Course: Business Research Methods (8510)
Semester: Autumn, 2021
ASSIGNMENT No. 1

Q. 1 Explain deductive method and its importance. How is this method applied in business research? Discuss with examples in detail.

Deductive reasoning is an important skill that can help you think logically and make meaningful decisions in the workplace. This mental tool enables professionals to come to conclusions based on premises assumed to be true or by taking a general assumption and turning it into a more specific idea or action. Here we explore what deductive reasoning is, how it differs from other types of reasoning, how to use this method of reasoning at work, and examples of deductive reasoning. Deductive reasoning is the act of coming to a conclusion based on information that is assumed to be generally true. Deductive reasoning, also referred to as deductive logic or top-down thinking, is a type of logical thinking that's used in various industries and is often sought after by employers in new talent. The following is a formula often used in deduction: If A = B and B = C, then in most cases A = C. So, for example, if traffic gets bad starting at 5 p.m. and you leave the office at 5 p.m., it can be deductively reasoned that you'll experience traffic on your way home. Another type of reasoning used in the workplace is inductive reasoning. This form of reasoning is the opposite of deductive reasoning and is when broad generalizations are made based on specific occurrences or facts. The following is an example of inductive reasoning: A lawyer analyzes various strategies used by other attorneys in cases that are similar to the lawyer's current case. The lawyer uncovers a consistent strategy used by other lawyers that results in frequent acquittals and uses this approach in their case.

There are several steps involved in the top-down thinking process to reach a viable conclusion. Most professionals rely on premises, or something that's already assumed, to reach a deduction. Beyond identifying the premises in a particular situation, other steps you'll likely take throughout this reasoning process include:

1. Ensure you fully understand the issue at hand and what's at stake.
2. Analyze the data that relates to the issue at hand and ask questions when necessary to further your understanding.
3. Come up with a hypothesis, or a potential cause or reason for the issue at hand. This will be your initial assumption.
4. Test the validity of your hypothesis by applying a solution you believe will solve the issue.
5. Continue to test the hypothesis in other scenarios to further validate its effectiveness if the solution solves the issue in the desired way.
6. Based on the results of your testing, you can decide if the information uncovered related to the issue is invalid or valid.

Types of deductive reasoning

Three types of deductive reasoning are seen most often in professional settings. These types of include:

1. **Syllogism:** This type of thinking is when you conclude from two assumed premises that both share a common term with the outcome. The following is an example of a syllogism: all cats are mammals, and all

mammals have four legs. Therefore, all cats have four legs. While this statement isn't necessarily true, it shows how two assumed premises can lead to a common conclusion.

2. **Modus ponens:** Modus ponens, also referred to as affirming the antecedent, is a type of reasoning in which the following formula is used: If P is true, and P implies Q, then Q will be true. For example, if Jane goes to work on Tuesdays, and today is Tuesday, then Jane is going to work today.
3. **Modus tollens:** Modus tollens is the opposite of modus ponens because it infers that if P implies Q, and Q is not true, then P is not true. For example, if Jane goes to work on Tuesdays, and Jane doesn't go to work today, then today is not Tuesday.

Examples of deductive reasoning

The following are several examples of deductive logic to give you a better understanding of how this skill is used in real life:

- A marketing team performs market research related to how much time professional women who are also mothers have to spend on their makeup each day. Based on their findings, they discover that professional women who are also mothers rarely have more than 10 minutes each day to put on their makeup due to family responsibilities. Using this information, the marketing team advertises that their makeup product can be put on in under three minutes, leaving ample room for other activities involved in getting ready each day. They realize an increase in sales in this makeup product.
- A student at a local university was informed that the career center at their college is offering free help with resumes. Because the student is an active member of the college and they have a resume, they assume they will not need to pay to get help with their resume at the career center.
- A customer service center recently received an influx of customer complaints due to how long it takes a member of the customer service team to return customer calls. Therefore, if the customer service center begins providing faster return calls, the customer complaints will stop and customers will be more satisfied with their experiences.
- A clothing retail store owner notices a trend in which customers are buying more dark denim jeans than other varieties of denim jeans. The owner uses this information to spend most of their advertising dollars in a local magazine to promote the dark denim jeans available at their store and offers a discount on dark denim jean purchases.

