# Research Method

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# EXECUTIVE SUMMARY

Research extends beyond mere skills; it's a critical thinking process. It involves examining various aspects of your professional work, formulating guiding principles, and developing and testing new theories. Research encourages questioning, systematic examination of observations, and implementing effective changes for professional advancement.

Research plays a crucial role in managerial decision-making. Good decisions lead to problem-solving, while poor decisions perpetuate issues. The key lies in a systematic decision-making process. Research helps identify problems, recognize relevant factors, gather information, draw conclusions, and implement solutions. This modules provides guidance through essential steps in doing research.

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# MODULE INTRODUCTION

## Module Description

Research methodology is taught as a supporting subject across various academic disciplines, including health, education, psychology, social work, nursing, public health, library studies, and marketing research. Although these disciplines differ in content, their broad approach to research inquiry is similar. Different academic disciplines emphasize either quantitative or qualitative research. The choice between these methods should align with the study's objectives. In practice, most research blends both approaches. Although they differ philosophically, their overall approach to inquiry is similar. Both have strengths and weaknesses.

This module aims to help students to determine the research are and theoretical, methodological and analytical background for development, design and eventual presentation of final thesis.

## Module objectives

Upon completion of this module, students should be able to:

| | |
|---|---|
| 01 | Describe the nature of business research problems and questions |
| 02 | Understand the ethics in research, approaches, strategies and research methodologies |
| 03 | Apply practical issues in conducting interview, focus groups, participant observation, and main principles of time-management organizing for being engaged in research |

## References

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**MODULE CONTENT**

# Chapter 1. Introduction to Research

### 1.1. Business Research

Business research systematically investigates specific workplace problems to find solutions. It involves identifying problem areas, gathering relevant information, analyzing data, and implementing corrective measures. Research helps managers make informed decisions by generating viable alternatives. Understanding research is essential for professionals in various roles, from treasurers to consultants. It enables discernment between good and bad studies and enhances interactions with researchers and consultants. In essence, business research provides critical information for effective decision-making

Research takes various forms and serves different purposes. Some research builds theory, while others test existing theories or describe phenomena. The term 'theory' can mean different things, but it generally explains a phenomenon and generates testable predictions. Whether it's about soccer teams, salaries, or moon landings, theory plays a crucial role in research.

In organizations, managers face daily problems that require effective decisions. Business research addresses issues in accounting, finance, management, and marketing. It investigates topics like budget control systems, inventory costing methods, financial ratios, employee attitudes, and marketing strategies. Understanding research helps managers make informed decisions and tackle organizational challenges.

### 1.2. Applied Research vs Biasic Research
**Research serves two main purposes:**
1. Applied Research
   Applied research directly addresses specific issues.
2. Basic Research
   Basic research enriches our understanding and informs problem-solving in the long term.

The main distinction between applied and basic research lies in their objectives. Applied research aims to solve specific current problems within an organization, while basic research seeks to generate broader knowledge about organizational phenomena. Despite this difference, both types of research follow systematic inquiry steps and are often conducted scientifically to provide reliable solutions.

## 1.3. Benefit of Research Knowledge

Managers with research knowledge have an advantage. While you may not conduct major research as a manager, understanding, predicting, and controlling dysfunctional events within the organization are essential. For instance, when a new product doesn't take off or a financial investment doesn't pay off as expected, research helps explain these phenomena. Managers who grasp research methods can identify and address problems before they escalate. Even if managers hire external researchers, understanding research enables effective interaction. It also helps managers evaluate scientific articles, make informed decisions, and avoid oversimplified notions. Research knowledge enhances decision-making and prevents vested interests from prevailing.

Managers play a crucial role in decision-making, and research knowledge significantly aids them. Understanding research enhances managers' sensitivity to internal and external factors. It also facilitates interactions with consultants and comprehension of the research process. In today's complex environment, various tools, theories, and data are available for modeling business processes, consumer behavior, and investment decisions. Even basic research knowledge helps managers engage confidently with experts. Managers ultimately decide whether to implement research recommendations. Staying objective, understanding recommendations, and adapting traditions based on research findings contribute to effective decision-making.

## 1.4. Research Ethics

Business research ethics involves adhering to a code of conduct and societal norms while conducting research. It applies to the organization, sponsors, researchers, and respondents. Ethical behavior is crucial at every step of the research process, from data collection to reporting.

## Chapter 2. Research Process

### 2.1. Scientific research

Scientific research follows a rigorous, logical, and organized approach to solve problems. It avoids relying on hunches or intuition and enables comparable findings when data are analyzed. Scientific investigation enhances objectivity and helps managers address critical workplace factors. Both basic and applied research benefit from this scientific method.

However, not all researchers always take a scientific approach. Sometimes simplicity or resource constraints lead to decisions based on hunches. Yet, such decisions carry a high risk of error. Even business leaders like Richard Branson and Steve Jobs have made mistakes due to judgment errors. Business publications often highlight organizations facing challenges from decisions made without sufficient research

Scientific research exhibits several key characteristics that distinguish it from other approaches. Let's consider an example: a manager investigating how to increase employee commitment. Applying **the eight hallmarks of science to this investigation ensures its scientific rigor:**

1. Purposiveness: The research aims to enhance employee commitment, benefiting the organization.
2. Rigor: A strong theoretical base and methodological design ensure careful, unbiased data collection and analysis.
3. Testability: Rigorous research allows for testable conclusions.
4. Replicability: Others can replicate the study to verify findings.
5. Precision and Confidence: Rigor leads to accurate results and confident decision-making.
6. Objectivity: Scientific research minimizes bias.
7. Generalizability: Findings apply beyond the specific case.
8. Parsimony: Simplicity in research design enhances clarity.

Understanding these hallmarks empowers managers to make informed decisions based on reliable research.

## 2.2. Hypothetico-deductive method vs Inductive Reasoning

Scientific research follows a systematic, logical, and rigorous method—the scientific method—to solve problems. Initially developed for natural sciences, it remains the primary approach across various fields. One common version is the **hypothetico-deductive method,** popularized by philosopher Karl Popper. Here are the key steps:

1. Identify a Broad Problem Area:
   Recognize an issue or phenomenon worth investigating (e.g., customer switching behavior).
2. Define the Problem Statement:
   Formulate a clear problem statement with research questions. Initial information gathering helps narrow down the problem.
3. Develop Hypotheses:
   Create testable predictions about relationships between variables (e.g., "Customers switch due to dissatisfaction").
4. Determine Measures:
   Decide how to collect relevant data (surveys, experiments, etc.).
5. Data Collection:
   Gather data based on the chosen approach.
6. Data Analysis:
   Analyze the collected data using statistical tools.
7. Interpretation of Data:
   Draw conclusions and refine hypotheses as needed.

