ANALYSIS TECHNIQUES IN RESEARCH METHODOLOGY

RM ISE I

—PARSHWA HERWADE (22510064)

Analysis Techniques in Research Methodology

Introduction to Analysis Techniques

- Research produces large amounts of raw data; analysis techniques transform this into knowledge.
- Aim: To ensure validity, accuracy, and reliability of findings.

- Analysis involves:

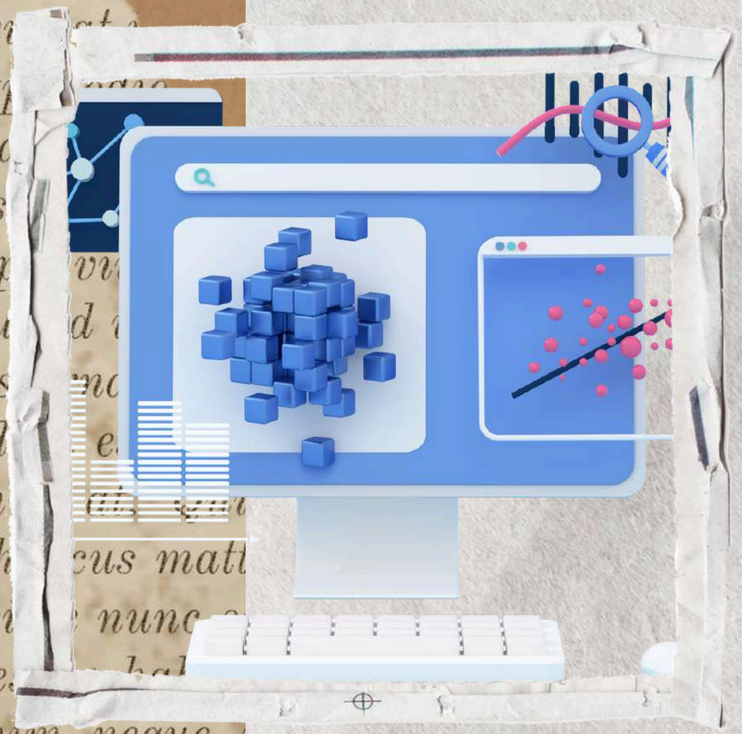
I. Organizing data systematically.
2. Applying statistical/mathematical methods.
3. Interpreting results to answer research questions.

- Types of Analysis:

I. Quantitative: Numerical/statistical evaluation.
2. Qualitative: Thematic/interpretative evaluation.

- Example: In a consumer survey, raw responses → frequency tables → statistical tests → insights into buying behavior.

Quantitative Techniques



- Methods that use numerical measurements to analyze patterns.
- Applications: Market research, scientific experiments, social sciences.
- Major Techniques:
- Descriptive Statistics: Summarize features (mean, median, mode, variance).
- Inferential Statistics: Generalize findings from a sample → population (z-test, t-test, ANOVA).
- Correlation & Regression: Measure relationships & prediction.
- Time-Series Analysis: Trends, forecasting future values.
- Multivariate Analysis: Complex relationships involving multiple variables.
- Strengths:
- Objective and replicable.
- Allows generalization.
- Useful for hypothesis testing.

Sampling Fundamentals

- Studying the whole population is costly, time-consuming, and often impossible.
- Population: Entire group under study.
- Sample: Subset of population.
- Sampling Frame: List of elements from which sample is drawn.
- Types of Sampling:
- Probability Sampling (every unit has equal chance):
- Simple Random Sampling - lottery method.
- Stratified Sampling - dividing into strata (e.g., age groups).
- Cluster Sampling - selecting clusters (e.g., schools, cities).
- Non-Probability Sampling (based on judgment/convenience):
- Convenience Sampling.
- Judgmental Sampling.
- Snowball Sampling (useful for hidden populations).
- Importance: Ensures representativeness, efficiency, and reduced bias.

Hypothesis Testing

- Process of testing assumptions about population parameters using sample data.
- <u>Steps:</u>
- State Null Hypothesis (H_0) - “No effect/No difference”.
- State Alternative Hypothesis (H_1) - “There is an effect/difference”.
- Select significance level ($\alpha = 0.05$ or 5%).
- Choose appropriate statistical test (z, t, χ^2, F).
- Calculate test statistic & p-value.
- Compare with critical values → Accept/Reject H_0.
- <u>Errors</u>:
- Type I Error (α): Rejecting true H_0.
- Type II Error (β): Accepting false H_0.
- Example: Testing whether a new medicine reduces blood pressure compared to placebo.

Multivariate Analysis

- Statistical analysis involving more than two variables simultaneously.
- Uses:
- To explore complex interrelationships.
- Data reduction and pattern identification.
- Types:
- Multiple Regression Analysis: Predict dependent variable using multiple independents.
- Factor Analysis: Identify underlying dimensions (e.g., customer satisfaction factors).
- Cluster Analysis: Group similar cases/individuals.
- Discriminant Analysis: Classify subjects into groups.
- MANOVA: Compare multiple dependent variables across groups.
- Applications: Marketing segmentation, psychology, economics, biological research.

