Research Methods & Technical Writing

Lesson 1 - Week 1

Introduction to Research Methodology

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Content

- Introduction
- What is Research?
- Objectives of Research
- Research types
- Approaches to research
- Research methods vs Methodology
- Research process
- Criteria of good research

Part 1

Introduction

Introduction

- As a student (whether undergraduate or postgraduate) regardless of the discipline you are studying you will be required at some point to undertake a study.
- If you are a student of the sciences, engineering or technology (what we simply call STEM) then this study will be in the form of a project. In the case of social sciences and humanities it will be perhaps a research project of some kind.
- The project is normally undertaken in two semesters (in the case of undergraduate students) and anywhere between 1 and 5 academic years for a postgraduate student.
- The project is normally in the form of you having to undertake some kind of investigation into some problem/opportunity, and solve the problem/opportunity as presented.

Introduction

- The deliverables are normally a proposal document (in the first semester), and a working system (in the case of technical students) or a report (in the case of social sciences and humanities) in the second semester.
- In both cases at the end of it all the problem has been solved or has been better understood.
- This course is designed to assist the learner to understand the steps taken into conducting a thorough investigation, that will lead to solving a problem or explaining phenomena.
- In the course of my professorship I have seen so many students struggle to understand how to go about conducting research; moreso, students don't understand WHY they are doing what they are doing, but rather simply follow direction given by their supervisors.
- This is very challenging, and most of the time it is because the students weren't exposed to a course where they could learn the WHY before learning the HOW.

Introduction

- This course has been designed to help the learner understand the whole research methodology process and also learn how to write the final report.
- By the end of the course the learner should be able to:
  - Understand research terminology.
  - Identify the types of methods best suited for investigating different types of problems and questions.
  - Develop research questions that are based on and build upon a critical appraisal of existing research.
  - Design a research proposal.
  - Begin initial preparations for embarking on a new research project.

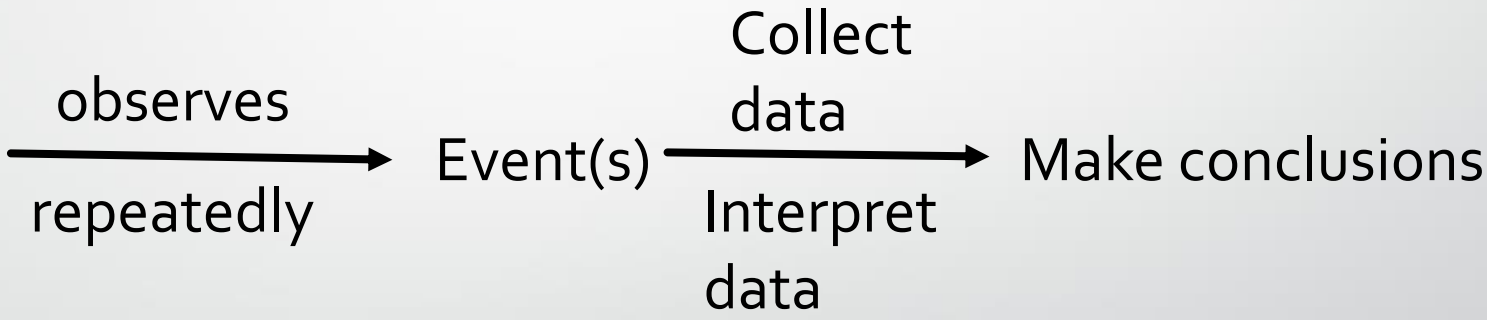
Part 2

What is Research?

2.1 What is research?

- Before delving into details regarding this topic the first thing to understand is "what is research" in the first place?
- How would you define research? Yes it's a word we commonly use in everyday language, so how would you define it?
- "Research is simply the process of arriving as dependable solution to a problem through the planned and systematic collection, analysis and interpretation of data."(sic) (Singh, 2006)
- Singh (2006) goes further to explain that research can be broken down into two words: "Re" plus "search"
- From the English dictionary we know that the prefix "re" means "again" or "again and again"; while the word "search" simply means to look for.
- The research process, consequently, can be captured as follows:

2.1 What is research?

- Student/Scientist 

2.2 Research definitions

- Singh (2006) in his book offers several definitions of research from different authorities; let us sample a few for clarity purposes:
- "Research is a point of view, an attitude of inquiry or a frame of mind. It asks questions which have hitherto not been asked, and it seeks to answer them by following a fairly definite procedure. It is not a mere theorizing, but rather an attempt to elicit facts and to face them once they have been assembled. Research is likewise not an attempt to bolster up pre-conceived opinions, and it implies a readiness to accept the conclusions to which an inquiry leads, no matter how unwelcome they may prove. When successful, research adds to the scientific knowledge of the subject." (Rusk)
- "Research is simply a systematic and refined technique of thinking, employing specialized tools, instruments, and procedures in order to obtain a more adequate solution of a problem than would be possible under ordinary means. It starts with a problem, collects data or facts, analysis these critically and reaches decisions based on the actual evidence. It evolves original work instead of mere exercise of personal. It evolves from a genuine desire to know rather than a desire to prove something. It is quantitative, seeking to know not only what but how much, and measurement is therefore, a central feature of it." (C.C. Crawford)

