

Lecture 5

Case study

THE CIO DILLEMA

Observation

The chief observation officer (CIO) of a firm observes that the newly installed Management Information System (MIS) is not being used by middle managers as much as was originally expected. The managers often approach the CIO or some other "computer expert" for help, or worse still, make decisions without facts. "There is surely a problem here," the CIO exclaims.

Information Gathering through Informal Interviews

Talking to some of the middle-level managers, the CIO finds that many of them have very little idea as to what MIS is all about, what kinds of information it could provide, and how to access it and utilize the information.

Obtaining More Information through Literature Survey

The CIO immediately uses the Internet to explore further information on the lack of use of MIS in organizations. The search indicates that many middle-level managers especially the old-timers are not familiar with operating personal computers and experience "computer anxiety." Lack of knowledge about what MIS offers is also found to be another main reason why some managers do not use it.

Formulating a Theory

Based on all this information, the CIO develops a theory incorporating all the relevant factors contributing to the lack of access to the MIS by managers in the organization.

Hypothesizing

From such a theory, the CIO generates various hypotheses for testing, one among them being: Knowledge of the usefulness of MIS would help managers to put it to greater use.

Data Collection

The CIO then develops a short questionnaire on the various factors theorized to influence the use of the MIS by managers, such as the extent of knowledge of what MIS is, what kinds of information MIS provides, how to gain access to the information, and the level of comfort felt by managers in using computers in general, and finally, how often managers have used the MIS in the preceding 3 months.

Data Analysis

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

Deduction

Based on the results, the manager deduces or concludes that managers do not use MIS owing to certain factors. These deductions help the CIO to take necessary action to rectify the situation, which might include, among other things, organizing seminars for training managers on the use of computers, and MIS and usefulness.

Research Language

- Theory
- Conceptualization
- Operationalization
- Variables
- Hypotheses
- Assumptions
- Population
-
- Sample
- Validity
- Reliability
- Data
- The research process
- Summary
- Methodological queries
- References

Concepts And Constructs

Constructs include happiness, recreation, love, hate, satisfaction, IQ, morality, etc. Scientist refer to these abstract concepts as constructs because they have been conceptually constructed to represent a name of something real that cannot be directly observed but may be useful to study or describe.

One can describe the difference between constructs and concepts in terms of set theory. Constructs extend over actual cases, whereas concepts extend over both actual and possible cases.

The terms "concept" and "construct" have similar meanings. Yet there is an important distinction. A concept expresses an abstraction formed by generalization from particulars. "Weight" is a concept: it expresses numerous observations of things that are more or less "heavy" or "light."

Constructs can be conceptually defined in that they have meaning in theoretical terms. They can be abstract and do not necessarily need to be directly observable.

Examples of concepts include common demographic measures: Income, Age, Education Level, number of Siblings. We can measure concepts through direct and indirect observations: Direct Observation: We can measure someone's weight or height. And, we can record the color of their hair or eyes.

Unit 2: Research Problem Identification and Formulation

Identification of Research Problem

Formulation of problem is the first and foremost step in a research work. The research problem can be formulated and selected rationally and then the whole research work can be conducted only if the identification of the problem is done precisely. To identify the problem a researcher should have some basic knowledge, which is then developed through discussion with experts or through the literature or by continuation of activities in the related field.

The research problem undertaken for the study must be carefully selected. This task is a difficult one, although it may not appear to be so.. Help may be taken from a supervisor in this connection. A research supervisor can at the most only help a researcher to choose a subject. Identifying the exact nature and dimensions of a problem is of major importance in research work. It is very essential that an investigator should learn how to recognize and define a problem.

The following steps are to be followed in identifying a research problem:

1. Determining the field of research in which a researcher is keen to do the research work.
2. Develop the mastery on the area or in field of specialization.
3. Review the recent research conducted in the selected area.
4. On the basis of review, select the priority field of the study.
5. Draw an analogy and insight in identifying a problem or employ the personal experience of the field in locating the problem. In this process researcher can take help of supervisor or expertise of the field.

