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BA4205BUSINESS RESEARCH METHODS

COURSE OBJECTIVE:
  ➢ To make the students of tourism understand the principles of scientific methodology in businessenquiry, develop analytical skills of business research and to prepare scientific business reports.

UNIT I   INTRODUCTION   9
Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross –Sectional and time –series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

UNIT II   RESEARCH DESIGN AND MEASUREMENT   9
Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

UNIT III   DATA COLLECTION   9
Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument – Types of Validity – Sampling plan – Sample size – determinants optimal sample size – sampling techniques – Sampling methods.

UNIT IV   DATA PREPARATION AND ANALYSIS   9
Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Applications of Bivariate and Multivariate statistical techniques, Factor analysis, Discriminantanalysis, Cluster analysis, Multiple regression and Correlation, Multidimensional scaling – Conjoint Analysis – Application of statistical software for data analysis.

UNIT V   REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH 9
Research report –Types – Contents of report – need for executive summary – chapterization –

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UNIT I   INTRODUCTION TO BUSINESS ANALYTICS

Business Analytics - Terminologies, Process, Importance, Relationship with Organisational Decision Making, BA for Competitive Advantage.

Introduction

The word analytics has come into the foreground in last decade or so. The proliferation of the internet and information technology has made analytics very relevant in the current age. Analytics is a field which combines data, information technology, statistical analysis, quantitative methods and computer-based models into one. This all are combined to provide decision makers all the possible scenarios to make a well thought and researched decision. The computer-based model ensures that decision makers are able to see performance of decision under various scenarios.

Application

Business analytics has a wide range of application from customer relationship management, financial management, and marketing, supply-chain management, human-resource management, pricing and even in sports through team game strategies.

IMPORTANCE OF BUSINESS ANALYTICS

- **Business analytics is a methodology or tool to make a sound commercial decision**. Hence it impacts functioning of the whole organization. Therefore, business analytics can help improve profitability of the business, increase market share and revenue and provide better return to a shareholder.
- Facilitates better understanding of available primary and secondary data, which again affect operational efficiency of several departments.
- Provides a competitive advantage to companies. In this digital age flow of information is almost equal to all the players. It is how this information is utilized makes the company competitive. Business analytics combines available data with various well thought models to improve business decisions.

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- Converts available data into valuable information. This information can be presented in any required format, comfortable to the decision maker.

EVOLUTION OF BUSINESS ANALYTICS

Business analytics has been existence since very long time and has evolved with availability of newer and better technologies. It has its roots in operations research, which was extensively used during World War II. Operations research was an analytical way to look at data to conduct military operations. Over a period of time, this technique started getting utilized for business. Here operation's research evolved into management science. Again, basis for management science remained same as operation research in data, decision making models, etc.

As the economies started developing and companies became more and more competitive, management science evolved into business intelligence, decision support systems and into PC software.

Data for Analytics

Business analytics uses data from three sources for construction of the business model. It uses business data such as annual reports, financial ratios, marketing research, etc. It uses the database which contains various computer files and information coming from data analysis.

Challenges

Business analytics can be possible only on large volume of data. It is sometime difficult obtain large volume of data and not question its integrity.

TYPES OF BUSINESS ANALYTICS

There are four main types of business analytics companies can employ to better understand and grow their business.

- **Descriptive analytics**—is one of the most basic forms of analytics, providing insights on what has happened or is currently happening. Sales reports and social media engagement are examples of descriptive analytics.

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- **Predictive analytics**—relies on tools like machine learning and artificial intelligence (AI) algorithms to project what will happen, such as how a product will sell or who will buy it.

- **Prescriptive analytics**—uses a variety of data points, such as available resources and past performance, to suggest a course of action or strategy to achieve a desired result.

- **Diagnostic analytics**—examines data to explain why something happened.

A company may use one or all of these forms of analytics, depending on what its goals are.

SCOPE OF BUSINESS ANALYTICS

With rapidly evolving technology and also the dynamic business environment, organisations are looking for an easy method to focus their attention on increasing profit while cutting operational costs. Business analytics is the key to unlocking this.

Let's see the scope of business analytics and how, in different verticals, it helps lower costs.

- **Client Relationship Management**

  To efficiently manage, analyze, and interpret customer data, business analytics is the key.

  The overall customer service experience and service is the backbone on which the entire customer relationship depends on. And, when an organisation can accurately measure as well as analyze their inefficiency in serving their customers, they can start improving the process.

- **Inventory Management**

  Managing the supply chain is essential, be it a small business, a medium enterprise or a multinational corporation. Incapability in inventory management can lead to loss, disintegrated processes, and not to mention increased costs. Business analytics can help businesses efficiently observe inventory levels and determine the amount of inventory they need to tackle any challenges or unforeseen circumstances.

- **HR Professionals**

  Business analytics and HR? Feel like something doesn't add up, right? Well, not quite. Business analytics plays a significant role in the HR domain. HR professionals can utilize data to find information about the educational background, employee attrition rate, number of years of

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employees on service, their age, gender, everything. This can help in the selection of applicants while interviewing.

WHY ANALYTICS IS IMPORTANT

Business analytics can help companies make better, more informed decisions and achieve a variety of goals. By leveraging data, businesses can:

- Better understand consumer behavior
- Gain insight into their competitors
- Identify market trends
- Measure accomplishments against goals
- Optimize operations

Business analytics has helped many companies navigate tough times, especially regarding the COVID-19 pandemic. According to a survey by business intelligence company Sisense, 50% of companies reported using analytics "more often" or "much more often," during the pandemic. The increased use of analytics was even more pronounced among smaller companies. Helping organizations navigate through crises is just one of the many reasons why analytics is important to business. Data suggest companies that use analytics to their advantage are twice as likely to rank in the top quarter for financial performance, five times more likely to make timely decisionsand three times more likely to execute their decisions and plans.

FUTURE OF BUSINESS ANALYTICS

Big data and analytics will shape the business of the future in remarkable ways. Global spending on business analytics was projected to reach $215.7 billion in 2021, a 10% increase from 2020 according to the IDC. Furthermore, that number is expected to grow even more over the next five years as the world economy recovers from the COVID-19 pandemic.

Organizations and their leaders will depend on business analytics to cut operating costs, improve asset use, and increase the agility and reliability of their operations. Analytics will be key to delivering real-time performance insight, real-time logistics management and production quality analysis.

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The emergence of AI and machine learning technology is key to the future of business analytics. This technology will allow companies to interpret and draw insights from massive datasets to gain a better understanding of their customers and overall operations. Additionally, advanced data visualization tools will make it easier for businesses to identify and communicate these insights, and allow everyone throughout the organization to understand them.

Big data used to merely be a buzzword, with futuristic-sounding connotations, but the future of business analytics and big data has arrived. Businesses that want to compete in the 21st century need to continue to embrace business analytics for their operations. They need to also equip their teams with individuals who have the requisite skills to help translate data into actionable intelligence.

MAIN COMPONENTS

The main components of a typical business analytics dashboard include:

- **Data Aggregation**: prior to analysis, data must first be gathered, organized, and filtered, either through volunteered data or transactional records
- **Data Mining**: data mining for business analytics sorts through large datasets using databases, statistics, and machine learning to identify trends and establish relationships
- **Association and Sequence Identification**: the identification of predictable actions that are performed in association with other actions or sequentially
- **Text Mining**: explores and organizes large, unstructured text datasets for the purpose of qualitative and quantitative analysis
- **Forecasting**: analyzes historical data from a specific period in order to make informed estimates that are predictive in determining future events or behaviors
- **Predictive Analytics**: predictive business analytics uses a variety of statistical techniques to create predictive models, which extract information from datasets, identify patterns, and provide a predictive score for an array of organizational outcomes
- **Optimization**: once trends have been identified and predictions have been made, businesses can engage simulation techniques to test out best-case scenarios
- **Data Visualization**: provides visual representations such as charts and graphs for easy and quick data analysis

The essentials of business analytics are typically categorized as either descriptive analytics, which analyzes historical data to determine how a unit may respond to a set of variables; predictive analytics, which looks at historical data to determine the likelihood of particular futureoutcomes; or prescriptive analytics, the combination of the descriptive analytics process, which provides insight on what happened, and predictive analytics process, which provides insight on what might happen, providing a process by which users can anticipate what will happen, when it will happen, and why it will happen.

Some business analytics examples include the operation and management of clinical information systems in the healthcare industry, the tracking of player spending and development of retention efforts in casinos, and the streamlining of fast food restaurants by monitoring peak customer hours and identifying when certain food items should be prepared based on assembly time.

Modern, high quality business analytics software solutions and platforms are developed to ingest and process the enormous datasets that businesses encounter and can exploit for optimal business operations.

PREPARE FOR A CAREER IN BUSINESS ANALYTICS

Companies across virtually every industry are increasingly recognizing the importance of business analytics. As a result, analytics experts are in high demand for their ability to extract meaningful insights from data that inform strategic business decisions.

The Villanova University online Master of Science in Analytics program offers a comprehensive curriculum that addresses the entire continuum of business analytics, from data collection and analysis to implementation.

Learn more about how the program can help you develop the skills to become a business analytics leader.

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FUTURE FOR BUSINESS ANALYTICS PROFESSIONALS

The future for business analytics is very bright, so professionals looking to build a career in this domain are in for the ride of a lifetime. This also means that the demand for such professionals will also be on the rise, so to get an edge, you need to have some aces up your sleeves. One way to hone your skills and give yourself the edge is by pursuing online analytics courses. Online analytics courses from credible platforms can equip you the latest tools and technologies that other applicants might not know about. One such online program you can pursue is the business analytic online course from IIM Kozhikode. Offered on the Talent edge platform, the business analytic online course from IIM Kozhikode helps you inherit the skill-set and training you need tosucceed in this domain.

As a new-age business, operating in a world full of social media updates and news, there is so much information that comes to you, about your consumers or even potential consumers. All data elements that reach you, whether through formal sources or informal ones, need to be converted into information that you can use, for decision making. Data is forming the biggest part of an organization's business strategy and future goals right now.

When the data is converted into information, it takes the form of intelligence or analytics. Courses for business analytics talk about these concepts in detail.

ROLES AND RESPONSIBILITIES IN BUSINESS ANALYTICS

Business analytics professionals' main responsibility is to collect and analyze data to influence strategic decisions that a business makes. Some initiatives they might provide analysis for include the following:

- Identifying strategic opportunities from data patterns;
- Identifying potential problems facing the business and solutions;
- Creating a budget and business forecast;

- Monitoring progress with business initiatives;

- Reporting progress on business objectives back to stakeholders;

- Understanding KPIs; and

- Understanding regulatory and reporting requirements.

Business analysts must have a mixture of hard and soft skills. A business analyst does not need a deep understanding of IT but does need to understand how systems work together. Some business analysts choose to move from an IT-centric role into a BA role.

When recruiting for these jobs, employers typically look for the following capabilities:

- Ability to perform cost-benefit analysis;

- Familiarity with process modeling;

- Understanding stakeholder analysis;

- Analytical problem-solving;

- Oral and written communications skills;

- A basic understanding of IT systems, including databases;

- Detail-oriented;

- Experience with BA tools and software; and

- Ability to create visual representations of data.

Here we will take a brief look at what differences exist between these.

Business Analytics is usually carried out using statistical analysis, to be able to determine why certain trends are showing up or specific things are happening. The analysis is oriented towards finding answers to certain concerns, based on past or present data. Business Intelligence, on the

other hand, is related to using the data to understand how it can be used and what decisions can it enable the company to make.