2.2 Research Definitions

- Additionally, P.M. Cook (in Singh, 2006) presents the following characteristics of research in his definition:
  - "1. It is an honest and exhaustive process.
  - 2. The facts are studied with understanding.
  - 3. The facts are discovered in the light of problem. Research is problem-centered.
  - 4. The findings are valid and verifiable.
  - 5. Research work should contribute new knowledge in that field."
- Cook's definition brings to light some key words that define research: process, understanding of facts, problem-centered, validity and verifiability of results, new knowledge.
- Based on all these definitions of research, it is possible to come up with some general characteristics of research.

2.3 Characteristics of Research

- Based on the various definitions of research, Singh (2006) describes the characteristics of research as:"
- 1. It gathers new knowledge or data from primary or first-hand sources.
- 2. It places emphasis upon the discovery of general principles.
- 3. It is an exact systematic and accurate investigation.
- 4. It uses certain valid data gathering devices.
- 5. It is logical and objective.
- 6. The researcher resists the temptation to seek only the data that support his hypotheses.

2.3 Characteristics of Research

- 7. The researcher eliminates personal feelings and preferences.
- 8. It endeavors to organize data in quantitative terms.
- 9. Research is patient and unhurried activity.
- 10. The researcher is willing to follow his procedures to the conclusions that may be unpopular and bring social disapproval.
- 11. Research is carefully recorded and reported.
- 12. Conclusions and generalizations are arrived at carefully and cautiously."

Part 3

Objectives of Research

3.1 Introduction

- As discussed in the previous section (from the definition of research), it has been ascertained that research is about finding answers to questions using a verifiable approach; a verifiable approach is synonymous to a scientific approach.
- Different authors present research into separate groupings. For purposes of understanding the objectives of research we examine the groupings by Kothari (2004) and Singh (2006).
- It is worth noting that the objectives of research can be loosely interpreted as being synonymous to the "purpose" of research. This is different from research objectives which are specific to a given research topic. Research objectives are the actions that you intend to undertake in the pursuit of finding a solution to the identified problem. There is normally a general objective, which is then broken down into specific objectives which are SMART (simple, measurable, achievable, realistic, time bound). These will be discussed later in the course.

3.2 Objectives of Research

- Kothari (2004) posits that research objectives can be grouped into 4 categories. His categories are based on the purpose of the research and are as follows:"
  - To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as *exploratory* or *formulative* research studies);
  - To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as *descriptive* research studies);
  - To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as *diagnostic* research studies);
  - To test a hypothesis of a causal relationship between variables (such studies are known as *hypothesis-testing* research studies)."

3.2 Objectives of Research

- Singh (2006) explains objectives of research from a different perspective, and presents three groupings:
  - Theoretical objective – these are those researches that purpose to bring about new theories, laws or principles. They explain relationships between variables and thus you would expect to find these in science oriented fields. The type of research is exploratory (compare this with the first grouping defined by Kothari (2004)).
  - Factual objective – as the name implies, these kinds of research purpose to find out new facts; they describe what happened previously and are therefore descriptive by nature. These will mostly be found in the arts, specifically in history. (compare with second grouping by Kothari (2004)).
  - Application objective – these do not add knowledge but suggest applications or improvements/modifications of what already exists.
- As can be seen both Singh (2006) and Kothari (2004) have similar descriptions in two groupings. However, in the remaining groupings they offer separate explanations.

Part 4

Research Types

4.1 Introduction

- There are many different types of research; a cursory examination of some of the existing literature, for example educba.com vs limbd.org vs innspub.net vs……. May actually confuse the first time research student.
- However, you are in the right place, and in this section we categorize the types of research into eight broad groupings. As is rightly observed by Kothari (2004) other groupings (which shall be mentioned after the 8 key groupings) are usually a derivation or cross between two or more of these 8 foundation types.
- Figure 1 shows 7 of the 8 groupings which are described thereafter.