6. Pin-point specific aspect of the problem which is to be investigated.

Ways of Understanding Research Problem

The selection of a suitable problem is not an easy task. It is a serious responsibility to commit oneself to a problem that will inevitably require much time and energy and which is so academically significant. Specifically, the concept for separating out the research problem from the diversified field can be made by the

- i. Discussion among the colleagues
- ii. Discussion with the research guide
- iii. Discussion with some experts and
- iv. Intensive reading all the available literature.

The following are the general ways for understanding problem to which one may proceed for a suitable research:

1. Personal experience of the investigator in any field is the main means for understanding a suitable problem.
2. The other ways of understanding of problem, most frequently used by the investigator as suggested by the supervisors, is the extensive study of available literature-research abstracts, journals, hand-books of research international abstracts etc
3. In the choice of a suitable problem, the researcher has to decide his field of investigation. He should study the field intensively in the specific area; this may enable him to identify a problem from the specific field.
4. The new innovations, technological changes and curricular developments are constantly bringing new problems and new-opportunities for social research.
5. The most practical ways of understanding problem is to consult supervisor, experts of the field and most experienced person of the field
6. It is a general practice that researchers suggest some problems in their research reports. The researcher can understand a suitable problem for his own study.

Steps in Research Problem Formulation

. In a scientific inquiry, the formulation of general topic into a specific problem is the formulation of research problem. The researcher must try to understand the whole problem thoroughly and then rephrasing the same into meaningful terms from an analytical point of view. The following points are suggested as the steps for the formulation of research problem.

- Statement of problem in general way
- Understanding the nature of the problem
- Surveying the available literature
- Developing the ideas through discussion
- Rephrasing the research problem.

Criteria of a Good Problem

Fred. N. Kerlinger has defined a good problem as an inquisitive sentence statement that asks what relation exists between two or more variables. The research questions, research objectives and the hypotheses of the research lie on the problem statement of the research work. So for selecting research questions, setting research objectives and the hypothesis of the research selected problem should be an ideal one. An ideal research problem must have the following three main criteria:

1. *The problem should express a relation between two or more variables.* The topic of the research work reflects the research problem and it would be inquisitive and interesting if stated in terms of relation between variables.
2. *The problem should be stated rigidly and unambiguously.* If a research problem has ambiguity and haziness in its interpretation consequently it affects research design and the whole research process and hence the result of the study.
3. *The problem statement should be such as to imply possibilities of empirical testing.* In case, when problem statement expresses the relationship between two variables and is stated rigidly but if the testing the relationship in the circumstances of adopted research design and within the available facility is impossible then the selected problem cannot be good problem. Thus, a good research problem should always be linked with the research design and it must consider the available facility and capability of the study.

Problem Statement

Developing a problem statement includes some combination of the interrelated tasks like generation of an issue, exploration of an issue, and from that exploration determining worthwhile research questions. The problem statement has thus the following three characteristics:

- It should raise a question about a relationship between variables.
- The relationship between the variables should be stated and explained clearly.
- The problem statement should suggest a method of researching the question.

A statement of problem could be stated either in declarative or in interrogative form.

EXAMPLES

Declarative: Factors contributing to the excessive absenteeism among Nepalese workers.

Interrogative: Why is absenteeism so high among workers in Nepalese organizations?

The following are some examples of well-defined research problems. These are stated in interrogative form:

EXAMPLES

- To what extent do age, education, length of service, level of earning, and place of residence of employees predict occupational aspirations?
- Do long work hours, lack of development opportunities, and discrimination account for the lack of inward mobility of women in civil service?
- Can cultural differences account for the differences in the nature of hierarchical relationships between supervisors and subordinates?

Problem statement that appeared in a research report is given here as an example:

EXAMPLES A review of research studies on leadership and age (Kabacoff & Stoffey, 2001) reveals the controversy and recent interest in examining the relationship between the variables. These studies explain some reasons for the importance of the association between age and leadership. In the first place, they explain that older workers remain in employment for longer years and they work side by side with younger members in various work and leadership roles. It

is no secret that today's workers, as a result of several reasons; live much longer than their counterparts in the last generation.