Analytics does help in predicting trends for the future. A lot of the Business Analytics is mainly about predictive modelling and sharing insights on what you might face, and therefore preparation for the same. Intelligence, on the other hand, gives a great depth of information for the data at hand. So business intelligence is what sets the foundation for the decision making that an organization undertakes. It shifts the focus from intuitive based decisions or judgement based approaches, to actual fact-based decisions.

Business Analytics is mainly related to making changes to the business or its direction. Business intelligence, on the other hand, is focused on sustaining the business. Therefore, if as an organization, you plan to switch gears and move into another direction, the analytics are what will help you to make crucial decisions and validate your approach. If you are planning to build stability in your existing venture, intelligence is what will help you in choosing how to define steps to do that.

Both these terms have often been used interchangeably. While there are some fundamental similarities between them, there are several differences too. The orientation for Business Intelligence has always been towards reporting the actual analysis that has been undertaken. It is the logical next step after Business Analytics since it shares implications that analyses have uncovered. So knowledge of both these areas is equally important for all business professionals, irrespective of their functional areas.

EXAMPLES OF BUSINESS ANALYTICS

Business analytics has applications in a wide array of different businesses. Some companies are developing innovative ways to use big data in order to improve their customer's experience and maximize profits. Here is a real life example of business analytics:

Fast-food companies have begun to implement business analytics to streamline their restaurants. Who wants to have a slow experience in a fast-food drive-thru? By monitoring how busy the drive-thru is these businesses can increase efficiency during peak hours. When the line gets long,

the digital order boards change. They begin to highlight items that can be prepared quickly. This leads to more simple orders that can be completed quickly. When the lines are short, slower items with higher margins are featured. In this way, the store can respond to real-time needs to improve efficiency.

Other types of business analytics applications do more than just respond to the current situation. These techniques help businesses predict which customers are less likely to return. They can then target advertising and promotions to these customers to improve retention. Here are someexamples of predictive analytics in business:

Casinos use business analytics to improve their profits and keep customers coming back. Though the house wins most of the time, players typically need to win enough to enjoy themselves and keep playing. Otherwise, players may lose interest and stop coming back. By tracking players spending, casinos can learn which customers they make the most money from. They can offer greater incentives to these big spenders to keep them coming back. The collected data also helps these resorts understand which amenities are most popular.

BUSINESS ANALYTICS TOOLS

There are data analytics tools that can be used in business analytics to streamline the big data pipeline.

Tools for use in business analytics range substantially in complexity. Self-service analytics tools provide a simplified interface, often are paid services that can do basic data analytics tasks in a user-friendly way. Alternatively, advanced statistical analysis tools require programming and software engineering skills to use effectively. Many of these tools are open-source and available for free to users.

The most well-known tools in both data analytics and business analytics are open source programming languages that provide statistical tools. Two widely used options are R and Python (with the pandas library). Any data processing or analysis task can be automated using these languages. R and Python both have large communities that provide support and many packages and libraries which provide added functionality and statistical

methods. These include data visualization tools, advanced statistical algorithms, data scraping tools and much more.

There are also paid statistical programming languages. These include SAS, SPSS and MATLAB. These languages have the advantage of paid support and professional development. However, they are typically used less often than open source solutions.

Not all statistical analysis tools require programming. There are many options for statistical analysis with a graphical user interface (GUI). These tools are generally paid and include Tableau, Qlik, Sisense and SAP. These are self-service analytics tools that can take raw data and turn it into user-friendly charts with the click of a button. This user-friendly workflow allows the most useful insights to quickly be visualized.

Selecting the right tool involves balancing financial costs, time costs, the complexity of the data and the ease of use.

BENEFITS OF BUSINESS ANALYTICS

Business analytics can help provide a wide array of benefits

- Enable data-driven decision making that has the potential to increase profits and improve efficiency
- With predictive analytics, allow businesses to plan for the future in ways that were previously impossible
- Helps a company make informed business decisions
- By modeling the outcomes and understanding the past, guesswork is minimized
- Present meaningful, clear data to support decision making and convince stakeholder

Business analytics provides a way for businesses to plan for the future. By modeling the trends in a businesses' sales, profits and other key metrics, these indicators can be projected into the future. Understanding the changes that are likely to occur seasonally, annually or on any scale allow businesses to better prepare. This may mean decreasing spending in preparation for a slow season or investing in new marketing campaigns to compensate. Large suppliers can use this data

to predict order volume and minimize waste in their warehouses. Planning for future events provides a huge advantage to all businesses.

Business analytics can also enable new types of marketing campaigns. The data collected by businesses give insights into customer behavior which helps businesses understand the effectiveness of advertising campaigns with different audiences. Targeting audiences that are more likely to respond to specific campaigns or products increases efficiency overall. In addition, understanding consumer habits can help businesses improve customer retention. By identifying customers who are less likely to return, businesses can offer targeted promotions. This provides a cost-effective way to gain customer loyalty.

The applications of business analytics are wide-ranging and the benefits of business analytics are clear – data-driven businesses have a competitive edge in almost every industry.

COMMON CHALLENGES OF BUSINESS ANALYTICS

Businesses might encounter both business analytics and business intelligence challenges when trying to implement a business analytics strategy:

- **Too many data sources.** There is an increasingly large spectrum of internet-connected devices generating business data. In many cases, they are generating different types of data that must be integrated into an analytics strategy. However, the more complex a data set becomes, the harder it is to use it as part of an analytics framework.

- **Lack of skills.** The demand for employees with the data analytic skills necessary to process BA data has grown. Some businesses, particularly small and medium-sized businesses (SMBs), may have a hard time hiring people with the BA expertise and skills they need.

- **Data storage limitations.** Before a business can begin to decide how it will process data, it must decide where to store it. For instance, a data lake can be used to capture large volumes of unstructured data.

BUSINESS ANALYTICS EXAMPLES AND TOOLS

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There are several BA and BI tools that can automate advanced data analytics functions and require few of the specialized skills or deep knowledge of the programming languages used in data science.

These tools help businesses organize and make use of the massive amounts of data that modern internet of things and enterprise cloud applications generate. These applications may be part of supply chain management, enterprise resource planning and customer relationship management applications.

Below are some business analytics tools on the market:

- *Dundas* BI, with automated trend forecasting and a user-friendly interface;

- *Knime Analytics Platform*, which has high-performance data pipelining and machine learning;

- *Qlik's* QlikView with data visualization and automated data association features;

- *Sisense*, known for its dynamic text-analysis features and data warehousing;

- *Splunk*, which has intuitive user interface and data visualization features;

- *Tableau,* which has advanced unstructured text analysis and natural language processing capabilities; and

- *Tibco Spotfire,* which offers powerful, automated statistical and unstructured text analysis.

BA tools are used in many ways. For example, they can identify customers who are likely to cancel a service offering subscription. A company would first use aggregate data from enterprise applications, using a Data Ops analytics platform like Data Kitchen. Then it would use a BA tool to present that data to employees. The BA tool would help employees identify customers at risk of canceling and let them take steps to keep those customers.

When choosing a business analytics tool, organizations should consider the following:

- the sources which their data comes from;

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- the type of the data to be analyzed; and

- the usability of the tool.

A good business analytics tool is intuitive and user-friendly. It also provides a full suite of features for more advanced analytics.

Career and salary trends in business analytics

There are several career paths for a person with a BA background. Some common job titles and annual salaries as of 2021, according to PayScale, include the following:

- senior business analyst -- $86,050

- business systems analyst -- $70,155

- business analyst -- $69,785

- business intelligence analyst -- $69,639

- junior business analyst -- $51,009

TERMINOLOGIES

Analytics Terminology

 Analytics, Business analytics, Predictive modeling, Advanced analytics, Big Data Analytics, Data Mining, Knowledge Discovery, Artificial Intelligence, Machine learning, Business Intelligence, OLAP, Reporting, Data warehousing, Statistics

There are many terms that get thrown around in the field of analytics. This article is an attempt to list the subtle differences or similarities between the common terms.

Analytics – Analytics can simply be defined as the process of breaking a problem into simpler parts and using inferences based on data to drive decisions. Analytics is not a tool or a technology; rather it is a way of thinking and acting.

Analytics has widespread applications in spheres as diverse as science, astronomy, genetics, financial services, telecom, retail, marketing, sports, gaming and health care.

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Business analytics – This term refers to the application of analytics specifically in the sphere of business. It includes subsets like –

- Marketing analytics
- Risk analytics
- Fraud analytics
- CRM analytics
- Loyalty analytics
- Operations analytics
- HR analytics

Industries which rely extensively on analytics include –

- Financial Services (Banks, Credit Cards, Loans, Insurance etc.)
- Retail
- Telecom
- Health care
- Consumer goods
- Manufacturing
- Sports
- Hotels
- Airlines
- Any industry where large amounts of data is generated

Predictive Analytics – Predictive analytics is one of the most popular analytics terms. Predictive analytics is used to make predictions on the likelihood of occurrence of an event or determine some future patterns based on data. Remember it does not tell whether an event will happen. It only assigns probabilities to the future events or patterns.

Google Trends analysis of "Predictive Analytics"

The term emphasizes the predictive nature of analytics (as opposed to, say the retrospective nature of tools like OLAP). This is one of those terms that is designed by sales people and marketers to add glamour to any business. "Predictive analytics" sounds fancier than just plain "analytics". In practice, predictive analytics is rarely used in isolation from descriptive analytics.

Descriptive analytics – Descriptive analytics refers to a set of techniques used to describe or explore or profile any kind of data. Any kind of reporting usually involves descriptive analytics. Data exploration and data preparation are essential ingredients for predictive modeling and these rely heavily on descriptive analytics.

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Inquisitive analytics – Whereas descriptive analytics is used for data presentation and exploration, inquisitive analytics answers terms why, what, how and what if. Ex: Why have the sales in the Q4 dropped could be a question based on which inquisitive analysis can be performed on the data

Advanced analytics – Like "Predictive analytics", "Advanced analytics" too is a marketing driven terminology. "Advanced" adds a little more punch, a little more glamour to "Analytics" and is preferred by marketers.

Big data analytics – When analytics is performed on large data sets with huge volume, variety and velocity of data it can be termed as big data analytics. The annual amount of data we have is expected to grow from 8 zettabytes (trillion gigabytes) in 2015 to 35 zettabytes in 2020.

Growing data sizes would inevitably require advanced technology like Hadoop and Map Reduce to store and map large chunks of data. Also, large variety of data (structured, unstructured) is flowing in at a very rapid pace. This would not only require advance technology but also advanced analytical platforms. So to summarize, large amounts of data together with the technology and the analytics platforms to get insights out of such a data can be called as the Big data analytics.

Data Mining – Data mining is the term that is most interchangeably used with "Analytics". Data Mining is an older term that was more popular in the nineties and the early 2000s. However, data mining began to be confused with OLAP and that led to a drive to use more descriptive terms like "Predictive analytics".

According to Google trends, "Analytics" overtook "Data mining" in popularity at some point in 2005 and is about 5 times more popular now. Incidentally, Coimbatore is one of the only cities in the world where "Data mining" is still more popular than "Analytics".

Data Science – Data science and data analytics are mostly used interchangeably. However, sometimes a data scientist is expected to possess higher mathematical and statistical sophistication than a data analyst. A Data scientist is expected to be well versed in linear algebra, calculus, machine learning and should be able to navigate the nitty-gritty details of mathematics and statistics with much ease.