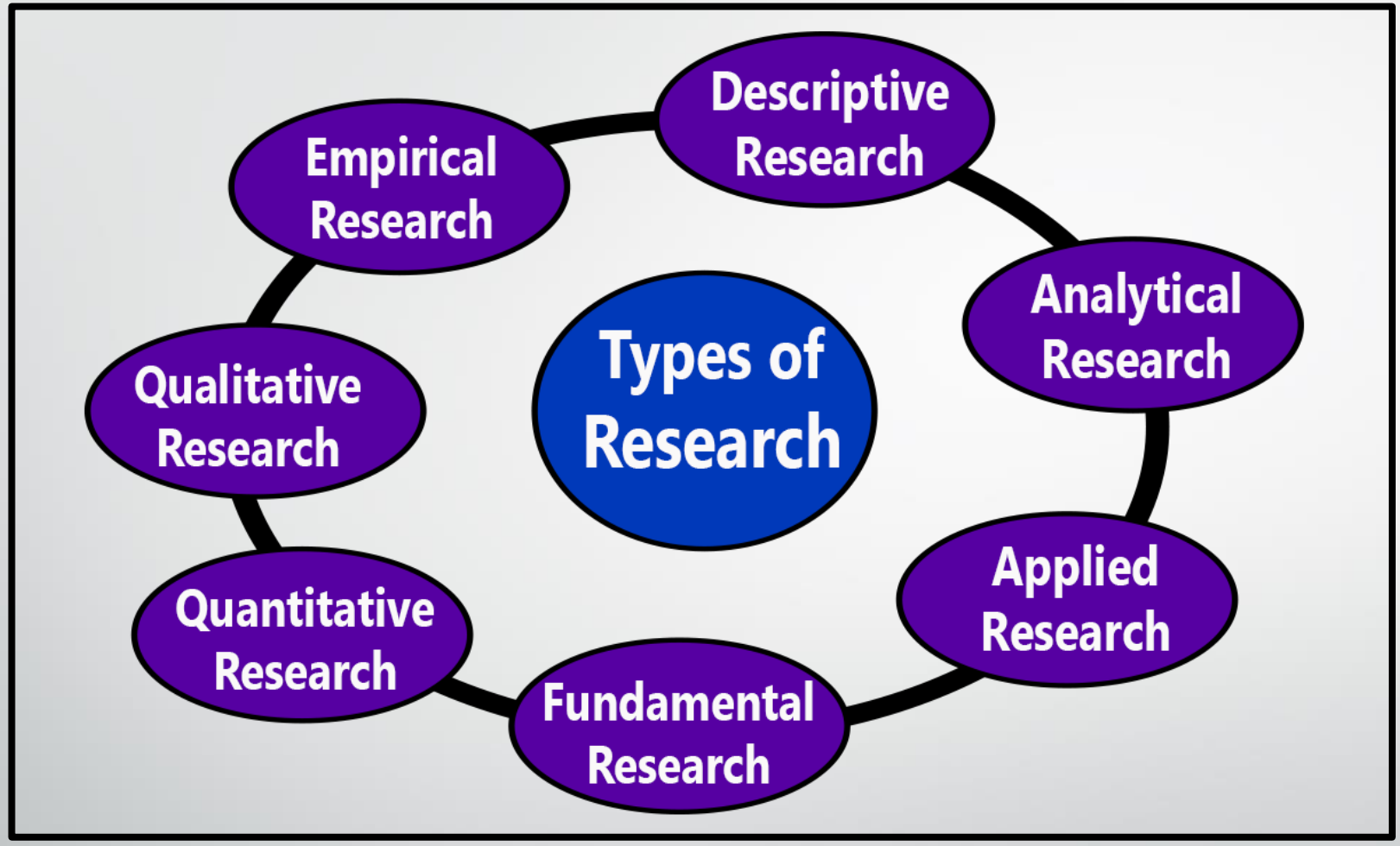


Fig 1. Types of research (limbd.org, accessed 13/03/2023)

4.2 Types of research

- Descriptive research - Descriptive research includes surveys and fact-finding inquiries of different kinds. The major purpose of descriptive research is a description of the state of affairs as it exists at present. The main characteristics of this method is that the research has no control over the variables, he can only report what has happened or what is happening. (limbd.org)
- Analytical research – in this kind of research information already available is analyzed for evaluation purposes.
- Applied research – this is aimed at finding a solution to a current problem facing an organization (so it is applied immediately).
- Fundamental research – concerned with generalizations and theory formulations, for example, in mathematics or physics.
- Quantitative research - Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. (Kothari, 2004). You can deduce that this type of research is used a lot in scientific environments.

4.2 Types of research

- Qualitative research - is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind. For instance, when we are interested in investigating the reasons for human behavior (i.e., why people think or do certain things), we quite often talk of 'Motivation Research', an important type of qualitative research. This type of research aims at discovering the underlying motives and desires, using in depth interviews for the purpose (Kothari, 2004). Naturally these types of research are found in abundance in the social sciences, where the study of societal behavioral phenomena is at the forefront.
- Conceptual research - Conceptual research is related to some abstract ideas or theories. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. (limbd.org)
- Empirical research - relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. (Kothari, 2004)
- All other types of research are based on the above 8.
- Fig 2 portrays a different view of the types of research, adding some more details for understanding purposes.