As older and younger employees abound in organizations there is the need to manage both of them effectively in order to realize organizational goals more fully. Both age groups have something to offer: technology has driven the rapid promotion of younger workers while experience has made the older worker very relevant. In addition, today's flatter organizations give greater interaction between younger and older workers and the practice of leadership is no longer an exclusive domain of the older people, as it used to be. In several organizations, therefore, top management team will comprise of multigenerational members. It is argued that the ability to understand, learn, and effectively leverage multigenerational diversity will be necessary for organizations now and in the future to build and maintain high performance systems (Kabacoff & Stoffey, 2001, p.2).

Another reason that underscores the importance of the study of the relationship between leadership and age is the finding by kakabedse. et al. (1998) that age, along with other time-related dimensions, has a powerful effect in shaping the attitudes and hence the behaviors of senior leaders within organizations. In a study undertaken in Australia, three leader profiles emerged - the radicals, the Bureaucrats and the team players. The radicals were the youngest (between 26- 35years), the team players were the oldest (56 years and over), while the bureaucrats were in between (45-55 years). Older workers were mature, saw challenges and had longer-term perspectives in managing people and systems. On the other hand, younger employees were competitive, result oriented, energetic and adopted an open style management.

Research Questions

Research is intended to help us learn something new. The research process encloses the research questions, the most important element of any research, for the effective execution of research activity. We often define our research goals in terms of questions and hence research questions describe the ideas contained in the research objectives. Research questions are the interrogative form of research objectives. Research questions are such questions that can help the researcher learn something new- fruitfully Formulation of research questions is the real starting point in preparation of a research process. The data required to be collected for the study are determined by the help of the research questions. The research design is necessarily based on the research questions; the research method to be adopted for the study of specific problem is also set on these questions. The data analysis tools and methods, result interpretation procedures and writing phases of the reports are also determined by the research questions. The questions have to be related to three aspects: What, Why and How? What question seeks descriptions, why question seek explanation and understanding and how question seek interventions to bring about change. If the researcher does not have clear formulated research questions at the starting point of the research in his practical field, then He (she) may face different challenges to precede the direction of research.

Types of Research Questions

Generally there are three types of research questions, they are: What questions (concerned with description), Why questions (concerned with explaining causes) and how questions (concerned with bringing about change). 'What questions' pertain to describing the characteristic of trend and pattern in the given situation? For example: What are the types of community involved in transformation of skills?, What are the socio economic characteristics of community?, what are the needs of the community ? etc. Why question relate to the cause or reasons for the characteristics of the particular phenomenon and the behavior of the individual involved. They also explain the relationship between events and activities. For example: Why do drug abusers commit thefts? , Why does stressful living result in heart attacks?, Why do some people use a product while other do not? How questions are concerned with bringing about change and the outcomes of change. For example: How has caste system changed in Nepal in last century?, How does technology create unemployment?, How do MC health service affect infant mortality?

Besides these three types of question different authors have proposed different types of research questions. Lin (1993) has proposed four more types of research questions they are Who, Where, How many and How much.

Identification of Research Question

The main purpose of formulating research question is to define the scope of the research. It is used to determine what is to be studied and the extent to which it will be studied. Neuman _ (1997) offered some techniques of developing research questions, which are:

- Record all questions that occur in mind after reading literature or after discussions with other or after thinking on various aspects of study.
- Review all these questions whether each question is necessary and delete those which are beyond the scope of the study. This will also remove overlapping between questions.
- Classify questions on the basis of their nature, i.e. What, Why and How questions
- Examine the scope of the questions for availability of time and money; chose these which can be answered within manageable time and resources.
- Separate major or key questions (which for the core of the research) from subsidiary questions.

Hypothesis

Definition

A hypothesis proposes relationship between two or more variables. In common usage, a hypothesis refers to a provisional idea whose merit requires evaluation. For example: **political participation increases with education**. This simple assertion can be seen as a hypothesis. **It has a subject (the variable, political participation), a connective verb (a relationship, increases), and an object (the variable, education)**. This hypothesis takes two basic ideas "political participation" and "education" and suggests that they are connected to the extent that as one increases then the other increases as well. This can be stated in more mathematical terms as one variable being directly proportionate to the other.

Fred N. Kerlinger and H. B. Lee (2000): "A hypothesis is a conjectured statement that implies or states a relationship between two or more variables".