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Artificial Intelligence –During the early stages of computing, there were a lot of comparisons between computing and human learning process and this is reflected in the terminology. The term "Artificial intelligence" was popular in the very early stages of computing and analytics (in the 70s and 80s) but is now almost obsolete.

Machine learning – involves using statistical methods to create algorithms. It replaces explicit programming which can become cumbersome due to the large amounts of data, inflexible to adapt to the solution requirements and also sometimes illegible.

It is mostly concerned with the algorithms which can be a black box to interpret but good models can give highly accurate results compared to conventional statistical methods. Also, visualization, domain knowledge etc. are not inclusive when we speak about machine learning. Neural networks, support vector machines etc. are the terms which are generally associated with the machine learning algorithms

Algorithm – Usually refers to a mathematical formula which is output from the tools. The formula summarizes the model Ex: Amazon recommendation algorithm gives a formula that can recommend the next best buy.

OLAP – *Online analytical processing* refers to descriptive analytic techniques of slicing and dicing the data to understand it better and discover patterns and insights. The term is derived from another term "OLTP" – online transaction processing which comes from the data warehousing world.

Reporting – The term "Reporting" is perhaps the most unglamorous of all terms in the world of analytics. Yet it is also one of the most widely used practices within the field. All businesses use reporting to aid decision making. While it is not "Advanced analytics" or even "Predictive analytics", effective reporting requires a lot of skill and a good understanding of the data as well as the domain.

Data warehousing – Ok, this may actually be considered more unglamorous than even "Reporting". Data warehousing is the process of managing a database and involves extraction, transformation and loading (ETL) of data. Data warehousing precedes analytics. The data managed in a data warehouse is usually taken out and used for business analytics.

Statistics – Statistics is the study of the collection, organization, and interpretation of data. Data mining does not replace traditional statistical techniques. Rather, it is an extension of statistical methods that is in part the result of a major change in the statistics community. The development of most statistical techniques was, until recently, based on elegant theory and analytical methods that worked quite well on the modest amounts of data being analyzed. The increased power of computers and their lower cost, coupled with the need to analyze enormous data sets with millions of rows, have allowed the development of new techniques based on a brute-force exploration of possible solutions.

Analytics platform – Software that provides for the computation required to carry out the statistical methods, descriptive and inquisitive queries, machine learning, visualization and Big data (which is software plus hardware). Ex: SAS, R, Tableau, Hadoop etc.

Click stream analytics/ Web analytics – Analysis on user imprints created on the web Ex: Number of clicks, probability to buy based on search times of a particular word etc.

Text analytics – Usually refers to analyzing unstructured (not tabulated) data in the form of continuous text. Ex: Face book data analysis, twitter analysis etc.

Location analytics – With advanced GPS and location data available location analytics has become quite popular, Ex: Offers based on customer location, insurance risk calculations based on proximity to hazards

Sports analytics – Analysis of sports data using analytical tool and methods. Performance as well as revenue data can be subjected to analytical procedures to achieve better results

BUSINESS ANALYTICS PROCESS - THE 7-STEP

Real-time analysis is an emerging business tool that is changing the traditional ways enterprises do business. More and more organisations are today exploiting business analytics to enable proactive decision making; in other words, they are switching from reacting to situations to anticipating them.

One of the reasons for the flourishing of business analytics as a tool is that it can be applied in any industry where data is captured and accessible. This data can be used for a variety of

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reasons, ranging from improving customer service as well improving the organization's capability to predict fraud to offering valuable insights on online and digital information.

However business analytics is applied, the key outcome is the same: The solving of business problems using the relevant data and turning it into insights, providing the enterprise with the knowledge it needs to proactively make decisions. In this way the enterprise will gain a competitive advantage in the marketplace.

So what is business analytics? Essentially, business analytics is a 7-step process, outlined below.

Step 1. Defining the business needs

The first stage in the business analytics process involves understanding what the business would like to improve on or the problem it wants solved. Sometimes, the goal is broken down into smaller goals. Relevant data needed to solve these business goals are decided upon by the business stakeholders, business users with the domain knowledge and the business analyst. At this stage, key questions such as, "what data is available", "how can we use it", "do we have sufficient data" must be answered.

Step 2. Explore the data

This stage involves cleaning the data, making computations for missing data, removing outliers, and transforming combinations of variables to form new variables. Time series graphs are plotted as they are able to indicate any patterns or outliers. The removal of outliers from the dataset is a very important task as outliers often affect the accuracy of the model if they are allowed to remain in the data set. As the saying goes: Garbage in, garbage out (GIGO)!

Once the data has been cleaned, the analyst will try to make better sense of the data. The analyst will plot the data using scatter plots (to identify possible correlation or non-linearity). He will visually check all possible slices of data and summarise the data using appropriate visualisation and descriptive statistics (such as mean, standard deviation, range, mode, median) that will help provide a basic understanding of the data. At this stage, the analyst is already looking for general patterns and actionable insights that can be derived to achieve the business goal.

Step 3. Analyze the data

At this stage, using statistical analysis methods such as correlation analysis and hypothesis testing, the analyst will find all factors that are related to the target variable. The analyst will also perform simple regression analysis to see whether simple predictions can be made. In addition, different groups are compared using different assumptions and these are tested using hypothesis testing. Often, it is at this stage that the data is cut, sliced and diced and different comparisons are made while trying to derive actionable insights from the data.

Step 4. Predict what is likely to happen

Business analytics is about being proactive in decision making. At this stage, the analyst will model the data using predictive techniques that include decision trees, neural networks and logistic regression. These techniques will uncover insights and patterns that highlight relationships and 'hidden evidences' of the most influential variables. The analyst will then compare the predictive values with the actual values and compute the predictive errors. Usually, several predictive models are ran and the best performing model selected based on model accuracy and outcomes.

Step 5. Optimize (find the best solution)

At this stage the analyst will apply the predictive model coefficients and outcomes to run 'what-if' scenarios, using targets set by managers to determine the best solution, with the given constraints and limitations. The analyst will select the optimal solution and model based on the lowest error, management targets and his intuitive recognition of the model coefficients that are most aligned to the organization's strategic goal.

Step 6. Make a decision and measure the outcome

The analyst will then make decisions and take action based on the derived insights from the model and the organisational goals. An appropriate period of time after this action has been taken, the outcome of the action is then measured.

Step 7. Update the system with the results of the decision

Finally the results of the decision and action and the new insights derived from the model are recorded and updated into the database. Information such as, 'was the decision and action effective?', 'how did the treatment group compare with the control group?' and 'what was the return on investment?' are uploaded into the database. The result is an evolving database that is continuously updated as soon as new insights and knowledge are derived.

TALKING ABOUT THE PROCESS OF BUSINESS ANALYTICS

Business Analytics techniques can be deployed in any industry where data is conquered and handy to obtain business solutions through concerned data and curve it into understanding and knowledge to make valuable decisions. Multiple BI tools are implemented that helps an organization to obtain a competing asset in the market.

Business Analytics in Action: 7-steps Process outlined below;

Step 1: Address the Business Problems

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Initially, business problems need to be addressed, the purpose of applying analytics is sometimes designated categorically or broken into parts. So, relevant data is selected to address these business problems by business users or business analysts equipped with domain knowledge.

Some examples are: keeping modeling for a postpaid subscription, fraud detection for credit cards, or customer analysis of a mortgage portfolio. Business experts define perimeters for the analytical process which is crucial for assuring general understanding of the goal.

Step 2: Identify Potential Interest from Data

All sources of data having potential interest are required to identify. The key asset in this step is the more the data, the better it is. All the data will then be accumulated and consolidated in a data warehouse or data mart or at a spreadsheet file. Some exploratory data analysis is executed to do the computation for missing data, removing outliers, and transforming variables.

For example, time-series analysis graphs are plotted to figure out some patterns or outliers, scatter plots are used to find correlation or non-linearity, OLAP system for multidimensional analysis.

Step 3: Inspect the data

Once moving to the analytics step, an analytical model will be predicted on the prepared and transformed data using statistical analysis techniques like correlation analysis and hypothesis testing. The analyst figures out all parameters in connection with the target variable. The business expert also performs regression analysis to make simple predictions depending upon the business objective. In this step, data is also often reduced, divided, crumbled and compared with various groups to derive powerful insights from data.

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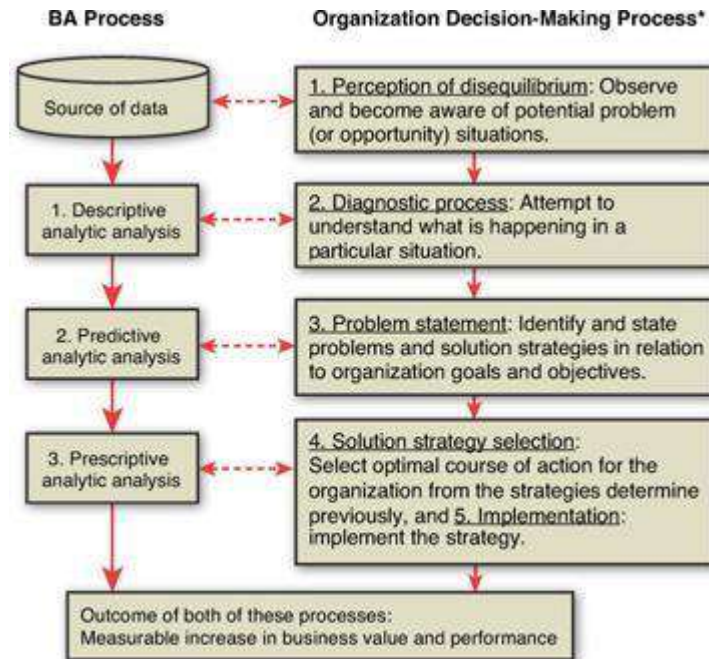
7-step representation of Business Analytics Process

Step 4: Interpretation and Evaluation by Experts

Finally, after obtaining model results, business experts interpret and evaluate them. Results may be clusters, rules, relations, or trends known as analytical models derived from applying analytics. Experts use predictive techniques like decision trees, neural networks, logistics regression to reveal the patterns and insights that show the relationship and invisible indication of the most persuasive variables.

Several prediction models are executed to select the best performing model on the basis of model accuracy and consequences. But yet, to explore unknown though engaging and tribal patterns are challenging that can add value to data and convert into new turnout opportunities.

Step 5: Optimization of Best Possible Solution

Once the analytical model has been validated and approved, the analyst will apply predictive model coefficients and conclusions to drive "what-if" conditions, using the defined to optimize the best solution within the given limitations and constraints.

Necessary considerations are how to serve model output in a user-friendly way, how to integrate it, how to confirm the monitoring of the analytical model accurately. An optimal solution is chosen based on the lowest error, management objectives, and identification of model coefficients that are associated with the company's goals.

Step 6: Decision Making and Estimate conclusions

Analysts then would make decisions and endure action based on the conclusions derived from the model in accordance with the predefined business problems. Spam of period is accounted for the estimation of conclusion, all the favorable and opponent consequences are measured in this

duration to satisfy the business needs.

Step 7: Upgrade performance system

At last, the outcome of decision, action and the conclusion conducted from the model are documented and updated into the database. This helps in changing and upgrading the performance of the existing system.

Some queries are updated in the database such as " were the decision and action impactful?" " what was the return or investment ?","how was the analysis group compared with the regulating class?". The performance-based database is continuously updated once the new insight or

knowledge is extracted.

