding that customer anger may be caused by insensitivity and impoliteness of service staff implies that hiring the right people, adequate training of service employees, and finding ways to motivate service staff to adequately perform services also reduces customer anger.

The present results partly converge with prior studies that have categorized dissatisfying experiences with service firm employees (Bitner, Booms & Tetreault, 1990) and retail failures (Kelley, Hoffman & Davis, 1993). Besides these similarities, there are important differences with the aforementioned studies as well. For instance, incidents reported by the participants of this study include difficulties with engaging in the service process and unfair rules and procedures (company policies). These behaviors, which account for more than 20% of the reported anger-provoking incidents, did not come forward as unfavorable behaviors of service providers in earlier research. This shows how the classification scheme developed here builds on and extends earlier models of service and retail failures.

RELIABILITY AND VALIDITY IN QUALITATIVE RESEARCH

It is important that the conclusions that you have drawn are verified in one way or another. That is, you must make sure that the conclusions that you derive from your qualitative data are plausible, reliable, and valid.

Reliability and validity have a slightly different meaning in qualitative research in comparison to quantitative research. Reliability in qualitative data analysis includes category and interjudge reliability. **Category reliability** "depends on the analyst's ability to formulate categories and present to competent judges definitions of the categories so they will agree on which items of a certain population belong in a category and which do not" (Kassarjian, 1977, p. 14). Thus, category reliability relates to the extent to which judges are able to use category definitions to classify the qualitative data. Well-defined categories will lead to higher category reliability and eventually to higher interjudge reliability (Kassarjian, 1977), as discussed next. However, categories that are defined in a very broad manner will also lead to higher category reliability. This can lead to the oversimplification of categories, which reduces the relevance of the research findings. For instance, McKellar (1949) in an attempt to classify instigations of anger distinguished between *need situations* and *personality instigations*. Need situations were defined as "any interference with the pursuit of a personal goal," such as missing a bus. Personality situations included the imposition of physical or mental pain or the violation of personal values, status, and possession. This classification, which focuses on whether an anger-provoking event can be classified as a personality situation or a need situation, will undoubtedly lead to high category and interjudge reliability, but it seems to be too broad to be relevant to service firm management trying to avoid customer anger. Therefore, Kassarjian (1977) suggests that the researcher must find a balance between category reliability and the relevance of categories. **Interjudge reliability** can be defined as a degree of consistency between coders processing the same data (Kassarjian, 1977). A commonly used measure of interjudge reliability is the percentage of coding agreements out of the total number of coding decisions. As a general guideline, agreement rates at or above 80% are considered to be satisfactory.

Earlier in this book, **validity** was defined as the extent to which an instrument measures what it purports to measure. In this context, however, validity has a different meaning. It refers to the extent to which the research results (1) accurately represent the collected data (internal validity) and (2) can be generalized or transferred to other contexts or settings (external validity). Two methods that have been developed to achieve validity in qualitative research are:

- Supporting generalizations by counts of events. This can address common concerns about the reporting of qualitative data: that anecdotes supporting the researcher's theory have been selected, or that too much attention has been paid to a small number of events, at the expense of more common ones.
- Ensuring representativeness of cases and the inclusion of deviant cases (cases that may contradict your theory). The selection of deviant cases provides a strong test of your theory.

Triangulation, discussed in Chapter 6, is a technique that is also often associated with reliability and validity in qualitative research. Finally, you can also enhance the validity of your research by providing an in-depth description of the research project. Anyone who wishes to transfer the results to another context is then responsible for judging how valid such a transfer is.

BOX 16.8

RELIABILITY AND VALIDITY

A rigorous classification system should be "intersubjectively unambiguous" (Hunt, 1983), as measured by interjudge reliability. The interjudge reliability averaged 0.84, and no individual coefficients were lower than 0.80. The content validity of a critical incident classification scheme is regarded as satisfactory if themes in the confirmation sample are fully represented by the categories and subcategories developed in the classification sample. In order to determine whether the sample size was appropriate, two confirmation samples (hold-out samples from the original 859 samples) of 100 new incidents (299 critical behaviors) were sorted into the classification scheme with an eye to developing new categories. No new categories emerged, indicating that the set of analyzed critical incidents forms an adequate representation of the precipitating events of anger in services.

SOME OTHER METHODS OF GATHERING AND ANALYZING QUALITATIVE DATA

Content analysis

Content analysis is an observational research method that is used to systematically evaluate the symbolic contents of all forms of recorded communications (Kolbe & Burnett, 1991). Content analysis can be used to analyze newspapers, websites, advertisements, recordings of interviews, and the like. The method of content analysis enables the researcher to analyze (large amounts of) textual information and systematically identify its properties, such as the presence of certain words, concepts, characters, themes, or sentences. To conduct a content analysis on a text, the text is coded into categories and then analyzed using conceptual analysis or relational analysis.

Conceptual analysis establishes the existence and frequency of concepts (such as words, themes, or characters) in a text. Conceptual analysis analyzes and interprets text by coding the text into manageable content categories. **Relational analysis** builds on conceptual analysis by examining the relationships among concepts in a text.

The results of conceptual or relational analysis are used to make inferences about the messages within the text, the effects of environmental variables on message content, the effects of messages on the receiver, and so on. Along these lines, content analysis has been used to analyze press coverage of election campaigns, to assess the effects of the content of advertisements on consumer behavior, and to provide a systematic overview of tools that online media use to encourage interactive communication processes.

Narrative analysis

A narrative is a story or "an account involving the narration of a series of events in a plotted sequence which unfolds in time" (Denzin, 2000). **Narrative analysis** is an approach that aims to elicit and scrutinize the stories we tell about ourselves and their implications for our lives. Narrative data are often collected via interviews. These interviews are designed to encourage the participant to describe a certain incident in the context of his or her life history. In this way, narrative analysis differs from other qualitative research methods; it is focused on a process or temporal order, for instance by eliciting information about the antecedents and consequences of a certain incident in order to relate this incident to other incidents. Narrative analysis has thus been used to study impulsive buying (Rook, 1987), customers' responses to advertisements (Mick & Buhl, 1992), and relationships between service providers and consumers (Stern, Thomson & Arnould, 1998).

Analytic induction

Another (more general) strategy of qualitative data analysis is analytic induction. Analytic induction is an approach to qualitative data analysis in which universal explanations of phenomena are sought by the collection of (qualitative) data until no cases that are inconsistent with a hypothetical explanation of a phenomenon are found. Analytic induction starts with a (rough) definition of a problem ("why do people use marijuana" is a famous example), continues with a hypothetical explanation of the problem (e.g., "people use marijuana for pleasure"), and then proceeds with the examination of cases (e.g., the collection of data via in-depth interviews). If a case is inconsistent with the researcher's hypothesis (e.g., "I use marijuana for health reasons"), the researcher either redefines the hypothesis or excludes the "deviant" case that does not confirm the hypothesis. Analytic induction involves inductive – rather than deductive – reasoning, allowing for the modification of a hypothetical explanation for phenomena throughout the process of doing research.

BIG DATA

Now that we have discussed data analysis, it is time to say a few words about *big data*. "**Big data**" is a popular term nowadays that is commonly used to describe the exponential growth and availability of data from digital sources inside and outside the organization. The term originally related to the volume of data that could not be processed and analyzed (efficiently) by traditional methods and tools. The original definition of big data focused on structured data, but most researchers and practitioners have come to realize that a lot of information resides in massive, unstructured or semi-structured data, such as texts (think weblogs, Twitter, and Facebook), images, clickstreams, and/or videos. New technologies have the ability to measure, record, and combine such data and that is why big data has great potential for making fast advances in many academic disciplines and improving decision making in organizations.

The main characteristics of big data are its *volume*, its *variety* and its *velocity*, where volume refers to the amount of data, variety refers to the many different types of data, and velocity refers to the pace at which data become available from business processes, social networks, mobile devices, and the like. Occasionally, additional "V"s are put forward, most notably *veracity*, which refers to the biases, noise and abnormality that are often present in big data.

Big data holds many promises for organizations and managers. However, it also provides them with new challenges and dilemmas, for instance with regard to how big data should be managed, processed, and analyzed. That is why many organizations find it difficult to successfully exploit the value in big data.

SUMMARY

- **Learning objective 1: Discuss three important steps in qualitative data analysis: data reduction, data display, and drawing conclusions.**
  Qualitative data are data in the form of words. There are generally three steps in qualitative data analysis: data reduction, data display, and the drawing of conclusions. Data reduction refers to the process of selecting, coding, and categorizing the data. Data display refers to ways of presenting the data. Data displays may help the researcher to draw conclusions based on patterns in the reduced set of data.

- **Learning objective 2: Discuss how reliability and validity have a different meaning in qualitative research in comparison to quantitative research and explain how reliability and validity are achieved in qualitative research.**
  Reliability and validity have a slightly different meaning in qualitative research in comparison to quantitative research. Reliability in qualitative data analysis includes category and interjudge reliability. Category reliability relates to the extent to which judges are able to use category definitions to classify the qualitative data. Interjudge reliability can be defined as a degree of consistency between coders processing the same data. Two methods that have been developed to achieve validity in qualitative research are (1) supporting generalizations by counts of events, and (2) ensuring representativeness of cases and the inclusion of deviant cases. Triangulation is a technique that is also often associated with reliability and validity in qualitative research.

- **Learning objective 3: Compare and contrast content analysis, narrative analysis, and analytic induction.**
  Content analysis is an observational research method that enables the researcher to analyze textual information and systematically identify its properties, such as the presence of certain words, concepts, characters, themes, or sentences. Narrative analysis is an approach that aims to elicit and scrutinize the stories we tell

about ourselves and their implications for our lives. Narrative data are often collected via interviews. Analytic induction is an approach to qualitative data analysis in which universal explanations of phenomena are sought by the collection of (qualitative) data until no cases that are inconsistent with a hypothetical explanation of a phenomenon are found.

- **Learning objective 4: Describe the characteristics of big data and explain why big data holds many promises for organizations and managers.**
  New technologies have the ability to measure, record, and combine large amounts of data that reside in massive, unstructured or semi-structured data, such as texts, images, clickstreams, and/or videos. That is why big data has great potential for making fast advances in many academic disciplines and improving decision making in organizations. The main characteristics of big data are its volume, its variety and its velocity. Occasionally, additional "V"s are put forward, most notably veracity.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case study: The Prevalence of Anger in Service Consumption Settings**.

DISCUSSION QUESTIONS

1. What is qualitative data? How do qualitative data differ from quantitative data?
2. Describe the main steps in qualitative data analysis.
3. Define reliability and validity in the context of qualitative research.
4. How can you assess the reliability and validity of qualitative research?
5. What is grounded theory?
6. How does narrative analysis differ from content analysis?
7. Why is analytic induction inductive (rather than deductive) in nature?

CHAPTER 17

The research report

LEARNING OBJECTIVES

After completing Chapter 17 you should be able to:

1. Describe the characteristics of a well-written research report that is tailored to the needs of a specific audience.
2. Write a thorough and complete research report.
3. Describe the characteristics of a good oral presentation and deliver a good oral presentation.

INTRODUCTION

The key purpose of any research report is to offer a clear description of what has been done in the various stages of the research process. Hence, a research report may possibly include information on the formulation of the problem statement, a critical review of the literature, the development of a theoretical framework, the collection of data, the analysis of the data, and the interpretation of the results.

When researchers describe what has been done in the research, they should keep the hallmarks of scientific research in mind. For instance, the researcher started the research with a definite aim or purpose. It is imperative to inform the reader about the specific aim or purpose of the research project as soon as possible; that is, in the introductory section of the research report. The researcher should also keep the criterion of replicability in mind; a research report is well written when a colleague researcher is able to replicate the research after reading the report. It is also important that the results of the study and the recommendations for solving the problem are objectively and effectively communicated to the sponsor, so that the suggestions made are accepted and implemented. Otherwise, all the effort hitherto expended on the investigation would have been in vain. Writing the report concisely, convincingly, and with clarity is perhaps as important as conducting a rigorous research study. Indeed, a well-thought-out written report and oral presentation are critical.

The exact contents and organization of both modes of communication – the written report and the oral presentation – depend on the purpose of the research study, and the audience to which it is targeted. The relevant aspects of the written report and oral presentation are discussed in this chapter.

THE WRITTEN REPORT

The written report starts with a description of the management problem and the research objective. This allows the reader to quickly become familiar with "the why" of the research project. The written report should also allow the reader to weigh the facts and arguments presented therein, to examine the results of the study, to reflect on the conclusions and recommendations, and eventually to implement the acceptable recommendations presented in the report, with a view to closing the gap between the existing state of affairs and the desired state. To achieve its goal, the written report has to focus on the issues discussed below.

The purpose of the written report

Research reports can have different purposes and hence the form of the written report will vary according to the situation. It is important to identify the purpose of the report, so that it can be tailored accordingly. If the purpose is simply to offer details on some specific areas of interest requested by a manager, the report can be very narrowly focused and provide the desired information to the manager in a brief format, as in the example below. A different form of report will be prescribed in some cases, where a manager asks for several alternative solutions or recommendations to rectify a problem in a given situation. Here the researcher provides the requested information and the manager chooses from among the alternatives and makes the final decision. In this case, a more detailed report surveying past studies, the methodology used for the present study, different perspectives generated from interviews and current data analyses, and alternative solutions based on the conclusions drawn therefrom will have to be provided. How each alternative helps to improve the problem situation will also have to be discussed. The advantage and disadvantages of each of the proposed solutions, together with a cost–benefit analysis in terms of dollars and/or other resources, will also have to be presented to help the manager make the decision. A situation like that in the third example would warrant this kind of a report. Such a report can also be found in Report 2 of the appendix to this chapter.

Yet another type of report might require the researcher to identify the problem and provide the final solution as well. That is, the researcher might be called in to study a situation, determine the nature of the problem, and offer a report of the findings and recommendations. Such a report has to be very comprehensive, following the format of a full-fledged study, as detailed later in this chapter. A fourth kind of research report is the very scholarly publication presenting the findings of a basic study that one usually finds published in academic journals.

EXAMPLE

A simple descriptive report

If a study is undertaken to understand, in detail, certain factors of interest in a given situation (variations in production levels, composition of employees, and the like), then a report describing the phenomena of interest, in the manner desired, is all that is called for.

For instance, let us say a human resources manager wants to know how many employees have been recruited during the past 18 months in the organization, their gender composition, educational level, and the average proportion of days that these individuals have absented themselves since recruitment. A simple report giving the desired information would suffice.

In this report, a statement of the purpose of the study will be first given (e.g., "It was desired that a profile of the employees recruited during the past 18 months in the company, and an idea of their rate of absenteeism be provided. This report offers those details"). The methods or procedures adopted to collect the data will then be given (e.g., "The payroll of the company and the personal files of the employees were examined"). Finally, a narration of the actual results, reinforced by visual tabular and graphical forms of representation of the data, will be provided. Frequency distributions, cross-tabulations, and other data will be presented in a tabular form, and illustrations will include bar charts (for gender), pie charts (to indicate the proportions of individuals at various educational levels), and so on. This section will summarize the data and may look as follows:

> ***A total of 27 employees were recruited during the past 18 months, of whom 45% are women and 55% are men. Twenty percent have a master's degree, 68% a bachelor's degree, and 12% a high school diploma. The average proportion of days that these employees remained absent during the past 18 months is six.***

These details provide the information required by the manager. It may, however, be a good idea to provide a further gender-wise breakdown of the mean proportion of days of absence of the employees in an appendix, even though this information might not have been specifically requested. If considered relevant, a similar breakdown can also be furnished for people at different job levels.

