

RNI No. RAJHIN/2007/26996
ISSN 0976-7452 Raaso
Refreed Journal

रासो

अन्तर्विषयी त्रैमासिक शोध पत्रिका

वर्ष-18, अंक-2, मार्च अप्रैल मई 2025





RNI No. RAJHIN/2007/26996
ISSN 0976-7452Raaso
Refreed Journal

रासो

इतिहास, संस्कृति, साहित्य एवं दर्शन की त्रैमासिक शोध पत्रिका

वर्ष-18

अंक - 2

मार्च-अप्रैल-मई-2025

सम्पादक

डॉ. दिनेश चन्द्र शर्मा

निदेशक

कॉम्पिटिशन प्लस संस्थान, ग्रुप ऑफ इन्स्टीट्यूशन्स, अजमेर (राजस्थान)

संरक्षक

* प्रो. जे. पी. शर्मा - पूर्व कुलपति, मोहनलाल सुखाड़िया विश्वविद्यालय, उदयपुर (राजस्थान)

सलाहकार मण्डल

- * प्रो. विभा उपाध्याय - प्रोफेसर, इतिहास एवं भारतीय संस्कृति विभाग, राजस्थान विश्वविद्यालय, जयपुर (राज.)
- * नर्मदा प्रसाद उपाध्याय - प्रसिद्ध साहित्यकार तथा संस्कृति चिंतक, इन्दौर (मध्य प्रदेश)
- * प्रो. टी.के. माथुर - पूर्व अध्यक्ष, इतिहास विभाग महर्षि दयानन्द सरस्वती विश्वविद्यालय, अजमेर (राज.)
- * डॉ. रमेश अग्रवाल - पूर्व स्थानीय सम्पादक, दैनिक भास्कर, अजमेर (राजस्थान)
- * डॉ. गौरव बिस्सा - सहआचार्य, विभागाध्यक्ष, प्रबंध अध्ययन विभाग, राजकीय अभियांत्रिकी महाविद्यालय, बीकानेर (राज.)
- * डॉ. बीना शर्मा - पूर्व विभागाध्यक्ष, हिन्दी विभाग, सावित्री कन्या महाविद्यालय, अजमेर
- * प्रो. शोभा आर. मिश्रा - आचार्य एवं विभागाध्यक्ष, दर्शनशास्त्र विभाग, माधव महाविद्यालय, उज्जैन
- * डॉ. वेद प्रकाश विद्यार्थी - पूर्व सहायक निदेशक, केन्द्रीय हिन्दी निदेशालय, नई दिल्ली।

☆ उप सम्पादक

डॉ. रीता पारीक

प्राचार्य

हुकुमचन्द नोबल इंस्टीट्यूट ऑफ साइंस एण्ड टेक्नोलॉजी, अजमेर

☆ प्रबन्ध सम्पादक

डॉ. मृत्युंजय शर्मा

सह-आचार्य

हुकुमचन्द नोबल इंस्टीट्यूट ऑफ साइंस एण्ड टेक्नोलॉजी, अजमेर

☆ सहायक सम्पादक

डॉ. निष्काम शर्मा

☆ शब्द संयोजन

मुकेश कुमार माहेश्वरी

☆ सम्पादकीय/सचिव

व्यवस्थापकीय कार्यालय

सृजन संस्थान,

आचमन, वेद विहार,

लोहाखान, अजमेर-06

दूरभाष : 0145-2426610

e-mail : rasoajmjournal@gmail.com

☆ प्रकाशक :

पुष्पा शर्मा

सृजन संस्थान,

द्वारा आचमन पब्लिकेशन्स,

अजमेर

☆ मुद्रक :

मैसर्स आर्य प्रिन्टर्स,

केसरगंज, अजमेर

☆ कम्प्यूटराइज्ड सेटिंग :

श्रीनिवास प्रिन्टोग्राफिक्स

132, पंचवटी कॉलोनी,

अजमेर दूरभाष : 0145-2442701

सहयोग दर

* वार्षिक सदस्यता - 500 रु. (चार अंक)

संस्थाओं हेतु - 600 रु. (चार अंक)

कृपया बैंक/ड्राफ्ट/मनीऑर्डर श्रीमती पुष्पा शर्मा, प्रकाशक, आचमन पब्लिकेशन्स,
अजमेर- 305006 के नाम भेजें।