The hypothetico-deductive method relies on deductive reasoning from general theories and then narrow it down into specific hypotheses for testing. Conversely, **inductive reasoning** works in the opposite direction, moving from specific observations to general conclusions. For instance, observing multiple white swans might lead to the proposition that "all swans are white." However, according to philosopher Karl Popper, induction cannot definitively prove a hypothesis because contrary evidence may still emerge. Despite this, both inductive and deductive processes play essential roles in research.

While deductive processes are common in causal and quantitative studies, inductive processes are regularly used in exploratory and qualitative research. Overall, theories based on deduction and induction help us understand, explain, and predict business phenomena. When testing specific hypotheses, researchers follow the hypothetico-deductive method, starting with a theoretical framework and logically deducing conclusions from study results.

## 2.3. Alternative Research Approach

**Several perspectives on truth and knowledge in research.**

1. Positivism: seek objective truths through scientific rigor

   Positivists believe that scientific research is the path to uncovering objective truth. They assume that the world operates based on discernible laws of cause and effect. Positivist research aims for robustness and consistency.Data collection methods should yield consistent results. Findings should apply beyond specific cases. Positivists often use experiments to test cause-and-effect relationships. Some positivists limit their focus to phenomena directly observable and objectively measurable, excluding emotions, feelings, and thoughts.

2. Constructionism: delve into mental constructs and context to understand how people perceive the world

   Constructionists take a different approach, challenging the idea of an objective truth. They view that the world we know is fundamentally mentally constructed. Instead of seeking objective truth, constructionists explore how people make sense of the world. Constructionists study how individuals construct knowledge. Methods like focus groups and unstructured interviews capture contextual uniqueness.Constructionists emphasize how views arise from interactions with others and the surrounding context.Rather than generalizing broadly, they often focus on understanding specific cases.

3. Pragmatism: bridges theory and practice, recognizing that adaptable approaches lead to meaningful insights.

   Pragmatists don't take a rigid stance on what constitutes good research.

   They believe that both objective, observable phenomena and subjective meanings can yield useful knowledge. Their focus is in practical, applied research to solve real-world problems. Different researchers may have varying perspectives and explanations. Pragmatists value diverse viewpoints and theories. Research results are provisional and subject to change.

   Pragmatists derive theory from practice and apply it intelligently. Theories and concepts guide us in navigating the world. Research's value lies in informing real-world practice.

# Chapter 3. Theoretical Framework

A theoretical framework serves as the fundamental basis for comprehending a specific phenomenon or problem. It offers a conceptual structure that directs researchers in designing, conducting, and interpreting their research.

## Theoretical Framework's Components:

1. Concepts or Variables: Introduce definitions for the key concepts or variables relevant to your study.
2. Conceptual Model: Develop a descriptive representation of your theory, showing how these variables relate to each other.
3. Theory: explain the rationale behind why you believe these variables are associated with each other, drawing from existing research.

From your theoretical framework, you can formulate testable hypotheses to assess the validity of your theory. The entire deductive research project hinges on the quality of the theoretical framework. Even if specific hypotheses aren't generated (as in some applied research), a well-developed theoretical framework is essential for investigating the problem. Given that a theoretical framework identifies relationships among important variables, understanding the different types of variables is crucial.

The procedure for developing a theoretical framework consists of the following steps

1. Define your model's concepts or variables.

   A good theoretical framework defines and identifies the relevant variables in the situation and explains their relationship to the problem. The framework should describe and explain the relationships among the independent variables, the dependent variable(s), and any moderating or mediating variables. The framework should also specify how and why moderating variables influence specific relationships, as well as how or why the mediating variables are treated as such. Any interrelationships between the independent or dependent variables themselves should also be clearly stated and explained. A good theoretical framework does not have to be complex.

   You should also select good definitions of concepts from the literature, because they will assist you in describing the relationship between the variables in your model and measuring your concepts during the data collection phase. You should avoid using dictionary definitions because they are too general. You should also justify why you selected a particular definition for your concept.

2. Create a conceptual model that clarifies your theory.

   A conceptual model assists in organizing a literature review. It indicates how you believe the variables in your model are related to one another. You can use a diagram to illustrate the relationships between the variables and make them easier to

understand. You should also provide a written explanation of the relationships and connect them to a sound theory. This way, the reader can see how your model can solve the management problem and engage with your ideas.

3. Come up with a theory that explains variable relationships.

   A theory should explain why and how the variables in your model are related. You should also specify the type and direction of the relationships, based on previous research and/or your own ideas. For example, you should specify if the relationships are positive or negative and linear or nonlinear. From the theory, you can develop hypotheses that can be tested to determine the validity of your theory.

   After developing the theoretical framework, you can use hypotheses and statistical analyses to test your theory. This is the basis for your deduction-based research assignment. Every research problem demands a solid theoretical foundation. You must also comprehend what a variable is and its various types.

You don't have to come up with a new theory every time you do a research project. Sometimes you can use existing theories to apply them to a specific situation. You can use arguments from prior research to support your theory. But sometimes you have to make some changes or additions to existing theories and models. This occurs when conducting basic research that explores new ideas. Then you have to rely on your own thoughts and insights.

## 3.1. Variables

A variable is something that can assume different values. These values may vary over time for the same object or person, or simultaneously for different objects or individuals, **The four types of variables are as follows:**

1. Dependent Variable (Criterion variable):

The dependent variable is the main focus of a research study. Researchers aim to understand, describe, explain, or predict this variable. It can vary based on different conditions, objects, or individuals. Examples include production units, absenteeism rates, and motivation levels. In multivariate studies, there can be more than one dependent variable. Quantifying and measuring the dependent variable helps find solutions to research problems.

2. Independent Variable (Predictor variable):

The independent variable is believed to have an impact on the the dependent variable either positively or negatively. When the independent variable changes, the dependent variable also changes accordingly. Four conditions must be met to establish causality:

- Covariation: Changes in the dependent variable are associated with changes in the independent variable.
- Temporal precedence: The cause (independent variable) occurs before the effect (dependent variable).