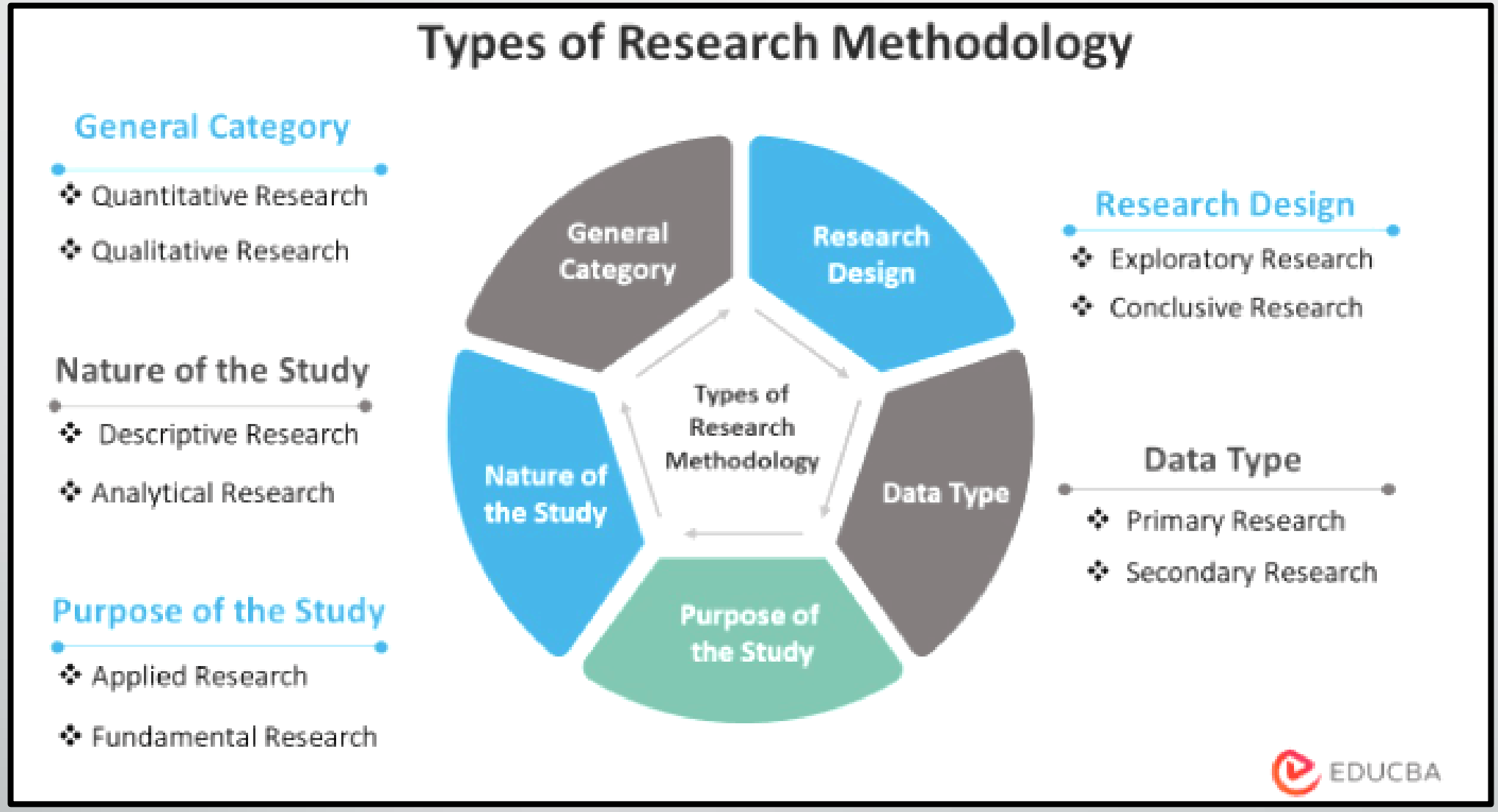


Fig 2. Types of research (Pedamkar, 2021)

Part 5

Approaches to Research

5.1 Introduction

- As you may have inferred from the last section (section 4) there are generally two approaches to research.
- These are the quantitative approach and the qualitative approach.
- These can further be broken down according to the needs of the research.
- An examination of the different approaches to both qualitative and quantitative research are covered in this section.
- Fig 4 summarizes the different types of quantitative research and discusses them in the slides that follow.
- Fig 5 does the same for qualitative research and discusses them in the slides that follow.