प्रकाशक-श्रीमती पुष्पा शर्मा, 51/1509, वेद विहार, लोहाखान, अजमेर द्वारा मैसर्स सृजन संस्थान, अजमेर
की ओर से प्रकाशित एवं मुद्रक-श्रीमती उषा गर्ग द्वारा मैसर्स आर्य प्रिन्टर्स, केसरगंज, अजमेर से मुद्रित।

USE OF QUANTITATIVE AND QUALITATIVE DATA IN COMPUTER-BASED STATISTICS

Shahin Parveen

*Asstt. Professor (Department of Science & Technology)
Hukumchand Noble Institute of Science & Technology, Ajmer*

ABSTRACT

Computer-Based Statistics (CBS) has become the backbone of modern data-driven research, enabling rapid, precise, and automated processing of complex datasets. As digital technologies integrate with statistical theory, the reliance on computers for storing, analyzing, and interpreting information has grown significantly across fields such as education, healthcare, marketing, governance, and social sciences. Two fundamental forms of data—quantitative and qualitative—play a central role in CBS. Quantitative data provides measurable and numerical evidence that supports mathematical analysis, statistical modeling, algorithmic prediction, and computational decision-making. Qualitative data, on the other hand, conveys descriptive, contextual, and human-centered information that adds depth, meaning, and interpretative richness to statistical outcomes.

This article explores the principles, characteristics, and applications of quantitative and qualitative data within the domain of CBS. It analyzes the methods used by computer systems to process each type of data, discusses various analytical tools and software employed in modern statistics, and highlights real-world case studies illustrating how both data types complement each other. The content also evaluates advantages, limitations, challenges, and future prospects of data-driven strategies in CBS. The integration of numerical and descriptive data strengthens the reliability, clarity, and relevance of analytical output, making CBS an indispensable component of contemporary research, policy formulation, and organizational planning.

Keywords

- * Computer-Based Statistics (CBS)
- * Quantitative Data
- * Qualitative Data
- * Data Analysis
- * Statistical Modelling
- * Numerical Data

शोध-पत्र में उल्लिखित सन्दर्भ एवं विचारों के लिए लेखक स्वयं उत्तरदायी है, सम्पादक नहीं।

- * Categorical Data
- * Data Processing
- * Data Visualization
- * Statistical Software
- * Big Data Analytics
- * Machine Learning
- * Predictive Analytics
- * Descriptive Statistics
- * Mixed Methods Research
- * Data Coding
- * Frequency Distribution
- * Text Analysis
- * Sentiment Analysis
- * Decision Support Systems
- * Digital Data Processing
- * Statistical Tools
- * Research Methodology
- * Data Interpretation
- * Data Classification

1. INTRODUCTION

The modernization of statistical analysis has brought computers and automated systems into the center of the research landscape. Traditionally, statistical operations were conducted manually, involving labor-intensive computations, handwritten tables, and time-consuming interpretations. The arrival of Computer-Based Statistics (CBS) transformed this scenario by introducing high-speed computing, simplified interfaces, powerful visualization tools, and automated analytical algorithms.

CBS refers to the use of computing devices, digital tools, programming software, and automated systems to manage, analyze, and interpret data. The process involves vast amounts of structured, semi-structured, and unstructured information that cannot be handled efficiently without technological support. Whether analyzing business performance, evaluating scientific experiments, studying market behavior, or interpreting social trends, CBS makes statistical operations accurate, scalable, and user-friendly.

At the foundation of CBS lies data, which is broadly classified into two essential types:

(1) Quantitative Data - information represented in numeric form that can be measured or counted.

(2) Qualitative Data - descriptive or categorical information that

represents characteristics, attributes, or subjective perceptions.

Both categories of data serve unique purposes. Quantitative data supports mathematical modeling and objective reasoning, while qualitative data adds interpretative insights, emotional perspectives, and contextual clarity. When combined, they offer a more holistic understanding of real-world problems.

The sections that follow examine the meaning of CBS, explore each data type in depth, and describe how computer-based tools strengthen the evaluation, comparison, and interpretation of both quantitative and qualitative inputs.

2. UNDERSTANDING COMPUTER-BASED STATISTICS (CBS)

Computer-Based Statistics refers to the application of digital technologies to conduct statistical operations more effectively than traditional manual methods. CBS involves data collection, storage, retrieval, computation, visualization, and reporting through computer software and automated systems.

2.1 Key Features of Computer-Based Statistics

1.Fast Processing Capability

Computers can analyze large datasets-such as census records or financial transactions-within seconds.

2.High Accuracy

Automated calculations minimize human errors common in manual computation.