A short simple report of the type discussed above is provided in Report 1 in the appendix to this chapter.

EXAMPLE

A situation where a comprehensive report, offering alternative solutions, is needed

The president of a tire company wants several recommendations to be made on planning for the future growth of the company, taking into consideration the manufacturing, marketing, accounting, and financial perspectives. In this case, only a broad objective is stated: corporate growth. There may currently be several impediments that retard growth. One has to carefully examine the situation to determine the obstacles to expansion and how these may be overcome through strategic planning from production, marketing, management, financial, and accounting perspectives. Identification of the problems or impediments in the situation would call for intensive interviews, literature review, industry analysis, formulation of a theoretical perspective, generation of several hypotheses to come up with different alternative solutions, data gathering, data analysis, and then exploration of alternative ways of attaining corporate growth through different strategies. To enable the president to evaluate the alternatives proposed, the pros and cons of implementing each of the alternative solutions, and a statement of the costs and benefits attached to each, would follow.

This report will be more elaborate than the previous one, detailing each of the steps in the study, emphasizing the results of data analysis, and furnishing a strong basis for the various recommendations. The alternatives generated and the pros and cons of each in a report such as this are likely to follow the format of Report 2 in the appendix. Report 3 in the appendix relates to basic research on an issue that was examined by a researcher.

As we can see, the contents and format of a report will depend on the purpose of the study and the needs of the sponsors to whom it is submitted.

The audience for the written report

The organization of a report, its length, focus on details, data presentation, and illustrations will, in part, be a function of the audience for whom it is intended. The letter of transmittal of the report will clearly indicate to whom the report is being sent. An executive summary placed at the beginning will offer (busy) executives just the right amount of vital details – usually in less than one page. This will help the managers to quickly grasp the essentials of the study and its findings, and turn to the pages that offer more detailed information on aspects that are of special interest to them.

Some managers are distracted by data presented in the form of tables and feel more comfortable with graphs and charts, while others want to see "facts and figures." Both tables and figures are visual forms of representation and need to be presented in reports. Which of these are to be prominently highlighted in the report and which relegated to an appendix is a function of the awareness of the idiosyncracies of the ultimate user of the report. If a report is to be handled by different executives, with different orientations, it should be packaged such that they know where to find the information that meets their preferred mode of information processing. The length, organization, and presentation modes of the report will, among other things, depend at least in part on the target audience. Some businesses might also prescribe their own format for report writing. In all cases, a good report is a function of the audience for whom it is intended and its exact purpose. As we have seen, some reports may have to be long and detailed, and others brief and specific.

Sometimes, the findings of a study may be unpalatable to the executive (e.g., the organizational policies are outdated and the system is very bureaucratic), or may reflect poorly on management, tending to make them react defensively (e.g., the system has an ineffective top-down approach). In such cases, tact should be exercised in presenting the conclusions without compromising on the actual findings. That is, while there is no need to suppress the unpleasant findings, they can be presented in a nonjudgmental, non-fault-finding or finger-pointing manner, using objective data and facts that forcefully lead to, and convince the managers of the correctness of, the conclusions drawn. If this is not done, the report will be read defensively, the recommendations will not be accepted, and the problem will remain unsolved.

Characteristics of a well-written report

Despite the fact that report writing is a function of the purpose of the study and the type of audience to which it is presented, and accordingly has to be tailored to meet both, certain basic features are integral to all written reports. Clarity, conciseness, coherence, the right emphasis on important aspects, meaningful organization of paragraphs, smooth transition from one topic to the next, apt choice of words, and specificity are all important features of a good report. The report should, to the extent possible, be free of technical or statistical jargon unless it happens to be of a technical or statistical nature. Care should also be taken to eliminate grammatical and spelling errors.

Any assumptions made by the researcher should be clearly stated in the report, and facts, rather than opinions, provided. The report should be organized in a manner that enhances the meaningful and smooth flow of materials, as the reader progresses through it. Indeed, every reader loves to read a well-built "story." The balance between the academic standpoint and the writing of a good story is not always easy to find though; some trial and error is often needed.

The importance of the appearance of the report and its readability cannot be overemphasized. Appropriate headings and subheadings help organize the report in a logical manner and allow the reader to follow the transitions easily. A double-spaced, typed report with wide margins on all sides enables the reader to make notes/comments while perusing the contents.

CONTENTS OF THE RESEARCH REPORT

A research report has a title page, an executive summary (in the case of applied research) or an abstract (in the case of basic research), a preface, a table of contents, and sometimes a copy of the authorization to conduct the study.

All reports should have an introductory section detailing the problem studied, the purpose of the study and the research questions, giving some background of what it relates to and setting the stage for what the reader should expect in the rest of the report. The body of the report should contain a conceptual background, details regarding the framework of the study and hypotheses (in case of deductive research), the sampling design, data collection methods, analysis of data, and the results obtained. The final part of the report should present the findings and draw conclusions. If recommendations have been called for, they will be included, with a cost–benefit analysis provided with respect to each. Such information clarifies the net advantages of implementing each of the recommendations. The details provided in the report should be such as to convince the reader of the thoroughness of the study, and induce confidence in accepting the results and the recommendations made. Every professional report should also point out the limitations of the study (e.g., in sampling, data collection, and the like). A list of references cited in the report should then follow.

Appendices, if any, should be attached to the report. A report on the factors influencing the upward mobility of women in accounting firms can be found in Report 3 of the appendix to this chapter. We will now discuss the different parts of the report.

The title and the title page

The title of your research report (together with the abstract or management summary) permits potential readers to obtain a first idea of your study and to decide whether they want to read your report in its entirety. For this reason you may decide to come up with a descriptive title that accurately reflects the contents of your research or that indicates the methodology used in the research. Examples of descriptive titles are: “The Impact of Venture Capital Investments on Public Firm Stock Performance”; “Compulsive Buying: An Exploration into Self-Esteem and Money Attitudes”; and “How Advertising Really Works: A Meta-Analysis.” Hence, a descriptive title may inform potential readers about the contents of the research, the method that was used, the results of the research report, and the like.

A good title also grabs attention and entices people to read the research report in its entirety. References to well-known (literary) quotes, proverbs, or popular movie and song titles are only some of the possibilities you have to stand out. “Scents and sensibility: When do (in) congruent ambient scents influence product evaluations?” is an excellent example of a title that is both informative and persuasive. Indeed, do not be afraid to use a subtitle. If you have a catchy title, but feel it does not provide enough information, use it to clarify the contents of your research.

In addition to the title of the project, the title page will also indicate further relevant information. Note that it is important that you are familiar with your institution’s rules and recommendations about what should be included here. You may need to enter your name, your student number, the name of your institution, department, sponsors, supervisor(s), the date of your final report, and so on.

The executive summary or abstract

An executive summary or abstract of your research report is placed on the page immediately following the title page. The executive summary is a brief account of the entire research study. It provides an overview, and highlights the following important information related to it: the problem statement, sampling design, data collection methods used, results of data analysis, conclusions, and recommendations, with suggestions for their implementation.

The executive summary is probably the first part of your research report that is read by the sponsors of your study. They will use it to get an initial idea about (the results) of your study. The executive summary will be brief – and is usually restricted to one page or less in length.

An example of a management summary of a study of customer satisfaction with the website of a Dutch investment bank follows.

EXAMPLE

Management Summary

The aim of this study was to determine the variables that drive website user satisfaction in the Dutch investment banking industry. The results of this study aim to help Peeters & Co.'s Structured Products (SP) desk to improve the quality of its website. The following problem statement was formulated:

> ***"What elements are of importance in driving website user satisfaction in the Dutch investment banking industry and how can the results of this study be used to ensure users spend more time on the website of the SP desk and use it as their main information source?"***

Based on a literature review and exploratory interviews, a conceptual model of website user satisfaction was constructed. The conceptual model includes website user satisfaction and its expected (hypothesized) antecedents: information quality, system quality, interactivity, and system design quality. To examine the effect of the independent variables on website user satisfaction, an online survey was used. The results of this survey showed that the current level of user satisfaction with the website of the SP desk is below Peeters & Co.'s standards. Furthermore, the results showed that the variables information quality, system quality, interactivity, and system design quality all have a linear and positive influence on website user satisfaction.

Based on the results of this study, it is recommended that the SP desk improves the information quality and interactivity of its website. Information quality can be improved by including more relevant content on the website and by making the information on the website more transparent, objective, and up to date. Interactivity can be improved by improving customer support and by including customization options and financial tools on the website.

Table of contents

The logic of the structure of your research report becomes evident not only through an apt choice of words in the titles of the sections, but also as a result of the arrangement of the different components of the work. For the reader, the table of contents serves as a guide through your research report. The table of contents usually lists the important headings and subheadings in the report with page references. A separate list of tables and figures should also be listed in the table of contents. Your institution may have guidelines or recommendations about the form the contents pages should take. An example of the guidelines of the TIAS School for Business and Society is provided next.

EXAMPLE

TIAS School for Business and Society guidelines for the table of contents

The table of contents contains the headings and subheadings of the chapters and sections of your research project, with the numbers of the pages on which these chapters and sections begin. The outer cover page and management summary are not entered in the table of contents and therefore the first item to be listed is the preface.

The minimum content of the table of contents should be the preface, each chapter or main division title, each appendix and the bibliography. All headings should correspond exactly in wording, arrangement, punctuation, and capitalisation with the headings as they appear in the body of the dissertation.

A main heading or chapter title is given entirely in capitals and begins at the left-hand margin of the page. Main subheadings should be indented and typed in upper and lower case. Subordinate subheadings should also be indented. Chapters, sections of chapters, and subsections, etc., are numbered using Arabic numerals in a decimal sequence. Thus the third subsection of the second section of chapter three is numbered 3.2.3.

The number of the page on which the division begins in the text of the management project is given in the table of contents in Arabic numerals flush with the right-hand margin of the page. Double-spacing is used except for overrun lines, which are single-spaced.

List of tables, figures, and other materials

If the research report contains charts, figures, maps, tables, photographs, or other types of material, each series of these should be listed separately in an appropriate list on the page or pages immediately following the table of contents. Each such list should appear on a separate page. In format, such lists should follow the general style of the table of contents.

The number of the item is given at the left-hand margin of the page under the appropriate column headings entitled, “Charts,” “Figures,” “Maps,” “Tables,” or “Photographs.” This is followed by the title of the item, given exactly as it appears in the text of the research report. The number of the page on which the item appears in the body of the research report is given flush with the right-hand margin of the page. Tables, figures, etc., should be numbered according to their chapter and position in the chapter. Thus Figure 2.10 is the tenth figure in chapter two.

Preface

The preface is used primarily to mention matters of background necessary for an understanding of the subject that do not logically fit into the text. Items such as the following may also be mentioned here unless they are more extensively considered in the body of the research report: why the report has been written (e.g., Management Project Report for . . .), reason for the selection of the subject, difficulties encountered along the way, etc. It is customary to include a brief expression of the author’s appreciation of help and guidance received in the research. Note that the preface is not the same as an introduction, which is a part of the main body of the research report.

The authorization letter

A copy of the letter of authorization from the sponsor of the study approving the investigation and detailing its scope is sometimes attached at the beginning of the research report. The authorization letter makes clear to the reader that the goals of the study have the full blessing of the organization.

The introductory section

The layout of the *first chapter* is more or less standard. This chapter could contain, in the following order:

1. Introduction (§1.1).
2. Reason for the research (description of the problem)(§1.2).
3. Research objective and research questions (§1.3).
4. The scope of the study (§1.4).
5. Research method (approach) (§1.5).
6. Managerial relevance (§1.6).
7. Structure and division of chapters in the research report (§1.7).

The introductory section starts with a short introduction providing background information on why and how the study was initiated. The introduction is followed by a section describing the objective of the research project, and a section providing the research questions. Brief (!) descriptions of the scope of the study, the research method, and the managerial relevance of the study are also provided in the introductory section. The last section offers an overview of the structure and division of chapters in the research report.

The body of the report

The central part of a research report usually has two large sections: a *theoretical* part and an *empirical* part. The theoretical part contains an in-depth exploration and a clear explication of the relevant literature. The exact nature of this part depends on the type of study you have done (exploratory, descriptive, or causal – see Chapter 4, Box 4.2 for an example). It documents the relevant instruments provided in earlier research that may help you to describe what you aim to describe (when your research is descriptive in nature) or relevant findings from earlier research (when your research is exploratory or causal in nature) and should be selective, goal oriented, thorough, and critical – a literature review is more than just a summary of the literature! The literature review can be concluded with a theoretical framework and a number of hypotheses, which will be tested in the empirical part of your study (if your research is deductive and causal in nature). Avoid elaborations that will ultimately not contribute to a better understanding of the problem and/or solutions to the problem.

The design details – such as sampling and data collection methods, as well as the time horizon, the field setting, and the unit of analysis – and the results of the study are described in the empirical part of the research report. The information provided here should enable the reader to replicate the research. In the case of experiments, the empirical part should therefore at the very least contain the components "participants," "material," and "method." In the case of survey research you should include the components "participants," "method," and, if relevant, "material."

The "participants" section clarifies who took part in the research, the number of participants, and how and why participants were selected. The section "material" describes the instruments (such as stimuli and measurement scales) that were used and their functions. The description should be detailed enough to allow another researcher to replicate your research at a later stage. Stimuli can, for example, be a series of product packages that you showed your participants during an experiment. This part also informs the reader about the measurement scales that were used in the research. If an existing measurement scale (to measure a construct from your conceptual model) is used, the source of the material should be mentioned. Self-developed measurement scales should be tested for validity and internal consistency. For existing and previously published scales, a mention of a coefficient of internal consistence usually suffices (e.g., Cronbach's alpha). The "method" section provides a step-by-step description of the execution of the research. Again, it is important that the full course of the research that was followed by the participants is given in enough detail to allow another person to carry out an exact replication of the research.

In the "results" part of the research report the data are presented that were uncovered through your empirical research and subsequent data analysis. In this part you do not come forward with an explanation for the results yet, or the implications that follow from the results; this information should be offered in the final part of the report. At this place you provide a well-organized and understandable overview of the results of your study, using the appropriate procedures for statistical analysis. The specific form in which you present your results depends on the type of research. It is customary in descriptive statistics always to process information in tables or graphs (e.g., means, standard deviations, number of subjects per cell, and so on) and to include statistical tests in the text. A few of the various ways in which data can be pictorially presented in written reports and oral presentations are illustrated in Figure 17.1.

Note that all relevant results should be reported: that is, also those that contradict your hypotheses. However, avoid an overflow of numbers and figures in your text. Only include the most relevant statistical data; incorporate the rest of the results in the appendices.