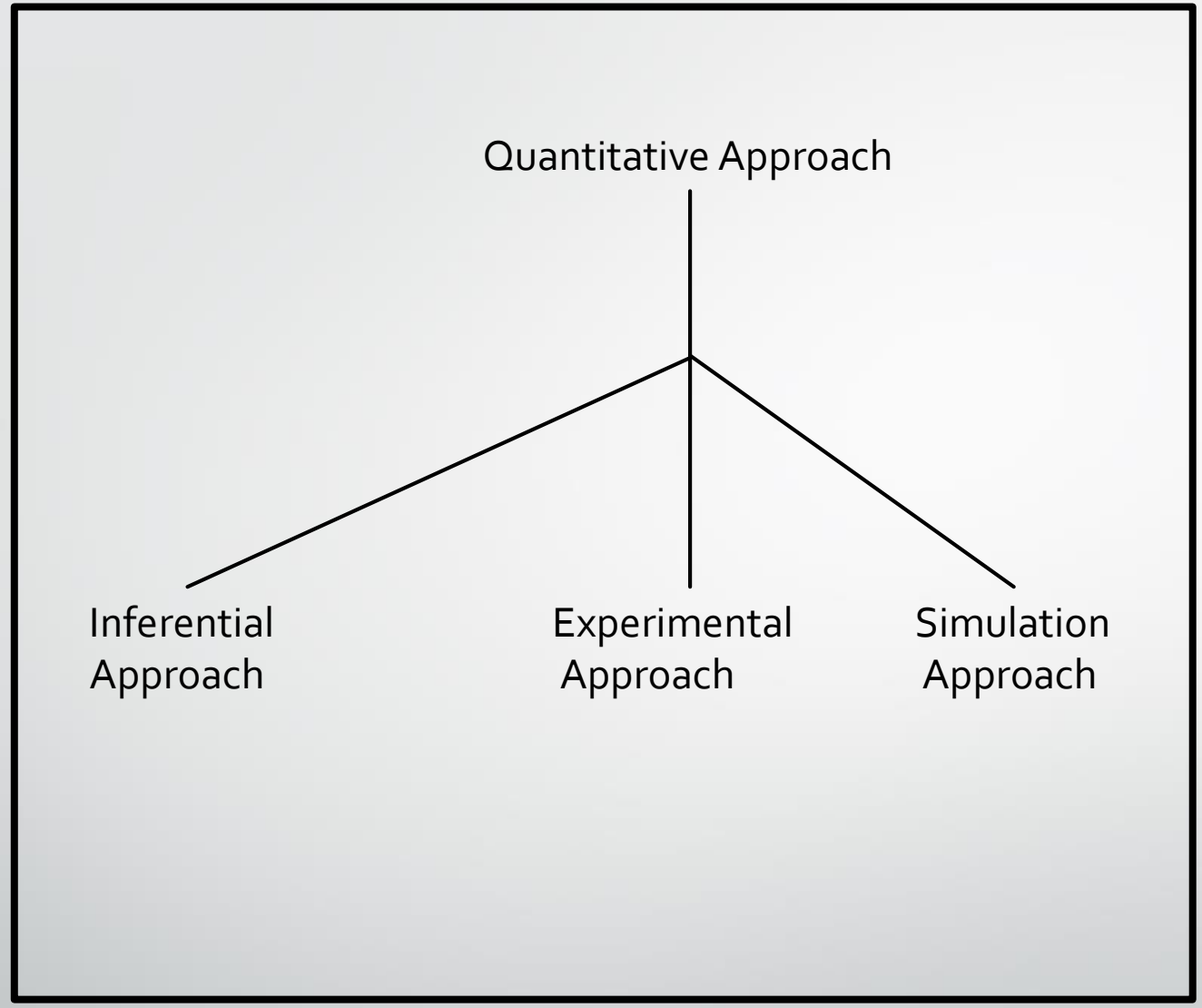


Fig 4. Types of quantitative research

5.2 Quantitative Approach

- The quantitative approach and its different types (approaches) all involve the use of numbers (quantities) in the attempt to solve a problem or even explain it. There are three approaches that may be used depending on the circumstances and phenomena being studied:
- Inferential approach – the purpose of *inferential approach* to research is to form a data base from which to infer characteristics or relationships of population. This usually means survey research where a sample of population is studied (questioned or observed) to determine its characteristics, and it is then inferred that the population has the same characteristics. (Kothari, 2004)
- Experimental approach – this entails the use of experiments to solve problems. Experiments allow for strict control of the environment and therefore with this approach the variables involved can be carefully controlled and monitored.
- Simulation approach – this involves creating an artificial environment (as opposed to emulation) where information can be gathered. A simulated environment is similar to the actual environment for purposes of gathering the information but it is not an exact replica of the simulated environment. In the field of computing there are several simulators that can simulate environments in areas of interest such as security, networking and cloud computing.