Q. 2 Explain the concept of research design and critically discuss the classification of research design.

Research design is the framework of research methods and techniques chosen by a researcher. The design allows researchers to hone in on research methods that are suitable for the subject matter and set up their studies up for success.

The design of a research topic explains the type of research (experimental, survey research, correlational, semi-experimental, review) and also its sub-type (experimental design, research problem, descriptive case-study).

There are three main types of designs for research: Data collection, measurement, and analysis.

The type of research problem an organization is facing will determine the research design and not vice-versa. The design phase of a study determines which tools to use and how they are used.

An impactful research usually creates a minimum bias in data and increases trust in the accuracy of collected data. A design that produces the least margin of error in experimental research is generally considered the desired outcome. The essential elements are:

1. Accurate purpose statement
2. Techniques to be implemented for collecting and analyzing research
3. The method applied for analyzing collected details
4. Type of research methodology
5. Probable objections for research
6. Settings for the research study
7. Timeline
8. Measurement of analysis

Proper research design sets your study up for success. Successful research studies provide insights that are accurate and unbiased. You'll need to create a survey that meets all of the main characteristics of a design. There are four key characteristics:

Neutrality: When you set up your study, you may have to make assumptions about the data you expect to collect. The results projected in the research should be free from bias and neutral. Understand opinions about the final evaluated scores and conclusions from multiple individuals and consider those who agree with the derived results.

Reliability: With regularly conducted research, the researcher involved expects similar results every time. Your design should indicate how to form research questions to ensure the standard of results. You'll only be able to reach the expected results if your design is reliable.

Validity: There are multiple measuring tools available. However, the only correct measuring tools are those which help a researcher in gauging results according to the objective of the research. The questionnaire developed from this design will then be valid.

Generalization: The outcome of your design should apply to a population and not just a restricted sample. A generalized design implies that your survey can be conducted on any part of a population with similar accuracy.

The above factors affect the way respondents answer the research questions and so all the above characteristics should be balanced in a good design.

A researcher must have a clear understanding of the various types of research design to select which model to implement for a study. Like research itself, the design of your study can be broadly classified into quantitative and qualitative.

Qualitative: Qualitative research determines relationships between collected data and observations based on mathematical calculations. Theories related to a naturally existing phenomenon can be proved or disproved using statistical methods. Researchers rely on qualitative research methods that conclude "why" a particular theory exists along with "what" respondents have to say about it.

Quantitative: Quantitative research is for cases where statistical conclusions to collect actionable insights are essential. Numbers provide a better perspective to make critical business decisions. Quantitative research methods are necessary for the growth of any organization. Insights drawn from hard numerical data and analysis prove to be highly effective when making decisions related to the future of the business.

You can further break down the types of research design into five categories:

1. Descriptive research design: In a descriptive design, a researcher is solely interested in describing the situation or case under their research study. It is a theory-based design method which is created by gathering, analyzing, and presenting collected data. This allows a researcher to provide insights into the why and how of research. Descriptive design helps others better understand the need for the research. If the problem statement is not clear, you can conduct exploratory research.

2. Experimental research design: Experimental research establishes a relationship between the cause and effect of a situation. It is a causal design where one observes the impact caused by the independent variable on the dependent variable. For example, one monitors the influence of an independent variable such as a price on a dependent variable such as customer satisfaction or brand loyalty. It is a highly practical research method as it contributes to solving a problem at hand.

The independent variables are manipulated to monitor the change it has on the dependent variable. It is often used in social sciences to observe human behavior by analyzing two groups. Researchers can have participants change their actions and study how the people around them react to gain a better understanding of social psychology.

3. Correlational research design: Correlational research is a non-experimental research technique that helps researchers establish a relationship between two closely connected variables. This type of research requires two different groups. There is no assumption while evaluating a relationship between two different variables, and statistical analysis techniques calculate the relationship between them.