Relationship of BA Process and Organization Decision-Making Process

The BA process can solve problems and identify opportunities to improve business performance. In the process, organizations may also determine strategies to guide operations and help achieve competitive advantages. Typically, solving problems and identifying strategic opportunities to follow are organization decision-making tasks. The latter, identifying opportunities, can be viewed as a problem of strategy choice requiring a solution. It should come as no surprise that the BA process described in Section 1.2 closely parallels classic organization decision-making

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processes. As depicted in Figure 1.2, the business analytic process has an inherent relationship to the steps in typical organization decision-making processes.

Figure 1.2 Comparison of business analytics and organization decision-making processes

The *organization decision-making process* (ODMP) developed by Elbing (1970) and presentedin Figure 1.2 is focused on decision making to solve problems but could also be applied to finding opportunities in data and deciding what is the best course of action to take advantage of them. The five-step ODMP begins with the perception of disequilibrium, or the awareness that a problem exists that needs a decision. Similarly, in the BA process, the first step is to recognize that databases may contain information that could both solve problems and find opportunities to improve business performance. Then in Step 2 of the ODMP, an exploration of the problem to determine its size, impact, and other factors is undertaken to diagnose what the problem is. Likewise, the BA descriptive analytic analysis explores factors that might prove useful in solvingproblems and offering opportunities. The ODMP problem statement step is similarly structuredto the BA predictive analysis to find strategies, paths, or trends that clearly define a problem or opportunity for an organization to solve problems. Finally, the ODMP's last steps of strategy selection and implementation involve the same kinds of tasks that the BA process requires in the

final prescriptive step (make an optimal selection of resource allocations that can be implemented for the betterment of the organization).

The decision-making foundation that has served ODMP for many decades parallels the BA process. The same logic serves both processes and supports organization decision-making skills and capacities.

What role does business analytics play in organizational decision-making?

Better business decisions

Data analytics **allows Executives to make decisions based on statistical facts**. Those facts can be used to guide choices about future company growth by evaluating a long-term view of the market and competition.

How Business Analytics impacts Decision Making in Businesses

Business analytics enables managers to understand their company's dynamics, forecast market developments, and manage risks.

Companies are adopting analytics and rigorous statistical reasoning to make decisions that enhance efficiency, risk management, and profits, rather than "going with gut" when keeping inventories, pricing solutions, or employing people.

Data is provided for all essential company activities, including industry trends, consumer behavior, productivity, inventory, and thorough financial analysis.

Business intelligence software collects information and transforms it into clear insights to enable actionable and strategic decision-making, allowing employees to easily achieve their objectives.

What is Business Analytics?

Big data is driving a lot of advancement in a variety of businesses. If you haven't already figured out how it works to make businesses and organizations more efficient through its many procedures, now is the time to do so!

One way Big Data may help with this is through strategic usage in Business Analytics. Don't worry if you've never heard of the phrase Business Analytics; it's very closely related to a term you've probably heard of — Data Analytics.

Data analytics is the process of analyzing data using various approaches, some quantitative and others predictive, in order to get insight into the data. So, what exactly is Business Analytics? Simply said, it's Data Analytics, but it's used to help businesses achieve their goals and make business decisions.

Business Analytics, like Data Analytics, may utilize past data to make sense of current data, discover trends, and forecast which consequence is likely to occur (if at all) and when.

Finally, it may provide crucial insight into what will be the greatest conclusion for your organization — and as a consequence, it becomes an indispensable tool, particularly when it comes to making profitable judgments.

As technology has slowly but steadily advanced beyond our expectations, there are now countless data sources and many more ways to categorize and analyze them. Every person, gadget, or organization generates an almost unmanageable quantity of data practically every day, which causes issues with logistical storage.

Businesses use a variety of methods to ensure that issue is resolved, with cloud storage being a significant one. Beyond that, the more immediate problem is the expertise necessary to sift through these mounds of data and uncover the insight that can cause a ripple effect across a business function or branch.

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Because that's the beauty of data: it doesn't only help in one area, even if that's how its benefits are typically perceived. It has an immediate influence and then gradually and progressively altersthe system around which the data point was constructed.

Business Analytics, in particular, uses Data Analytics to enhance efficiency in terms of production and expenses, as well as to determine whether or not the general structural systems that are applied are successful.

Furthermore, Business Analytics may aid in broad strategic direction as well as the formalization of decision making procedures.

Business Analytics for Competitive Advantage

The Competitive Advantage of Business Analytics

Business analytics is the process of gathering data, measuring business performance, and producing valuable conclusions that can help companies make informed decisions on the future of the business, through the use of various statistical methods and techniques.

Analytics has become one of the most important tools at an organization's disposal. When data and analytics work hand in hand, the benefits become obvious. Companies can leverage data to improve cost savings, redefine processes, drive market strategy, establish competitive differentiators and, perhaps most importantly, build exceptional and truly personalized customer experience.

Business analytics for organisations is becoming a competitive advantage and is now necessary to apply business analytics, particularly its subset of predictive business analytics. The use of business analytics is a skill that is gaining mainstream value due to the increasingly thinner margin for decision error. It is there to provide insights, predict the future of the business and inferences from the treasure chest of raw transactional data, that is internal and external data that many organizations now store (and will continue to store) as soft copy.

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Business analytics enables differentiation. It is primarily about driving change. Business analytics drives competitive advantage by generating economies of scale, economies of scope, and quality improvement. Taking advantage of the economies of scale is the first way organizations achieve comparative cost efficiencies and drive competitive advantage against their peers. Taking advantage of the economies of scope is the second-way organizations achievecomparative cost efficiencies and drive competitive advantage against their peers.

Business analytics improves the efficiency of business operations. The efficiencies that accumulate when a firm embraces big data technology eventually contributes to a ripple effect of increased production and reduced business costs. In the modern world, the vast quantities of data produced by corporations make their study and management practically impossible.

One can make the case that increasing the primary source of attaining a competitive advantage will be an organization's competence in mastering all flavours of analytics. If your management team is analytics-impaired, then your organization is at risk. Predictive business analytics is arguably the next wave for organizations to successfully compete. This will result not only from being able to predict outcomes but also to reach higher to optimize the use of their resources, assets and trading partners. It may be that the ultimate sustainable business strategy is to foster analytical competency and eventually mastery of analytics among an organization's workforce.

Analytics gives companies an insight into their customers' behaviour and needs. It also makes it possible for a company to understand the public opinion of its brand, to follow the results of various marketing campaigns, and strategize how to create a better marketing strategy to nurture long and fruitful relationships with its customers.

Business analytics helps organisations to know where they stand in the industry or a particular niche provides the company with the needed clarity to develop effective strategies to position itself better in the future.

For a company to remain competitive in the modern marketplace that requires constant change and growth, it must stay informed on the latest industry trends and best practices. Not only does

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business analytics provide the needed knowledge for companies to survive in today's constantly changing business environment, but it also makes room for growth and improvement, providing a detailed look into various opportunities and challenges that companies face on a day-to-day basis.

The retention of company employees has been a concern for business enterprises although it is taken more seriously in some niches that it is in other industries. A recent study that was conducted by IBM infers that a business enterprise had over 5,000 job applications reviewed but only hired 200 employees monthly. Big data has made it possible for companies to quickly analyse long time worker's histories to identify the job traits for long-term employment prospects.

As a result, corporations and small business enterprises are revamping their recruitment process which reduces employee turnover significantly. Companies can dedicate resources that are newlyavailable to activities that are of more productive value to the business and increase their levelsof service delivery. The retention of an experienced pool of employees can significantly assist a business enterprise to outperform its competitors using their long-term experiences.

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Unit-II

Research Design and Measurement

Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

RESEARCH DESIGN

A research design is a "Blue Print" for collection, measurement and analysis of data. It outlines how the research will be carried out. It is like glue which sticks together the entire process of research. It provides answers to various questions like - What techniques will be used to gather data. What kind of sampling will be used? How time and cost constraints be dealt with? Etc.

Definition

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.

Essentials of Research Design

▸ The design should be an activity and time based plan
▸   It is always based on research question
▸   It guides the selection of sources and types of information
▸   It indicates a framework for specifying the relationship among the study's variables
▸   Outlines procedures for every research activity
▸ It must be appropriate, efficient and economical
▸ It should be flexible
▸   It must be adequate

Types of Research Design

"You cannot put the same shoe on every foot" - Syrus

Although every problem and research objective may seem unique, there are usually enough similarities among problems and objectives to allow decisions to be made in advance about the best plan to resolve the problem. There are some basic research designs that can be successfully matched to given problems and research objectives.

     Three traditional categories of research design:

▸ • Exploratory
▸ • Descriptive
▸ • Causal

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Basic Research Objectives and Research Design

Research Objective	Appropriate Design
To gain background information, to define terms, to clarify problems and develop hypotheses, to establish research priorities, to develop questions to be answered	Exploratory
To describe and measure phenomena at a point In time	Descriptive
To determine causality, test hypotheses, to make "if-then" Statements, to answer questions	Causal

Research Design: Exploratory Research

▸ Exploratory research is most commonly unstructured, "informal" research that is undertaken to gain background information about the general nature of the research problem.

▸ Exploratory research is usually conducted when the researcher does not know much about the problem and needs additional information.

▸ Exploratory research helps diagnose the dimensions of the problem so that successive research will be on target.

Exploratory research is used in a number of situations:

▸ To gain background information
▸ To define terms
▸ To clarify problems and hypotheses
▸ To establish research priorities

Categories of Exploratory Research

Experience Surveys: - Issues and ideas may be discussed with persons who have had personal experience in the field.

Secondary data analysis:- Another quick and economical source of background information is existing literature containing data that has been compiled for some purpose other than the purpose in hand.

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Case Study method: -obtains information from one or a few situations that are similar to the problem situation. Primary advantage is that an entire organisation or entity can be investigated in depth and with meticulous attention to detail.

Pilot Studies are used in different types of designs. - Within the context of exploratory research it covers some part of the research on a small scale. Major categories of pilot study include focus group interviews, projective techniques, and depth interviews.

Categories of Pilot Studies
Focus Group interviews: - Unstructured, free flowing, group dynamic sessions that allow individuals the opportunity to initiate the topics of discussion. There is synergistic and spontaneous interaction among the respondents. Found to be highly advantageous.

Projective techniques; - An indirect means of questioning the respondents. Uses word association tests, sentence completion test, third person test, role playing technique and Thematic Apperception Test.

Depth interviews:- unstructured,, extensive interviews that encourage an individual to talk freely and in depth about a topic

Descriptive Research
Descriptive research is undertaken to provide answers to questions of who, what, where, when, and how – but not why.

Two basic classifications:
▶ • Cross-sectional studies
▶ • Longitudinal studies

Research Design - Descriptive Research -Cross-sectional Studies

▶ Cross-sectional studies measure units from a sample of the population at only one point in time.

▶ Sample surveys are cross-sectional studies whose samples are drawn in such a way as to be representative of a specific population.

▶ On-line survey research is being used to collect data for cross-sectional surveys at a faster rate of speed.

Descriptive Research -Longitudinal Studies

▶ Longitudinal studies repeatedly draw sample units of a population over time.

▶ One method is to draw different units from the same sampling frame.

▶ A second method is to use a "panel" where the same people are asked to respond periodically.

▶ On-line survey research firms recruit panel members to respond to online queries.