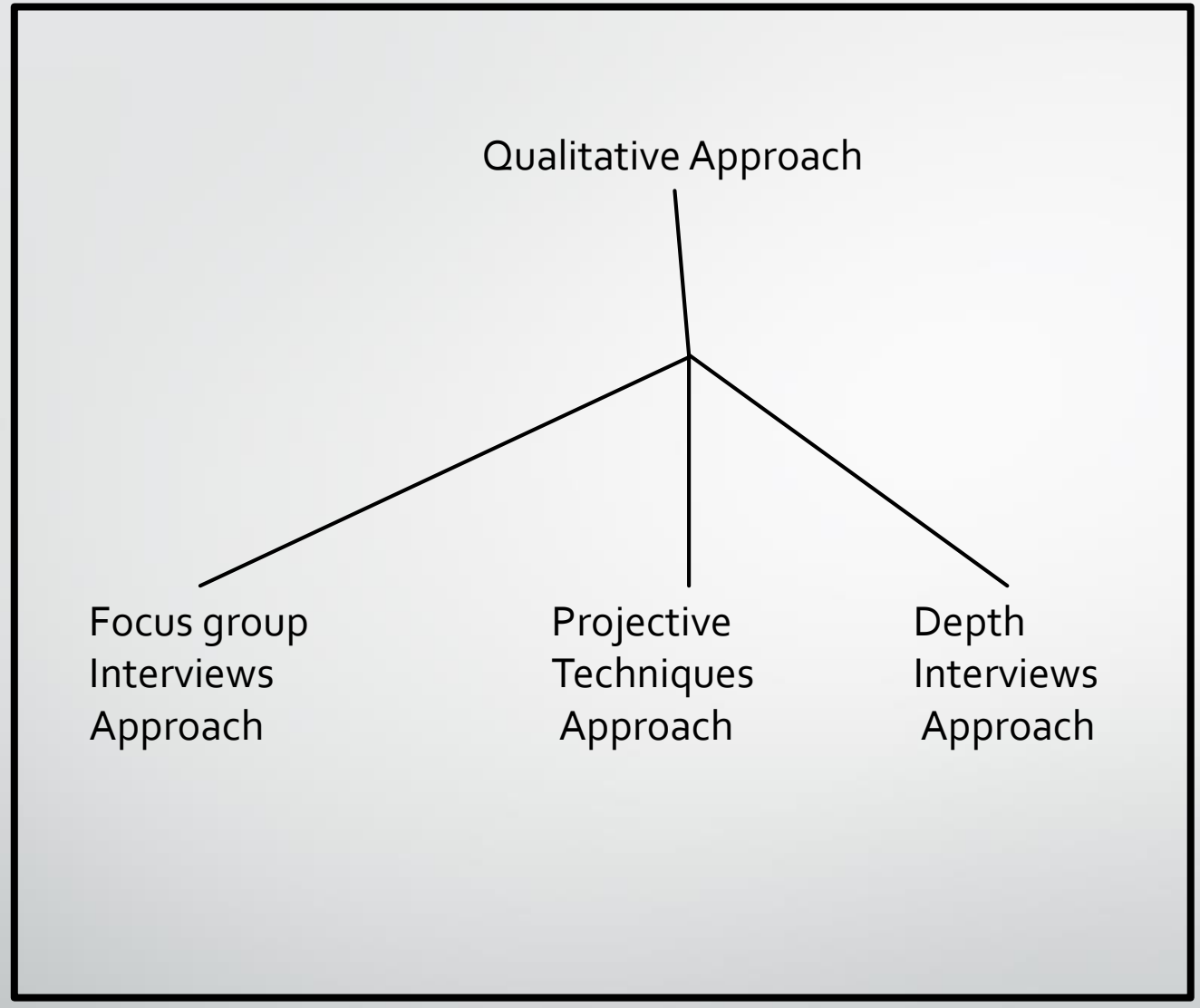


Fig 5. Qualitative approaches

5.3 Qualitative Approach

- Qualitative approach is based on the quality of something as a basis for measure. With this approach the subjects give assessment of different variables such as opinion, insights or even impressions/attitudes. There are three different applicable approaches:
- Focus group interviews - is performed by planned discussion and interview with a small group of people conducted by a moderator. The participants are sampled from the study population. The aim is to obtain knowledge of the participant's considerations and ideas on a specific topic. The method is feasible in illuminating the variation of viewpoints held in a population. (Bojlén and Lunde, 1995)
- Projective techniques - Projective techniques are a subset of personality testing in which the examinee is given a simple unstructured task, with a goal of uncovering personality characteristics. Projective techniques are often the most recognizable yet the most psychometrically controversial psychological testing technique. Based on the projective hypothesis, projective stimuli are purposefully ambiguous with the goal of eliciting the examinee's true feelings, desires, fears, motives, and other unconscious personality characteristics. (Kolakowsky-Hayner, 2011)
- Depth interviews - is a qualitative research technique which is used to conduct intensive individual interviews where numbers of respondents are less and research is focused on a specific product, technique, situation or objective. (mbaskool.com)

Part 6

Research Methods vs Methodology

6.1 Introduction

- In the field of research there are two terms that are (wrongly) used interchangeably; these are research methods and research methodology.
- These two mean very different things; the former is about incorporation of techniques, while the latter is a whole process by itself.
- Let's begin by defining what research methods are before explaining what research methodology is.
- "Research methods may be understood as all those methods/techniques that are used for conduction of research. Research methods or techniques, thus, refer to the methods the researchers use in performing research operations. In other words, all those methods which are used by the researcher during the course of studying his research problem are termed as research methods." (Kothari, 2004).

6.2 Research Methods

- Based on the foregoing information, research methods can hence be categorized into three groups:
  - Those concerned with data collection. Note that data only needs to be collected when the available information is not sufficient to solve the problem.
  - Statistical techniques/approaches used to establish the relationship between the data and what is not known.
  - Methods used to verify the accuracy of the data (validation and verification methods)

6.3 Research Methodology

- Kothari (2004) explains the difference between research methods and research methodology succinctly:
- " *when we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or technique and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others*. Why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data have been collected and what particular method has been adopted, why particular technique of analyzing data has been used and a host of similar other questions are usually answered when we talk of research methodology concerning a research problem or study."