A correlation coefficient determines the correlation between two variables, whose value ranges between -1 and +1. If the correlation coefficient is towards +1, it indicates a positive relationship between the variables and -1 means a negative relationship between the two variables.

4. Diagnostic research design: In diagnostic design, the researcher is looking to evaluate the underlying cause of a specific topic or phenomenon. This method helps one learn more about the factors that create troublesome situations.

This design has three parts of the research:

· Inception of the issue

· Diagnosis of the issue

· Solution for the issue

5. Explanatory research design: Explanatory design uses a researcher's ideas and thoughts on a subject to further explore their theories. The research explains unexplored aspects of a subject and details about what, how, and why of research questions.

Q. 3 Discuss the concept of cluster sampling. In which situations, researcher could apply cluster sampling method in business research? Discuss critically.

Cluster sampling is a probability sampling technique where researchers divide the population into multiple groups (clusters) for research. Researchers then select random groups with a simple random or systematic random sampling technique for data collection and data analysis.

Example: A researcher wants to conduct a study to judge the performance of sophomore's in business education across the U.S. It is impossible to conduct a research study that involves a student in every university. Instead, by using cluster sampling, the researcher can club the universities from each city into one cluster. These clusters then define all the sophomore student population in the U.S. Next, either using simple random sampling or systematic random sampling and randomly pick clusters for the research study. Subsequently, by using simple or systematic sampling, the sophomore's from each of these selected clusters can be chosen on whom to conduct the research study.

In this sampling technique, researchers analyze a sample that consists of multiple sample parameters such as demographics, habits, background – or any other population attribute, which may be the focus of conducted research. This method is usually conducted when groups that are similar yet internally diverse form a statistical population. Instead of selecting the entire population, cluster sampling allows the researchers to collect data by bifurcating the data into small, more productive groups.

Cluster sampling definition

Cluster sampling is defined as a sampling method where the researcher creates multiple clusters of people from a population where they are indicative of homogeneous characteristics and have an equal chance of being a part of the sample.

Example: Consider a scenario where an organization is looking to survey the performance of smartphones across Germany. They can divide the entire country's population into cities (clusters) and select further towns with the highest population and also filter those using mobile devices.

Types of cluster sampling

There are two ways to classify this sampling technique. The first way is based on the number of stages followed to obtain the cluster sample, and the second way is the representation of the groups in the entire cluster. In most cases, sampling by clusters happens over multiple stages. A stage is considered to be the step taken to get to the desired sample. We can divide this technique into single-stage, two-stage, and multiple stages.

Single-stage cluster sampling:

As the name suggests, sampling is done just once. An example of single-stage cluster sampling – An NGO wants to create a sample of girls across five neighboring towns to provide education. Using single-stage sampling, the NGO randomly selects towns (clusters) to form a sample and extend help to the girls deprived of education in those towns.

Two-stage cluster sampling:

Here, instead of selecting all the elements of a cluster, only a handful of members are chosen from each group by implementing systematic or simple random sampling. An example of two-stage cluster sampling – A business owner wants to explore the performance of his/her plants that are spread across various parts of the U.S. The owner creates clusters of the plants. He/she then selects random samples from these clusters to conduct research.

Multiple stage cluster sampling:

Multiple-stage cluster sampling takes a step or a few steps further than two-stage sampling.

For conducting effective research across multiple geographies, one needs to form complicated clusters that can be achieved only using the multiple-stage sampling technique. An example of Multiple stage sampling by clusters – An organization intends to survey to analyze the performance of smartphones across Germany. They can divide the entire country's population into cities (clusters) and select cities with the highest population and also filter those using mobile devices.

Steps to conduct cluster sampling

Here are the steps to perform cluster sampling:

1. **Sample:** Decide the target audience and also the sample size.
2. **Create and evaluate sampling frames:** Create a sampling frame by using either an existing framework or creating a new one for the target audience. Evaluate frameworks based on coverage and clustering and make adjustments accordingly. These groups will be varied, considering the population, which can be exclusive and comprehensive. Members of a sample are selected individually.
3. **Determine groups:** Determine the number of groups by including the same average members in each group. Make sure each of these groups are distinct from one another.
4. **Select clusters:** Choose clusters by applying a random selection.
5. **Create sub-types:** It is bifurcated into two-stage and multi-stage subtypes based on the number of steps followed by researchers to form clusters.