Research Design: Causal Research

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- Causality may be thought of as understanding a phenomenon in terms of conditional statements of the form "If x, then y."

- Causal relationships are typically determined by the use of experiments, but other methods are also used.

Experiments

An experiment is defined as manipulating (changing values/situations) one or more independent variables to see how the dependent variable(s) is/are affected, while also controlling the effects of additional extraneous variables.

Independent variables: - that over which the researcher has control and wishes to manipulate i.e. package size, ad copy, price. –

Dependent variables: - that over which the researcher has little to no direct control, but has a strong interest in testing i.e. sales, profit, market share.

Extraneous variables: - those that may affect a dependent variable but are not independent variables.

Experimental Design

An experimental design is a procedure for devising an experimental setting such that a change in the dependent variable may be solely attributed to a change in an independent variable.

There are various types of experimental designs. The selection of a particular design depends upon factors like nature and purpose of experiment, the type of variables to be manipulated, the nature of the data, the facilities available for carrying out the experiment and the competence of the experimenter. The following categories of experimental research designs are popular in educational research:

(i) Pre-experimental designs – They are least effective and provide little or no control of extraneous variables.

(ii) True experimental designs – employ randomization to control the effects of variables such as history, maturation, testing, statistical regression, and mortality.

(iii) Quasi-experimental designs – provide less satisfactory degree of control and are used only when randomization is not feasible.

(iv) Factorial designs- more than one independent variables can be manipulated simultaneously. Both independent and interaction effects of two or more than two factors can be studied with the help of this factorial design.

Symbols used: In discussing experimental designs a few symbols are used.

- E – Experimental group
- C – Control group
- X – Independent variable
- Y – Dependent variable

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▸ R – Random assignment of subjects to groups

▸ Yb – Dependent variable measures taken before experiment / treatment (pre-test)

▸ Ya – Dependent variable measures taken after experiment/ treatment (Post-test)

▸ Mr – Matching subjects and then random assignment to groups.

Pre-Experimental design :

▸ There are two types of pre-experimental designs:

1. The one group pre-test post-test design:

This is a simple experimental research design without involvement of a control group. In this design the experimenter takes dependent variable measures (Yb) before the independent variable (X) is manipulated and again takes its measures (Ya) afterwards: The difference if any, between the two measurements (Yb and Ya) is computed and is ascribed to the manipulation of X.

Pre-test	Independent variable	Post-test
Yb	**X**	**Y a**

The design has the inherent limitation of using one group only. The design also lacks scope of controlling extraneous variables like history, maturation, pre-test sensitization, and statistical regression etc.

2. The two groups static design:

This design provides some improvement over the previous by adding a control group which is not exposed to the experimental treatment. The experimenter may take two sections of grade-V of one school or grade-V of one school or grade-V students of two different schools (intact classes) as experimental and control groups respectively and assume the two groups to be equivalent. No pre-test is taken to ascertain it.

Group	Independent Variable	Post-test
E	**X**	**Ya**
C	**-**	**Ya**

This design compares the post-test scores of experimental group (Ya E) that has received experimental treatment (X) with that of control group (Ya C) that has not received X.

The major limitation of the design is that there is no provision for establishing the equivalence of the experimental (E) and control (C) groups. However, since no pre-test is used, this design controls for the effects of extraneous variables such history, maturation, and pre-testing.

Quasi-Experimental Design:

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Researchers commonly try to establish equivalence between the experimental and control groups, the extent they are successful in doing so; to this extent the design is valid. Sometimes it is extremely difficult or impossible to equate groups by random selection or random assignment, or by matching. In such situations, the researcher uses quasi- experimental design.

The Non-Equivalent Groups Design: It is probably the most frequently used design in social research. It is structured like a pre-test - post test randomized experiment, but it lacks the key feature of the randomized designs -- random assignment.

Pre-test	Independent Variable	Post-test
Yb	X	Ya (Experimental)
Yb	-	Ya (Control)

Counterbalanced design : It may be used when the random assignment of subject to experimental group and control group is not possible. This design is also known as rotation group design. In counterbalanced design each group of subject is assigned to experimental treatment at different times during the experiment. This design overcomes the weakness of non-equivalent design

c. True experimental design:

True experimental designs are used in educational research because they ascertain equivalence of experimental and control groups by random assignment of subjects to these groups, and thus, control the effects of extraneous variables like history, maturation, testing, measuring instruments, statistical regression and mortality. This design, in contrast to pre- experimental design, is a better and used in educational research wherever possible.

1. Two groups, randomized subjects, post-test only design:

This is one of the most effective designs in minimizing the threats to experimental validity. In this design subjects are assigned to experimental and control groups by random assignment which controls all possible extraneous variables, e.g. testing, statistical regression, mortality etc. At the end of experiment the difference between the mean post- test scores of the experimental and control group are put to statistical test –'t' test or analysis of variance (ANOVA). If the differences between the means are found significant, it can be attributed to the effect of (X), the independent variable.

Group	Independent Variable	Post-test E
	X	Y a
R C	-	Y a

The main advantage of this design is random assignment of subjects to groups, which assures the equivalence of the groups prior to experiment.

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This design is useful in the experimental studies at the pre-primary or primary stage and the situations in which a pre-test is not appropriate or not available.

2. **Two groups, randomized matched subject, post-test only design:**

This design, instead of using random assignment of subjects to experimental and control group, uses the technique of matching. In this technique, the subjects are paired so that their scores on matching variable(s), i.e. the extraneous variable(s) the experimenter wants to control, are as close as possible.

Group	Independent Variable	Post-test
E	X	Y a
C	-	Y a

This design is mainly used where "two groups randomized subjects, post-test only" design is not applicable and where small groups are to be used. The random assignment of subjects to groups after matching adds to the strength of this design.

3. **Two groups randomized subjects, pre-test post-test design:**

In this design subjects are assigned to the experimental group and the control group at random and are given a pre-test (Yb). The treatment is introduced only to the experimental group, after which the two groups are measured on dependent variable. The difference in scores or gain scores (D) in respect of pre-test and post-test ($Ya – Yb = D$) is found for each group and the difference in scores of both the groups (De and Dc) is compared in order to ascertain whether the experimental treatment produced a significant change. If they are analyzed, however, a 't' or 'F' test is used.

Group	Pre-test	Independent Variable	Post-test
E	Yb	X	Ya
MR C	Yb	-	Ya

The main advantages of this design include:
Through initial randomization and pre-testing equivalence between the two groups can be ensured.

Randomization seems to control most of the extraneous variables.

4. **The Solomon three groups design:**

This design, developed by Solomon seeks to overcome the difficulty of the design: Randomized Groups, Pre-test Posttest Design, i.e. the interactive effects of pre-testing and the experimental manipulation. This is achieved by employing a second control group (C2) which is not pre-tested but is exposed to the experimental treatment (X).

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Group	Pre-test	Independent Variable	Post-test
E	Yb	X	Y a
C1	Y b	-	Y a
C2	-	X	Y a

This design provides scope for comparing post-tests (Ya) scores for the three groups. Even though the experimental group has a significantly higher mean score as compared to that of the first control group (YaE > Ya C 1), one cannot be confident that this difference is due to the experimental treatment (X).

5. The Solomon four group design:

This design is an extension of Solomon three group design and is really a combination of two two-group designs:

　　(i) Two groups randomized subjects pre-test post-test design; and

　　(ii) Two group randomized subjects post-test only design.

This design provides rigorous control over extraneous variables and also provides opportunity for multiple comparisons to determine the effects of the experimental treatment (X).

In this design the subjects are randomly assigned to the four groups. One experimental (E) and three control (Cl, C2 and C3). The experimental and the first control group (E and C1) are pre-tested groups, and the second and third control groups (C2 and C3) are not pre- tested groups.

Group	Pretest	Independent Variable	Post test
E	Yb	X	Ya
C 1	Y b	-	Ya
C 2	-	X	Ya
C 3	-	-	Ya

(R)

FACTORIAL DESIGN

Experiments may be designed to study simultaneously the effects of two or more variables. Such an experiment is called factorial experiment. Experiments in which the treatments are combinations of levels of two or more factors are said to be factorial. When three independent factors have two levels each, we call it 2x2x2 factorial design. Similarly, we may have 2x3, 3x3, 3x4, 3x3x3, 2x2x2x2, etc.

Simple Factorial Design : A simple factorial design is 2x2 factorial design. In this design there are two independent variables and each of the variables has two levels. One advantage is that information is obtained about the interaction of factors.

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How Valid Are Experiments?

An experiment is valid:

- If the observed change in the dependent variable is, in fact, due to the independent variable (internal validity)

- if the results of the experiment apply to the "real world" outside the experimental setting (external validity) .

Choosing the right instrument for data collection

• The instrument you choose for data collection affects your entire study.

• Validity is your primary concern!

• Reliability is a secondary concern

What is the Validity of a Study?

- **Internal Validity** – The degree to which changes in the dependent variable are affected by the manipulated independent variable. Maintaining high internal validity means controlling for all other independent variables other than the one(s) being studied

- **External Validity** – The degree to which the results of a study can be generalized to the "real world". Factors that negatively affect external validity also negatively affect the generalizability of the results

- **Instrument Validity**

Does an instrument measure what it is supposed to measure? Four types of instrument validity are as follows:

– Construct

– Criterion related

– Content

– Inter-rater / Intra-rater

Construct Validity

It is the most important type of validity. Construct validity is the degree to which the instrument actually measures whether or not an underlying construct is being measured.

For example, does a math test actually measure math achievement? Does a personality test actually measure personality?

Criterion Related Validity

Criterion Related Validity is of two types:-

Concurrent validity – Degree to which scores on one test are correlated with scores on another test administered at the same time. Only one group is used.

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Predictive validity – Degree to which scores on one test predicts scores on a test administered in the future. Only one group is used.

MEASUREMENT AND SCALING

The word scale or scaling is generally used for indicating measurements or measuring something. Many aspects of social phenomena like emotion, attitude, faiths etc. are not measurable directly. They are not quantitative in nature.

Essentials of Scaling (Criteria for Good Scaling)

· Continuum means judging the scalability of the phenomenon under study.

· Reliability means that it should consistently produce the same result when applied to the same design.

· Validity implies correct measurement. A scale is valid if it measures correctly what is expected to measure.

· Weighting items means proper weights are to be provided to the attributes involved in the study because they are not of equal importance.

· Equality of units is a desirable characteristic but not essential for sound scientific procedure. In order to make the units equal, sometimes subtraction or addition can be made.

Measurement

Measurement is a systematic way of assigning numbers or names to objects and their attributes. It is easy to assign numbers in respect of properties of some objects, properties like weight, height.

Why Measurement?

"When you can measure what you are talking about and express it in numbers, you know something about it" Lord Kelvin

Rules of Measurement

• A rule is a guide which instructs us to do.

• Operational definitions help us to specify the rules for assigning the numbers.

Scales

Scales are devised for measuring variable in social science research. Scaling is the procedure for determining the quantitative measure of abstract concepts like leadership style, brand image of product etc. It is therefore -

• Any series of items which is progressively arranged according to value or magnitude into which an item can be placed according to its quantification.

• A continuous spectrum or series of categories

• Used to represent, usually quantitatively, an item's or person's place in that spectrum.

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Scale Classification

(A) Level of Measurement

I. Nominal scales

II. Ordinal scales

III. Interval scales

IV. Ratio scale

Nominal Scale

Numbers or letters assigned to objects which serve as labels for identification or classification. They are Scales "in name only"

Ordinal Scale

Arranges objects or alternatives according to their magnitude in an ordered relationship. eg rating career opportunities as excellent, good, average poor or very poor.