Part 7

Research Process

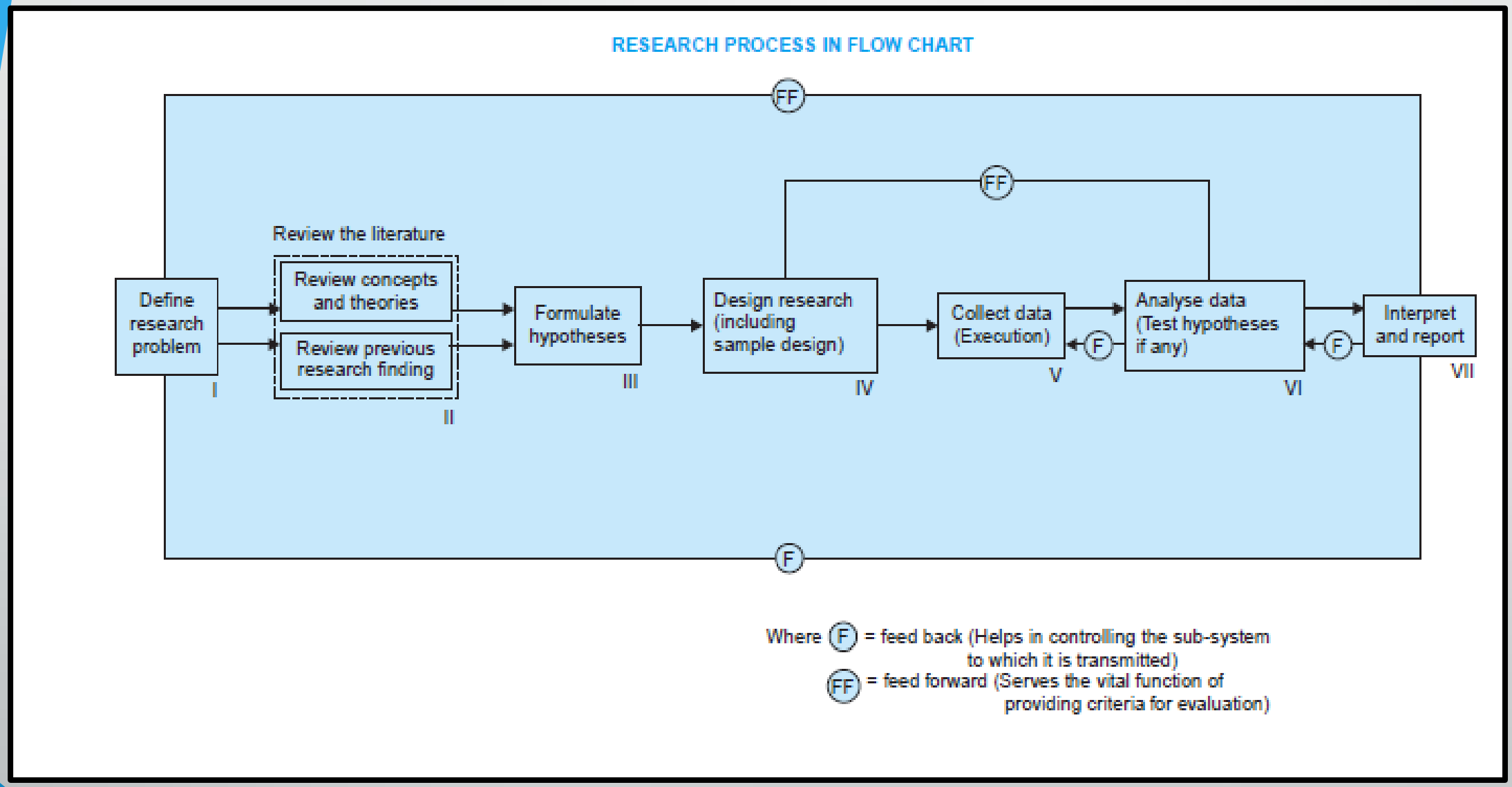


Fig 6. Research process (Kothari, 2004)

7.1 Research Process

- A process is simply a series of steps taken to achieve a desired outcome.
- The research process, therefore, are the steps that are taken to effectively carry out the research in order to achieve the desired results. Fig 6 shows a flowchart displaying the numbered steps in sequential order. The steps are as follows:
- Defining the research problem – this is the pivotal and crucial step in the research process. At this point the researcher must first of all understand what the problem is and be able to define it in a manner that can jumpstart a critical analysis. The problem must be written in a language that makes it clearly known and understood. The researcher must then examine any information regarding this problem from the word go (since the solution might already be available in literature, no?). Information may be empirical (from past studies) or just available literature on the topic. The result of this step is a clear definition of the problem, and some idea of existing information on the problem. Kothari (2004) states that "the statement of the objective is of basic importance because it determines the data which are to be collected, the characteristics of the data which are relevant, relations which are to be explored, the choice of techniques to be used in these explorations and the form of the final report."