- No alternative explanations: Other factors should not be possible causes of the change.
- Logical explanation (theory): Why does the independent variable affect the dependent variable?
- Experimental designs often help establish causal relationships.
3. Moderating Variable:

A moderating variable has a contingent effect on the relationship between the independent and dependent variables. It modifies the original relationship.For example, when the relationship between production quality and customer satisfaction depends on another factor (e.g., cost), that third factor acts as a moderating variable.

4. Mediating Variable:

A mediating variable explains the process through which the independent variable affects the dependent variable. It lies between the independent and dependent variables. Mediation analysis helps understand the underlying mechanisms.

## 3.2. Theoretical Framework Development

The theoretical framework serves as the foundation for deductive research projects. It is a logically developed network of associations among relevant variables. Variables are identified through processes like interviews, observations, and literature review. Experience and intuition also guide the framework's development. Theoretical frameworks help arrive at solutions by correctly identifying the problem and relevant variables. Hypotheses are developed and tested based on the network of associations. Theoretical frameworks play a crucial role in the research process.

The literature review provides a solid foundation for developing the theoretical framework. Previous research findings help identify important variables. Theoretical frameworks elaborate relationships among variables, explain underlying theory, and describe the nature and direction of these relationships. A good theoretical framework is essential for developing testable hypotheses.

**Theoretical Framework component:**
1. Clearly Defined Variables:
   Identify and define important variables relevant to the problem.
2. Conceptual Model:
   Describe relationships between variables within the model.
3. Explanation of Relationships:
   Clearly explain why these relationships are expected to exist.
4. Complexity Not Necessary:
   A good theoretical framework need not be overly complex.
5. Challenges in Defining Variables:
   Generally agreed-upon definitions of relevant variables can be challenging to establish due to varying interpretations in the literature.

### 3.3. Hypothesis Development

After identifying important variables and establishing their relationships through logical reasoning in the theoretical framework, we can test whether these theorized relationships hold true. Scientific testing (statistical analyses or qualitative research) provides reliable information on existing relationships among variables. The results guide potential solutions to address the problem.

A hypothesis is a tentative yet testable statement that predicts expected findings in empirical data. Hypotheses are derived from the theory underlying the conceptual model. They often express relational relationships between two or more variables.

### Statement of Hypotheses Formats: If–Then Statements

Hypotheses can be set as propositions or in the form of if–then statements.

> Example 1:
> "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."
> Example 2:
> "If young women are more frequently exposed to images of thin models in the advertisements, then they will be more likely to express dissatisfaction with their body weight."

### Directional and Nondirectional Hypotheses:

- Directional Hypotheses:

  When terms such as "positive," "negative," "more than," or "less than" are employed, the hypotheses become directional. Directional hypotheses specify the expected relationship or difference between variables.

  Examples:

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

  "Women are more motivated than men."

- Nondirectional Hypotheses:

  These hypotheses postulate a relationship or difference but do not specify the direction. Nondirectional hypotheses are used when: relationships or differences have not been explored previously, conflicting findings exist in previous research studies, and in cases where the direction is known, it's better to develop directional hypotheses.

  Examples:

  "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

### The Null hypothesis vs The Alternate Hypothesis:

- The null hypothesis is formulated to be rejected in favor of an alternate hypothesis. It is presumed true until statistical evidence indicates otherwise.
  Examples:
  "Advertising does not affect sales."
  "Women and men buy equal amounts of shoes."
  "The correlation between two variables is equal to zero."
  "The difference in means between two groups is equal to zero."
- The Alternate Hypothesis ($H_a$) expresses a relationship between variables or indicates differences between groups. It is the opposite of the null hypothesis.
  Examples:
  "Advertising affects sales."
  "There is a difference in buying behavior between women and men."
  "The correlation between two variables is not equal to zero."
  "The difference in means between two groups is not equal to zero."

The null hypothesis assumes no significant relationship or difference. Any observed differences or relationships in our sample are attributed to random sampling fluctuations. If we reject the null hypothesis, alternate hypotheses become plausible.

A sound theoretical framework supports the generation of defensible alternate hypotheses. Researchers should ground their theoretical frameworks in logical reasoning. This ensures that alternate hypotheses are well-founded and can withstand scrutiny.

### The steps involved in hypothesis testing:

1. Formulate Hypotheses:
   State the null hypothesis ($H_0$) by assuming that there is no significant relationship or difference. Additionally, express the alternate hypothesis ($H_a$), which expresses a relationship or difference.
2. Select the Appropriate Statistical Test:
   Choose a statistical test based on whether your data follow parametric assumptions (e.g., normal distribution) or nonparametric assumptions. Common tests include t-tests, F-tests, and correlation analyses.
3. Determine Significance Level ($\alpha$):
   Decide on the desired level of significance (usually $\alpha = 0.05$). This represents the threshold for rejecting the null hypothesis.
4. Analyze Results:
   Use computer analysis tools or statistical software to obtain results. If the significance level is not directly provided, consult critical value tables (e.g., t-tables, F-tables, $\chi^2$-tables). Compare the calculated value with the critical value:
   - If the calculated value is larger than the critical value, reject the null hypothesis in favor of the alternate.

     o  If the calculated value is smaller than the critical value, accept the null hypothesis and reject the alternate.

Managers benefit from understanding how theoretical frameworks are developed and hypotheses are generated. A theoretical framework serves as the fundamental basis for comprehending a specific phenomenon or problem. It offers a conceptual structure that directs researchers in designing, conducting, and interpreting their research. IVs represent potential solutions, while the DV represents the problem itself. An understanding of "moderating variables" helps managers recognize that proposed solutions may not work universally. Moderators influence the relationship between IVs and DVs.

Managers should understand the statistical meaning of 'significance.' Hypothesis testing determines whether evidence supports or contradicts hypotheses. Accepting or rejecting hypotheses guides decision-making. Without this knowledge, research findings may be confusing for managers.

# Chapter 4. Research Design Elements

**A research design** is a plan for collecting, measuring, and analyzing data to answer specific research questions. Key decisions include research strategy (experiments, surveys, case studies), researcher control, study location, unit of analysis, and time considerations. As shown in Figure 5.1., each component (strategy, interference level, etc.) has important choices. No one-size-fits-all design; decisions depend on project goals, questions, and practical constraints (e.g., data availability, time, budget). In addition to research design decisions, researchers also must think about data collection methods, sampling design, measurement of variables, and data analysis techniques.

