Research Design

The formidable problem that follows the task of defining the research problem is the preparation of the design of the research project, popularly known as the "research design". Decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study constitute a research design. "A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure." In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data. As such the design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data.

Types of Research Design

There are different types of research designs. They may be broadly categorized as: (1) Exploratory Research Design; (2) Descriptive and Diagnostic Research Design; and (3) Hypothesis-Testing Research Design.

1. **Exploratory Research Design:** The Exploratory Research Design is known as formulative research design. The main objective of using such a research design is to formulate a research problem for an in-depth or more precise investigation, or for developing a working hypothesis from an operational aspect. The major purpose of such studies is the discovery of ideas and insights. Therefore, such a research design suitable for such a study should be flexible enough to provide opportunity for considering different dimensions of the problem under study. The in-built flexibility in research design is required as the initial research problem would be transformed into a more precise one in the exploratory study, which in turn may necessitate changes in the research procedure for collecting relevant data. Usually, the following three methods are considered in the context of a research design for such studies. They are (a) a survey of related literature; (b) experience survey; and (c) analysis of 'insight-stimulating' instances.
2. **Descriptive And Diagnostic Research Design:** A Descriptive Research Design is concerned with describing the characteristics of a particular individual or a group. Meanwhile, a diagnostic research design determines the frequency with which a variable

occurs or its relationship with another variable. In other words, the study analyzing whether a certain variable is associated with another comprises a diagnostic research study. On the other hand, a study that is concerned with specific predictions or with the narration of facts and characteristics related to an individual, group or situation, are instances of descriptive research studies. Generally, most of the social research design falls under this category. As a research design, both the descriptive and diagnostic studies share common requirements, hence they are grouped together. However, the procedure to be used and the research design need to planned carefully. The research design must also make appropriate provision for protection against bias and thus maximize reliability, with due regard to the completion of the research study in an economical manner. The research design in such studies should be rigid and not flexible. Besides, it must also focus attention on the following: a) Formulation of the objectives of the study, b) Proper designing of the methods of data collection, c) Sample selection, d) Data collection, e) Processing and analysis of the collected data, and f) Reporting the findings.

3. **Hypothesis-Testing Research Design:** Hypothesis-Testing Research Designs are those in which the researcher tests the hypothesis of causal relationship between two or more variables. These studies require procedures that would not only decrease bias and enhance reliability, but also facilitate deriving inferences about the causality. Generally, experiments satisfy such requirements. Hence, when research design is discussed in such studies, it often refers to the design of experiments.

Need for research design:

Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money. Just as for better, economical and attractive construction of a house, we need a blueprint (or what is commonly called the map of the house) well thought out and prepared by an expert architect, similarly we need a research design or a plan in advance of data collection and analysis for our research project. Research design stands for advance planning of the methods to be adopted for collecting the relevant data and the techniques to be used in their analysis, keeping in view the objective of the research and the availability of staff, time and money. Preparation of the research design should be done with great care as any error in it may upset the entire project. Research design, in fact, has a great bearing on

the reliability of the results arrived at and as such constitutes the firm foundation of the entire edifice of the research work.

Even then the need for a well thought out research design is at times not realised by many. The importance which this problem deserves is not given to it. As a result many researches do not serve the purpose for which they are undertaken. In fact, they may even give misleading conclusions. Thoughtlessness in designing the research project may result in rendering the research exercise futile. It is, therefore, imperative that an efficient and appropriate design must be prepared before starting research operations. The design helps the researcher to organize his ideas in a form whereby it will be possible for him to look for flaws and inadequacies. Such a design can even be given to others for their comments and critical evaluation. In the absence of such a course of action, it will be difficult for the critic to provide a comprehensive review of the proposed study.

Principles of research design:

Professor Fisher has enumerated three principles of experimental designs: (1) the Principle of

Replication; (2) the Principle of Randomization; and the (3) Principle of Local Control.

1. **The Principle Of Replication:** According to this principle, the experiment should be repeated more than once. Thus, each treatment is applied in many experimental units instead of one. This way the statistical accuracy of the experiments is increased. For example, suppose we are going to examine the effect of two varieties of wheat. Accordingly, we divide the field into two parts and grow one variety in one part and the other variety in the other. Then we compare the yield of the two parts and draw conclusion on that basis. But if we are to apply the principle of replication to this experiment, then we first divide the field into several parts, grow one variety in half of these parts and the other variety in the remaining parts. Then we collect the data of yield of the two varieties and draw conclusion by comparing the same. The result so obtained will be more reliable in comparison to the conclusion we draw without applying the principle of replication. The entire experiment can be repeated several times for better results.

2. The Principle Of Randomization: When we conduct an experiment, the principle of randomization provides us a protection against the effects of extraneous factors. This means that this principle indicates that the researcher should design or plan the experiment in such a way that the variations caused by extraneous factors can all be combined under the general heading of 'chance'. For example, when a researcher grows one variety of wheat , say , in the first half of the parts of a field and the other variety he grows in the other half, then it is just possible that the soil fertility may be different in the first half in comparison to the other half. If this is so the researcher's result is not realistic. In this situation, he may assign the variety of wheat to be grown in different parts of the field on the basis of some random sampling technique i.e., he may apply randomization principle and protect himself against the effects of the extraneous factors. Therefore, by using the principle of randomization, he can draw a better estimate of the experimental error.

3. The Principle Of Local Control: This is another important principle of experimental designs. Under this principle, the extraneous factor which is the known source of variability is made to vary deliberately over as wide a range as necessary. This needs to be done in such a way that the variability it causes can be measured and hence eliminated from the experimental error. The experiment should be planned in such a way that the researcher can perform a two-way analysis of variance, in which the total variability of the data is divided into three components attributed to treatments (varieties of wheat in this case), the extraneous factor (soil fertility in this case) and experimental error. In short, through the principle of local control we can eliminate the variability due to extraneous factors from the experimental error.