The final part of the report

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The aim of this part of the research report is to interpret the results of the research with regard to the research questions. This is a very important aspect of the research report. Readers (managers) often skip the method section and move straight to the conclusions of the research. For this reason, the discussion should stand on its own, and should form a whole with a beginning and an ending. Include the following aspects in your discussion:

1. The main findings of your research.
2. The (managerial) implications of these findings (vis-à-vis your research questions).
3. Recommendations for implementation and a cost–benefit analysis of these recommendations.
4. The limitations of your study and suggestions for future research following up on your research project.

References

Immediately after the final part of the research report, starting on a fresh page, a list of the references cited in the literature review and in other places in the report will be given. The format of the references has been discussed and illustrated in the appendix to Chapter 4. Footnotes, if any in the text, are referenced either separately at the end of the report, or at the bottom of the page where the footnote occurs.

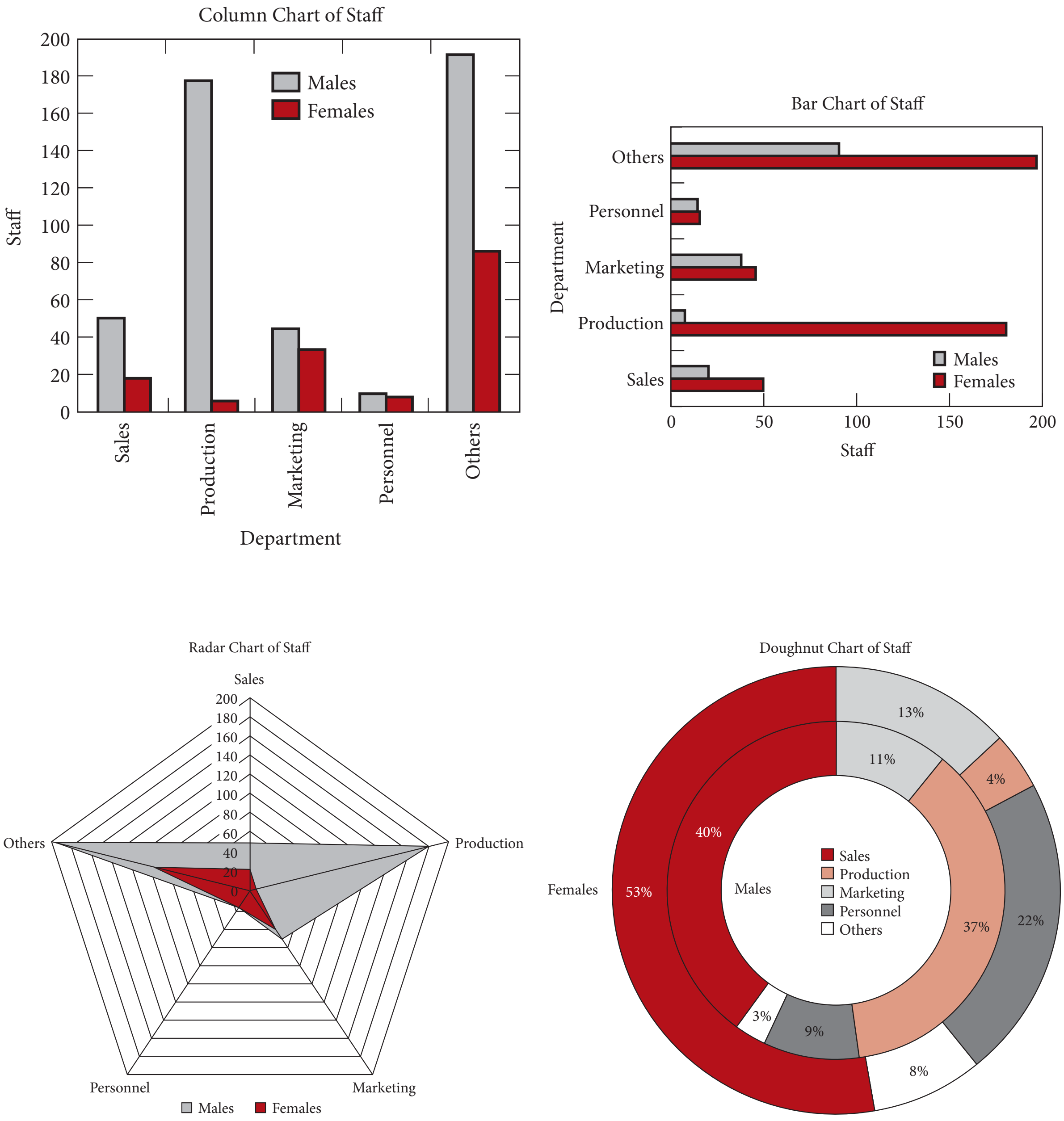

FIGURE 17.1

Pictorial representation of data

Appendix

The appendix, which comes last, is the appropriate place for the organization chart, newspaper clippings or other materials that substantiate the text of the report, detailed verbatim narration of interviews with members, and whatever else might help the reader follow the text. It should also contain a copy of the questionnaire administered to the respondents. If there are several appendices, they should be referenced as Appendix A, Appendix B, and so on, and appropriately labeled.

The above will make clear that the table of contents (mentioned earlier), following the title page and the letter of transmittal, will look somewhat as indicated below, with some possible variations.

EXAMPLE

Table of contents

Preface
- Introduction to your research report
    - Introduction
    - Problem statement
    - Research objective(s)
    - Research questions
    - The scope of the study
    - Research method
    - Managerial relevance
    - Structure of the research report
- Theoretical framework
- Research design
- Results
- Conclusions
- Recommendations
- Limitations of study and suggestions for further research
- References
- Appendices

ORAL PRESENTATION

Usually organizations (and instructors in classes) require about a 20-minute oral presentation of the research project, followed by a question-and-answer session. The oral presentation calls for considerable planning. Imagine a study that spanned several months having to be presented in 20 minutes to a live audience! Those who have not read the report at all, or at best only superficially, have to be convinced that the recommendations made therein will indeed prove to be beneficial to the organization. All this will have to be effectively accomplished in the matter of a few minutes.

The challenge is to present the important aspects of the study so as to hold the interest of the audience, while still providing detailed information, which may drive many to ennui. Different stimuli (charts, short movies, pictorial and tabular depiction, etc.) have to be creatively provided to the audience to sustain their interest throughout the presentation. To make all this possible, time and effort have to be expended in crafting, planning, organizing, and rehearsing the presentation.

Check out the information provided on the TEDx Speaker Guide (www.ted.com) or review the "TEDx Illustrated Guide for Speakers" document (http://storage.ted.com/tedx/manuals/IllustratedTEDxSpeakerGuide.pdf) for some guiding principles on how to draft and deliver a compelling talk.

Slides are often helpful for the audience – even though they are not necessary for every talk. Images, photos, graphs and infographics help you to sustain the interest of your audience. They also help you to discuss and explain the research project coherently, without reading from prepared notes.

Factors irrelevant to the written report, such as dress, mannerisms, gestures, voice modulation, and the like, take on added importance in oral presentations. Speaking audibly, clearly, without distracting mannerisms, and at the right speed for the audience to comprehend is vital for holding their attention. Varying the length of the sentences, establishing eye contact, tone variations, voice modulation, and the rate of flow of information make all the difference to audience receptivity. That is why it is very important that you rehearse. The contents of the presentation, timing, and the style of delivery should be practiced in detail. Keep rehearsing until you feel comfortable about your presentation.

Deciding on the content

Because a lot of material has to be covered in, perhaps, a 20-minute presentation, it becomes necessary to decide on the points to focus on and the importance to be given to each. Remembering that the listener absorbs only a small proportion of all that he or she has heard, it is important to determine what the presenter would like the listener to walk away with, and then organize the presentation accordingly.

Obviously, the problem investigated, the results found, the conclusions drawn, the recommendations made, and the ways in which they can be implemented are of vital interest to organizational members, and need to be emphasized during the presentation. The design aspects of the study, details of the sample, data collection methods, details of data analysis, and the like, can be mentioned in passing to be picked up at the question-and-answer session by interested members.

However, depending on the type of audience, it may become necessary to put more stress on the data analytic aspects. For example, if the presentation is being made to a group of statisticians in the company, or in a research methods class, the data analyses and results will receive more time than if the project is being presented to a group of managers whose main interest lies in the solution to the problem and implementation of the recommendations. Thus, the time and attention devoted to the various components of the study will require adjustment, depending on the audience.

Visual aids

Graphs, charts, and tables help to drive home the points one wishes to make much faster and more effectively, true to the adage that a picture is worth a thousand words. Visual aids provide a captivating sensory stimulus that sustains the attention of the audience. Slides, flip charts, and handout materials also help the audience to easily follow the points of the speaker's focus. The selection of specific visual modes of presentation will depend, among other things, on the size of the room, the availability of a good screen for projection, and the cost constraints of developing sophisticated visuals. Visuals that present side-by-side comparisons of the existing and would-be state of affairs via graphs or pie charts drive home the points made much more forcefully than elaborate and laborious verbal explanations.

Integrated multimedia presentations using PowerPoint, Prezi, and other visuals are quite common in this technological age. When planning a presentation using PowerPoint or Prezi, it is important to ensure before the presentation starts that the related equipment is properly hooked up and tested so that the presentation can go smoothly without interruptions.

The presenter

An effective presentation is also a function of how "unstressed" the presenter is. The speaker should establish eye contact with the audience, speak audibly and understandably, and be sensitive to the nonverbal reactions of the audience. Strict adherence to the time frame and concentration on the points of interest to the audience are critical aspects of presentation. A display of extreme nervousness throughout the presentation, stumbling for words, fumbling with the notes or audiovisuals, speaking inaudibly and/or with distracting mannerisms, straying away from the main focus of the study, and exceeding the time limit all detract from effectiveness. One should also not minimize the importance of the impression created on the audience by dress, posture, bearing, and the confidence with which one carries oneself. Such simple things as covering the materials on the visuals until they need to be exhibited, and voice modulation, help to focus the attention of the audience on the discussion.

The presentation

The opening remarks set the stage for riveting the attention of the audience. Certain aspects such as the problem investigated, the findings, the conclusions drawn, the recommendations made and their implementation are, as previously mentioned, important aspects of the presentation. The speaker should drive home these points at least three times – once in the beginning, again when each of these areas is covered, and finally, while summarizing and bringing the presentation to a conclusion.

Handling questions

Concentrated and continuous research on the research topic over a considerable period of time indisputably makes the presenter more knowledgeable about the project than anyone else in the audience. Hence, it is not difficult to handle questions from the members with confidence and poise. It is important to be nondefensive when questions are posed that seemingly find fault with some aspect of the research. Openness to suggestions also helps, as the audience might, at times, come up with some excellent ideas or recommendations that the researcher might not have thought of. Such ideas must always be acknowledged graciously. If a question or a suggestion from a member in the audience happens to be flawed, it is best addressed in a nonjudgmental fashion.

The question-and-answer session, when handled well, leaves the audience with a sense of involvement and satisfaction. Questioning should be encouraged and responded to with care. This interactive question-and-answer session offers an exciting experience both to the audience and to the presenter.

As may be readily seen, a 20-minute presentation and a short question-and-answer session thereafter do call for substantial planning, anticipation of audience concerns, psychological preparedness, and good impression management skills.

Reporting has to be done in an honest and straightforward manner. It is unethical to fail to report findings that are unpalatable to the sponsors or that reflect poorly on management. As suggested earlier, it is possible to be tactful in presenting such findings without withholding or distorting information to please the sponsors. Internal researchers, in particular, will have to find ways of presenting unpopular information in a tactful manner. It is also important to state the limitations of the study – and practically every study has some limitation – so that the audience is not misled.

SUMMARY

- **Learning objective 1: Describe the characteristics of a well-written research report that is tailored to the needs of a specific audience.**
  The written report should allow the reader to weigh the facts and arguments presented therein, to examine the results of the study, to reflect on the conclusions and recommendations, and to implement the recommendations presented, with a view to solving the problem that catalyzed the research project. Despite the fact that report writing is a function of the purpose of the study and the type of audience to which it is presented, and accordingly has to be tailored to meet both, certain basic features are integral to all written reports. Clarity, conciseness, coherence, and the right emphasis on important aspects are examples of characteristics of a well-written research report.

- **Learning objective 2: Write a thorough and complete research report.**
  The exact content and organization of the written report depends on the purpose of the research study, and the audience to which it is targeted. In general, a research report has a title page, an executive summary or an abstract, a preface, a table of contents, and (sometimes) a copy of the authorization to conduct the study. The introductory section details the problem studied, the purpose of the study and the research questions, giving some background of what it relates to and setting the stage for what the reader should expect in the rest of the report. The body of the report contains a conceptual background, the theoretical framework of the study and hypotheses, if any, the sampling design, data collection methods, analysis of data, and the results obtained. The final part of the report should present the findings, conclusions, and recommendations (for further research). A list of references cited in the report should then follow. Appendices should be attached to the report.

- **Learning objective 3: Describe the characteristics of a good oral presentation and deliver a good oral presentation.**
  Usually organizations require about a 20-minute oral presentation of the research project, followed by a question-and-answer session. The oral presentation calls for considerable planning: time and effort have to be expended in crafting, planning, organizing, and rehearsing the presentation. Because a lot of material has to be covered, it becomes necessary to decide on the points to focus on and the importance to be given to each. The problem investigated, the results found, the conclusions drawn, the recommendations made, and the ways in which they can be implemented are of vital interest to organizational members, and need to be emphasized during the presentation.

Visit the companion website at **www.wiley.com/college/sekaran** for **Case Study: The Jupiter Consumer Electronics Chain.**

DISCUSSION QUESTIONS

1. Discuss the purpose and contents of the executive summary.
2. What are the similarities and differences between basic and applied research reports?
3. How have technological advancements helped in writing and presenting research reports?
4. Why is it necessary to specify the limitations of the study in the research report?
5. What aspects of a class research project would be stressed by you in the written report and in the oral presentation?

Now do Exercises 17.1 and 17.2.

EXERCISE 17.1

Critique Report 3 in the appendix. Discuss it in terms of good and bad research, suggesting how the study could have been improved, what aspects of it are good, and how scientific it is.

EXERCISE 17.2

Give a title to and write the introductory section of any study you might like to conduct.

APPENDIX

Examples

REPORT 1: SAMPLE OF A REPORT INVOLVING A DESCRIPTIVE STUDY

Sekras Company

TO: Mr L. Raiburn, Chairman
Strategic Planning Committee
FR: Joanne Williams
Public Relations Officer
RE: Report requested by Mr Raiburn

Attached is the report requested by Mr Raiburn. If any further information or clarification is needed, please let me know.

Encl: Report

Report for the strategic planning committee

Introduction

Vice President Raiburn, Chairman of the Strategic Planning Committee, requested two pieces of information:

1. The sales figures of the top five retailers in the country.
2. Customers' ideas of what improvements can be made to Sekras to enhance their satisfaction. For this purpose, he desired that a quick survey of the company's customers be done to elicit their opinions.

Method used for obtaining the requisite information

Figures of sales of the top five retailers in the country were obtained from *BusinessWeek*, which periodically publishes many kinds of industry statistics.