Interval Scale

• Interval scales not only indicate order, they also measure order or distance in units of equal intervals. When an interval scale is used to measure psychological attribute, the researcher can comment on the magnitude of differences or compare the average differences on attributes that are measured, but cannot determine the actual strength of the attitude towards an object .

Ratio Scale

• A ratio scale has equal interval properties of an interval scale but has two additional features:

• Has a true zero. Possible to indicate the complete absence of a property.

The numerals of the ratio scale have the qualities of real numbers and can be added, subtracted, multiplied, Divided and expressed in ratio relationships.

<div style="border:1px solid green; text-align:center; color:red;">Analysis of Scales</div>

Type of scale	Numerical Operation	Descriptive statistics
Nominal	Counting	Frequency in each category Percentage in each category Mode

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Ordinal	Rank ordering	Median Range Percentile ranking

Interval	Arithmetic operations on intervals between numbers	Mean Standard Deviation Variance
Ratio	Arithmetic operations on actual quantities	Geometric mean Coefficient of variation

Lickert Scale

Respondents indicate their attitude by checking how strongly they agree or disagree with carefully constructed statements that range from the very positive to the very negative towards the attitudinal object. Individuals generally choose from five alternatives: strongly agree, agree, uncertain, disagree and strongly disagree

Example

1) If the price of raw materials fell firms would reduce the price of their food product.	SA	A	N	DA	SD
2) Without Government regulation the firms would exploit the customers.					
3) Most food companies are so concerned about making profit they do not care about quality.					

Semantic Differential

An attitude measure consisting of a series of seven –point bipolar rating scales allowing response to a concept. Bi Polar adjectives such as "good and bad", "clean or dirty" anchor the beginning and end poles of the scale.

Numerical Scales

An attitude rating scale similar to a semantic differential except that it uses numbers as response options to identify response positions instead of verbal descriptions. Usually five point scale or seven point scale

Constant Sum Scale

A measure of attitudes in which the respondents are asked to divide a constant sum to indicate the relative importance of the attributes

Stapel Scale

Measures the direction and intensity of an attitude simultaneously.

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+3

+2

+1

Supportive

-1

-2

-3

Scaling Techniques

Some of the important scaling techniques are as follows:

Rating Scale: It means measuring an attribute by judgement in a continuum For eg. Students are rated by their teachers. In rating three elements are taken into consideration namely judges, continuum and subjects. Judges must be impartial. Continuum must accommodate the attributes realistically. Subjects should be amenable to rating. Rating scales are generally used for measuring the attitudes and the intensity of attitudes.

Ranking Scales: Ranking scales are identical to rating scales. In ranking scales, we make relative the score will place judgements against other similar objects. There are two generally used approaches of ranking scales namely.

1. Method of Paired Comparison where the respondent can express his attitude by making a choice between two objects.

2. 2. Method of Ranking Order where the respondents are asked to rank their choices.

3. **Attitude Scales**: In this type of scale, the attitude of an individual towards a matter can be known from the score of his responses given on a questionnaire. The score will place him in a scale. He simply expresses his likes or dislikes, agreement or disagreement with the issue involved as given in the forms of questions. On the basis of reply, he is assigned a score which indicates his position. In the attitude scale some relevant statements are to be considered by the respondents. The statements are found in such a way as to be intimately related to the attribute which is sought to be measured.

4. **Factor Scaling**: This is a type of scaling in which multi dimensions of a complex attitude is identified

Sources of Error in Measurement

▸ **a) Response Error** – sometimes the respondent may be reluctant to express strong negative feelings or they may have very little knowledge about various aspects but he will not admit his ignorance. The figure, boredom, anxiety etc of the respondents may limit the ability of the respondent to express his response accurately. In these situations the researcher has to make guesses in interviews. These guesses may sometimes be erroneous, thus resulting into wrong measurement.

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▸ **b) Situational Error** – situational factors also cause error in measurement. If something happens at the time of interview which places a strain on the interview that will have serious effects on the response from the respondent. For example, if somebody is present at the time of interview the respondent may not reveal facts correctly.

▸ **c) Errors Due To Faulty Instruments** – Use of complex words, ambiguous meanings, poor printing, inadequate space for replies etc may result in measurement errors.

(f) Scale construction techniques: Following are the five main techniques by which scales can be developed.

(i) *Arbitrary approach:* It is an approach where scale is developed on *ad hoc* basis. This is the most widely used approach. It is presumed that such scales measure the concepts for which they have been designed, although there is little evidence to support such an assumption.

(ii) *Consensus approach:* Here a panel of judges evaluate the items chosen for inclusion in the instrument in terms of whether they are relevant to the topic area and unambiguous in implication.

(iii) *Item analysis approach:* Under it a number of individual items are developed into a test which is given to a group of respondents. After administering the test, the total scores are calculated for every one. Individual items are then analysed to determine which items discriminate between persons or objects with high total scores and those with low scores.

(iv) *Cumulative scales* are chosen on the basis of their conforming to some ranking of items with ascending and descending discriminating power. For instance, in such a scale the endorsement of an item representing an extreme position should also result in the endorsement of all items indicating a less extreme position.

(v) *Factor scales* may be constructed on the basis of intercorrelations of items which indicate that a common factor accounts for the relationship between items. This relationship is typically measured through factor analysis method.

▸ **What are Comparative scaling techniques?**

Pairwise comparison scale – a respondent is presented with two items at a time and asked to select one (example : Do you prefer Pepsi or Coke?). This is an ordinal level technique when a measurement model is not applied. Krus and Kennedy (1977) elaborated the paired comparison scaling within their domain-referenced model. The Bradley–Terry–Luce (BTL) model (Bradley and Terry, 1952; Luce, 1959) can be applied in order to derive measurements provided the data derived from paired comparisons possess an appropriate structure. Thurstone's Law of comparative judgment can also be applied in such contexts.

Rasch model scaling – respondents interact with items and comparisons are inferred between items from the responses to obtain scale values. Respondents are subsequently also scaled based on their responses to items given the item scale values. The Rasch model has a close relation to the BTL model.

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Rank-ordering – a respondent is presented with several items simultaneously and asked to rank them (example : Rate the following advertisements from 1 to 10.). This is an ordinal level technique.

Bogardus social distance scale – measures the degree to which a person is willing to associate with a class or type of people. It asks how willing the respondent is to make various associations. The results are reduced to a single score on a scale. There are also non-comparative versions of this scale.

Q-Sort – Up to 140 items are sorted into groups based a rank-order

Guttman scale – This is a procedure to determine whether a set of items can be rank-ordered on a unidimensional scale. It utilizes the intensity structure among several indicators of a given variable. Statements are listed in order of importance. The rating is scaled by summing all responses until the first negative response in the list. The Guttman scale is related to Rasch measurement; specifically, Rasch models bring the Guttman approach within a probabilistic framework.

▸ **Constant sum scale** – a respondent is given a constant sum of money, script, credits, or points and asked to allocate these to various items (example : If you had 100 Yen to spend on food products, how much would you spend on product A, on product B, on product C, etc.). This is an ordinal level technique.

▸ **Magnitude estimation scale** – In a psychophysics procedure invented by S. S. Stevens people simply assign numbers to the dimension of judgment. The geometric mean of those numbers usually produces a power law with a characteristic exponent. In cross-modality matching instead of assigning numbers, people manipulate another dimension, such as loudness or brightness to match the items. Typically the exponent of the psychometric function can be predicted from the magnitude estimation exponents of each dimension.

▸ **What is Non-comparative scaling techniques?**

Continuous rating scale (also called the graphic rating scale) – respondents rate items by placing a mark on a line. The line is usually labeled at each end. There are sometimes a series of numbers, called scale points, (say, from zero to 100) under the line. Scoring and codification is difficult.

Likert scale – Respondents are asked to indicate the amount of agreement or disagreement (from strongly agree to strongly disagree) on a five- to nine-point scale. The same format is used for multiple questions. This categorical scaling procedure can easily be extended to a magnitude estimation procedure that uses the full scale of numbers rather than verbal categories.

Phrase completion scales – Respondents are asked to complete a phrase on an 11-point response scale in which 0 represents the absence of the theoretical construct and 10 represents the theorized maximum amount of the construct being measured. The same basic format is used for multiple questions.

▸ **Semantic differential scale** – Respondents are asked to rate on a 7 point scale an item on various attributes. Each attribute requires a scale with bipolar terminal labels.

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- ▸ **Stapel scale** – This is a unipolar ten-point rating scale. It ranges from +5 to −5 and has no neutral zero point.

- ▸ **Thurstone scale** – This is a scaling technique that incorporates the intensity structure among indicators.

- ▸ **Mathematically derived scale** – Researchers infer respondents' evaluations mathematically. Two examples are multi dimensional scaling and conjoint analysis.

Unit III Data Collection

Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument – Validation of questionnaire – Sampling plan – Sample size – determinants optimal sample size – sampling techniques – Probability Vs Non–probability sampling methods.

Data

It is a set of values of qualitative or quantitative variables. Data is the raw facts or figures, the researcher collects from the respondents. The processed data is called information. Data and information are often used interchangeably.

Data collection

Data collection is a process of collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcomes. Data collection methods can be divided into two categories: secondary methods of data collection and primary methods of data collection.

Types of Data
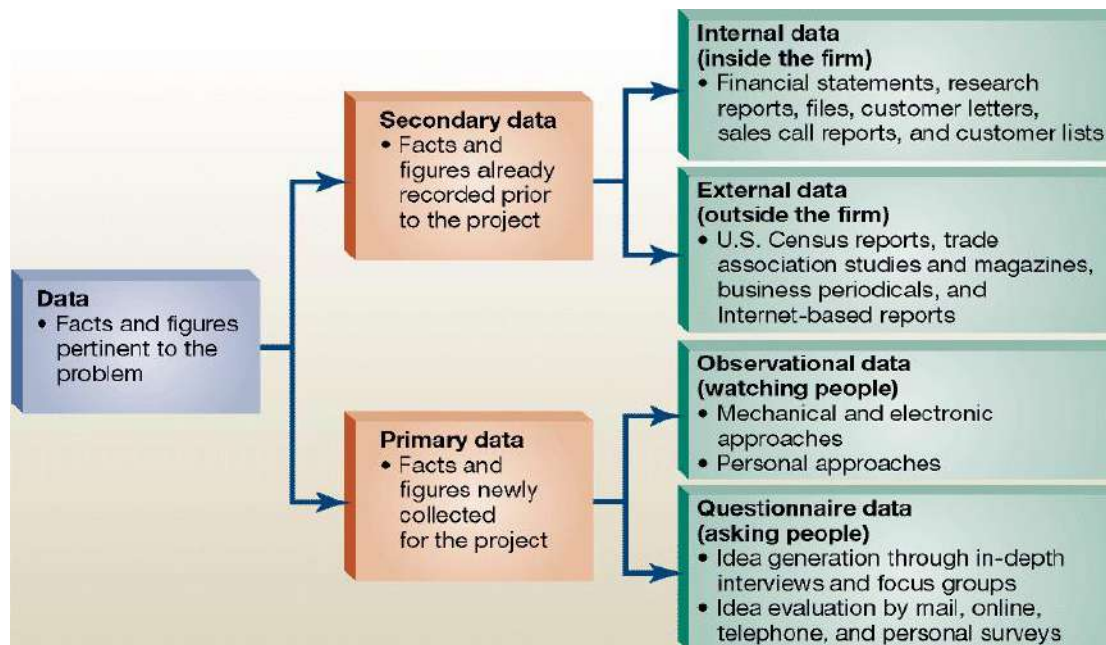
1. Primary Data: Are those which are collected a fresh and for the first time and thus happen to be original in character.