John W. Creswell (2014): "A hypothesis is a formal statement that presents the expected relationship between independent and dependent variables". A hypothesis is thus a statement about the relationship between two or more variables which needs to be investigated for its truth. It is basically a working assumption. If the relationship between two variables is found as the hypothesis predicts, then the hypothesis is supported and a new theory has been suggested. A good hypothesis states as clearly as possible the expected relationship (or difference) between two variables and defines these variables in operational and measurable terms.

Functions of Hypothesis

Specifically, a hypothesis serves the following functions (Kumar, 2011):

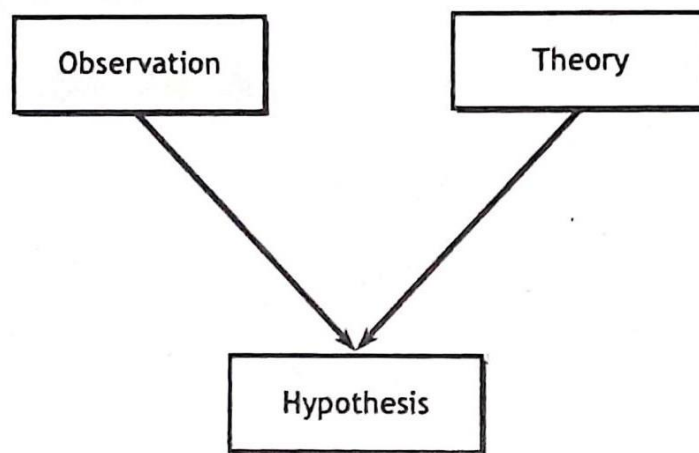
- The formulation of a hypothesis provides a study the focus. It tells you what specific aspects of a research problem to investigate.
- A hypothesis tells you what data to collect and what not to collect, thereby providing focus to the study.
- As it provides a focus, the construction of a hypothesis enhances objectivity in a study.
- A hypothesis may enable you to add to the formulation of theory. It enables you to specifically conclude what is true or what is false.

Hypothesis Formulation

Hypothesis can be derived in a variety of ways i.e. general culture, past research/scientific theory, personal experience, discussion and conversations and intuition. A researcher observes a social situation and come to a conclusion about some of the variables which are operating within it. You could then develop some hypotheses which connect two or more of these variables. Generally there are two grounds on which a hypothesis may be justified: logical and empirical.

Logical justification is developed from arguments based on concepts and theories relating directly to the research problem. Empirical justification is based on reference to other research found in the literature. Hence, in order to formulate a useful hypothesis, you need to have good knowledge of the background to the subject and the nature of the problem or issue which is being addressed. A hypothesis statement is derived directly from the statement of the problem. Hypothesis can be stated rather easily once the research problem is known. The hypothesis is thus more operational than the problem statement.

A diagrammatic presentation of the process of hypothesis formulation is given in figure.



Hypothesis generation and testing require an understanding of the deductive and inductive reasoning. A simple definition of deductive reasoning is "taking a known idea or theory and applying it to a situation with the intention of testing whether it is true". Deduction is thus the process of arriving at conclusion by interpreting the meaning of the results of the data analysis. In this form of reasoning, one goes from general knowledge to specific knowledge. For example, consider the following two arguments:

