

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, and necessary instrumentations

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Lecture 4

Today

- Research problem: Approaches of Investigation
- Quantitative Vs Qualitative, data
- Primary and secondary Data Collection
- Data preparation
- Data analysis, interpretation, and necessary instrumentations

Approaches of Investigation

Literature review: This involves reviewing existing studies, research articles, books, and other publications related to the research problem to gain a better understanding of the current state of knowledge and identify gaps in the literature.

Surveys and questionnaires: These are tools used to gather data from a sample of individuals related to the research problem. The data collected can be analyzed to identify patterns, trends, and relationships.

Approaches of Investigation

Case studies: This approach involves analyzing a particular instance of the research problem in depth. It is useful for gaining a detailed understanding of the problem in its context and identifying potential solutions.

Experiments: This involves designing and conducting experiments to test hypotheses related to the research problem. This approach can be used to establish cause-and-effect relationships and test the effectiveness of potential solutions.

Approaches of Investigation

Interviews and focus groups: These approaches involve gathering qualitative data by conducting interviews or focus groups with individuals who are knowledgeable about or affected by the research problem. This data can be used to gain insights and perspectives on the problem and potential solutions.

Observational studies: This approach involves observing and documenting behavior or events related to the research problem. This can provide valuable information about the problem in its natural setting and inform potential solutions.

Quantitative Vs Qualitative

Quantitative adjective relating to, measuring, or measured by the quantity of something rather than its quality. Often contrasted with qualitative.

Qualitative: relating to, measuring, or measured by the quality or kind of something rather than its quantity. Often contrasted with quantitative.

Quantitative Vs Qualitative

Quantitative data are measures of values or counts and are expressed as numbers. Quantitative data are data about numeric variables (e.g., how many; how much; or how often). Qualitative data are measures of 'types' and may be represented by a name, symbol, or a number code.

Quantitative Data

Defining Quantitative Data

Quantitative data is numerical and measurable information that can be used to identify trends, relationships, and make predictions. This type of data is the cornerstone of quantitative research, which relies on gathering numerical data and using statistical methods to analyze it.

Credit: <https://getthematic.com/insights/qualitative-vs-quantitative-data/>

Qualitative data

Defining Qualitative Data

So what exactly is qualitative data? At its core, qualitative data is descriptive, non-numerical information that helps us understand complex social phenomena. It refers to the words, phrases, or labels used to describe certain characteristics or traits, such as people's opinions, motivations, and emotions.

Qualitative research is subjective, less rigid, and approaches the research topic from the perspective of those living it.

Credit: <https://getthematic.com/insights/qualitative-vs-quantitative-data/>

Primary Data Collection

We collect primary data during the course of **doing experiments in an experimental research but in case we do research of the descriptive type and perform surveys**, whether sample surveys or census surveys, then we can obtain primary data either through observation or through direct communication with respondents in one form or another or through personal interviews.*

Primary Data Collection

Important ones are: (i) observation method, (ii) interview method, (iii) through questionnaires, (iv) through schedules, and (v) other methods which include (a) warranty cards; (b) distributor audits; (c) pantry audits; (d) consumer panels; (e) using mechanical devices; (f) through projective techniques; (g) depth interviews, and (h) content analysis.

Secondary Data Collection

Usually published data are available in: (a) various publications of the central, state or local governments; (b) various publications of foreign governments or of international bodies and their subsidiary organizations; (c) technical and trade journals; (d) books, magazines and newspapers; (e) reports and publications of various associations connected with business and industry, banks, stock exchanges, etc.;

Secondary Data Collection

(f) reports prepared by research scholars, universities, economists, etc. in different fields; and (g) public records and statistics, historical documents, and other sources of published information. The sources of unpublished data are many; they may be found in diaries, letters, unpublished biographies and autobiographies and also may be available with scholars and research workers, trade associations, labor bureaus and other public/private individuals and organizations.

What is data preparation?

Data preparation is the process of cleaning and transforming raw data prior to processing and analysis. It is an important step prior to processing and often involves reformatting data, making corrections to data, and combining datasets to enrich data.

Credit: <https://www.talend.com/resources/what-is-data-preparation/>

What is data preparation?

Data preparation is often a lengthy undertaking for data engineers or business users, but it is essential as a prerequisite to put data in context in order to turn it into insights and eliminate bias resulting from poor data quality.

Credit: <https://www.talend.com/resources/what-is-data-preparation/>

What is data preparation?