Use of Statistical Software

- Manual calculations = slow & error-prone. Modern research = large datasets requiring automation.
- Common Software & Uses:
- SPSS (Statistical Package for Social Sciences): Widely used in academia, surveys.
- R: Open-source, powerful for statistical modeling & visualization.
- SAS: Enterprise-level analytics for industries.
- Python (Pandas, NumPy, SciPy, Scikit-learn): For both statistics & machine learning.
- MATLAB: Advanced computational statistics, simulations.
- Advantages:
- Reduces time.
- Minimizes human error.
- Handles big data.
- Provides graphs, charts, visualizations.

Data Processing

- Raw data → Refined data suitable for analysis.
- Steps:
- Editing: Checking for completeness & consistency.
- Coding: Assigning numerical codes to qualitative responses (e.g., Male=I, Female=2).
- Classification: Grouping similar responses.
- Tabulation: Summarizing in rows & columns.
- Data Cleaning: Removing duplicates, handling missing values.
- Importance: Ensures accuracy, consistency & facilitates correct interpretation.

Preliminary Data Analysis & Interpretation

- Preliminary Checks:
- Data Distribution: Normality test (Shapiro-Wilk).
- Outliers: Identify extreme values (Boxplots).
- Missing Data: Imputation or removal.

- Basic Analysis:
- Descriptive statistics → Mean, variance, standard deviation.
- Graphical representation → Histograms, pie charts.

- Interpretation:
- Converting numbers into meaningful insights.
- Explaining what results imply for research objectives.
- Example: If survey shows 70% customers prefer online shopping → interpretation = companies should improve online services.

Univariate vs. Bivariate Analysis

- Definition: Examining one variable at a time.
- Measures Used:
- Central Tendency: Mean, Median, Mode.
- Dispersion: Range, Variance, Standard Deviation.
- Distribution Shape: Skewness, Kurtosis.
- Graphical Tools: Histogram, Pie Chart, Bar Chart.
- Example: Analyzing average monthly income of respondents.

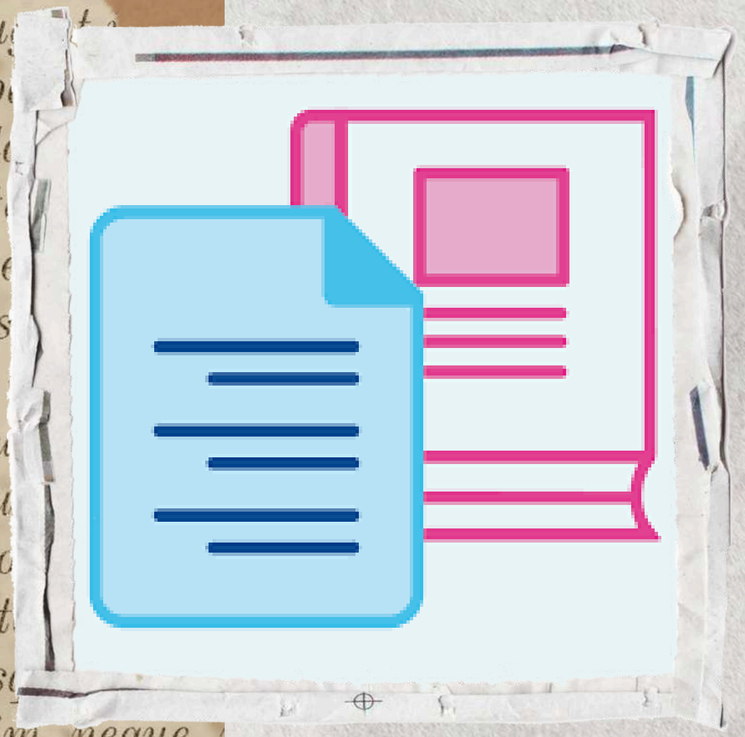
- Definition: Examining the relationship between two variables.
- Techniques:
- Correlation (r): Measures strength & direction (-I to +I).
- Simple Regression: Predict dependent variable using independent variable.
- Chi-square Test: Tests association between categorical variables.
- Cross-tabulation: Summarizing two variables in a contingency table.
- Example: Relationship between “hours studied” and “exam performance.”

Applications of Analysis Techniques

- Business Research: Market demand, consumer satisfaction, advertising effectiveness.
- Medical Research: Clinical trials, drug testing, epidemiology.
- Social Sciences: Human behavior, education studies, political science.
- Engineering/Technology: Product testing, system optimization, defect analysis.
- Government & Policy Making: Census data, poverty estimates, policy effectiveness.
- Education: Student performance analysis, curriculum effectiveness.

References

- Kothari, C.R. - Research Methodology
- Cooper & Schindler - Business Research Methods
- Montgomery - Design and Analysis of Experiments
- Online resources: IEEE, Springer, ResearchGate



Thank you