Figure 4.1.
Research Design
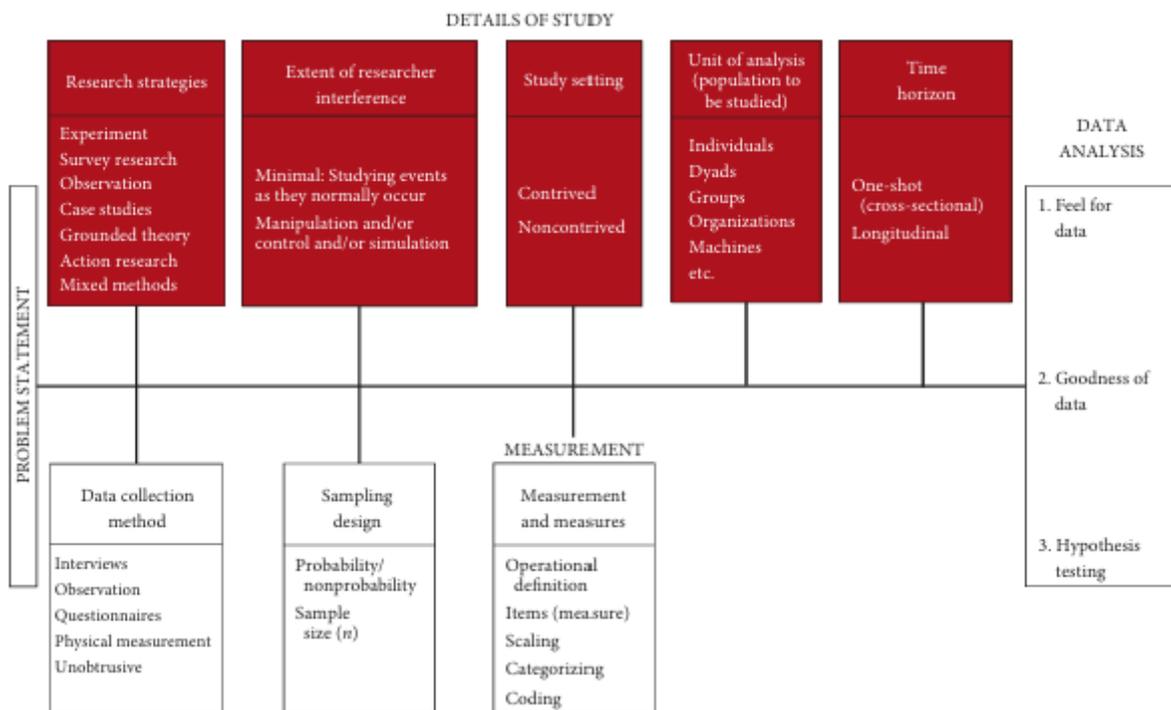


Source: Sekaran, U. and Bougie R. (2016). Research Methods for Business, 7th edition. John Wiley & Sons.

**4.1. Research Strategies:**

4.1.1. Experiments

Experiments are commonly associated with a hypothetico-deductive approach to research. Their purpose is to study causal relationships between variables. Experiments are less suitable for exploratory and descriptive research questions. Researchers manipulates the independent variable to observe its effect on the dependent variable. For example, changing the "reward system" may affect "productivity."

Research compare groups to understand the effect of treatment. One group receives a treatment (e.g., "fix wages"), while the comparison group (e.g., "hourly wages") does not. Researchers randomly assign subjects (workers) to these groups.

4.1.2. Survey Research

Surveys collect information from or about people to describe, compare, or explain their knowledge, attitudes, and behavior. The survey strategy is popular in business research, allowing collection of both quantitative and qualitative data. Surveys are commonly used for exploratory and descriptive research. Business surveys cover topics like consumer decision-making, customer satisfaction, job satisfaction, health service usage, and management information systems. Some surveys are one-time, while others track changes over time.Survey instruments include self-administered questionnaires (completed on paper or via computer), interviews, and structured observation.

4.1.3. Ethnograph

Ethnography, rooted in anthropology, is a research strategy. Researchers closely observe, record, and immerse themselves in the daily life of a specific culture. Researchers listen to conversations and ask questions. They gain an insider's understanding of behavior and culture. It often involves long-term engagement with a social group. Ethnography is closely related to participant observation. It uses multiple methods, including interviews, questionnaires, and observation.

4.1.4. Case Studies

Case studies focus on specific objects, events, or activities (e.g., a business unit or organization). Researchers examine real-life situations from various angles using multiple data collection methods. Case studies provide both qualitative and quantitative data. Hypotheses can be developed and tested within case studies.

4.1.5. Grounded Theory

Grounded theory is a systematic approach for developing inductively derived theories from data. Key tools in grounded theory include theoretical sampling, coding, and constant comparison. Theoretical sampling involves collecting data to develop emerging theories. In constant comparison, data (e.g., interviews) are compared to other data and to the emerging theory. If discrepancies arise, categories and theories are modified until they align with the data.

4.1.6. Action Research

Action research is often conducted by consultants aiming to initiate planned changes in organizations. Researchers start with an identified problem and gather relevant data.

A tentative solution is implemented, with awareness of potential unintended consequences. Effects are evaluated, defined, and diagnosed, leading to ongoing adjustments. Action research involves an interplay between problem, solution, consequences, and new solutions. Clear problem definition and creative data collection methods are crucial.

4.1.7. Mixed Methods Research:

Combines qualitative and quantitative approaches to answer complex research questions. Collects, analyzes, and integrates both types of data in a single study or series of studies. Allows researchers to blend inductive and deductive thinking. Addresses research problems using diverse data sources and methods. Triangulation is often associated with mixed methods:

- Method triangulation: Using multiple data collection and analysis methods.
- Data triangulation: Collecting data from various sources or at different time points.
- Researcher triangulation: Involving multiple researchers in data collection or analysis.
- Theory triangulation: Using multiple theories or perspectives to interpret data.

**4.2. Extent of Researcher Interference**

The level of interference by the researcher significantly impacts whether a study is correlational or causal.

- Correlational studies occur in natural environments (e.g., supermarkets or factory floors) with minimal researcher interference. For instance, when studying factors affecting training effectiveness, researchers collect relevant data without disrupting the normal flow of work.
- In causal studies, researchers deliberately manipulate variables to observe their effects on the dependent variable.

  For example, adjusting lighting intensity to study its impact on worker performance involves considerable researcher interference. Some studies even create entirely new artificial settings (such as laboratory experiments) to tightly control variables.