7.1 Research Process

- Literature review – with the problem already well formulated, the researcher should now do a thorough literature review on the topic. This will include a study of all online available literature (Google's your friend), journals, books, conference proceedings, blogs, op-eds, and so on. This will help to understand what is already known about the problem and thus help in finding a solution to it. If there are similar cases in the domain, the researcher can even borrow methodologies that have worked in the past; there is no need to reinvent the wheel, so to speak.
- Formulate hypothesis – a hypothesis is a statement saying what you expect to come out of the research; it is what you (the researcher) will test to see whether it is true or not. An example of a hypothesis statement is "Eating white chocolate is a prominent cause of obesity". This is now a working hypothesis and can be tested using research techniques/methods. Kothari (2004) offers the following approach in developing a working hypothesis:
  - Discussions with experts and workmates
  - Perusal of available data to find any clues (peculiarities, trends, and so on)
  - Review of analogous studies
  - Exploratory investigations with interested parties.

7.1 Research Process

- Research design - this is the step where the structure of the research will be determined. There are several options depending on the type of data, type of problem and so on. Options include use of experiments, simulations, non-experimental, and so on. Also of importance is the sample design.
- Sample design – this refers to the different ways in which the research will collect the samples to use in his/her research. Available sample designs include deliberate sampling, simple random sampling, systematic sampling, stratified sampling, quota sampling, cluster sampling, multistage sampling, and sequential sampling. These will be described in detail in a later lesson.
- Data collection – once the sampling design has been chosen the next step is to choose the data collection method. There are several approaches to choose from including observations, interviews and questionnaires.
- Project execution – this refers to the implementation of the data collection phase; for example, if questionnaires were the choice tool for data collection, then the researcher or assistants will now go to issue the questionnaires to the target groups.

7.1 Research Process

- Data analysis – after the data has been collected the next step will involve analyzing what has been collected. At this point the data is categorized and grouped appropriately depending on the hypothesis/criteria determined in earlier steps. In today's age there are several computer packages that can assist in this; what is of key importance is for the researcher to know what s/he is looking for in the data, in order to draw meaningful inferences. There are several statistical tests that can be applied at this stage.
- Hypothesis testing – at this point the hypotheses formulated earlier can be tested. This is done using various statistical tests such as Chi square test, and others which will be described in detail in later lessons. Based on the results of the tests, the hypotheses can then be either rejected or accepted.

7.1 Research Process

- Generalization and interpretation - If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalization, i.e., to build a theory. As a matter of fact, the real value of research lies in its ability to arrive at certain generalizations. If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as interpretation. The process of interpretation may quite often trigger off new questions which in turn may lead to further researches. (Kothari, 2004)
- Report writing – finally the researcher should write a report covering all the important aspects of the research. Some of the key areas that must be captured include the problem statement, hypotheses, objectives, literature review, research methodology, analysis (and results), interpretation, recommendations, and conclusion. These will also be discussed in later lessons.

Part 8

Criteria of good Research

8.1 Criteria of good research

- Kothari (2004) describes the following as the criteria of good research:"
- 1. The purpose of the research should be clearly defined and common concepts be used.
- 2. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping the continuity of what has already been attained.
- 3. The procedural design of the research should be carefully planned to yield results that are as objective as possible.
- 4. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.

8.1 Criteria of good research

- 5. The analysis of data should be sufficiently adequate to reveal its significance and the methods of analysis used should be appropriate. The validity and reliability of the data should be checked carefully.
- 6. Conclusions should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis.
- 7. Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity."
- In conclusion Kothari (2004) states that:
  - Good research is systematic
  - Good research is logical.

Summary

- Research is simply the process of arriving at a dependable solution to a problem through the planned and systematic collection, analysis and interpretation of data.
- Some key words that define research: process, understanding of facts, problem-centered, validity and verifiability of results, new knowledge.
- Types of research include qualitative, quantitative, descriptive, analytic, empirical, applied, fundamental, and conceptual.
- Approaches to research include quantitative (inferential, experimental, simulation) and qualitative (focus groups, projective, depth interviews).
- Research methods or techniques, thus, refer to the methods the researchers use in performing research operations.
- When we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods

References

- Bojlén, N. S., & Lunde, I. M. (1995). Fokusgruppeinterview som kvalitativ forskningsmetode [Focus group interview as a qualitative research method]. *Ugeskrift for laeger*, *157*(23), 3315–3318.
- Kreutzer, J. S., Caplan, B., & Deluca, J. (2011). *Encyclopedia of clinical neuropsychology*. Springer.
- Kothari, C. R. (2004). *Research methodology : methods & techniques* (2nd ed.). New Age International (P) Ltd., Publishers, Cop.
- Pedamkar, P. (2021, January 19). *Types of Research Methodology | Top 10 Types of Research*. EDUCBA. https://www.educba.com/types-of-research-methodology/
- Singh, Y., K. (2006). *Fundamental of research methodology and statistics.* New Age International Pvt. Ltd., Publishers.
- *Types of Research*. (2019, August 2). Library & Information Management. https://limbd.org/research-types-of-research-objectives-of-research-characteristics-of-research/
- Zigu. (2011). *Depth Interview Definition | Marketing Dictionary | MBA Skool-Study.Learn.Share.* MBA Skool-Study.Learn.Share. https://www.mbaskool.com/business-concepts/marketing-and-strategy-terms/13314-depth-interview.html