Argument 1

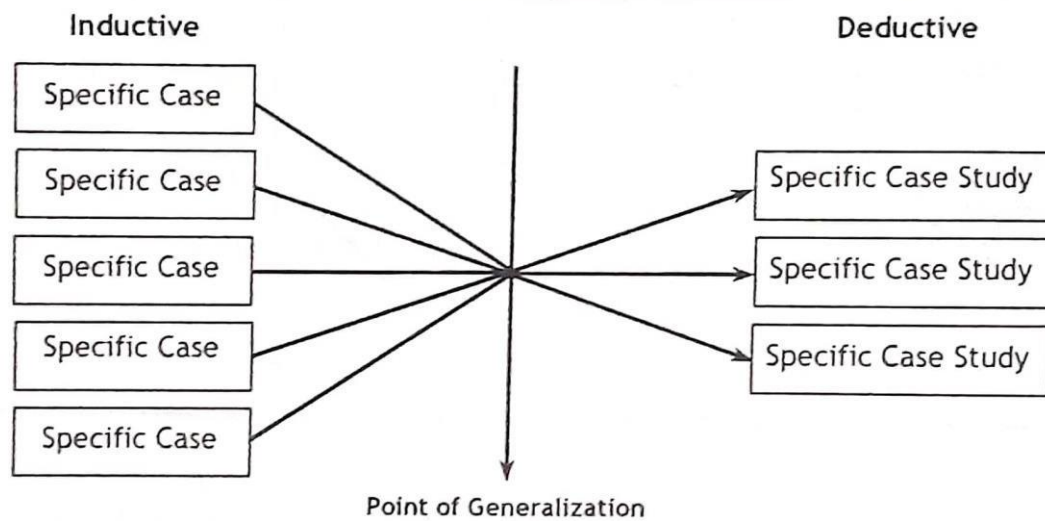
- All books have pages (theory or generalization).
- This is a book (empirical observation - fact).
- Therefore, this book has pages (logical conclusion).

Argument 2

- Lung cancer is caused by smoking (theory or generalization).
- John has lung-cancer (empirical observation-fact).
- John was a cigarette smoker (logical conclusion).

Deduction starts from a generalization and goes to a specific case. Inductive reasoning is the opposite. A simple definition of inductive reasoning is "using observation to formulate an idea or theory". Induction is thus the process of examining many cases and then generalizing from them. In this form of reasoning, one goes from a specific knowledge to the general knowledge. Looking at the cigarette-cancer example, the researcher would investigate whether the people who have long-cancer had previously smoked before they received cancer. Both induction and

deduction are used by the researchers to organize facts, describe results, develop new relationship, and suggest new research.



Deductive logic, as stated above, is useful for going from a general problem to a specific hypothesis. This statement can be understood by an example:

■ **Problem:** Nepal's population is increasing so rapidly that if it continues at its present rate, in 30 years, it will not be possible to feed all of its citizens.

■ **Theory:** Population growth can be controlled through family planning clinics.

■ **Hypothesis:** Family planning can reduce the growth of population in Nepal.

The above example is stated in very general terms and later will be made specific so that it can be tested, but it is a good example of the deductive logic used in a thesis. The problem statement has been created from the facts of Nepal's present population and from the prediction of its growth in the future. The prediction is made from examining past facts of population growth in Nepal. The theory is a very general theory, which has been true in other parts of the world; it has almost become a principle for population control. The hypothesis is the result of deductive logic from the first two statements.

It is now possible to examine the stating of problems and hypotheses. The problem asks about the relation between several facts or observations. Accordingly, the hypothesis suggests that the relationship exists. It is important to realize that the hypothesis has to be stated in a very specific terms so that the means of investigating the hypothesis are included in the statement. A problem is formulated in the form of a question; it serves as the basis or the origin from which a hypothesis is derived. A hypothesis is a suggested solution to a problem. A problem (question) cannot be directly tested, whereas a hypothesis can be tested and verified. Hence, a problem cannot be scientifically solved unless it is reduced to hypothesis form.

EXAMPLE

Research Problem: What is the relationship between population growth in Kathmandu before the introduction of family planning and after the introduction of family planning?

Research Hypothesis: There is a significant difference in the population growth in Kathmandu between when family planning was first introduced and five years later.

Hypothesis statements should be clear if the definition of a variable is understood as some characteristic, which changes. The above hypothesis is simply stating that two groups exist in relation to some characteristic. If there is a significant difference between the two groups then the hypothesis is supported. The theory that family planning can reduce the growth of population in Nepal is supported and becomes tentative. Hence, there appears to be a solution to the population problem in Nepal.

One-sided Vs Two-sided Hypothesis

During the planning of our research, we need to specify whether we plan to use a one-sided or two-sided hypothesis. A one-sided hypothesis states a specific direction (e.g. increase or decrease). If a change in the unexpected direction is equivalent in practice to no change, then we should use a one-sided hypothesis. A two-sided hypothesis states that there is a difference between the dependent and independent variable, but does not specify the direction. If we expect that a change in either direction is possible and that changes in either direction are interested, then we should use a two-sided hypothesis.