To obtain customers' inputs on improvements that could be made by the company, a short questionnaire (specimen in Appendix A) was mailed to 300 of our credit card customers – 100 who had most frequently used the card in the last 18 months, 100 who most infrequently used it during the same period, and 100 average users. Questionnaires in three different colors were sent to the three groups. Respondents were offered a complimentary magnet for responses received within a week. The questionnaire asked for responses to three questions:

1. What are some of the things you like best about shopping at Sekras?
2. What are some of the things that you dislike and would like to see improved at Sekras? Please explain in as much detail as possible.
3. What are your specific suggestions for making improvements to enhance the quality of our service to customers like you?

Findings

Sales figures of the top five retailers Information regarding sales of the top five retailers in 2000 and 2003 is provided in Table 17.1.

As can be seen, Wal-Mart and Home Depot retained their top positions in 2003. Kroger (a supermarket chain with 2532 grocery stores in 32 states) which was not among the top five in 2000, occupied the third place in 2003, whereas Costco (an international chain of membership warehouses, primarily under the "Costco Wholesale" name) occupied the fourth place. Target (the company's stores offer men's and women's clothing, home furnishings, electronic products, sports products, toys, and entertainment products) retained the fifth position in 2003. Sears, Roebuck and Kmart did not find a place among the top five retailers during 2003. It may be observed that even though Wal-Mart increased its sales by about 1.33 times during the three-year period, its share among the top five did not increase.

Customer suggestions for improvements Of the 300 surveys sent out, 225 were received, a 75% response rate. Of the 100 most frequent users of our credit card to whom questionnaires were sent, 80 responded; among the most infrequent users, 60 responded; and among the average users, 85 responded.

About 75% of the respondents were women. The majority of the customers were between the ages of 35 and 55 (62%).

The responses to the three open-ended questions were analyzed. The information needed by the Committee on the suggested improvements is tabulated (see Table 17.2). Responses to the other two questions on features

TABLE 17.1

Comparative sales figures of the five top retail companies during 2000 and 2003

Top retailers in 2000			Top retailers in 2003		
Company	Sales in billions of $	Share among top five	Company	Sales in billions of $	Share among top five
Wal-Mart Stores	191.33	54.7%	Wal-Mart Stores	256.0	53.4%
Home Depot	45.74	13.1%	Home Depot	73.10	15.2%
Sears, Roebuck	40.94	11.7%	Kroger	56.40	11.8%
Kmart	36.50	10.3%	Costco	47.15	9.8%
Target	35.51	10.2%	Target	46.80	9.8%

Source: Businessweek

liked by the customers, and their specific suggestions for improvement, are provided in the two tables in the appendix. The following are suggestions received from one or two respondents only:

1. Have more water fountains on each floor.
2. The pushcarts could be lighter, so they will be less difficult to push.
3. More seats for resting after long hours of shopping would help.
4. Prices of luxury items are too high.

From looking at Table 17.2, it can be seen that the most dissatisfaction stems from (1) out-of-stock small appliances, and (2) inability to locate store assistants who could guide customers in locating what they need (44% each). The need for child care services is expressed by 38% of the customers. Twenty percent also indicate that the cafeteria should cater to tastes for international spicy type of foods. The next two important items pertain to the temperature (18%) and billing mistakes (16%). Some customers (16%) also wish the store was open 24 hours.

The rest of the suggestions were offered by less than 10% of the customers and, hence, can perhaps be attended to later.

TABLE 17.2

Suggested areas for improvement

Features	Frequent users no.	Medium users no.	Infrequent users no.	Total no.	%
1. Small appliances such as mixers, blenders are often not in stock. This is irritating.	30	48	22	100	44
2. The cafeteria serves only bland, uninteresting food. How about some spicy international food?	26	14	5	45	20
3. Often, we are unable to locate where the items we want are!	3	6	14	23	10
4. It would be nice if you could have a child care service so we can shop without distractions.	28	32	25	85	38
5. It is often difficult to locate an assistant who can help us with answers to our questions.	29	49	22	100	44
6. I wish it were a 24-hour store.	17	13	7	37	16
7. Sometimes, there is a mistake in billing. We have to make some telephone calls before charges are corrected. This is a waste of our time.	4	12	14	20	16
8. Allocate some floor space for kids to play video games.	2	—	4	6	2
9. Import more Eastern apparel like the kimono, sarees, sarongs.	—	8	4	12	5
10. Regulate the temperature better; often, it is too cold or too hot.	15	12	17	44	18

A note of caution is in order at this juncture. We are not sure how representative our sample is. We thought that a mix of high, average, and infrequent users of our credit card would provide us with some useful insights. If a more detailed study obtaining information from a sample of all the customers who come to the store is considered necessary, we will initiate it quickly. In the meantime, we are also interviewing a few of the customers who shop here daily. If we find anything of significance from these interviews, we will inform you.

Improvements indicated by these suggestions

Based on the current sample of customers who have responded to our survey, the following improvements and actions seem called for:

1. Small appliances need to be adequately stocked (44% complained about this). An effective reorder inventory system has to be developed for this department to minimize customer dissatisfaction and avoid loss of sales for lack of sufficient stock. The research team can help in this, if requested.
2. Customers seem to need help to locate store items and would appreciate help from store assistants (44% expressed this need). If providing assistance is a primary concern, it would be a good idea to have liveried store personnel with badges to indicate they are there to assist customers. During idle hours, if any (when there are no customers seeking help), these individuals can be deployed as shelf organizers.
3. Need for child care has been expressed by more than a third of our customers (38%). It would be a good idea to earmark a portion of the front of the building for parents to drop off their children while shopping. The children will have to be supervised by a trained child care professional recruited by the organization. An assistant could be recruited later if needed. From the cost–benefit analysis in Exhibit 7, it may be seen that this additional expenditure will pay off multifold in sales revenue, and at the same time, create a fund of goodwill for the company.
4. Adding to the variety of foods served in the cafeteria (a need expressed by 20%) is at once a simple and a complex matter. We need further ideas and details as to what types of food need to be added. This information can be obtained through a short survey, if Mr Raiburn so desires.
5. Billing errors should not occur (16% indicated this). The billing department should be warned that such mistakes should be avoided and should not recur. Performance assessment should be tied to such mistakes.
6. Regulation of temperature (16% identified this) is easy. This, in fact, could be immediately attended to by the engineering department personnel.

I hope this report contains all the information sought by Mr Raiburn. As stated earlier, if the non-credit card customers also have to be sampled, this can be easily arranged.

REPORT 2: SAMPLE OF A REPORT OFFERING ALTERNATIVE SOLUTIONS AND EXPLAINING THE PROS AND CONS OF EACH ALTERNATIVE

TO: Mr Charles Orient, CEO, Lunard Manufacturing Company
FR: Alex Ventura, Senior Researcher, Beam Research Team
RE: Suggestions on alternative ways of cutting costs in anticipation of recession.

Enclosed is the report requested by Mr Orient. If any additional Information or clarification is needed, please let me know.

Encl: Report

Report on alternative ways of handling recessionary times without massive layoffs

Introduction

The Beam Research Team was asked to suggest alternative ways of tiding over the anticipated recession of the next several months, when a slowdown of the economy is expected. A recent article in *BusinessWeek* entitled "Hunkering Down in a Hurry" indicated that executives in a large number of companies are slashing costs mostly through layoffs and restructuring. Mr Orient wanted the Beam Research Team to suggest other alternatives besides layoffs.

This report provides five alternatives citing the advantages and disadvantages of each.

Method used for developing the alternatives

The team studied the economic indicators and the published industry analyses, read the Federal Reserve Board Chairman's speeches, examined the many ways in which companies cut costs during nonrecessionary periods as well as recessions, and, based on these, suggests the following five alternatives.

Alternatives suggested:

1. A moratorium on all capital expenditure.
2. Hiring freeze.
3. Recovery of bad debts through sustained efforts.
4. Trimming of operating expenditure with substantial reduction in travel and entertainment expenditure.
5. Discontinuance of the manufacture of low-profit-margin products.

Advantages and disadvantages of each of the above

Itemized details of the cost–benefit analysis for each of the above suggestions are furnished in the appendix. We give only the net benefits for each alternative here.

Moratorium on all capital expenditure It makes good sense to desist from all capital expenditure since manufacture of most of the items will slow down during recession. Except for parts for existing machines, there is no need to buy capital equipment, and all proposals in this regard should be shelved.

This strategy will cut down expenditure to the extent of 7 to 10% of revenue. See appendix for full details. A reserve fund can be created to catch up with future orders when the economy returns to normal.

Hiring freeze The annual increase in the strength of staff during the past four years has been about 15%. With a slowdown of the economy, a hiring freeze in all branch offices will save over $10 million annually.

This might initially result in some extra workload for the staff and cause some job dissatisfaction, but once they get used to it, and the impact of the actual recession hits them, employees will be thankful for the job they have. It will be a good idea to explain in advance the reasons for the hiring freeze to the employees so that they understand the motive behind the company's policy, and appreciate having been informed.

Recovery of bad debts through aggressive efforts Bad debts of the company have been on the increase over the past three years, and no intensive efforts to recover them seem to have been made hitherto.

We suggest that collection agents who have successfully recovered bad debts for other companies be hired immediately. Such agents may have to be paid more than other collection agents, but the extra cost will be well worth it. About a billion dollars can be collected within a few weeks of their being on the job, and this will help the financial cash flow of the company.

Trimming of operating expenditure Several operating expenses can be cut down – the travel expenses of managers in particular – as shown in Exhibit 4 of the appendix. Videoconferencing costs much less and is quicker, and should be encouraged for most of the meetings and negotiations. This alone will result in savings of more than $175000 per month.

Another way of considerably curtailing expenditure is to restrict entertainment expenses only for such purposes and to such managers as actively promote the business of the company or are essential for public relations.

These changes will have a negative impact on morale, but managers understand the economic situation, and will adjust to the new system once the initial mental resistance wears off.

Eliminating the manufacture of low-margin products The team found from a detailed study of the company records of manufacturing, sales, and profits figures for the various products that all the items listed in Exhibit 5 of the appendix have very low profit margins. It is evident from the data provided that considerable time and effort are expended in manufacturing and selling these items.

It will be useful to phase out the manufacture of these items and divert the resources to the high-profit items suggested in Exhibit 6. From the cost–benefit analysis in Exhibit 7, it may be seen that several billions can be saved through this strategy.

It is possible to put into effect all of the five alternatives above and handle the onslaught of the recession with confidence.

REPORT 3: EXAMPLE OF AN ABRIDGED BASIC RESEARCH REPORT

Factors affecting the upward mobility of women in public accounting

Introduction

A substantial number of women have entered the public accounting profession in the past 15 years or so. However, less than 4% of the partners in the big eight accounting firms are women, indicating a lack of upward mobility for women in the accounting profession. Against the backdrop of the fact that the women students perform significantly better during their academic training than their male counterparts, it is unfortunate that their intellectual ability and knowledge remain underutilized during their professional careers. The recent costly litigation and discrimination suits filed make it imperative for us to study the factors that affect the upward mobility of women and examine how the situation can be rectified.

A brief literature review

Studies of male and female accounting majors indicate that the percentage of women accounting students has increased severalfold since 1977 (Kurian, 1998). Based on the analysis of longitudinal data collected over a 15-year period, Mulcher, Turner, and Williams (2000) found that female students' grades in senior accounting courses were significantly higher than those of the male students. This higher level of academic performance has been theorized as being due to the higher need and desire that women have to achieve and overcome stereotypes (Messing, 2000), having higher career aspirations (Tinsley *et al*., 1999), or having a higher aptitude for accounting (Jones & Alexander, 2001; Riley, 2001). Empirical studies by Fraser, Lytle, and Stolle (1998) and Johnson and Meyer (1999), however, found no significant differences in personality predispositions or behavioral traits among male and female accounting majors.

Several surveys of women accountants in the country pinpoint three major factors that hinder women's career progress in the public accounting field (see, for instance, Kaufman, 1986; Larson, 1999; Walkup & Fenman, 2001). They are: (1) the long hours of work demanded by the profession (a factor that conflicts with family demands); (2) failure to be entrusted with responsible assignments; and (3) discrimination. In sum, the lack of upward mobility seems to be due to factors over which the organization has some control.

Research question

Do long work hours, failure to be handed greater responsibilities, and discrimination account for the lack of upward mobility of women in public accounting?

Theoretical framework

The variance in the dependent variable, upward mobility, can be explained by the three independent variables: long hours of work, not handling greater responsibilities, and discrimination. As women are expected to, and do indeed, take on responsibility for household work and childrearing, they are not able to work beyond regular work hours at the workplace. This creates the wrong impression among higher-ups in the organization that women are less committed to their work. Because of this perception, they are not entrusted with significant responsibilities. This further hinders their progress as they are not afforded exposure to the intricacies of accounting practices as much as men. Hence, women are overlooked at the time of promotion.

Deliberate discriminatory practices due to sex-role stereotypes, as evidenced in the well-known case of *Hopkins vs. Price Waterhouse & Co*., also arrest women's progress. If women are not valued for their potential and are expected to conform to sex-typed behavior (which confines them to inconspicuous roles), their chances of moving up the career ladder are significantly reduced.

Thus, the three independent variables considered here would significantly explain the variance in the upward mobility of women in public accounting. The impracticability of putting in long hours of work, lack of opportunities to handle greater responsibilities, and sex-role stereotyping all negatively impact upward mobility.

Hypotheses

If women spend more hours on the job after regular work hours, they will be given greater responsibilities.

If women are entrusted with higher levels of responsibility, they will have more opportunities to move up in the organization.

If women are not expected to conform to stereotypical behavior, their chances for upward mobility will increase.

All three independent variables will significantly explain the variance in women CPAs' upward mobility.

Method section

Study design In this cross-sectional correlational field study, data on the three independent variables and the dependent variable were collected from women CPAs in several public accounting organizations in the country through mail questionnaires.

Population and sample The population for the study comprised all women CPAs in the country. A systematic sampling procedure was first used to select 30 cities from the various regions of the country, from which a sample of accounting firms would be drawn. Then, through a simple random sampling procedure, five CPA firms from each of the cities were chosen for the study. Data were collected from all the women in each of the firms so chosen. The total sample size was 300 and responses were received from 264 women CPAs, for an 88% response rate for the mail questionnaires, which is pretty good. The unit of analysis was the individuals who responded to the survey.

All respondents had, as expected, the CPA degree. Their ages ranged from 28 to 66. About 60% of the women were over 45 years of age. The average number of children in the house below the age of 13 was two. The average number of years of work in the organization was 15, and the average number of organizations worked for was two. The average number of hours spent daily at home on office-related matters was 1.4.

Variables and measures All demographic variables such as age, number of years in the organization, number of other organizations in which the individual had worked, number of hours spent at home on office-related matters, and number of children in the house and their ages, were tapped by direct single questions.

Upward mobility. This dependent variable indicates the extent to which individuals are expected to progress in their career during the succeeding three to ten years. Hall (1986) developed four items to measure this variable, a sample item being: "I see myself being promoted to the next level quite easily." The measure is reported to have convergent and discriminant validity, and Cronbach's alpha for the four items for this sample was 0.86.

Sex-role stereotyping. This independent variable was measured using Hall and Humphreys' (1972) eight-item measure. An example item is: "Men in this organization do not consider women's place to be primarily in the home." Cronbach's alpha for the measure for this sample was 0.82.