## 4.3. Study Settings: Contrived and Noncontrived

Business research can occur in either natural (noncontrived) or artificial (contrived) environments:

- Exploratory and descriptive studies typically take place in noncontrived settings. Causal studies often occur in contrived lab settings.
- Field studies involve noncontrived settings, where researchers manipulate independent variables while subjects function normally.
- Field experiments establish cause-and-effect relationships within the natural environment.
- Experiments aiming for irrefutable causal relationships require strict control over extraneous factors in artificial settings.

## 4.4. Unit of Analysis in Research: Individuals, Dyads, Groups, Organizations, and Cultures

The unit of analysis refers to the level at which data are combined for analysis. It determines how we group and interpret information. Here are some examples:

1. Individuals:

   When studying how to raise employee motivation, the focus is on individual employees.Data are collected from each employee, treating their responses as individual data sources.

2. Dyads (Two-Person Interactions):

   Dyads, such as husband-wife interactions or supervisor-subordinate relationships, become the unit of analysis. Researchers study interactions between pairs of individuals.

3. Groups:

   If the problem statement relates to group effectiveness, the unit of analysis shifts to the group level. Data from individuals within different groups are aggregated to compare group differences.

4. Organizations:

   Comparing different departments within an organization involves analyzing data at the departmental level. Individuals within each department are treated as one unit for comparisons.

## 4.5. Cross-Sectional vs. Longitudinal Studies: Time Horizon

### Cross-Sectional Studies:

Data are gathered once, typically over days, weeks, or months. These studies are called "one-shot" or cross-sectional studies. It collect data relevant to answering a research question at a single point in time.

Example:

Surveying employees' behavior to understand a specific issue.

## Longitudinal Studies:

Researchers study people or phenomena at multiple points in time.

Example:

Studying employee behavior before and after a change in top management.

Longitudinal studies track changes over time. It can identify cause-and-effect relationships.

Example:

Analyzing sales volume before and after an advertisement campaign.

If sales increase, attribute it to the ad; if not, explore other factors.

Experimental designs are often longitudinal (data collected before and after manipulation). Field studies can also be longitudinal (e.g., comparing managers' reactions to working women over years). Although more time-consuming and costly, longitudinal studies provide valuable insights.

### 4.6. Trade-Offs and Compromises

Researchers make deliberate decisions based on research objectives, rigor, and practical constraints. Resource limitations may lead to suboptimal design choices (e.g., cross-sectional instead of longitudinal studies). Explicitly stating trade-offs in research reports is essential. Despite compromises, management studies contribute valuable insights.

# Chapter 5. Measurement of Variables: Operational Definition

## 5.1. Operational Definition

Measurement in research involves assigning numbers or symbols to characteristics or attributes of objects based on predefined rules. Researchers use measurement to test hypotheses.

There are two main types of variables: one that allows for objective and precise measurement and another that is more abstract and subjective, making accurate measurement challenging.

Operationalizing concepts allows researchers to tap into more nebulous variables without physical measuring devices. This technique involves translating abstract notions into observable behaviors or characteristics. A valid measurement scale includes quantitatively measurable questions or items that adequately represent the construct's domain or universe. If the construct has multiple domains or dimensions, researchers must ensure the measure includes questions representing each aspect. Operationalization focuses on defining how to measure a concept rather than describing its correlates.

These are the four steps in the Operationalization Process

1. Concept Definition:
   Define the construct you want to measure (e.g., thirst).
2. Content Development:
   Create an instrument (questions or items) that captures the essence of the concept. For example, asking about fluid intake. Researchers can find these measures in scientific journals and scale handbooks.
3. Response Format:
   Choose a format (e.g., a five-point rating scale) for participants to express their agreement or disagreement.
4. Validity and Reliability:
   Check whether it measures what it is supposed to measure (Validity) and the consistency of the result (Reliability)

Acknowledging that certain variables may have varying meanings and connotations across different cultures is essential, especially when conducting transnational research.

**5.2. Scaling.**

Measurement scales allow us to assign numbers to object attributes. These scales distinguish individuals based on the variables of interest in our study. There are four fundamental types of scales:

1. Nominal

   Categories without any inherent order (e.g., city of birth, gender).

2. Ordinal

   Categories with a rank order but no equal intervals (e.g., language ability levels)

3. Interval

   Equal intervals between adjacent data points (e.g., temperature in Fahrenheit or Celsius).

4. Ratio.

   Equal intervals with a true zero point (e.g., test scores)

As we progress from nominal to ratio scales, the sophistication and precision of the scales increase.

Rating scales evaluate how respondents feel about a specific product, feature, or statement. Variety of Scales Used:

1. Dichotomous Scale:

   Used to elicit "Yes" or "No" answers and uses a nominal scale.

2. Category Scale:

   Uses multiple items to elicit a single response (e.g., low, medium, high). It uses a nominal scale.

3. Semantic Differential Scale:

   Measures opposite attributes (e.g., good vs. bad) and used to assess respondent's attitudes toward a particular brand, advertisement, object, or individual. It is ordinal in nature. However, it is often treated as an interval scale.

4. Numerical Scale:

   Uses numbers without specific meanings. It is ordinal in nature, though often treated as an internal scale.

5. Itemized Rating Scale:

   Provides flexibility in choosing the number of scale points (e.g., 4, 5, 7, 9) and allows different anchors (e.g., "Very Unimportant" to "Very Important" or "Extremely Low" to "Extremely High"). Increasing scale points beyond five (e.g., seven or nine points) doesn't enhance reliability (Elmore & Beggs, 1975). Itemized rating scales are common in business research. When it includes a neutral point, it is a Balanced Scale, and when it is not, it is an unbalanced rating scale. It uses an interval scale.

6. Likert Scale:

   Commonly used for attitudes and behaviors in business research to examine how strongly subjects agree or disagree with statements on a five-point scale. There is a debate whether a likert scale should be treated as ordinal or interval scale.

7. Fixed or Constant Sum Rating Scale: Allocates points across options. It is an ordinal scale.

8. Stapel Scale: This scale simultaneously assesses the direction and intensity of attitudes toward the items under study. It is an interval scale.
9. Graphic Rating Scale: Allows respondents to select a point on a line. This is an ordinal scale.
10. Consensus Scale: Assesses collective opinions.
11. Other scales: Multidimensional scaling is an advanced method where objects or people are visually positioned in space, and conjoint analysis is performed. It helps create a visual representation of the relationships among different dimensions of a construct.