Formats of Stating Hypothesis

The different formats of hypothesis construction based on association and correlation between variables are as follows:

Correlation There is a significant relationship between Variable A and Variable B for Group 1,

Difference between Means

There is a significant difference between mean levels of Variable A for Group 1 and Group 2.

Difference between Frequencies

There is a significant relationship between Group 1 and Group 2 for Variable A. There is a significant difference between Group 1, 2 and 3 for the following variables:

Variable A **Variable B** etc.

Types of Hypothesis

1. Descriptive and Relational Hypothesis

Research hypothesis can be classified as: descriptive and relational. Descriptive hypotheses are in the form of propositions that only state the existence, size, form, or distribution of some variable (Cooper & Schindler, 2011).

EXAMPLES

- Tribhuvan University (case) is experiencing budget difficulties (variable).
- The Hetauda- Narayangadh sector of the East-West Highway (case) has a higher-than- average accident rates (variable).
- The average stockholders of Nepal Development Bank (case) favor returns in the form of bonus dividends (variable).

These descriptive statements contain only one variable. Hence, the relationship between variable cannot be studied and explored. These statements do not fulfill the criteria of research hypotheses. It is, therefore, advisable to use research questions rather than descriptive hypotheses. The research questions for the above three statements could be stated as follows:

EXAMPLES

- What is the extent of budget difficulties in Tribhuvan University?
- Why is the accident rate higher in Hetauda-Narayangadh sector of the East-West Highway?
- Why do the stockholders of commercial banks favor returns in the form of bond dividends?

A relational hypothesis, on the other hand, describes the relationship between two or more variables with respect to some case. Relational hypotheses are of two types: correlational hypothesis and explanatory (causal) hypothesis. When a statement describes the relationship between two variables, it is called a correlational hypothesis.

EXAMPLES

- Families with higher incomes spend more for recreation.
- With education people's political participation will increase.

2. Explanatory Hypotheses

In an explanatory hypothesis, the implications of one variable on the other are stated. How one variable would cause or lead to a change in the other variable? Such causal relations can be unidirectional, in which variable A influences variable B, but not vice versa. They can also be bidirectional, in which each variable influences the other. The following are the examples of unidirectional and bidirectional relations:

EXAMPLES

- The increase in age would lead to decrease in organizational commitment.
- The productivity of skilled workers will increase if the workers are given added pay for production in excess of the standard.

3. Directional and Non-directional Hypotheses

The directional hypothesis indicates the particular direction of the expected relationship between two variables. These relationships could be stated in positive or negative form. In stating the relationship between the two variables, the terms such as "positive", "negative", "more than", "less than" and the like are used. The directional hypothesis requires a one-tailed test. The following are the examples of directional hypotheses.

EXAMPLES

- Younger workers are less motivated than older workers.
- The greater the workload, the lower the job satisfaction of the workers..

The non-directional hypotheses are formulated when there are no clues available about the positive or negative relationship between two variables. Hence, these hypotheses do not indicate any direction of the relationship or difference and require a two-tailed test. Non-directional hypotheses are formulated in cases where previous studies do not exist or indicate conflicting findings (Sekaran & Bougie, 2013). The following are some examples of non-directional hypothesis:

EXAMPLES

- There is a difference between work attitudes of industrial and agricultural workers.
- There is no relationship between educated and uneducated employees in their occupational commitments.

4. Null and Alternative Hypotheses

There are the two methods of stating the hypothesis: null and alternative: A null hypothesis is

a statistical hypothesis that is tested for possible rejection under the assumption that it is true. The hypothesis contrary to null hypothesis is known as alternative hypothesis. In other words, a null hypothesis is a hypothesis set up to be nullified or refuted in order to support an alternative hypothesis. The null hypothesis is called null because it usually reflects the "no-difference" or "no-effect" situation.

The following example would clarify the concepts of null and alternative hypothesis. Suppose you are interested in a study to determine whether production would increase if the skilled workers are given a bonus or incentive pay for production in excess of a standard. For this investigation, you can formulate a research hypothesis in the following way:

EXAMPLE

The productivity of skilled workers will increase if they are given added pay for production in excess of the standard.