Responsibilities assigned. This was tapped by three items from Sonnenfield and McGrath (1983), which asked respondents to indicate their levels of assigned responsibility to (a) make important decisions, (b) handle large accounts, and (c) account for the annual profits of the firm. Cronbach's alpha for the three items was 0.71 for this sample.

Data collection method Questionnaires were mailed to 300 women CPAs in the United States. After two reminders, 264 completed questionnaires were received within a period of six weeks. The high return rate of 88% can be attributed to the shortness of the questionnaire and perhaps the motivation of the women CPAs to respond to a topic close to their heart.

Questionnaires were not electronically administered for various reasons, including the advantage it afforded to the busy respondents to reply without switching on the computer.

Data analysis and results After determining the reliabilities (Cronbach's alpha) for the measures for this sample, frequency distributions for the demographic variables were obtained. These may be seen in Exhibit 1. Then a Pearson correlation matrix was obtained for the four independent and dependent variables. This may be seen in Exhibit 2. It is to be noted that no correlation exceeded 0.6.

Each hypothesis was then tested. The correlation matrix provided the answer to the first three hypotheses. The first hypothesis stated that the number of hours put in beyond work hours on office-related matters would be positively correlated to the responsibilities assigned. The correlation of 0.56 ($p < 0.001$) between the number of hours spent on office work beyond regular work hours and the entrusted responsibilities substantiates this hypothesis.

The second hypothesis stated that if women were given higher responsibilities, their upward mobility would improve. The positive correlation of 0.59 ($p < 0.001$) between the two variables substantiates this hypothesis. That is, the greater the entrusted responsibilities, the higher are the perceived chances of being promoted.

The third hypothesis indicated that sex-role stereotyping would be negatively correlated to upward mobility. The correlation of -0.54 ($p < 0.001$) substantiates this hypothesis as well. That is, the greater the expected conformity to stereotyped behavior, the less the chances of upward mobility.

To test the fourth hypothesis that the number of hours spent beyond regular work hours on job-related matters, assignment of higher responsibilities, and expectations of conformity with stereotyped behavior will significantly explain the variance in perceived upward mobility, the three independent variables were regressed against the dependent variable. The results, which are shown in Exhibit 3, indicate that this hypothesis is also substantiated. That is, the R^2 value of 0.43 at a significance level of $p < 0.001$, with df (3.238), confirms that 43% of the variance in upward mobility is significantly explained by the three independent variables.

Discussion of results The results of this study confirm that the variables considered in the theoretical framework are important. By focusing solely on the number of hours worked, ignoring the quality of work done, the organization is perhaps not harnessing the full potential and encouraging the development of the talents of the women CPAs adequately. It seems worth while to remedy this situation.

It would be useful if the top executives were to assign progressively higher levels of responsibility to women. This would utilize their abilities fully and, in turn, enhance the effectiveness of the firm. If executives are helped to modify their mental attitudes and sex-role expectations, they should tend to expect less stereotypical behavior and encourage the upward mobility of women CPAs. Knowing women bring a different kind of perspective to organizational matters (Smith, 1999; Vernon, 2001), it is quite possible that having them as partners of the firm will enhance the organizational effectiveness as well.

Recommendations It is recommended that a system be set up to assess the value of the contributions of each individual in discharging his or her duties, and use that, rather than the number of hours of work put in, as a yardstick for promotion.

Second, women CPAs should be given progressively more responsibility after they have served three to five years in the system. Assigning a mentor to train them will facilitate smooth functioning of the firm.

Third, a short seminar should be organized for executives to sensitize them to the adverse effects of sex-role stereotyping at the workplace. This will help them to beneficially utilize the talents of women CPAs. If viewed as professionals with career goals and aspirations, rather than in stereotyped ways, women CPAs will be enabled to handle more responsibilities and advance in the system. The organization also stands to benefit from their contributions.

In conclusion, it would be worth while for public accounting firms to modify their mental orientations toward, and expectations of, women CPAs. It is a national waste if their potential is not fully tapped and utilized.

A FINAL NOTE TO STUDENTS

If you have enjoyed learning about research and built up a repertoire of research skills, you are prepared and ready for your professional life. Earlier in the book we have explained how research helps managers to get a grip on issues, concerns, and conflicts within the company or in its environment, to take effective decisions and to develop effective courses of action. As you must have realized from these and other discussions in this book, research is an integral part of organizational reality that helps businesses to continuously improve and grow progressively.

Though you may not have become an *expert* researcher after one semester of coursework, and perhaps a research project, we are sure you would have gained an intelligent appreciation of, and an adequate depth of knowledge for, business research – great assets in dealing effectively with consultants. The ability to discriminate between the good and the not-so-good research will also be invaluable to you in sifting through the materials you will undoubtedly read in the practitioner and academic journals in your professional life as managers. And, more important, as you get deluged by all the information from various sources, including the Internet, newspapers, talk shows, and the like, you will be better able to evaluate the validity of the messages and judge them for what they truly represent. You are thus armed to handle the information overload that one faces in today's information age.

If you have satisfactorily met the chapter objectives, you can be confident that you have taken a giant step toward becoming even more effective as a manager.

Research is the excitement of exploring avenues for problem solving, and as a manager you will find the research knowledge and skills you have now acquired to be extremely useful. Research, when applied with good common sense, yields the desired results.

We wish you success in your personal, academic, and professional careers!

—Uma Sekaran and Roger Bougie

STATISTICAL TABLES

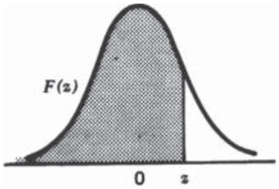

Table I

Cumulative Normal Probabilities

z	F(z)	z	F(z)	z	F(z)
0.00	0.5000000	0.30	0.6179114	0.60	0.7257469
0.01	0.5039894	0.31	0.6217195	0.61	0.7290691
0.02	0.5079783	0.32	0.6255158	0.62	0.7323711
0.03	0.5119665	0.33	0.6293000	0.63	0.7356527
0.04	0.5159534	0.34	0.6330717	0.64	0.7389137
0.05	0.5199388	0.35	0.6368307	0.65	0.7421539
0.06	0.5239222	0.36	0.6405764	0.66	0.7453731
0.07	0.5279032	0.37	0.6443088	0.67	0.7485711
0.08	0.5318814	0.38	0.6480273	0.68	0.7517478
0.09	0.5358564	0.39	0.6517317	0.69	0.7549029
0.10	0.5398278	0.40	0.6554217	0.70	0.7580363
0.11	0.5437953	0.41	0.6590970	0.71	0.7611479
0.12	0.5477584	0.42	0.6627573	0.72	0.7642375
0.13	0.5517168	0.43	0.6664022	0.73	0.7673049
0.14	0.5556700	0.44	0.6700314	0.74	0.7703500
0.15	0.5596177	0.45	0.6736448	0.75	0.7733726
0.16	0.5635595	0.46	0.6772419	0.76	0.7763727
0.17	0.5674949	0.47	0.6808225	0.77	0.7793501
0.18	0.5714237	0.48	0.6843863	0.78	0.7823046
0.19	0.5753454	0.49	0.6879331	0.79	0.7852361
0.20	0.5792597	0.50	0.6914625	0.80	0.7881446
0.21	0.5831662	0.51	0.6949743	0.81	0.7910299
0.22	0.5870604	0.52	0.6984682	0.82	0.7938919
0.23	0.5909541	0.53	0.7019440	0.83	0.7967306
0.24	0.5948349	0.54	0.7054015	0.84	0.7995458
0.25	0.5987063	0.55	0.7088403	0.85	0.8023375
0.26	0.6025681	0.56	0.7122603	0.86	0.8051055
0.27	0.6064199	0.57	0.7156612	0.87	0.8078498
0.28	0.6102612	0.58	0.7190427	0.88	0.8105703
0.29	0.6140919	0.59	0.7224047	0.89	0.8132671

(continued)

Table I (Continued)

z	$F(z)$	z	$F(z)$	z	$F(z)$
0.90	0.8159399	1.37	0.9146565	1.84	0.9671159
0.91	0.8185887	1.38	0.9162067	1.85	0.9678432
0.92	0.8212136	1.39	0.9177356	1.86	0.9685572
0.93	0.8238145	1.40	0.9192433	1.87	0.9692581
0.94	0.8263912	1.41	0.9207302	1.88	0.9699460
0.95	0.8289439	1.42	0.9221962	1.89	0.9706210
0.96	0.8314724	1.43	0.9236415	1.90	0.9712834
0.97	0.8339768	1.44	0.9250663	1.91	0.9719334
0.98	0.8364569	1.45	0.9264707	1.92	0.9725711
0.99	0.8389129	1.46	0.9278550	1.93	0.9731966
1.00	0.8413447	1.47	0.9292191	1.94	0.9738102
1.01	0.8437524	1.48	0.9305634	1.95	0.9744119
1.02	0.8461358	1.49	0.9318879	1.96	0.9750021
1.03	0.8484950	1.50	0.9331928	1.97	0.9755808
1.04	0.8508300	1.51	0.9344783	1.98	0.9761482
1.05	0.8531409	1.52	0.9357445	1.99	0.9767045
1.06	0.8554277	1.53	0.9369916	2.00	0.9772499
1.07	0.8576903	1.54	0.9382198	2.01	0.9777844
1.08	0.8599289	1.55	0.9394292	2.02	0.9783083
1.09	0.8621434	1.56	0.9406201	2.03	0.9788217
1.10	0.8643339	1.57	0.9417924	2.04	0.9793248
1.11	0.8665005	1.58	0.9429466	2.05	0.9798178
1.12	0.8686431	1.59	0.9440826	2.06	0.9803007
1.13	0.8707619	1.60	0.9452007	2.07	0.9807738
1.14	0.8728568	1.61	0.9463011	2.08	0.9812372
1.15	0.8749281	1.62	0.9473839	2.09	0.9816911
1.16	0.8769756	1.63	0.9484493	2.10	0.9821356
1.17	0.8789995	1.64	0.9494974	2.11	0.9825708
1.18	0.8809999	1.65	0.9505285	2.12	0.9829970
1.19	0.8829768	1.66	0.9515428	2.13	0.9834142
1.20	0.8849303	1.67	0.9525403	2.14	0.9838226
1.21	0.8868606	1.68	0.9535213	2.15	0.9842224
1.22	0.8887676	1.69	0.9544860	2.16	0.9846137
1.23	0.8906514	1.70	0.9554345	2.17	0.9849966
1.24	0.8925123	1.71	0.9563671	2.18	0.9853713
1.25	0.8943502	1.72	0.9572838	2.19	0.9857379
1.26	0.8961653	1.73	0.9581849	2.20	0.9860966
1.27	0.8979577	1.74	0.9590705	2.21	0.9864474
1.28	0.8997274	1.75	0.9599408	2.22	0.9867906
1.29	0.9014747	1.76	0.9607961	2.23	0.9871263
1.30	0.9031995	1.77	0.9616364	2.24	0.9874545
1.31	0.9049021	1.78	0.9624620	2.25	0.9877755
1.32	0.9065825	1.79	0.9632730	2.26	0.9880894
1.33	0.9082409	1.80	0.9640697	2.27	0.9883962
1.34	0.9098773	1.81	0.9648521	2.28	0.9886962
1.35	0.9114920	1.82	0.9656205	2.29	0.9889893
1.36	0.9130850	1.83	0.9663750	2.30	0.9892759

Table I (Continued)

z	$F(z)$	z	$F(z)$	z	$F(z)$
2.31	0.9895559	2.45	0.9928572	2.59	0.9952012
2.32	0.9898296	2.46	0.9930531	2.60	0.9953388
2.33	0.9900969	2.47	0.9932443	2.70	0.9965330
2.34	0.9903581	2.48	0 9934309	2.80	0.9974449
2.35	0.9906133	2.49	0.9936128	2.90	0.9981342
2.36	0.9908625	2.50	0.9937903	3.00	0.9986501
2.37	0.9911060	2.51	0.9939634	3.20	0.9993129
2.38	0.9913437	2.52	0.9941323	3.40	0.9996631
2.39	0.9915758	2.53	0.9942969	3.60	0.9998409
2.40	0.9918025	2.54	0.9944574	3.80	0.9999277
2.41	0.9920237	2.55	0.9946139	4.00	0.9999683
2.42	0.9922397	2.56	0.9947664	4.50	0.9999966
2.43	0.9924506	2.57	0.9949151	5.00	0.9999997
2.44	0.9926564	2.58	0.9950600	5.50	0.9999999

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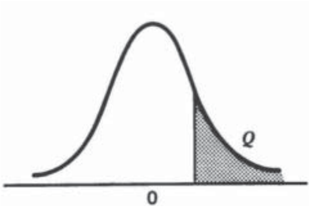

Table II

Upper Percentage Points of the *t* Distribution

	$Q = 0.4$	0.25	0.1	0.05	0.025	0.01	0.005	0.001
υ	$2Q = 0.8$	0.5	0.2	0.1	0.05	0.02	0.01	0.002
1	0.325	1.000	3.078	6.314	12.706	31.821	63.657	318.31
2	0.289	0.816	1.886	2.920	4.303	6.965	9.925	22.326
3	0.277	0.765	1.638	2.353	3.182	4.541	5.841	10.213
4	0.271	0.741	1.533	2.132	2.776	3.747	4.604	7.173
5	0.267	0.727	1.476	2.015	2.571	3.365	4.032	5.893
6	0.265	0.718	1.440	1.943	2.447	3.143	3.707	5.208
7	0.263	0.711	1.415	1.895	2.365	2.998	3.499	4.785
8	0.262	0.706	1.397	1.860	2.306	2.896	3.355	4.501
9	0.261	0.703	1.383	1.833	2.262	2.821	3.250	4.297
10	0.260	0.700	1.372	1.812	2.228	2.764	3.169	4.144
11	0.260	0.697	1.363	1.796	2.201	2.718	3.106	4.025
12	0.259	0.695	1.356	1.782	2.179	2.681	3.055	3.930
13	0.259	0.694	1.350	1.771	2.160	2.650	3.012	3.852
14	0.258	0.692	1.345	1.761	2.145	2.624	2.977	3.787
15	0.258	0.691	1.341	1.753	2.131	2.602	2.947	3.733
16	0.258	0.690	1.337	1.746	2.120	2.583	2.921	3.686
17	0.257	0.689	1.333	1.740	2.110	2.567	2.898	3.646
18	0.257	0.688	1.330	1.734	2.101	2.552	2.878	3.610
19	0.257	0.688	1.328	1.729	2.093	2.539	2.861	3.579
20	0.257	0.687	1.325	1.725	2.086	2.528	2.845	3.552
21	0.257	0.686	1.323	1.721	2.080	2.518	2.831	3.527
22	0.256	0.686	1.321	1.717	2.074	2.508	2.819	3.505
23	0.256	0.685	1.319	1.714	2.069	2.500	2.807	3.485
24	0.256	0.685	1.318	1.711	2.064	2.492	2.797	3.467
25	0.256	0.684	1.316	1.708	2.060	2.485	2.787	3.450
26	0.256	0.684	1.315	1.706	2.056	2.479	2.779	3.435
27	0.256	0.684	1.314	1.703	2.052	2.473	2.771	3.421
28	0.256	0.683	1.313	1.701	2.048	2.467	2.763	3.408
29	0.256	0.683	1.311	1.699	2.045	2.462	2.756	3.396
30	0.256	0.683	1.310	1.697	2.042	2.457	2.750	3.385
40	0.255	0.681	1.303	1.684	2.021	2.423	2.704	3.307
60	0.254	0.679	1.296	1.671	2.000	2.390	2.660	3.232
120	0.254	0.677	1.289	1.658	1.980	2.358	2.617	3.160
∞	0.253	0.674	1.282	1.645	1.960	2.326	2.576	3.090