Ranking scales help assess preferences between objects or items. Here's how they work:
1. Paired Comparison Scale: Respondents choose between two objects at a time, forcing them to rank the objects relative to each other.
2. Forced choice: allows respondents to rank objects relative to each other among the provided alternatives. This approach is especially straightforward when the number of choices to be ranked is limited.
3. Comparative Scale: This scale provides a reference point for evaluating attitudes toward the current object, event, or situation.

Cross-cultural differences in scaling reveal that people from various countries exhibit distinct behaviours when using rating scales. Recent research indicates that individuals differ in their tendency to use extreme scale points (e.g., 1 and 5 or 1 and 7) and may also respond in socially desirable ways. Analyzing and interpreting data collected across multiple countries presents challenges due to these cultural variations.

### 5.3. Goodness of Measures

Now that we've learned how to define variables operationally and apply various scaling techniques, ensuring that the measurement instrument accurately captures the intended concept is crucial. We want to be certain we are measuring precisely what we set out to measure. Ensuring we accurately measure perceptual and attitudinal variables involves avoiding oversights in important dimensions and excluding irrelevant elements. Imperfections in scales can lead to errors in measuring attitudinal variables. Using better instruments enhances research quality.

Assessing the "Goodness" of Measures:
1. **Item Analysis**: Examine responses to questions related to the variable.
   Determines whether items in an instrument are appropriate. Examines each item's ability to discriminate between high-score and low-score subjects. High t-values indicate items that effectively discriminate and should be included.

2. **Reliability (consistency) of measures**

Reliability assesses how consistently a measuring instrument produces similar results under similar conditions. Example: If thermometer consistently displays the same temperature when measuring a liquid sample, it is considered reliable There are two stability tests: test-retest reliability and parallel-form reliability.

a. Test-Retest Reliability:
   Administer the same questionnaire to respondents twice (several weeks to six months apart). Calculate the correlation between scores obtained at different times. Higher correlation indicates better test-retest reliability and greater stability.

b. Parallel-Form Reliability:
   Compare responses on two comparable sets of measures tapping the same construct. Both forms have similar items but differ in wording or question order. High correlation (e.g., 0.8 and above) indicates reliable measures with minimal error variance.

Internal Consistency of Measures:
Ensures that items within a measure consistently measure the same concept and can be examined through the:

1. Interitem consistency reliability: Measures consistency across all items. Commonly assessed using Cronbach's coefficient alpha (for multipoint-scaled items) or Kuder-Richardson formulas (for dichotomous items).

2. Split-Half Reliability: Correlations between two halves of an instrument. Cronbach's alpha is usually adequate for assessing inter-item consistency reliability.

3. **Validity (accuracy) of measures**

Validity evaluates how accurately a method measures what it is intended to measure. Example: High validity means that research results correspond to real properties and variations in the physical or social world.
Types of Validity Tests:

1. Content Validity: Ensures the measurement includes an adequate set of items representing the concept.

2. Criterion-Related Validity: Differentiates individuals based on an expected criterion. This can be done by establishing:
   - Concurrent validity (the scale effectively distinguishes individuals who are known to be different) or
   - Predictive validity.

3. Construct Validity: Assesses how well the measure aligns with relevant theories. This is assessed through:
   a. Convergent validity: Demonstrated when scores from two different instruments measuring the same concept are highly correlated.

b. Discriminant validity: Established when two theoretically unrelated variables are predicted to be uncorrelated, and empirical measurements confirm this lack of correlation.

Researchers use various methods:

a. Correlational analysis: For concurrent, predictive, convergent, and discriminant validity.

b. Factor analysis: Confirms dimensions of the concept and identifies appropriate items for each dimension (construct validity).

c. Multitrait, multimethod matrix: Measures concepts using different forms and methods, ensuring robustness.

In summary, construct validity ensures that our measurement instruments accurately capture the intended concepts, and various validity tests contribute to the "goodness" of the measure.

Figure 5.1.

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? |

Source: Sekaran, U. and Bougie R. (2016). Research Methods for Business, 7th edition. John Wiley & Sons.

## 5.4. Reflective vs Formative Measurement Scales

In a **reflective scale**, the items are expected to correlate with each other. These scales assume that the items share a common basis (the underlying construct of interest). An increase in the value of the construct leads to an increase in the value for all items representing that construct. The direction of "causality" is from the construct to the items. Example: The Attitude Toward the Offer scale developed by Burton and Lichtenstein (1988). It includes six items (e.g., unfavorable–favorable, bad–good) measured on a nine-point graphic scale. We expect all six items to correlate because they represent a person's attitude toward a product offered at a certain price.

In a **formative scale**, the items do not necessarily correlate with each other. These scales view a construct as an explanatory combination of its indicators. Each item contributes uniquely to defining the construct. Example: The Job Description Index includes five dimensions (type of work, opportunities for promotion, satisfaction with supervision, coworkers, and pay). Each dimension is translated into observable and measurable elements (e.g., "Good opportunity for advancement," "Highly paid"). These items may not correlate with each other because they represent different dimensions of job satisfaction.

# Chapter 6. Sampling

**Definitions:**

- Population: The entire group of people, events, or things of interest that a researcher wishes to investigate.
- Element: A single member of the population.
- Sample: A subset of the population.
- Sampling Unit: The element or set of elements available for selection during the sampling process.
- Subject: A single member of the sample (similar to an element in the population).
- Statistical Terms in Sampling:
    - Parameters: Characteristics of the population (e.g., population mean ($\mu$), population standard deviation ($\sigma$), population variance($\sigma2$)) that we want to estimate.
    - Representative Sample: When the properties of the population are not overrepresented or underrepresented in the sample, we have a representative sample.

**Sampling Process:**

- Sampling: Selecting a sufficient number of the right elements from the population.
- Major steps in sampling:
    - Define the population.
    - Determine the sample frame (list of potential sampling units).
    - Choose the sampling design (e.g., simple random sampling, stratified sampling).
    - Determine an appropriate sample size.
    - Execute the sampling process.

## 6.1. Probability and Nonprobability Sampling Design.

**Probability Sampling Designs:**

- Unrestricted (Simple Random) Sampling: Each element in the population has an equal chance of being chosen.
- Restricted (Complex) Probability Sampling: More complex methods (e.g., stratified, cluster sampling) with known probabilities for selection.