This is a positive statement whose validity you would attempt to test through your research. However, many researchers would object to the use of a positive hypothesis like this. A positive hypothesis like this may indicate a built-in prejudice on the part of the researcher toward a result favoring the hypothesis. To them, a null hypothesis is more desirable. The null hypothesis takes the form of a statement indicating no prejudice toward an answer. How can then this hypothesis be stated in a null form? The following is an example:

EXAMPLE No significant difference will exist between productivity of skilled workers on an incentives plan and productivity of skilled workers on a regular wage plan.

This null hypothesis thus indicates a definitive, exact relationship between two variables. That is, it states that the population correlation between two variables is equal to zero, or that the difference in the means of two groups in the population is equal to zero. In statistics, the only way of supporting your hypothesis is to refute your null hypothesis. Rather than trying to prove your idea (the alternative hypothesis) right, you must show that the null hypothesis is likely to be wrong. You have to refute or nullify the null hypothesis. You have to assume that your alternative hypothesis is wrong until you find evidence to the contrary. The following is another example of null hypothesis:

H_0 : There is no difference between male and female statistically in their productivity.

Statistically expressed: $H_0: \mu_1 = \mu_2$

Where, H_0 = the null hypothesis

μ_1 = the productivity of male workers

μ_2 = the productivity of female workers

The alternate form of the above null hypothesis can be formulated as follows:

H_A : Male workers will have more productivity than female workers, or female workers will have less productivity than male workers.

Statistically expressed: $H_A : \mu_1 >$

μ_2 where, H_A = the alternate

hypothesis μ_1 = the productivity

of male workers

μ_2 = the productivity of female workers

From the above example, it is clear that an alternative hypothesis, which is the opposite of the null, is a statement expressing a relationship between two variables or indicating differences between groups. The following are some other examples of null and alternative hypotheses:

- H_0 : There is no relationship between working conditions and job satisfaction of employees.

H_A : If the working conditions are improved, then the job satisfaction of employees will

improve. H_0 : There is no difference between male and female workers in their organizational commitment. H_A : Male workers will have greater organizational commitment than female workers.

- H_0 : There is no relationship between pay and productivity. H_A : Pay and productivity are positively related.

- H_0 : Working condition, pay and fringe benefits have no influence on job satisfaction of workers.

H_A : Working conditions, pay and fringe benefits all have positive influence on job satisfaction of workers.

Stating the Null Hypothesis

- There is no difference between the means of the two populations from which the two samples were drawn at random.

- The two means in the two populations from which the samples were respectively

drawn at random are equal.

Criteria of Good Hypothesis Statement

The main requirement of hypothesis formulation is that it should fulfill certain basic criteria. Many different criteria can be found in the literature over what are the desirable qualities of a "good" hypothesis. Mason and Bramble (1997) outline the important features (criteria) of good hypothesis statement as follows: •

- Hypothesis should be stated in declarative form.
- Hypothesis should state the expected (articulated) relationship between two or more variables.
- Hypothesis should be testable empirically.
- Hypothesis should be limited in scope.
- Hypothesis should be clearly and precisely stated. There should be no ambiguity in the variables or the relationships proposed.
- Hypothesis should state the conditions and circumstances under which it is supposed to apply.
- Hypothesis should reflect a guess at a solution or outcome to a problem based upon some knowledge, previous research, or identified needs. It should be consistent with most known facts.

Linkage between Research Hypothesis and Statistical Hypothesis

A research hypothesis is a specific and focused hypothesis that guides a research project or study. It is derived from a broader research question or problem, and it reflects the objectives and expectations of the researcher. For example, a research question could be: "How does gender affect the academic performance of students?". A research hypothesis could be: "Female students have higher grades than male students".

A statistical hypothesis is a hypothesis that can be formally tested with statistical methods and techniques. It is usually expressed in terms of parameters or distributions of a population or a sample. For example, a statistical hypothesis could be: "The mean height of men is equal to 175 cm".

In statistical hypothesis there are two types, null and alternative. Null is default hypothesis as statistical tests are designed to test homogeneity only. Almost Statistical tests can't test heterogeneity. This restriction is important as research question may go along with Null or

Alternative hypothesis. It is also useful to avoid further confusion as whatever research question default hypothesis will be null.