3.Scalability

CBS can handle small datasets as well as extremely large datasets (Big Data) that traditional methods cannot manage.

4.Advanced Visualization

Tools such as graphs, dashboards, heat maps, and interactive charts help users interpret results intuitively.

5.Real-time Analysis

Many modern systems provide continuous, real-time updates for financial markets, healthcare monitoring, and industrial processes.

6.Integration with Databases

CBS tools can connect with SQL databases, cloud storage, IoT systems, and APIs.

7.Support for Mixed Data Types

Both quantitative (numeric) and qualitative (categorical or textual) data can be analyzed using appropriate techniques.

CBS enhances the efficiency and interpretability of statistics, making it a

powerful element in modern research and decision-making.

3. UNDERSTANDING QUANTITATIVE DATA

Quantitative data refers to information that can be measured, counted, and expressed numerically. It is used to perform mathematical operations, statistical modeling, and scientific comparisons.

3.1 Characteristics of Quantitative Data

- * Numeric in nature
- * Objective and measurable
- * Suitable for mathematical computation
- * Useful for identifying patterns and trends
- * Can be represented using graphs and tables

3.2 Types of Quantitative Data

A. Discrete Data

Discrete data consists of whole numbers or counts that cannot take fractional values.

Examples:

- * Number of students in a class
- * Number of accidents in a month
- * Number of machines in a factory

B. Continuous Data

Continuous data includes values that can take any number within a specific range, including decimals or fractions.

Examples:

- * Temperature
- * Height and weight
- * Time
- * Speed

4. USE OF QUANTITATIVE DATA IN COMPUTER-BASED STATISTICS

Quantitative data forms the analytical foundation of CBS due to its numerical nature. Computers excel at processing such information for mathematical calculations, modelling, forecasting, and decision-making.

4.1 Numerical and Statistical Calculations

Computers perform complex calculations instantly, such as:

- * Averages (mean, median, mode)
- * Measures of spread (variance, standard deviation)

- * Ratios and percentages
- * Probability computations
- * Index numbers
- * Time series components (trend, seasonality)

Automation eliminates manual errors and speeds up analysis significantly.

4.2 Statistical Modelling and Hypothesis Testing

CBS uses advanced algorithms to perform:

- * Linear and multiple regression
- * ANOVA
- * Correlation analysis
- * Probability distribution fitting
- * Logistic regression
- * Classification models

These models help predict future trends and understand relationships between variables.

4.3 Data Visualization

Quantitative data is best represented using:

- * Histograms
- * Line graphs
- * Scatter plots
- * Bar charts
- * Box-and-whisker plots

Visualization tools reveal hidden patterns and help communicate findings effectively.

4.4 Quantitative Data in Machine Learning and Big Data

Machine learning algorithms rely heavily on numeric data for:

- * Fraud detection
- * Predictive maintenance
- * Sales forecasting
- * Medical diagnosis
- * Customer behavior prediction

Large datasets help models improve their accuracy through training and testing cycles.

4.5 Quantitative Inputs in Decision Support Systems

Organizations utilize quantitative data for:

- * Inventory management
- * Budgeting

- * Quality control
- * Performance evaluation
- * Economic forecasting

Quantitative data thus becomes a powerful tool for operational and managerial decision-making.

5. UNDERSTANDING QUALITATIVE DATA

Qualitative data refers to descriptive or categorical information that expresses attributes, characteristics, behaviors, or opinions. Unlike numeric data, qualitative data emphasizes meaning and understanding rather than measurement.

5.1 Characteristics of Qualitative Data

- * Descriptive and non-numeric
- * Subjective in many cases
- * Useful for understanding behavior and context
- * Often requires coding for computation
- * Analyzed through thematic or categorical methods

5.2 Examples

- * Gender
- * Color
- * Occupation
- * Feedback comments
- * Customer preferences
- * Social status
- * Symptoms or experiences

6. USE OF QUALITATIVE DATA IN COMPUTER-BASED STATISTICS

Computers analyze qualitative data by classifying, coding, and interpreting descriptive information.

6.1 Classification and Grouping

Qualitative variables are grouped into categories such as:

- * Rural/Urban
- * Employed/Unemployed
- * Positive/Negative feedback
- * Low/Medium/High quality

Grouping helps identify demographic, behavioral, or categorical patterns.

6.2 Data Coding for Statistical Computation

Computers convert qualitative information into numerical codes

Qualitative Attribute	Code
Male	1
Female	2
Others	3

Coding enables mathematical and statistical analysis.