Applications of cluster sampling

This sampling technique is used in an area or geographical cluster sampling for market research. A broad geographic area can be expensive to survey in comparison to surveys that are sent to clusters that are divided based on region. The sample numbers have to be increased to achieve accurate results, but the cost savings involved make this process of rising clusters attainable.

Cluster sampling in statistics

The technique is widely used in statistics where the researcher can't collect data from the entire population as a whole. It is the most economical and practical solution for statisticians doing research. Take the example of a researcher who is looking to understand the smartphone usage in Germany. In this case, the cities of Germany will form clusters. This sampling method is also used in situations like wars and natural calamities to draw inferences of a population, where collecting data from every individual residing in the population is impossible.

Cluster sampling advantages

There are multiple advantages to using cluster sampling. Here they are:

- **Consumes less time and cost:** Sampling of geographically divided groups requires less work, time, and cost. It's a highly economical method to observe clusters instead of randomly doing it throughout a particular region by allocating a limited number of resources to those selected clusters.
- **Convenient access:** Researchers can choose large samples with this sampling technique, and that'll increase accessibility to various clusters.
- **Data accuracy:** Since there can be large samples in each cluster, loss of accuracy in information per individual can be compensated.
- **Ease of implementation:** Cluster sampling facilitates information from various areas and groups. Researchers can quickly implement it in practical situations compared to other probability sampling methods.

In comparison to simple random sampling, tis technique can be useful in deciding the characteristics of a group such as population, and researchers can implement it without having a sampling frame for all the elements for the entire population.

Q. 4 Explain scientific thinking? Critically discuss the scientific methods applied in business research. Discuss with examples in detail.

Scientific Processes

At some point in your student career, you may have spent hours "learning" something, only to realize you were memorizing facts and not truly thinking about what you were studying. When you take time to reflect on what you are learning, do you always agree with the information.

Critical thinking, or systematically evaluating information before accepting or rejecting it, enables individuals to move beyond memorization of facts to truly learning about the world. The basis of scientific study is critical thought. Although fields such as biology are often used synonymously with the term, **science** actually refers to studying anything through objective, critical thinking about observations of the world.

Science strives to provide objective, testable answers to questions naturally arising from observation. It avoids subjective questions and answers better addressed by religion and society. Although scientific theories often spark controversy in human societies, a scientific hypothesis is meant solely to provide a testable, **falsifiable** explanation for observed natural phenomena. As you study biology, carefully consider each hypothesis or theory based on the observations and other available **data** before drawing conclusions.

Traditionally, the scientific method has been taught as a linear progression from observation to hypothesis to experimentation to conclusion. In reality, the scientific process follows a general framework in which observation is critical throughout. Focusing on the progression of logical thought involved in both science and everyday life is more important than following steps in a "scientific method."

Although observation and investigation are extremely valuable, science progresses only with innovation and creativity. If every scientist only proposed existing ideas, how could we improve understanding of the world? A **hypothesis**, or logical explanation for a set of observations, provides a framework for continued investigation of a situation.

Scientific processes require a hypothesis be derived by objective analysis of existing data, but moving from facts to a logical explanation of the facts often requires creativity. A hypothesis must be falsifiable, able to be proven incorrect by experimentation or continued observation. The nature of the scientific process requires that no scientific hypothesis can ever be proven true because it is impossible to know every piece of relevant data. Scientific knowledge is growing exponentially, and future observations or experiments could change what we understand about any topic. An objective explanation of existing facts could be proven false at any time by discovery of new facts contradicting the hypothesis.

The classical, step-wise scientific method involves **inductive reasoning** to develop a hypothesis deriving most logically from available data. Hypotheses may be generalized, but are usually specific to what can be observed and analyzed in a reasonable time frame. **Deductive reasoning** generates a specific set of testable predictions. Finally, testing specific predictions may disprove, support, or modify the hypothesis for additional testing.