2. Secondary Data: Are those data which have collected by someone else and which have already been passed through statistical process are known as secondary data

- Employee records

- Sales data

- Other sources: customer databases, CRM data, warranty records, etc.

External data sources:

- Published data: data that is in on public domains, which could be compiled by public or private sources

- Government sources: census data, other documented and available government publications

- Other data sources: essentially non-government sources like books, periodicals, guides and directories, Indices and standardized non-government statistical data

Computerised Database / Electronic Database

- Bibliographic databases are composed of citations to articles.

- Numeric databases contain numerical and statistical information.

- Full-text databases contain the complete text of the source documents comprising the database.

- Directory databases provide information on individuals, organizations, and services.

- Special-purpose databases provide specialized information.

Computer database / Electronic database

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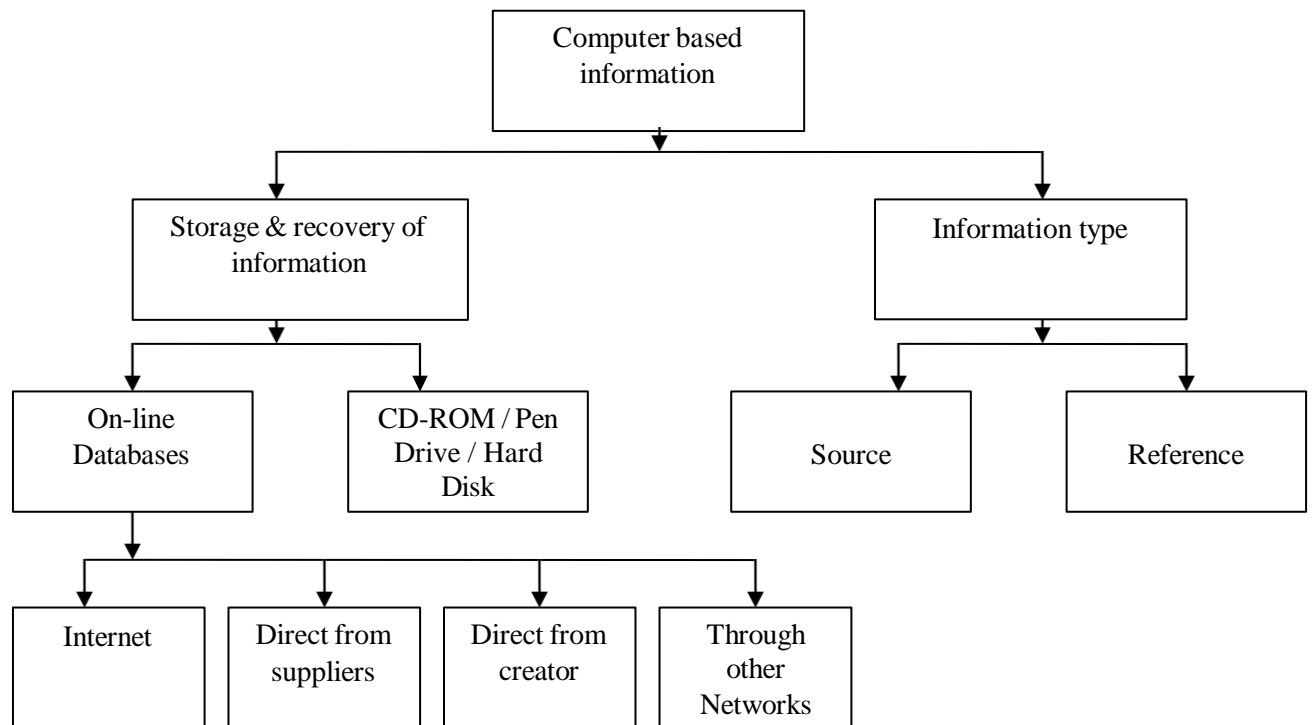
Syndicated Sources

- Companies that collect and sell common pools of data of known commercial value designed to serve a number of clients.

- Syndicated sources can be classified based on the unit of measurement (households/consumers or institutions).

- Household/consumer data may be obtained from surveys, diary panels, or electronic scanner services.

- Institutional data may be obtained from retailers, wholesalers, or industrial firms

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Advantages and disadvantages of secondary data:

Advantages /Merits

- Use of secondary data is very convenient.

- It saves time and finance.

- In some enquiries primary data cannot be collected.

- Reliable secondary data are generally available for many investigations.

Disadvantages /Demerits

- It is very difficult to find sufficiently accurate secondary data.

- It is very difficult to find secondary data which exactly fulfils the need of present investigation.

- Extra caution is required to use secondary data.

- These are not available for all types of enquiries.

Primary vs. Secondary Sources

What's the difference between them?

Primary Sources	Secondary Sources
Definition: Main text or work that you are discussing, actual data or research results, or historical documents. Also: first-hand testimony.	**Definition**: Records generated by an event but written by non-participants in the event. Based on/derived from primary sources - but they have been interpreted, or analyzed.
Examples	**Examples**
Diaries, journals, speeches, interviews, letters, memos, manuscripts, memoirs, autobiographies, government records, records of organizations (e.g. minutes, reports, correspondence) **Published materials** (books and journal/newspaper articles) written AT THE TIME about a particular event **Documentary:** photographs, audio recordings, movies or videos **Public opinion polls**, field notes, scientific experiments, artifacts **Reprinted primary sources** (often in reference books such as: Speeches of the American Presidents and Documents of American History) **Maps**, oral histories, postcards, court records, paintings, sculptures, consumer surveys, patents, schematic drawings, technical reports, personal accounts, jewelry, private papers, deeds, wills, proceedings, census data	**Encyclopedias**, chronologies, fact books **Biographies**, monographs, dissertations **General histories** **Most journal articles** (except those discussed in column one) **Most published books** (except those discussed in column one)

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PRIMARY METHODS
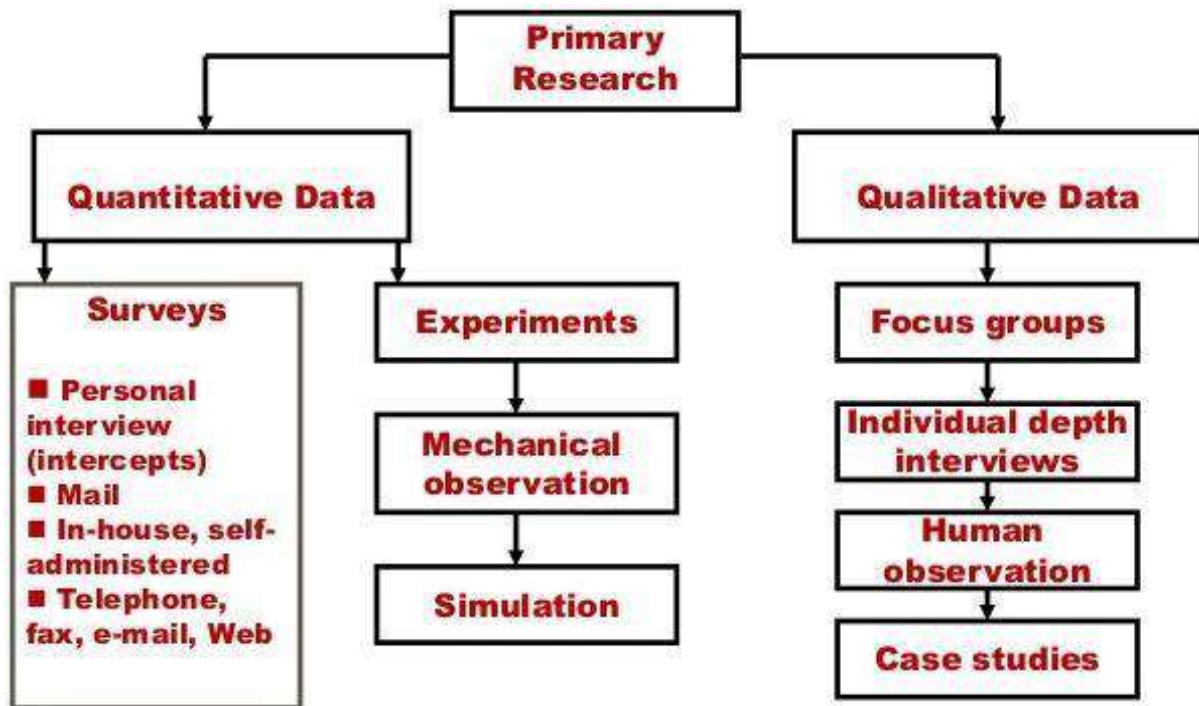
- **Quantitative Data.** These are data that deal with quantities, values or numbers, making them measurable. Thus, they are usually expressed in numerical form, such as length, size, amount, price, and even duration. The use of statistics to generate and subsequently analyze this type of data add credence or credibility to it, so that quantitative data is overall seen as more reliable and objective.

- **Qualitative Data.** These data, on the other hand, deals with quality, so that they are descriptive rather than numerical in nature. Unlike quantitative data, they are generally not measurable, and are only gained mostly through observation. Narratives often make use of adjectives and other descriptive words to refer to data on appearance, color, texture, and other qualities.

Quantitative Methods

- **Survey: Definition**

- A Survey is defined as a research method used for collecting data from a pre-defined group of respondents to gain information and insights on various topics of interest. Surveys have a variety of purposes and can be carried out in many ways depending on the methodology chosen and the objectives to be achieved.

- **Interviews**

- Personal one-on-one interviews may also be used for gathering quantitative data. In collecting quantitative data, the interview is more structured than when gathering qualitative data, comprised of a prepared set of standard questions.

- **Face-to-face interviews:** Much like when conducting interviews to gather qualitative data, this can also yield quantitative data when standard questions are asked.

- (+) The face-to-face setup allows the researcher to make clarifications on any answer given by the interviewee.

- (-) This can be quite a challenge when dealing with a large sample size or group of interviewees. If the plan is to interview everyone, it is bound to take a lot of time, not to mention a significant amount of money.

- **Telephone and/or online, web-based interviews.** Conducting interviews over the telephone is no longer a new concept. Rapidly rising to take the place of telephone interviews is the video interview via internet connection and web-based applications, such as Skype.

  - (+) The net for data collection may be cast wider, since there is no need to travel through distances to get the data. All it takes is to pick up the phone and dial a number, or connect to the internet and log on to Skype for a video call or video conference.

  - (-) Quality of the data may be questionable, especially in terms of impartiality. The net may be cast wide, but it will only be targeting a specific group of subjects: those with telephones and internet connections and are knowledgeable about using such technologies.

  Computer-assisted interviews. This is called CAPI, or Computer-Assisted Personal Interviewing where, in a face-to-face interview, the data obtained from the interviewee will be entered directly into a database through the use of a computer.

  - (+) The direct input of data saves a lot of time and other resources in converting them into information later on, because the processing will take place immediately after the data has been obtained from the source and entered into the database.

  - (-) The use of computers, databases and related devices and technologies does not come cheap. It also requires a certain degree of being tech-savvy on the part of the data gatherer.