**Nonprobability Sampling Designs:**

- Elements in the population do not have attached probabilities for being chosen.
- Two main types:
    - Convenience Sampling: Choosing subjects based on convenience (not representative). This is the least reliable sampling design.
    - Purposive Sampling: Selecting subjects intentionally based on specific criteria. There are two major types of purposive sampling:

- Judgement sampling:
  Judgment sampling refers to selecting subjects who are strategically positioned or best suited to provide the specific information needed. This method is employed when only a limited number of specific category of people possess the sought-after information

- Quota sampling:
  Quota sampling, a type of purposive sampling, ensures that specific groups are well-represented in a study by assigning quotas. Each subgroup's quota is determined based on the total population numbers for that group. However, because this method is nonprobability sampling, the results cannot be generalized to the entire population. Think of quota sampling as a variation of proportionate stratified sampling, where a predetermined proportion of people is sampled from different groups, but convenience plays a role in the selection process.

Figure 6.1.
Probability and nonprobability sampling design

| 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. |
| 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. |

Source: Sekaran, U. and Bougie R. (2016). Research Methods for Business, 7th edition. John Wiley & Sons

## 6.2. Precision and Confidence

**Precision and Confidence:**

- Precision: How closely sample statistics (e.g., mean, proportion) reflect population parameters.
- Confidence: The level of certainty that our sample estimate is close to the true population value. A 95% confidence level is commonly accepted in business research. It's often expressed by denoting the significance level as $p \leq 0.05$. In practical terms, this means that at least 95 times out of 100, our estimate will accurately reflect the true characteristics of the population.
- Larger sample size increases both precision and confidence.

## 6.3. Testing Hypotheses with Sample Data

Sample data are used to estimate population parameters and test hypotheses.

**Determining Sample Size:**

- Consider precision and confidence needed.
- A sample size that is too large can lead to Type II errors.
- Efficiency: Balance precision and confidence for a given sample size.
- Rules of thumb for determining sample size (Roscoe, 1975):
  - For most research, sample sizes larger than 30 and less than 500 are appropriate. This range balances statistical power and practical feasibility.
  - When breaking samples into subsamples (e.g., males/females, juniors/seniors), aim for a minimum sample size of 30 for each category. Ensuring representation within subsamples is essential.
  - 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. Larger samples enhance the reliability of multivariate analyses.
  - For simple experimental research with tight experimental controls (e.g., matched pairs), successful research is possible with samples as small as 10 to 20. Rigorous control over experimental conditions compensates for smaller sample sizes.

## 6.4. Efficiency in sampling

Efficiency in sampling refers to achieving a balance between precision (reducing standard error) and sample size:

1. Probability Sampling Designs:
- Not all designs are equally efficient.
- While simple random sampling is common, other methods can be more efficient.
- Stratified random sampling often proves most efficient.

- o Disproportionate stratified sampling can outperform proportionate sampling in many cases.
2. Cluster Sampling:
- Cluster sampling is less efficient than simple random sampling.
- Clusters tend to have more homogeneity among subjects than individual elements in the population.
- Multistage cluster sampling is more efficient when there's heterogeneity in earlier stages.

## 6.5. Qualitative Sampling

- Precise Definition of Target Population: Qualitative research begins by clearly defining the target population.
- Nonprobability Sampling: Qualitative research typically uses nonprobability sampling methods because it doesn't aim to draw statistical inferences.
- Purposive Sampling: One common technique is purposive sampling, where subjects are intentionally selected to reflect the diversity of the population.
- Theoretical Sampling: A specific form of purposive sampling, theoretical sampling, is used. It involves selecting subjects based on theoretical concepts rather than predetermined sample sizes. The goal is to achieve theoretical saturation, which occurs when new data no longer provide additional insights.

Managers benefit from understanding sampling designs and sample size decisions used by researchers. In upcoming chapters, we'll explore how data collected from a sample are analyzed to test hypotheses and answer research questions. This understanding also includes cost implications, the trade-off between precision and confidence, and assessing the risk associated with implementing changes based on research results. Ultimately, it helps managers evaluate the generalizability of study findings.

# Chapter 7. Quantitative Data Analysis

## 7.1. Hypothesis Testing and Errors

In statistical hypothesis testing, we evaluate whether our data provide evidence to support or refute a research prediction; in which:

1. Null Hypothesis ($H_0$):
   The null hypothesis represents the assumption of no difference or no effect in the population. It serves as the default position until statistical evidence suggests otherwise. For example, in a drug intervention study, the null hypothesis might state that the new drug has no effect on symptoms of a disease.

2. Alternative Hypothesis ($H_1$):
   The alternative hypothesis represents the researcher's prediction of an actual difference or effect. It contradicts the null hypothesis. In our drug intervention example, the alternative hypothesis would suggest that the drug is effective for alleviating symptoms.

3. Type I Error (False Positive):
   A Type I error occurs when we wrongly reject the null hypothesis when it is actually true. It leads to a false positive conclusion. For instance, concluding that the drug improves symptoms when it doesn't. The probability of a Type I error is denoted by $\alpha$ (alpha) and is typically set at significance levels like 5% or 1%.

4. Type II Error (False Negative):
   A Type II error occurs when we fail to reject the null hypothesis when it is actually false. It results in missing a true effect. For example, concluding that the drug has no effect when it actually does. The probability of a Type II error is denoted by $\beta$ (beta).

## 7.2. Statistical Power

Statistical power ($1 - \beta$) is the probability of correctly rejecting the null hypothesis when it is false. In other words, it's the chance of detecting a true effect. Key factors affecting statistical power include:

1. Alpha ($\alpha$):
   - $\alpha$ is the significance level used in hypothesis tests (e.g., 0.05 or 0.01).
   - As $\alpha$ decreases (e.g., moving from 5% to 1%), the risk of Type I error decreases, but statistical power also decreases.
   - Lower $\alpha$ means stricter criteria for rejecting the null hypothesis.

2. Effect Size:
   - Effect size measures the magnitude of a difference or strength of a relationship in the population.
   - Larger effects are easier to detect, leading to higher statistical power.
   - Smaller effects require larger sample sizes to achieve sufficient power.

3. Sample Size:
   - Larger sample sizes provide more accurate estimates of population parameters.

- Increased sample sizes lead to higher statistical power.
- However, excessively large samples can result in overpowered tests.

Researchers must strike a balance:

- High Power: Desirable for detecting true effects.
- Low Type I Error: Avoiding false positives.
- Practical Sample Size: Balancing resources and precision.