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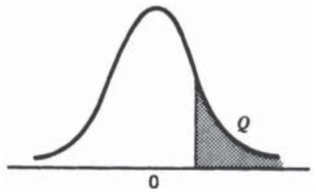

Table III

Upper Percentage Points of the χ^2 Distribution

Q υ	0.995	0.990	0.975	0.950	0.900	0.750	0.500
1	392704.10^{-10}	157088.10^{-9}	982069.10^{-9}	393214.10^{-8}	0.0157908	0.1015308	0.454937
2	0.0100251	0.0201007	0.0506356	0.102587	0.210720	0.575364	1.38629
3	0.0717212	0.114832	0.215795	0.351846	0.584375	1.212534	2.36597
4	0.206990	0.297110	0.484419	0.710721	1.063623	1.92255	3.35670
5	0.411740	0.554300	0.831211	1.145476	1.61031	2.67460	4.35146
6	0.675727	0.872085	1.237347	1.63539	2.20413	3.45460	5.34812
7	0.989265	1.239043	1.68987	2.16735	2.83311	4.25485	6.34581
8	1.344419	1.646482	2.17973	2.73264	3.48954	5.07064	7.34412
9	1.734926	2.087912	2.70039	3.32511	4.16816	5.89883	8.34283
10	2.15585	2.55821	3.24697	3.94030	4.86518	6.73720	9.34182
11	2.60321	3.05347	3.81575	4.57481	5.57779	7.58412	10.3410
12	3.07382	3.57056	4.40379	5.22603	6.30380	8.43842	11.3403
13	3.56503	4.10691	5.00874	5.89186	7.04150	9.29906	12.3398
14	4.07468	4.66043	5.62872	6.57063	7.78953	10.1653	13.3393
15	4.60094	5.22935	6.26214	7.26094	8.54675	11.0365	14.3389
16	5.14224	5.81221	6.90766	7.96164	9.31223	11.9122	15.3385
17	5.69724	6.40776	7.56418	8.67176	10.0852	12.7919	16.3381
18	6.26481	7.01491	8.23075	9.39046	10.8649	13.6753	17.3379
19	6.84398	7.63273	8.90655	10.1170	11.6509	14.5620	18.3376
20	7.43386	8.26040	9.59083	10.8508	12.4426	15.4518	19.3374
21	8.03366	8.89720	10.28293	11.5913	13.2396	16.3444	20.3372
22	8.64272	9.54249	10.9823	12.3380	14.0415	17.2396	21.3370
23	9.26042	10.19567	11.6885	13.0905	14.8479	18.1373	22.3369
24	9.88623	10.8564	12.4011	13.8484	15.6587	19.0372	23.3367
25	10.5197	11.5240	13.1197	14.6114	16.4734	19.9393	24.3366
26	11.1603	12.1981	13.8439	15.3791	17.2919	20.8434	25.3364
27	11.8076	12.8786	14.5733	16.1513	18.1138	21.7494	26.3363
28	12.4613	13.5648	15.3079	16.9279	18.9392	22.6572	27.3363
29	13.1211	14.2565	16.0471	17.7083	19.7677	23.5666	28.3362
30	13.7867	14.9535	16.7908	18.4926	20.5992	24.4776	29.3360
40	20.7065	22.1643	24.4331	26.5093	29.0505	33.6603	39.3354
50	27.9907	29.7067	32.3574	34.7642	37.6886	42.9421	49.3349
60	35.5346	37.4848	40.4817	43.1879	46.4589	52.2938	59.3347
70	43.2752	45.4418	48.7576	51.7393	55.3290	61.6983	69.3344
80	51.1720	53.5400	57.1532	60.3915	64.2778	71.1445	79.3343
90	59.1963	61.7541	65.6466	69.1260	73.2912	80.6247	89.3342
100	67.3276	70.0648	74.2219	77.9295	82.3581	90.1332	99.3341
Z_Q	−2.5758	−2.3263	−1.9600	−1.6449	−1.2816	−0.6745	0.0000

(continued)

Table III (Continued)

Q υ	0.250	0.100	0.050	0.025	0.010	0.005	0.001
1	1.32330	2.70554	3.84146	5.02389	6.63490	7.87944	10.828
2	2.77259	4.60517	5.99147	7.37776	9.21034	10.5966	13.816
3	4.10835	6.25139	7.81473	9.34840	11.3449	12.8381	16.266
4	5.38527	7.77944	9.48773	11.1433	13.2767	14.8602	18.467
5	6.62568	9.23635	11.0705	12.8325	15.0863	16.7496	20.515
6	7.84080	10.6446	12.5916	14.4494	16.8119	18.5476	22.458
7	9.03715	12.0170	14.0671	16.0128	18.4753	20.2777	24.322
8	10.2188	13.3616	15.5073	17.5346	20.0902	21.9550	26.125
9	11.3887	14.6837	16.9190	19.0228	21.6660	23.5893	27.877
10	12.5489	15.9871	18.3070	20.4831	23.2093	25.1882	29.588
11	13.7007	17.2750	19.6751	21.9200	24.7250	26.7569	31.264
12	14.8454	18.5494	21.0261	23.3367	26.2170	28.2995	32.909
13	15.9839	19.8119	22.3621	24.7356	27.6883	29.8194	34.528
14	17.1170	21.0642	23.6848	26.1190	29.1413	31.3193	36.123
15	18.2451	22.3072	24.9958	27.4884	30.5779	32.8013	37.697
16	19.3688	23.5418	26.2962	28.8454	31.9999	34.2672	39.252
17	20.4887	24.7690	27.5871	30.1910	33.4087	35.7185	40.790
18	21.6049	25.9894	28.8693	31.5264	34.8053	37.1564	42.312
19	22.71578	27.2036	30.1435	32.8523	36.1908	38.5822	43.820
20	23.8277	28.4120	31.4104	34.1696	37.5662	39.9968	45.315
21	24.9348	29.6151	32.6705	35.4789	38.9321	41.4010	46.797
22	26.0393	30.8133	33.9244	36.7807	40.2894	42.7956	48.268
23	27.1413	32.0069	35.1725	38.0757	41.6384	44.1813	49.728
24	28.2412	33.1963	36.4151	39.3641	42.9798	45.5585	51.179
25	29.3389	34.3816	37.6525	40.6465	44.3141	46.9278	52.620
26	30.4345	35.5631	38.8852	41.9232	45.6417	48.2899	54.052
27	31.5284	36.7412	40.1133	43.1944	46.9630	49.6449	55.476
28	32.6205	37.9159	41.3372	44.4607	48.2782	50.9933	56.892
29	33.7109	39.0875	42.5569	45.7222	49.5879	52.3356	58.302
30	34.7998	40.2560	43.7729	46.9792	50.8922	53.6720	59.703
40	45.6160	51.8050	55.7585	59.3417	63.6907	66.7659	73.402
50	56.3336	63.1671	67.5048	71.4202	76.1539	79.4900	86.661
60	66.9814	74.3970	79.0819	83.2976	88.3794	91.9517	99.607
70	77.5766	85.5271	90.5312	95.0231	100.425	104.215	112.317
80	88.1303	96.5782	101.879	106.629	112.329	116.321	124.839
90	98.6499	107.565	113.145	118.136	124.116	128.299	137.208
100	109.141	118.498	124.342	129.561	135.807	140.169	149.449
z_Q	+0.6745	+1.2816	+1.6449	+1.9600	+2.3263	+2.5758	+3.0902

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Table IV

Percentage Points of the *F* Distribution: Upper 5% Points

υ_1 υ_2	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	243.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.31	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.93	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.83	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.93	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.31
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.03	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.30	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

(continued)

Table IV (continued)
Upper 2.5% Points

υ_2 \ υ_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	647.8	799.5	864.2	899.6	921.8	937.1	948.2	96.67	93.33	968.6	976.7	984.9	993.1	997.2	1001	1006	1010	1014	1018
2	38.51	39.00	39.17	39.25	39.30	39.33	39.36	39.37	39.39	39.40	39.41	39.43	39.45	39.46	39.46	39.47	39.48	39.49	39.50
3	17.44	16.04	15.44	15.10	14.88	14.73	14.62	14.54	14.47	14.42	14.34	14.25	14.17	14.12	14.08	14.04	13.99	13.95	13.90
4	12.22	10.65	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.75	8.66	8.56	8.51	8.46	8.41	8.36	8.31	8.26
5	10.01	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.52	6.43	6.33	6.28	6.23	6.18	6.12	6.07	6.02
6	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.37	5.27	5.17	5.12	5.07	5.01	4.96	4.90	4.85
7	8.07	6.54	5.89	5.52	5.29	5.21	4.99	4.90	4.82	4.76	4.67	4.57	4.47	4.42	4.36	4.31	4.25	4.20	4.14
8	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.20	4.10	4.00	3.95	3.89	3.84	3.78	3.73	3.67
9	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.87	3.77	3.67	3.61	3.56	3.51	3.45	3.39	3.33
10	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.62	3.52	3.42	3.37	3.31	3.26	3.20	3.14	3.08
11	6.72	5.26	4.63	4.28	4.04	3.88	3.76	3.66	3.59	3.53	3.43	3.33	3.23	3.17	3.12	3.06	3.00	2.94	2.88
12	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44	3.37	3.28	3.18	3.07	3.02	2.96	2.91	2.85	2.79	2.72
13	6.41	4.97	4.35	4.00	3.77	3.60	3.48	3.39	3.31	3.25	3.15	3.05	2.95	2.89	2.84	2.78	2.72	2.66	2.60
14	6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.21	3.15	3.05	2.95	2.84	2.79	2.73	2.67	2.61	2.55	2.49
15	6.20	4.77	4.15	3.80	3.58	3.41	3.29	3.20	3.12	3.06	2.96	2.86	2.76	2.70	2.64	2.59	2.52	2.46	2.40
16	6.12	4.69	4.08	3.73	3.50	3.34	3.22	3.12	3.05	2.99	2.89	2.79	2.68	2.63	2.57	2.51	2.45	2.38	2.32
17	6.04	4.62	4.01	3.66	3.44	3.28	3.16	3.06	2.98	2.92	2.82	2.72	2.62	2.56	2.50	2.44	2.38	2.32	2.25
18	5.98	4.56	3.95	3.61	3.38	3.22	3.10	3.01	2.93	2.87	2.77	2.67	2.56	2.50	2.44	2.38	2.32	2.26	2.19
19	5.92	4.51	3.90	3.56	3.33	3.17	3.05	2.96	2.88	2.82	2.72	2.62	2.51	2.45	2.39	2.33	2.27	2.20	2.13
20	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.68	2.57	2.46	2.41	2.35	2.29	2.22	2.16	2.19
21	5.83	4.42	3.82	3.48	3.25	3.09	2.97	2.87	2.80	2.73	2.64	2.53	2.42	2.37	2.31	2.25	2.18	2.11	2.04
22	5.79	4.38	3.78	3.44	3.22	3.05	2.93	2.84	2.76	2.70	2.60	2.50	2.39	2.33	2.27	2.21	2.14	2.08	2.00
23	5.75	4.35	3.75	3.41	3.18	3.02	2.90	2.81	2.73	2.67	2.57	2.47	2.36	2.30	2.24	2.18	2.11	2.04	1.97
24	5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70	2.64	2.54	2.44	2.33	2.27	2.21	2.15	2.08	2.01	1.94
25	5.69	4.29	3.69	3.35	3.13	2.97	2.85	2.75	2.68	2.61	2.51	2.41	2.30	2.24	2.18	2.12	2.05	1.98	1.91
26	5.66	4.27	3.67	3.33	3.10	2.94	2.82	2.73	2.65	2.59	2.49	2.39	2.28	2.22	2.16	2.09	2.03	1.95	1.88
27	5.63	4.24	3.65	3.31	3.08	2.92	2.80	2.71	2.63	2.57	2.47	2.36	2.25	2.19	2.13	2.07	2.00	1.93	1.85
28	5.61	4.22	3.63	3.29	3.06	2.90	2.78	2.69	2.61	2.55	2.45	2.34	2.23	2.17	2.11	2.05	1.98	1.91	1.83
29	5.59	4.20	3.61	3.27	3.04	2.88	2.76	2.67	2.59	2.53	2.43	2.32	2.21	2.15	2.09	2.03	1.96	1.89	1.81
30	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.41	2.31	2.20	2.14	2.07	2.01	1.94	1.87	1.79
40	5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.29	2.18	2.07	2.01	1.94	1.88	1.80	1.72	1.64
60	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.17	2.06	1.94	1.88	1.82	1.74	1.67	1.58	1.48
120	5.15	3.80	3.23	2.89	2.67	2.52	2.39	2.30	2.22	2.16	2.05	1.94	1.82	1.76	1.69	1.61	1.53	1.43	1.31
∞	5.02	3.69	3.12	2.79	2.57	2.41	2.29	2.19	2.11	2.05	1.94	1.83	1.71	1.64	1.57	1.48	1.39	1.27	1.00

(continued)