Some scientific methodologies focus on a discovery process, using observations and extensive data analysis to develop new or global ideas. Hypotheses derived from this kind of scientific method are frequently innovative, using inductive reasoning to draw conclusions that change the way scientists view a topic. The goal of discovery-based science is to focus on the observations and data alone, avoiding the potential bias of seeking data to match an existing hypothesis.

In scientific research, complex or multifaceted hypotheses may encompass several supported, specific hypotheses or may be derived from the synthesis of a large volume of existing data. Because of their complex nature, years of testing may be required to collect new data to support or disprove this kind of hypothesis. With enough supporting evidence, a multifaceted hypothesis is designated a theory.

Scientific Methods

Although one "scientific method" does not exist, scientific investigation follows a basic framework to guide critical thinking about an observation or set of observations. Depending on the nature of the observation or question, scientists follow a progression of steps leading to objective hypotheses supported by data. Scientific methodologies are applicable in more than biology; they are valuable in every aspect of life.

Testing a Hypothesis

Disproving or providing support for any new hypothesis requires experimentation, observational study, and/or analysis of existing data. **Experiments** are scientific studies that assess a hypothesis by testing its predictions. In an experiment, scientists manipulate one factor, the **independent variable**, in order to discern its effect on another factor, the **dependent variable**. Conclusions about cause and effect can be drawn only when all other variables are controlled (kept constant). For comparison, a **control group** is tested in tandem with the **experimental group**. All factors except the independent variable are kept the same in both control and experimental groups in order to attribute differences in the dependent variable to changes in the independent variable.

When a problem cannot be analyzed by manipulation of the variables involved, comparative studies, extensive analysis of existing data, and systematic observation of new situations or environments may be used to evaluate a hypothesis. Many hypotheses cannot be tested directly and require extensive use of observational study and data analysis. Systematic, organized data collection and analysis disproves or provides support for hypotheses, but effort is required to avoid bias or inappropriate conclusions. Sometimes, correlation is mistaken for causation in non-experimental studies. When two events occur together frequently (correlation), drawing conclusions about the relationship between them (causation) may be premature, or even incorrect.

Sometimes, a hypothesis may describe a causal relationship between variables that cannot be investigated further through collection of correlation data, particularly in human studies. Scientists will sometimes use a **model system** to allow experimental analysis of the hypothesis. A model system is a living organism whose biology is analogous to human biology, at least in regards to the variables under investigation. Unlike human subjects, model organisms can be manipulated to control external variables in an experiment, allowing cause-and-effect relationships to be examined. Experiments in model systems provide additional support for causative relationships between two variables. For example, a high correlation between smoking and lung cancer exists in humans. Scientists cannot set up control and experimental groups of humans and ask them to smoke, or not smoke, for years in a controlled laboratory environment. To evaluate possible causative effects of smoking on lung cancer, studies are performed using rats as a model system. Although data collected in model systems may be affected by differences between humans and the model system being used, combining experimental data in one or more model systems with observational data in humans can provide stronger support for a hypothesis than either data set alone.

New data is analyzed in an objective manner to avoid bias. A hypothesis that is not supported is either discarded or modified in response to the complete body of data. A supported hypothesis is subject to additional testing until the body of supporting evidence is so extensive scientists no longer actively test it. Although many well-supported hypotheses have become integrated parts of textbook material, listed as though they are "facts," science can never prove a hypothesis. As you read a textbook, try to distinguish between observations and data, and the well-supported explanations derived from them. Consider whether you agree with the logic and support for each explanation separately. If you feel more evidence is necessary, do some additional research and see if you agree or disagree after you have gathered additional data.