Data preparation helps:

- **Fix errors quickly** — Data preparation helps catch errors before processing.
- **Produce top-quality data** — Cleaning and reformatting datasets ensures that all data used in analysis will be of high quality.
- **Make better decisions** — Higher-quality data that can be processed and analyzed more quickly and efficiently leads to more timely, efficient, better-quality business decisions.

Credit: <https://www.talend.com/resources/what-is-data-preparation/>

Types of data analysis

Analysis may categorize as descriptive analysis and inferential analysis (Inferential analysis is often known as statistical analysis).

“Descriptive analysis is largely the study of distributions of one variable. This study provides us with profiles of companies, work groups, persons and other subjects on any of a multiple of characteristics such as size. Composition, efficiency, preferences, etc.”

This sort of analysis may be in respect of one variable (described as unidimensional analysis), or in respect of two variables (described as bivariate analysis) or in respect of more than two variables (described as multivariate analysis).

Types of data analysis

Data analysis comes in different forms, each serving its own purpose. Here's a clear breakdown of the main types:

Quantitative

Qualitative

Descriptive Analysis

Diagnostic Analysis

Predictive Analysis

Prescriptive Analysis

Data analysis, interpretation, and necessary instrumentations

These are crucial steps in the research process, providing insights and meaning to the collected data. The choice of data analysis methods and instruments depends on the nature of your research problem, the type of data collected, and your research objectives. Here are key considerations for data analysis, interpretation, and necessary instrumentations:

Data analysis, interpretation, and necessary instrumentations

Quantitative Data Analysis:

1. Methods:

1. Descriptive Statistics: Mean, median, mode, standard deviation.
2. Inferential Statistics: t-tests, ANOVA, regression analysis.

2. Instrumentation:

1. Statistical software such as MS Excel, SPSS, R, or Python with relevant libraries.

Data analysis, interpretation, and necessary instrumentations

:

1. Methods:
 1. Thematic Analysis: Identifying and analyzing patterns or themes in the data.
 2. Content Analysis: Systematically categorizing textual or visual data.
2. Instrumentation:
 1. Qualitative analysis software (e.g., NVivo, ATLAS.ti) or manual coding.
3. Mixed-Methods Analysis:
 1. Integration: Combining both quantitative and qualitative data for a comprehensive analysis.
 2. Triangulation to validate findings from different data sources.
4. Instrumentation:
 1. Statistical software for quantitative data and qualitative analysis tools for qualitative data.

Univariate, bivariate and multivariate data

Univariate data refers to a type of data in which each observation or data point corresponds to a single variable.

Heights (in cm) 110 114 168 188 190.5

Bivariate data involves two different variables, and the analysis of this type of data focuses on understanding the relationship or association between these two variables.

Heights (in cm) 110 114 168 188 190.5

Weight (in kg) 55 67 88 76 66

Multivariate data refers to datasets where each observation or sample point consists of multiple variables or features.

Heights (in cm) 110 114 168 188 190.5

Weight (in kg) 55 67 88 76 66

Energy Storage (kJ/day) 30 34.2 20 56 45

Univariate, bivariate and multivariate data and its analysis

Difference between Univariate, Bivariate and Multivariate data

| Univariate | Bivariate | Multivariate |
|---|--|--|
| It only summarize single variable at a time. | It only summarize two variables | It only summarize more than 2 variables. |
| It does not deal with causes and relationships. | It does deal with causes and relationships and analysis is done. | It does not deal with causes and relationships and analysis is done. |
| It does not contain any dependent variable. | It does contain only one dependent variable. | It is similar to bivariate but it contains more than 2 variables. |
| The main purpose is to describe. | The main purpose is to explain. | The main purpose is to study the relationship among them. |

Interpretation

The action of explaining the meaning of something.

Interpretation is essential for the simple reason that the usefulness and utility of research findings lie in proper interpretation.

C.R. Kothari - Research Methodology New Age Publications (Academic) (2009)

Interpretation

Interpretation is basic component of research process because of the following reasons:

1. Researcher must give reasonable explanations of the relations which he has found, and he must interpret the lines of relationship in terms of the underlying processes
2. Researcher must accomplish the task of interpretation only after considering all relevant factors affecting the problem to avoid false generalization.
3. It is advisable, before embarking upon final interpretation, to consult someone
4. Extraneous information (not directly linked), if collected during the study, must be considered

Interpretation

Precautions:

One should always remember that even if the data are properly collected and analysed, wrong interpretation would lead to inaccurate conclusions.

The task of interpretation be accomplished with patience in an impartial manner and also in correct perspective.

Summary

Explained

- Approaches of Investigation
- What is quantitative and qualitative data
- Primary and secondary data Collection
- Data preparation
- Types of data analysis and instrumentations
- Interpretation