Upper 1% Points

υ_1 υ_2	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	4052	4999.5	5403	5625	5764	5859	5928	5982	6022	6056	6106	6157	6209	6235	6261	6287	6313	6339	6366
2	98.50	99.00	99.17	99.25	99.30	99.33	99.36	99.37	99.39	99.40	99.42	99.43	99.45	99.46	99.47	99.47	99.48	99.49	99.50
3	34.12	30.82	29.46	28.17	28.24	27.91	27.67	27.49	27.35	22.23	27.05	26.87	26.69	26.60	26.50	26.41	26.32	26.22	26.13
4	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55	14.37	14.20	14.02	13.93	13.84	13.75	13.65	13.56	13.46
5	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16	10.05	9.89	9.72	9.05	9.47	9.38	9.29	9.20	9.11	9.06
6	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.72	7.56	7.40	7.31	7.23	7.14	7.06	6.97	6.88
7	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.47	6.31	6.61	6.07	5.99	5.91	5.82	5.74	5.65
8	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.67	5.52	5.36	5.28	5.20	5.12	5.03	4.95	4.86
9	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	5.11	4.96	4.81	4.73	4.65	4.57	4.48	4.40	4.31
10	10.04	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.71	4.56	4.41	4.33	4.25	4.17	4.08	4.00	3.91
11	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63	4.54	4.40	4.25	4.10	4.02	3.94	3.86	3.78	3.69	3.60
12	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39	4.30	4.16	4.01	3.86	3.78	3.70	3.62	3.54	3.45	3.36
13	9.07	6.70	5.74	5.21	4.86	4.62	4.44	4.30	4.19	4.10	3.96	3.82	3.66	3.59	3.51	3.43	3.34	3.25	3.17
14	8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94	1.80	3.66	3.51	3.43	3.35	3.27	3.18	3.09	3.00
15	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.67	3.52	3.37	3.29	3.21	3.13	3.05	2.96	2.87
16	8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.55	3.41	3.26	3.18	3.10	3.02	2.93	2.84	2.75
17	8.40	6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.46	3.31	3.16	3.08	3.00	2.92	2.83	2.75	2.65
18	8.29	6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.60	3.51	3.37	3.23	3.08	3.00	2.92	2.84	2.75	2.66	2.57
19	8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.30	3.15	3.00	2.92	2.84	2.76	2.67	2.58	2.49
20	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	3.23	3.09	2.94	2.86	2.78	2.69	2.61	2.52	2.42
21	8.02	5.78	4.87	4.37	4.04	3.81	3.64	3.51	3.40	3.31	3.17	3.03	2.88	2.80	2.72	2.64	2.55	2.46	2.36
22	7.95	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.12	2.98	2.83	2.75	2.67	2.58	2.50	2.40	2.31
23	7.88	5.66	4.76	4.26	3.94	3.71	3.54	3.41	3.30	3.21	3.07	2.93	2.78	2.70	2.62	2.54	2.45	2.35	2.26
24	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.03	2.89	2.74	2.66	2.58	2.49	2.40	2.31	2.21
25	7.77	5.57	4.68	4.18	3.85	3.63	3.46	3.32	1.22	3.13	2.99	2.85	2.70	2.62	2.54	2.45	2.36	2.27	2.17
26	7.72	5.53	4.64	4.60	3.82	3.59	3.42	3.29	3.18	3.09	2.96	2.81	2.66	2.58	2.50	2.42	2.33	2.23	2.13
27	7.68	5.49	4.60	4.11	3.78	3.56	3.39	3.26	3.15	3.06	2.93	2.78	2.63	2.55	2.47	2.38	2.29	2.20	2.10
28	7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03	2.90	2.75	2.60	2.52	2.44	2.35	2.26	2.17	2.06
29	7.60	5.42	4.54	4.04	3.73	3.50	3.33	3.20	3.09	3.00	2.87	2.73	2.57	2.49	2.41	2.33	2.23	2.14	2.03
30	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.84	2.70	2.55	2.47	2.39	2.30	2.21	2.11	2.01
40	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.66	2.52	2.37	2.29	2.20	2.11	2.02	1.92	1.80
60	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.50	2.35	2.20	2.12	2.03	1.94	1.84	1.73	1.60
120	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.34	2.19	2.03	1.95	1.86	1.76	1.66	1.53	1.38
∞	6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.18	2.04	1.88	1.79	1.70	1.59	1.47	1.32	1.00

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GLOSSARY

A

Action research: A research strategy aimed at initiating change processes, with an incremental focus, for narrowing the gap between the desired and actual states.

Alternate hypothesis: An educated conjecture that sets the parameters one expects to find. The alternate hypothesis is tested to see whether or not the null is to be rejected.

Ambiguous questions: Questions that are not clearly worded and are likely to be interpreted by respondents in different ways.

ANOVA: Stands for analysis of variance, which tests for significant mean differences in variables among multiple groups.

Applied research: Research conducted in a particular setting with the specific objective of solving an existing problem in the situation.

Area sampling: Cluster sampling within a specified area or region; a probability sampling design.

B

Basic research: Research conducted to generate knowledge and understanding of phenomena (in the work setting) that adds to the existing body of knowledge (about organizations and management theory).

Bias: Any error that creeps into the data. Biases can be introduced by the researcher, the respondent, the measuring instrument, the sample, and so on.

Bibliography: A listing of books, articles, and other relevant materials, alphabetized according to the last name of the authors, referencing the titles of their works, and indicating where they can be located.

Big data: Term commonly used to describe the exponential growth and availability of data from digital sources inside and outside the organization.

C

Canonical correlation: A statistical technique that examines the relationship between two or more dependent variables and several independent variables.

Case study: Focuses on collecting information about a specific object, event or activity, such as a particular business unit or organization.

Categorization: The process of organizing, arranging, and classifying coding units (in qualitative data analysis).

Category (in qualitative data analysis): A group of coding units that share some commonality.

Category reliability: The extent to which judges are able to use category definitions to classify qualitative data.

Category scale: A scale that uses multiple items to seek a single response.

Causal study: A research study conducted to establish cause-and-effect relationships among variables.

Chi-square test: A nonparametric test that establishes the independence or otherwise between two nominal variables.

Classification data: Personal information or demographic details of the respondents such as age, marital status, and educational level.

Closed questions: Questions with a clearly delineated set of alternatives that confine the respondents' choice to one of them.

Cluster sampling: A probability sampling design in which the sample comprises groups or chunks of elements with intragroup heterogeneity and intergroup homogeneity.

Coding: The analytic process through which the qualitative data that you have gathered are reduced, rearranged, and integrated to form theory (compare Data coding).

Coding scheme: Contains predetermined categories for recording what is observed. Such schemes come in many forms and shapes.

Comparative scale: A scale that provides a benchmark or point of reference to assess attitudes, opinions, and the like.

Complex probability sampling: Several probability sampling designs (such as systematic and stratified random), which offer an alternative to the cumbersome, simple random sampling design.

Computer-assisted telephone interviews (CATI): Interviews in which questions are prompted onto a PC monitor that is networked into the telephone system, to which respondents provide their answers.

Concealed observation: Members of a social group under study are not told that they are being observed.

Concealment of observation: Relates to whether the members of the social group under study are told that they are being observed.

Conceptual analysis: Establishes the existence and frequency of concepts (such as words, themes, or characters) in a text.

Concurrent validity: Relates to criterion-related validity, which is established at the same time the test is administered.

Confidence: The probability estimate of how much reliance can be placed on the findings; the usual accepted level of confidence in social science research is 95%.

Conjoint analysis: A multivariate statistical technique used to determine the relative importance respondents attach to attributes and the utilities they attach to specific levels of attributes.

Consensus scale: A scale developed through consensus or the unanimous agreement of a panel of judges as to the items that measure a concept.

Constant sum rating scale: A scale where the respondents distribute a fixed number of points across several items.

Construct validity: Testifies to how well the results obtained from the use of the measure fit the theories around which the test was designed.

Constructionism: An approach to research that is based on the idea that the world as we know it is fundamentally mental or mentally constructed. Constructionists aim to understand the rules people use to make sense of the world by investigating what happens in people's minds.

Content analysis: An observational research method that is used to systematically evaluate the symbolic contents of all forms of recorded communication.

Content validity: Establishes the representative sampling of a whole set of items that measures a concept, and reflects how well the dimensions and elements thereof are delineated.

Contextual factors: Factors relating to the organization under study such as the background and environment of the organization, including its origin and purpose, size, resources, financial standing, and the like.

Contrived setting: An artificially created or "lab" environment in which research is conducted.

Control group: The group that is not exposed to any treatment in an experiment.

Controlled observation: Controlled observation occurs when observational research is carried out under carefully arranged conditions.

Convenience sampling: A nonprobability sampling design in which information or data for the research are gathered from members of the population conveniently accessible to the researcher.

Convergent validity: That which is established when the scores obtained by two different instruments measuring the same concept, or by measuring the concept by two different methods, are highly correlated.

Correlation matrix: A correlation matrix is used to examine relationships between interval and/or ratio variables.

Correlational study: A research study conducted to identify the important factors associated with the variables of interest.

Criterion-related validity: That which is established when the measure differentiates individuals on a criterion that it is expected to predict.

Criterion variable: The variable of primary interest to the study, also known as the dependent variable.

Critical literature review: A step-by-step process that involves the identification of published and unpublished work from secondary data sources on the topic of interest, the evaluation of this work in relation to the problem, and the documentation of this work.

Critical realism: A school of thought combining the belief in an external reality (an objective truth) with the rejection of the claim that this external reality can be objectively measured. The critical realist is critical of our ability to understand the world with certainty.

Cross-sectional study: A research study for which data are gathered just once (stretched though it may be over a period of days, weeks, or months) to answer the research question.

D

Data coding: In quantitative research data coding involves assigning a number to the participants' responses so they can be entered into a database.

Data display: Taking the reduced qualitative data and displaying them in an organized, condensed manner.

Data editing: Data editing deals with detecting and correcting illogical, inconsistent, or illegal data and omissions in the information returned by the participants of the study.

Data mining: Helps to trace patterns and relationships in the data stored in the data warehouse.

Data reduction: Breaking down data into manageable pieces.

Data transformation: The process of changing the original numerical representation of a quantitative value to another value.

Data warehouse: A central repository of all information gathered by the company.

Deductive reasoning: The application of a general theory to a specific case.

Delphi technique: A forecasting method that uses a cautiously selected panel of experts in a systematic, interactive manner.

Dependent variable: *See* Criterion variable.

Descriptive statistics: Statistics such as frequencies, the mean, and the standard deviation, which provide descriptive information about a set of data.

Descriptive study: A research study that describes the variables in a situation of interest to the researcher.

Dichotomous scale: Scale used to elicit a Yes/No response, or an answer to two different aspects of a concept.

Directional hypothesis: An educated conjecture as to the direction of the relationship, or differences among variables, which could be positive or negative, or more or less, respectively.

Discriminant analysis: A statistical technique that helps to identify the independent variables that discriminate a nominally scaled dependent variable of interest.

Discriminant validity: That which is established when two variables are theorized to be uncorrelated, and the scores obtained by measuring them are indeed empirically found to be so.

Disproportionate stratified random sampling: A probability sampling design that involves a procedure in which the number of sample subjects chosen from various strata is not directly proportionate to the total number of elements in the respective strata.

Double-barreled question: Refers to the improper framing of a question that should be posed as two or more separate questions, so that the respondent can give clear and unambiguous answers.

Double-blind study: A study where neither the experimenter nor the subjects are aware as to who is given the real treatment and who the placebo.

Double sampling: A probability sampling design that involves the process of collecting information from a set of subjects twice – such as using a sample to collect preliminary information, and later using a subsample of the primary sample for more information.

Dummy variable: A variable that has two or more distinct levels, which are coded 0 or 1.

E

Efficiency in sampling: Attained when the sampling design chosen either results in a cost reduction to the researcher or offers a greater degree of accuracy in terms of the sample size.

Electronic questionnaire: Online questionnaire administered when a microcomputer is hooked up to computer networks.

Element: A single member of the population.

Epistemology: Theory about the nature of knowledge or how we come to know.

Ethics: Code of conduct or expected societal norms of behavior.

Ethnography: A research process in which the anthropologist closely observes, records, and engages in the daily life of another culture and then writes accounts of this culture, emphasizing descriptive detail.

Exogenous variable: A variable that exerts an influence on the cause-and-effect relationship between two variables in some way, and needs to be controlled.

Experimental design: A study design in which the researcher might create an artificial setting, control some variables, and manipulate the independent variable to establish cause-and-effect relationships.

Experimental group: The group exposed to a treatment in an experimental design.

Expert panel: A group of people specifically convened by the researcher to elicit expert knowledge and opinion about a certain issue.

Exploratory research: A research study where very little knowledge or information is available on the subject under investigation.

Ex post facto experimental design: Studying subjects who have already been exposed to a stimulus and comparing them to those not so exposed, so as to establish cause-and-effect relationships (in contrast to establishing cause-and-effect relationships by manipulating an independent variable in a lab or a field setting).

External consultants: Research experts outside the organization who are hired to study specific problems to find solutions.

External validity: The extent of generalizability of the results of a causal study to other field settings.

F

Faces scale: A particular representation of the graphic scale, depicting faces with expressions that range from smiling to sad.

Face-to-face interview: Information gathering when both the interviewer and interviewee meet in person.

Face validity: An aspect of validity examining whether the item on the scale, on the face of it, reads as if it indeed measures what it is supposed to measure.

Factorial validity: That which indicates, through the use of factor analytic techniques, whether a test is a pure measure of some specific factor or dimension.

Field experiment: An experiment done to detect cause-and-effect relationships in the natural environment in which events normally occur.

Field study: A study conducted in the natural setting with a minimal amount of researcher interference in the flow of events in the situation.

Fixed rating scale: *See* Constant sum rating scale.

Focus group: A group consisting of eight to ten members randomly chosen, who discuss a product or any given topic for about two hours with a moderator present, so that their opinions can serve as the basis for further research.

Forced choice: Elicits the ranking of objects relative to one another.

Formative scale: Used when a construct is viewed as an explanatory combination of its indicators.

Frequencies: The number of times various subcategories of a phenomenon occur, from which the percentage and cumulative percentage of any occurrence can be calculated.

Fundamental research: *See* Basic research.

Funneling technique: The questioning technique that consists of initially asking general and broad questions, and gradually narrowing the focus thereafter to more specific themes.

G

Generalizability: The applicability of research findings in one setting to others.

Going native: The researcher/observer becomes so involved with the group under study that eventually every objectivity and research interest is lost.

Goodness of measures: Attests to the reliability and validity of measures.

Graphic rating scale: A scale that graphically illustrates the responses that can be provided, rather than specifying any discrete response categories.

Grounded theory: A systematic set of procedures to develop an inductively derived theory from the data.

H

History effects: A threat to the internal validity of the experimental results, when events unexpectedly occur while the experiment is in progress and contaminate the cause-and-effect relationship.

Hypothesis: A tentative, yet testable, statement that predicts what you expect to find in your empirical data.

Hypothetico-deductive method: A seven-step research process of identifying a broad problem area, defining the problem statement, developing hypotheses, determining measures, data collection, data analysis, and the interpretation of data.

I

Independent samples *t*-test: Test that is done to see if there are significant differences in the means for two groups in the variable of interest.

Independent variable: A variable that influences the dependent or criterion variable and accounts for (or explains) its variance.

Inductive reasoning: A process where we observe specific phenomena and on this basis arrive at general conclusions.

Inferential statistics: Statistics that help to establish relationships among variables and draw conclusions therefrom.

Instrumentation effects: The threat to internal validity in experimental designs caused by changes in the measuring instrument between the pretest and the posttest.

Inter item consistency reliability: A test of the consistency of responses to all the items in a measure to establish that they hang together as a set.

Interjudge reliability: The degree of consistency between coders processing the same (qualitative) data.

Internal consistency: Homogeneity of the items in the measure that tap a construct.

Internal consultants: Research experts within the organization who investigate and find solutions to problems.

Internal validity of experiments: Attests to the confidence that can be placed in the cause-and-effect relationship found in experimental designs.

Interval scale: A multipoint scale that taps the differences, the order, and the equality of the magnitude of the differences in the responses.

Intervening variable: A variable that surfaces as a function of the independent variable, and helps in conceptualizing and explaining the influence of the independent variable on the dependent variable.

Interview: A data collection method in which the researcher asks for information verbally from the respondents.

Itemized rating scale: A scale that offers several categories of response, out of which the respondent picks the one most relevant for answering the question.

J

Judgment sampling: A purposive, nonprobability sampling design in which the sample subject is chosen on the basis of the individual's ability to provide the type of special information needed by the researcher.

L

Lab experiment: An experimental design set up in an artificially contrived setting where controls and manipulations are introduced to establish cause-and-effect relationships among variables of interest to the researcher.