6.3 Frequency and Percentage Distribution

Qualitative data helps create:

- * Frequency tables
- * Crosstabulations
- * Percentage comparisons

These tools are vital for surveys and social research.

6.4 Computer-Based Text and Sentiment Analysis

Modern CBS tools use Natural Language Processing (NLP) to interpret textual data:

- * Sentiment detection
- * Keyword extraction
- * Topic modeling
- * Opinion mining

This is widely used in marketing, customer support, and social media analysis.

6.5 Decision Support through Qualitative Insights

Qualitative data adds meaning to numerical outcomes.

Example:

- * Sales data shows what was sold.
- * Customer feedback explains why it was sold.

This interpretative layer enriches decision-making.

7. COMBINED USE OF QUANTITATIVE & QUALITATIVE DATA

Modern statistical analysis often uses a mixed-method approach.

Healthcare Example

- * Quantitative: Pulse rate, blood sugar level
- * Qualitative: Symptoms, patient experiences

Marketing Example

- * Quantitative: Sales figures, number of customers
- * Qualitative: Brand perception, product reviews

Combining both types results in a more complete and realistic analysis.

8. ADVANTAGES OF USING BOTH DATA TYPES IN CBS

1. Higher accuracy and reliability
2. Balanced interpretation of results
3. Better problem-solving and prediction
4. Human-centered insights
5. Stronger decision-making capability
6. Holistic understanding of data

9. CHALLENGES IN USING QUANTITATIVE AND QUALITATIVE DATA

9.1 Incorrect Coding

Errors in coding categorical variables can distort outcomes.

9.2 Misinterpretation

Qualitative data requires careful expert interpretation.

9.3 Integration Difficulties

Merging different data types requires structured models.

9.4 Software Limitations

Not all tools handle qualitative data effectively.

9.5 Sampling Issues

Bias affects both quantitative and qualitative insights.

10. TOOLS USED IN COMPUTER-BASED STATISTICS

Common CBS tools include:

- * MS Excel
- * SPSS
- * R
- * Python (NumPy, Pandas, Matplotlib)
- * SAS
- * Tableau
- * Power BI
- * Google Data Studio
- * NVivo (for qualitative analysis)

11. REAL-WORLD APPLICATIONS

11.1 Banking and Finance

- * Loan approval models
- * Credit scoring
- * Fraud detection

11.2 Healthcare

- * Diagnosis support
- * Patient satisfaction studies
- * Disease prediction

11.3 Education

- * Student performance analysis
- * Attendance analytics

11.4 Government

- * Census data processing
- * Policy evaluation

11.5 Business

- * Market research
- * Customer segmentation

12. CASE STUDY: E-COMMERCE CUSTOMER ANALYSIS

Quantitative Inputs

- * Order frequency
- * Average spent
- * Delivery time
- * Rating scores

Qualitative Inputs

- * Customer complaints
- * Color and style preferences
- * Comments and reviews

CBS processes both to create recommendation systems and improve customer satisfaction.

13. FUTURE OF DATA IN COMPUTER-BASED STATISTICS

The future of CBS will include:

- * Real-time automated analytics
- * AI-based decision-making
- * Advanced machine learning integration
- * Expanded use of unstructured data
- * Predictive and prescriptive analytics

CBS will continue to evolve as AI and big data technologies advance.

14. CONCLUSION

Quantitative and qualitative data form the dual pillars of Computer-Based Statistics. While quantitative data provides measurable, objective, and

mathematical evidence, qualitative data introduces interpretative richness, human perspectives, and contextual understanding. Through CBS, both data types can be processed more efficiently, enabling organizations and researchers to make informed decisions with a high degree of accuracy. The integration of automated software, artificial intelligence, machine learning, and advanced visualization tools strengthens the analytical capability of CBS. As the world continues to generate massive amounts of digital information, the combined application of quantitative and qualitative data will remain essential for comprehensive and meaningful statistical interpretation.



References

1. Anderson, D., Sweeney, J., & Williams, T. *Statistics for Business and Economics*.
2. Gupta, S.C. *Fundamentals of Statistics*.
3. Creswell, J.W. *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*.
4. IBM Corp. *SPSS Statistical Software Documentation*.
5. NumPy & Pandas. *Official Python Documentation*.
6. Kotler, P. *Marketing Management*.
7. *Journal of Statistical Software* - www.jstatsoft.org
8. NVivo. *Qualitative Data Analysis Software Guide*.