A hypothesis that is broad enough to affect perspective on many scientific observations and phenomena becomes a **theory** when the supporting evidence is strong enough that continuing to test the main premise is considered a waste of resources. Many important theories begin with one or more observations so groundbreaking that the observations require a universal descriptor. The law of gravity is a classic example. In science, the term law refers to a very well-tested observation (or set of related observations) significant enough to affect a wide range of scientific investigations. Scientific laws only describe a phenomenon; they do not attempt to explain how the effect occurs. In this example, the law of gravity is the equation describing the response of objects attracted to one another, but does not explain why the objects are attracted. As physicists learned more, they were able to test the explanations, until hypotheses explaining the law of gravity were supported by enough evidence to become gravitational theory. Despite widespread evidence to support gravitational theory, science dictates that if an object were to behave in a way counter to the current understanding of gravity, scientists would discard gravitational theory and seek to find a new, testable hypothesis to explain the existing observations, including all new data.

Q. 5 Explain the concept of ordinal scale. In which situations, researcher could apply ordinal scales in business research. Discuss with examples in detail.

Ordinal Scale is listed 2nd in the four 'Levels of Measurement', as described by S.S. Stevens. The Ordinal scale includes statistical data type where variables are in order or rank but without a degree of difference between categories.

The ordinal scale contains qualitative data; 'ordinal' meaning 'order'. It places variables in order/rank, only permitting to measure the value as higher or lower in scale. The scale cannot generate a precise comparison between the two categories.

For instance, in a horse race, we only see the ranking of the horses that won as 1st, 2nd, and 3rd. The ranks don't tell us by how much distance did the first horse win or the third horse lose.

1. You can use an ordinal scale for research and survey purposes to understand the higher or lower value of a data set. The scale identifies the magnitude of the variables.
2. It does not explain the distance between the variables. The ordinal scale cannot answer "how much" different the two categories are.
3. Like a Likert scale, the ordinal scale can measure frequency, importance, satisfaction, likelihood, quality, and experience, etc.
4. The measures in ordinal scale do not have absolute value hence the real difference between adjacent values may not have the same meaning. For example, the values in the age scale "less than 20" and "20-50" do not have the same meaning as "50-80" and "over 80".

For better understanding and clear vision of the variables from ordinal scale several different methods can be used.

Common examples are pie charts or bar charts for visualization of ordinal data. The color gradation in bar charts can help indicate the nature of variables of the scale.

For instance, a single-direction scale like income ranges can use the darkness or lightness of single color to indicate the higher or lower income attribute. While a dual-direction scale, like the Likert scale can illustrate the variables using a neutral color for the item in the middle. Contrasting colors can be used on the two opposite sides of the scale.

Table charts are useful when you have to display frequencies and Mosaic plots are useful for showing relationships between two ordinal variables.

General use of ordinal scale is for online surveys on preference or opinions.

- Movie ratings: When you need the audience to rate movies you can generate a scale based on opinions that would help measure the success rate of the said movie. The items on the scale: Did not like, Tolerable, Liked, Liked a lot, and Loved.
- Ranking: Mobile or car users may be asked to rank a particular brand based on their price, features, appeal and usability. The audience can be asked to give a ranking from 1 to 4 based on their opinion.

1: best, 2: good, 3: need improvement and 4: bad.

Ranking can also be used to put school students in order of their marks in exams from rank 1 to 10; 1st being the student who received 99/100 until 10th position.

Ranking in the office can be used to reward employees based on their job performance. 1st,2nd and 3rd position could be given to employees.

- Likert scale: Likert-type questions can be used to understand employee satisfaction or receive feedback on a product of your company.

The scale may include attributes like: Very poor, Poor, Fair, Good, and Excellent.

The company can also use agree-disagree scale to evaluate your employee satisfaction with the company's environment and policies.

- Restaurant survey: A restaurant may design an online survey or may give their customers a survey paper to rate their service, food quality, waiting time and such.

For customer service and food quality: Very poor, Poor, Fair, Good, and Excellent

They can also ask "how likely" would they refer to other people about the restaurant; ranging from "not at all likely" to "extremely likely".

- The ordinal scale can be further used to categorize the audience based on:
  - Socio-economic status: Poor, middle class, rich
  - Education level: High school, bachelor's, Master's, PhD
  - Income level: low income, middle income, high income
- You can ask the target audience to rank brands from most liked to least liked based on their preference.

Ordinal scale mostly collects data by psychometric tests. Sometimes another scale such as interval or ratio is also grouped onto the ordinal scale.