Leading questions: Questions phrased in such a manner as to lead the respondent to give the answers that the researcher would like to obtain.

Likert scale: An interval scale that specifically uses the five anchors of *Strongly Disagree*, *Disagree*, *Neither Disagree nor Agree*, *Agree*, and *Strongly Agree*.

Literature review: A step-by-step process that involves the identification of published and unpublished work from secondary data sources on the topic of interest, the evaluation of this work in relation to the problem, and the documentation of this work.

Loaded questions: Questions that elicit highly biased emotional responses from subjects.

Logistic regression: A specific form of regression analysis in which the dependent variable is a nonmetric, dichotomous variable.

Longitudinal study: A research study for which data are gathered at several points in time to answer a research question.

M

Manipulation: How the researcher exposes the subjects to the independent variable to determine cause-and-effect relationships in experimental designs.

MANOVA: A statistical technique that is similar to ANOVA, with the difference that ANOVA tests the mean differences of more than two groups on *one* dependent variable, whereas MANOVA tests mean differences among groups across *several* dependent variables simultaneously, by using sums of squares and cross-product matrices.

Match groups: A method of controlling known contaminating factors in experimental studies, by deliberately spreading them equally across the experimental and control groups, so as not to confound the cause-and-effect relationship.

Maturation effects: A threat to internal validity that is a function of the biological, psychological, and other processes taking place in the respondents as a result of the passage of time.

McNemar's test: A nonparametric method used on nominal data. It assesses the significance of the difference between two dependent samples when the variable of interest is dichotomous.

Mean: The average of a set of figures.

Measure of central tendency: Descriptive statistics of a *data set* such as the mean, median, or mode.

Measure of dispersion: The variability in a set of observations, represented by the range, variance, standard deviation, and the interquartile range.

Measurement: The assignment of numbers or other symbols to characteristics (or attributes) of objects according to a prespecified set of rules.

Median: The central item in a group of observations arranged in an ascending or descending order.

Mediating variable: A variable that surfaces as a function of the independent variable, and helps in conceptualizing and explaining the influence of the independent variable on the dependent variable.

Mode: The most frequently occurring number in a data set.

Moderating variable: A variable on which the relationship between two other variables is contingent. That is, if the moderating variable is present, the theorized relationship between the two variables will hold good, but not otherwise.

Mortality: The loss of research subjects during the course of the experiment, which confounds the cause-and-effect relationship.

Multicollinearity: A statistical phenomenon in which two or more independent variables in a multiple regression model are highly correlated.

Multiple regression analysis: A statistical technique to predict the variance in the dependent variable by regressing the independent variables against it.

Multistage cluster sampling: A probability sampling design that is a stratified sampling of clusters.

N

Narrative analysis: A qualitative approach that aims to elicit and scrutinize the stories we tell about ourselves and their implications for our lives.

Nominal scale: A scale that categorizes individuals or objects into mutually exclusive and collectively exhaustive groups, and offers basic, categorical information on the variable of interest.

Noncontrived setting: Research conducted in the natural environment where activities take place in the normal manner (i.e., the field setting).

Nondirectional hypothesis: An educated conjecture of a relationship between two variables, the directionality of which cannot be guessed.

Nonparametric test: A hypothesis test that does not require certain assumptions about the population's distribution, such as that the population follows a normal distribution.

Nonparticipant observation: The researcher is never directly involved in the actions of the actors, but observes them from outside the actors' visual horizon, for instance via a one-way mirror or a camera.

Nonprobability sampling: A sampling design in which the elements in the population do not have a known or predetermined chance of being selected as sample subjects.

Nonresponse error: Exists to the extent that those who did respond to your survey are different from those who did not on (one of the) characteristics of interest in your study. Two important sources of non-response are not-at-homes and refusals.

Nuisance variable: A variable that contaminates the cause-and-effect relationship.

Null hypothesis: The conjecture that postulates no differences or no relationship between or among variables.

Numerical scale: A scale with bipolar attributes with five points or seven points indicated on the scale.

O

Objectivity: Interpretation of the results on the basis of the results of data analysis, as opposed to subjective or emotional interpretations.

Observation: The planned watching, recording, analysis, and interpretation of behavior, actions, or events.

One sample *t*-test: A test that is used to test the hypothesis that the mean of the population from which a sample is drawn is equal to a comparison standard.

One-shot study: *See* Cross-sectional study.

Ontology: The philosophical study of what can be said to exist.

Open-ended questions: Questions that the respondent can answer in a free-flowing format without restricting the range of choices to a set of specific alternatives suggested by the researcher.

Operationalizing: Reduction of abstract concepts to render them measurable in a tangible way.

Operations research: A quantitative approach taken to analyze and solve problems of complexity.

Ordinal scale: A scale that not only categorizes the qualitative differences in the variable of interest, but also allows for the rank-ordering of these categories in a meaningful way.

Outlier: An observation that is substantially different from the other observations.

P

Paired comparisons: Respondents choose between two objects at a time, with the process repeated with a small number of objects.

Paired samples *t*-test: Test that examines the differences in the same group before and after a treatment.

Parallel-form reliability: That form of reliability which is established when responses to two comparable sets of measures tapping the same construct are highly correlated.

Parametric test: A hypothesis test that assumes that your data follow a specific distribution.

Parsimony: Efficient explanation of the variance in the dependent variable of interest through the use of a smaller, rather than a larger number of independent variables.

Participant observation: In participant observation the researcher gathers data by participating in the daily life of the group or organization under study.

Population: The entire group of people, events, or things that the researcher desires to investigate.

Positivism: A school of thought employing deductive laws and quantitative methods to get at the truth. For a positivist, the world operates by laws of cause and effect that one can discern if one uses a scientific approach to research.

Posttest: A test given to the subjects to measure the dependent variable after exposing them to a treatment.

Pragmatism: A viewpoint on research that does not take on a particular position on what makes good research. Pragmatists feel that research on both objective, observable phenomena and subjective meanings can produce useful knowledge, depending on the research questions of the study.

Precision: The degree of closeness of the estimated sample characteristics to the population parameters, determined by the extent of the variability of the sampling distribution of the sample mean.

Predictive validity: The ability of the measure to differentiate among individuals as to a criterion predicted for the future.

Predictor variable: *See* Independent variable.

Pretest: A test given to subjects to measure the dependent variable before exposing them to a treatment.

Pretesting survey questions: Test of the understandability and appropriateness of the questions planned to be included in a regular survey, using a small number of respondents.

Primary data: Data collected first-hand for subsequent analysis to find solutions to the problem researched.

Probability sampling: The sampling design in which the elements of the population have some known chance or probability of being selected as sample subjects.

Problem definition: A definition of the difference between the actual and desired situation.

Problem statement: A problem statement includes both a statement of the research objective(s) and the research question(s).

Proportionate stratified random sampling: A probability sampling design in which the number of sample subjects drawn from each stratum is proportionate to the total number of elements in the respective strata.

Pure observation: Seeks to remove the researcher from the observed actions and behavior; the researcher is never directly involved in the actions and behavior of the group under study.

Pure participation: The researcher becomes so involved with the group under study that eventually every objectivity and research interest is lost.

Pure research: *See* Basic research.

Purposiveness in research: The situation in which research is focused on solving a well-identified and defined problem, rather than aimlessly looking for answers to vague questions.

Purposive sampling: A nonprobability sampling design in which the required information is gathered from special or specific targets or groups of people on some rational basis.

Q

Qualitative data: Data that are not immediately quantifiable unless they are coded and categorized in some way.

Questionnaire: A preformulated written set of questions to which the respondent records the answers, usually within rather closely delineated alternatives.

Quota sampling: A form of purposive sampling in which a predetermined proportion of people from different subgroups is sampled.

R

Randomization: The process of controlling the nuisance variables by randomly assigning members among the various experimental and control groups, so that the confounding variables are randomly distributed across all groups.

Range: The spread in a set of numbers indicated by the difference in the two extreme values in the observations.

Ranking scale: Scale used to tap preferences between two or among more objects or items.

Rapport: A trusting relationship with the social group under study, by showing respect, being truthful, and showing commitment to the well-being of the group or the individual members of the group, so that they feel secure in sharing (sensitive) information with the researcher

Rating scale: Scale with several response categories that evaluate an object on a scale.

Ratio scale: A scale that has an absolute zero origin, and hence indicates not only the magnitude, but also the proportion, of the differences.

Reactivity: The extent to which the observer affects the situation under observation.

Recall-dependent question: Question that elicits from the respondents information that involves recall of experiences from the past that may be hazy in their memory.

Reference list: A list that includes details of all the citations used in the literature review and elsewhere in the paper or report.

Reflective scale: Each item in a reflective scale is assumed to share a common basis (the underlying construct of interest).

Regression analysis: Used in a situation where one or more metric independent variable(s) is (are) hypothesized to affect a metric dependent variable.

Relational analysis: Builds on conceptual analysis by examining the relationships among concepts in a text.

Reliability: Attests to the consistency and stability of the measuring instrument.

Replicability: The extent to which a re-study is made possible by the provision of the design details of the study in the research report.

Representativeness of the sample: The extent to which the sample that is selected possesses the same characteristics as the population from which it is drawn.

Research: An organized, systematic, critical, scientific inquiry or investigation into a specific problem, undertaken with the objective of finding answers or solutions thereto.

Research design: A blueprint or plan for the collection, measurement, and analysis of data, created to answer your research questions.

Research objective: The purpose or objective of the study explains why the study is being done. Providing a solution to a problem encountered in the work setting is the purpose of the study in most applied research.

Research proposal: A document that sets out the purpose of the study and the research design details of the investigation to be carried out by the researcher.

Research question(s): Specify *what* you want to learn about the topic. They guide and structure the process of collecting and analyzing information to help you to attain the purpose of your study. In other words, research questions are the translation of the problem of the organization into a specific need for information.

Researcher interference: The extent to which the person conducting the research interferes with the normal course of work at the study site.

Restricted probability designs: *See* Complex probability sampling.

Rigor: The theoretical and methodological precision adhered to in conducting research.

S

Sample: A subset or subgroup of the population.

Sample size: The actual number of subjects chosen as a sample to represent the population characteristics.

Sampling: The process of selecting items from the population so that the sample characteristics can be generalized to the population. Sampling involves both design choice and sample size decisions.

Sampling frame: A (physical) representation of all the elements in the population from which the sample is drawn.

Sampling unit: The element or set of elements that is available for selection in some stage of the sampling process.

Scale: A tool or mechanism by which individuals, events, or objects are distinguished on the variables of interest in some meaningful way.

Scientific investigation: A step-by-step, logical, organized, and rigorous effort to solve problems.

Secondary data: Data that already exist and do not have to be collected by the researcher.

Selection effects: The threat to internal validity that is a function of improper or unmatched selection of subjects for the experimental and control groups.

Semantic differential scale: Usually a seven-point scale with bipolar attributes indicated at its extremes.

Sequence record: A sequence record allows the researcher conducting an observational study to collect information on how often an event occurs.

Simple checklist: Checklist used in structured observation that provides information about how often a certain event has occurred.

Simple random sampling: A probability sampling design in which every single element in the population has a known and equal chance of being selected as a subject.

Simulation: A model-building technique for assessing the possible effects of changes that might be introduced in a system.

Social desirability: The respondents' need to give socially or culturally acceptable responses to the questions posed by the researcher even if they are not true.

Solomon four-group design: The experimental design that sets up two experimental groups and two control groups, subjecting one experimental group and one control group to *both* the pretest and the posttest, and the other experimental group and control group to *only* the posttest.

Split-half reliability: The correlation coefficient between one half of the items measuring a concept and the other half.

Stability of a measure: The ability of the measure to repeat the same results over time with low vulnerability to changes in the situation.

Standard deviation: A measure of dispersion for parametric data; the square root of the variance.

Standardized regression coefficients (or beta coefficients): The estimates resulting from a multiple regression analysis performed on variables that have been standardized (a process whereby the variables are transformed into variables with a mean of 0 and a standard deviation of 1).

Stapel scale: A scale that measures both the direction and intensity of the attributes of a concept.

Statistical power ($1 - \beta$): The probability of correctly rejecting the null hypothesis.

Statistical regression: The threat to internal validity that results when various groups in the study have been selected on the basis of their extreme (very high or very low) scores on some important variables.

Stratified random sampling: A probability sampling design that first divides the population into meaningful, nonoverlapping subsets, and then randomly chooses the subjects from each subset.

Structured interviews: Interviews conducted by the researcher with a predetermined list of questions to be asked of the interviewee.

Structured observation: Form of observation where the observer has a predetermined set of categories of activities or phenomena planned to be studied.

Subject: A single member of the sample.

Survey: A *system* for collecting information from or about people to describe, compare, or explain their knowledge, attitudes, and behavior.

Systematic sampling: A probability sampling design that involves choosing every *n*th element in the population for the sample.

T

Telephone interview: The information-gathering method by which the interviewer asks the interviewee *over the telephone*, rather than face to face, for information needed for the research.

Test–retest reliability: A way of establishing the stability of the measuring instrument by correlating the scores obtained through its administration to the same set of respondents at two different points in time.

Testability: The ability to subject the data collected to appropriate statistical tests, in order to substantiate or reject the hypotheses developed for the research study.

Testing effects: The distorting effects on the experimental results (the posttest scores) caused by the prior sensitization of the respondents to the instrument through the pretest.

Theoretical framework: A logically developed, described, and explained network of associations among variables of interest to the research study.

Treatment: The manipulation of the independent variable in experimental designs so as to determine its effects on a dependent variable of interest to the researcher.

Two-way ANOVA: A statistical technique that can be used to examine the effect of two nonmetric independent variables on a single metric dependent variable.

Type I error (α): The probability of rejecting the null hypothesis when it is actually true.

Type II error (β): The probability of failing to reject the null hypothesis given that the alternative hypothesis is actually true.

U

Unbalanced rating scale: An even-numbered scale that has no neutral point.

Unbiased questions: Questions posed in accordance with the principles of wording and measurement, and the right questioning technique, so as to elicit the least biased responses.

Unconcealed observation: Members of a social group under study are told that they are being observed.

Uncontrolled observation: An observational technique that makes no attempt to control, manipulate, or influence the situation.

Unit of analysis: The level of aggregation of the data collected during data analysis.

Unobtrusive methods: Methods that do not require the researcher to interact with the people he or she is studying.

Unrestricted probability sampling: *See* Simple random sampling.

Unstructured interviews: Interviews conducted with the primary purpose of identifying some important issues relevant to the problem situation, without prior preparation of a planned or predetermined sequence of questions.

Unstructured observation: Form of observation that is used when the observer has no definite ideas of the particular aspects that need focus.

V

Validity: Evidence that the instrument, technique, or process used to measure a concept does indeed measure the intended concept.

Variable: Anything that can take on differing or varying values.

Variance: Indicates the dispersion of a variable in the data set, and is obtained by subtracting the mean from each of the observations, squaring the results, summing them, and dividing the total by the number of observations.

W

Wilcoxon signed-rank test: A nonparametric test used to examine differences between two related samples or repeated measurements on a single sample. It is used as an alternative to a paired samples *t*-test when the population cannot be assumed to be normally distributed.

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