## 7.3. Appropriate Statistical Techniques

Once you've determined an acceptable level of statistical significance for testing your hypotheses, the next crucial step is selecting the appropriate method to test those hypotheses

Figure 9.1.

Univariate and multivariate statistical techniques

**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

Source: Sekaran, U. and Bougie R. (2016). Research Methods for Business, 7th edition. John Wiley & Sons

An effective information system gathers, analyzes, and offers a diverse array of information related to both an organization's external and internal environments. By leveraging available tools and techniques, organizations can address various challenges by accessing and interpreting the data within the system

When it comes to analyzing data, researchers have a diverse array of software options available, such as : LISREL, MATLAB, QUALTRICS, SPSS, STATA, etc.

# Chapter 8. Qualitative Data Analysis

Qualitative data refers to non-numerical data collected and analyzed to gain an in-depth understanding of complex phenomena. It captures people's opinions, attitudes, behaviors, and beliefs. Examples of qualitative data are interview notes, transcripts of focus groups, answers to open-ended questions, transcriptions of video recordings, accounts of experiences on the internet, and news articles. These data can be sourced from primary (directly collected from individuals, focus groups, or observations) and secondary sources (derived from existing records, company documents, government publications, or online platforms) such as company records, government publications, and online platforms.

Three Key Steps in Qualitative Data Analysis
1. Data Reduction:
   - Purpose: Data reduction involves simplifying and organizing the collected qualitative data.
   - Activities:
     - Selection: Choose relevant portions of the data (interview transcripts, notes, etc.).
     - Coding: Assign descriptive labels (codes) to segments of data.
     - Categorization: Group similar codes into meaningful categories.
     - Outcome: Reduced, manageable data that captures essential themes and patterns.
2. Data Display:
   - Purpose: Present the data in a way that facilitates understanding and reveals insights.
   - Formats:
     - Quotes: Select impactful quotes that exemplify key themes.
     - Matrices: Organize data into tables or matrices for comparison.
     - Graphs/Charts: Visualize patterns, relationships, or trends.
   - Benefits: Data displays aid both researchers and readers in interpreting the findings.
3. Drawing Conclusions:
   - Iterative Process: Qualitative data analysis is not linear; it involves continuous refinement.
   - Feedback Loop:
     - Data Coding: As you code data, ideas for display and preliminary conclusions emerge.
     - Preliminary Conclusions: These feed back into how raw data are coded, categorized, and displayed.
   - Holistic Understanding: Conclusions emerge from the interplay of data reduction and display.

## 8.1. Reliability and Validity in Qualitative Data Analysis:

Reliability in Qualitative Data Analysis

- Category Reliability: Refers to the consistency with which judges can use predefined category definitions to classify qualitative data.
    - Well-defined categories lead to higher category reliability.
    - However, overly broad categories can oversimplify findings.
- Interjudge Reliability: Measures consistency between different coders processing the same data.
    - Commonly assessed as the percentage of coding agreements.
    - Agreement rates above 80% are considered satisfactory.

Validity in Qualitative Research:

- Internal Validity: Ensures that research results accurately represent the collected data.
- External Validity: Addresses the generalizability or transferability of findings to other contexts or settings.
- Methods for Achieving Validity:
    - Supporting Generalizations by Counts of Events: Address concerns about selective reporting and anecdotal evidence.
    - Including Deviant Cases: Testing theories by deliberately including cases that may contradict them.
    - Triangulation: Using multiple data sources or methods to enhance reliability and validity.
    - In-Depth Project Description: Providing context and details to enhance the validity of research results.

## 8.2. Other Methods of Gathering and Analyzing Qualitative Data

a. Content Analysis:
- Definition: Content analysis is an observational research method used to systematically analyze textual information.
- Purpose: Researchers use content analysis to identify patterns, themes, and properties within recorded communication.
- Types of Texts Analyzed:
    - Written texts (e.g., books, newspapers, magazines).
    - Oral communication (e.g., speeches, interviews).
    - Visual content (e.g., photographs, films).
- Quantitative and Qualitative Approaches:
    - Quantitative Content Analysis: Focuses on counting and measuring occurrences of specific words, phrases, or concepts.
    - Qualitative Content Analysis: Aims to interpret and understand the meaning and relationships within the text.
b. Narrative Analysis:

- Definition: Narrative analysis explores the stories (narratives) people tell about themselves and their experiences.
- Method: Researchers closely examine long-form participant responses or written stories.
- Goals:
  - Uncover themes and meanings embedded in narratives.
  - Understand human experiences, motivations, and intentions.
- Data Collection: Often involves interviews or accounts of personal experiences.

2  Analytic Induction:
- Approach: Analytic induction seeks universal explanations of phenomena through qualitative data analysis.
- Process:
  - Collect qualitative data.
  - Develop a hypothetical explanation (theory) for the phenomenon.
  - Continuously test the theory against new cases.
  - If no inconsistent cases are found, the theory is considered valid.
- Goal: Achieve a deeper understanding of underlying patterns and causal relationships.

## 8.3. Big Data

Big data refers to large and diverse datasets that are too complex or expansive to be effectively processed and analyzed using traditional data-processing methods and tools. Initially, the term focused on the sheer volume of data, but it has evolved to encompass various data types, including unstructured or semi-structured data (such as text, images, and videos). New technologies enable the measurement, recording, and combination of diverse data sources, making big data a powerful resource across academic disciplines and organizational decision-making.

Key Characteristics of Big Data:
1. Volume:
   - Refers to the sheer amount of data generated.
   - Massive quantities of information are collected from digital sources both within and outside organizations.
   - Examples include transaction records, social media posts, sensor data, and more.
2. Variety:
   - Encompasses the diverse types of data.
   - Data can be structured (e.g., databases), unstructured (e.g., text documents), or semi-structured (e.g., XML files).
   - Sources include weblogs, social media, images, videos, and more.
3. Velocity:
   - Relates to the speed at which data are generated and become available.

- Real-time data streams from business processes, mobile devices, social networks, and other sources.
- Rapid data flow requires efficient processing and analysis.
4. Veracity (Occasionally Included):
   - Addresses the quality and reliability of data.
   - Considers biases, noise, and abnormality present in big data.
   - Ensuring data accuracy and trustworthiness is crucial.

Promises and Challenges:
- Promises:
  - Informed decision-making in marketing, product development, pricing, and more.
  - Opportunities for organizations of all sizes and sectors.
- Challenges:
  - Managing, processing, and analyzing big data effectively.
  - Balancing value extraction with ethical considerations.