    - **Experiments**

- Have you ever wondered where clinical trials fall? They are considered to be a form of experiment, and are quantitative in nature. These methods involve manipulation of an independent variable, while maintaining varying degrees of control over other variables, most likely the dependent ones. Usually, this is employed to obtain data that will be used later on for analysis of relationships and correlations.

- Quantitative researches often make use of experiments to gather data, and the types of experiments are:

- **Laboratory experiments.** This is your typical scientific experiment setup, taking place within a confined, closed and controlled environment (the laboratory), with the data

collector being able to have strict control over all the variables. This level of control also implies that he can fully and deliberately manipulate the independent variable.

- **Field experiments.** This takes place in a natural environment, "on field" where, although the data collector may not be in full control of the variables, he is still able to do so up to a certain extent. Manipulation is still possible, although not as deliberate as in a laboratory setting.

- **Natural experiments.** This time, the data collector has no control over the independent variable whatsoever, which means it cannot be manipulated. Therefore, what can only be done is to gather data by letting the independent variable occur naturally, and observe its effects.

Qualitative methods

- **Paper surveys or questionnaires.** Questionnaires often utilize a structure comprised of short questions and, in the case of qualitative questionnaires, they are usually open-ended, with the respondents asked to provide detailed answers, in their own words. It's almost like answering essay questions.

- **Web-based questionnaires.** This is basically a web-based or internet-based survey, involving a questionnaire uploaded to a site, where the respondents will log into and accomplish electronically. Instead of a paper and a pen, they will be using a computer screen and the mouse.

    - **Focus Groups**

- **Focus groups method** is basically an interview method, but done in a group discussion setting. When the object of the data is behaviours and attitudes, particularly in social situations, and resources for one-on-one interviews are limited, using the focus group approach is highly recommended. Ideally, the focus group should have at least 3 people and a moderator to around 10 to 13 people maximum, plus a moderator.

- Depending on the data being sought, the members of the group should have something in common. For example, a researcher conducting a study on the recovery of married mothers from alcoholism will choose women who are (1) married, (2) have kids, and

(3) recovering alcoholics. Other parameters such as the age, employment status, and income bracketdo not have to be similar across the members of the focus group.

    - **Observation**

- In this method, the researcher takes a participatory stance, immersing himself in the setting where his respondents are, and generally taking a look at everything, while taking down notes.

- Aside from note-taking, other documentation methods may be used, such as video and audio recording, photography, and the use of tangible items such as artefacts, mementoes, and other tools

Case Studies

- In this qualitative method, data is gathered by taking a close look and an in-depth analysis of a "case study" or "case studies" – the unit or units of research that may be an individual, a group of individuals, or an entire organization. This methodology's versatility is demonstrated in how it can be used to analyse both simple and complex subjects.

- **Survey: Definition**

- A Survey is defined as a research method used for collecting data from a pre-defined group of respondents to gain information and insights on various topics of interest. Surveys have a variety of purposes and can be carried out in many ways depending on the methodology chosen and the objectives to be achieved.

- **Characteristics of a Survey**

- The need to observe or research facts about a situation leads us to conduct a survey. As we mentioned at the beginning, a survey is a method of gathering information.

- Effective survey questions are the cornerstone for the success of any survey and subsequently, any research study.

- **Characteristics of survey questions**

- **Data collection:** Whether it an email survey, SMS survey, web intercept survey or a mobile app survey, the single common denominator that determines how effectively you are able to collect accurate and complete survey responses is your survey questions and their types.

  - **Fundamental levels of measurement scales:**

- There are four measurement scales which are fundamental to creating a multiple-choice question in a survey. They are, nominal, ordinal, interval and ratio measurement scales without the fundamentals of which, no multiple choice questions can be created. Hence, it is important to understand these levels of measurement to be able to create a robust survey.

  - **Use of different question types:**

- Multiple choice questions are the most common type of survey questions, in which, some of the popular question types are: dichotomous question, semantic differential scale question, rank order questions and rating scale questions. Open ended questions are used to collect in-depth qualitative data.

  - **Administering the survey:**

- To conduct a survey, it is important to plan the type of survey to ensure you get the optimum number of responses required for your survey. It could be a mix of interviews and survey questions or a questionnaire. Interviews could be telephone interviews, face-to-face interviews, online interviews and questionnaires can be mall surveys or web surveys. The underlying difference between a survey and a questionnaire is that a

questionnaire may or may not be delivered in the form of a survey, but a survey always consists of a questionnaire.

- **Survey Methods based on Design**

- **Cross-sectional studies:** Cross-sectional study is defined as an observational research type that analyzes data of variables collected at one given point of time across a sample population. population or a pre-defined subset. This study type is also known as cross-sectional analysis, transverse study or prevalence study.

- **Longitudinal studies:** Longitudinal study is an observational study that employs continuous or repeated measures to follow particular individuals over prolonged period of time often years or decades. Longitudinal study collects data that is either qualitative or quantitative in nature. In longitudinal study a survey creator is not interfering with survey respondents.

- **Correlational studies:** Correlational study is a non-experimental type of research design where two distinct variables are studied and a statistical analysis is run to study relation between them without the interference of external "variables". This study aims to understand the change and level of change in one of the two variables in study, if the other variable changes.Survey Methods based on Distribution

- **Email:** Sending out an email is the easiest way of conducting a survey. The respondents are targeted and there is higher chance of response due to the respondents already knowing about your brand. You can use the QuestionPro email management feature to send out and collect survey responses.

- **Buy respondents:** Buying a sample helps achieve a lot of the response criteria because the people who are being asked to respond have signed up to do so and the qualifying criteria for the research study is met.

- **Embed survey in website:** Embedding a survey in a website ensures that the number of responses is very high. This can be done while the person enters the website or is exiting it. A non intrusive method of collecting feedback is important to achieve a higher number of responses.

- **Post to social network:** Posting on social networks is another effective way of collecting responses. The survey can be posted as a link and people that follow the brand can take a survey.

- **QR code:** QuestionPro QR codes store the URL for the survey. You can print/publish this code in magazines, on signs, business cards, or on just about any object/medium. Users with a camera phone equipped with the correct reader application can scan the image of the QR Code to open the survey in the phone's browser.

- **Question Pro App:** The QuestionPro App allows to quickly circulate surveys and the responses can be collected both online and offline.

- **API:** You can use the API integration of the QuestionPro platform for potential respondents to take your survey.

- **SMS:** Using SMS surveys are another quick way to collect feedback. This method can be used in the case of quick responses and when the survey is simple, straightforward and not too long. This method is used to increase the open and response rate of collecting feedback.

  - **Survey Data Collection**

- The methods used to collect survey data have evolved with time. Researchers have increasingly moved away from paper surveys to using smart, online surveys. Each survey data collection method has it's pros and cons and the researcher has to in most cases, use **different methods** to collect the requisite data from a sample.

- **Online surveys:** Online surveys have now become the most widely used survey data collection method. This method is now widely being used because the reach of the surveys has increased to wherever there is internet access, which is everywhere.

- **Telephone surveys:** Telephone surveys are a cheaper method than face-to-face surveys and less-time consuming too. Contacting respondents via the telephonic medium requires less effort and manpower but the survey response rate could be debated as respondents aren't very trusting to give out information on call.

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- **Face-to-face surveys:** Face-to-face surveys are on the most widely used methods of survey data collection. The survey response rate in this survey data collection method is always higher because the respondent trusts the researcher since it is in-person.

- **Paper surveys:** The least used survey data collection method that is now being used mostly in field research, are paper surveys. Since they are logistically tough to manage and tough to analyze, researchers and organizations are moving away from using this method.

  - **Survey Data Analysis**

- **Cross-tabulation:** Cross-tabulation is one of the simplest statistical analysis tool that uses a basic tabulation framework to make sense of data. Raw survey data can be daunting but structuring that data into a table helps draw parallels between different research parameters. It involves data that is mutually exclusive to each other.

- **Trend analysis:** Trend analysis provides the ability to look at survey-data over a long period of time. This method of statistical analysis of survey data helps plot aggregated response data over time which can be used to draw conclusions about the change in respondent perception over time.

- **MaxDiff analysis:** The MaxDiff analysis method is used to understand customer preferences across multiple parameters. For example, a product's pricing, features, marketing etc. become the basis for maxdiff analysis. In a simplistic form, this method is also called the "best-worst" method. This method is similar to conjoint analysis but is much easier to implement

- **Conjoint analysis:** Conjoint analysis is an advanced statistical research method that aims to understand the choices a person makes in selecting a product or service. This method offers in-depth insights into what is important to a customer and what parameters sway their purchasing decisions.

- **TURF analysis:** TURF analysis or Total Unduplicated Reach and Frequency Analysis, is a statistical research methodology that assesses the total market reach of a product or service or a mix of both. This method is widely used by organizations to understand at what frequency is their messaging reaching the audience and if that needs tweaking. TURF Analysis is widely used to formulate and measure the success of go-to-market strategies.

- **Gap analysis:** Gap analysis uses a side-by-side matrix question type that helps measure the difference between expected performance and actual performance. This statistical method for survey data helps understand the things that have to be done to move performance from actual to planned performance.

- **SWOT analysis:** SWOT analysis, another widely used statistical method organizes survey data into data that represents strength, weaknesses, opportunities and threats of an organization or product or service that provides a holistic picture about competition. This method helps to create effective business strategies.

- **Text analysis:** Text analysis is an advanced statistical method where intelligent tools make sense of and quantify or fashion qualitative and open-ended data into easily understandable data. This method is used when the survey data is unstructured.

-

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Methods of data Collection :Primary Data

- 1)   OBSERVATION   METHOD   : Observation method is a method under which data from the field is collected with the help of observation by the observer or by personally going to the field.

- In the words of P.V. Young, "Observation may be defined as systematic viewing, coupled with consideration of seen phenomenon."

ADVANTAGES:

- Subjective bias eliminated (No bias info)
- Information researcher gets is Current information
- Independent to respondent's variable (as in interview and may be bias)

DISADVANTAGES :

- It is expensive method (time requires more)
- Limited information
- Unforeseen factors may interfere with observational task
- Respondents opinion can not be recorded on certain subject

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TYPES OF OBSERVATION

Structured and Unstructured Observation

- When observation is done by characterizing style of recording the observed information, standardized conditions of observation , definition of the units to be observed , selection of pertinent data of observation then it is structured observation

- When observation is done without any thought before observation then it is unstructured observation

Participant & Non Participant Observation

- When the Observer is member of the group which he is observing then it is Participant Observation

- In participant observation Researcher can record natural behavior of group , Researcher can verify the truth of statements given by informants in the context of questionnaire , Difficult to collect information can obtain through this method but in this researcher may loose objectivity of research due emotional feelings. Prob. of control in observation isn't solved.

Non Participant Observation

- When observer is observing people without giving any information to them then it is non participant observation

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Controlled & Uncontrolled Observation
- When the observation takes place in natural condition i.e. uncontrolled observation. It is done to get spontaneous picture of life and persons
- When observation takes place according to definite pre arranged plans, with experimental procedure then it is controlled observation generally done in laboratory under controlled condition.

CONSTRUCTION OF QUESTIONNAIRE AND INSTRUMENT

Questionnaire- Definition

- A set of predetermined questions for all respondents that serve as a primary research instrument in survey research.

- Questionnaires are used in sample surveys or censuses to elicit reports of facts, attitudes, and other subjective states.

Purpose of Questionnaire

- To extract data from respondents

- Inexpensive way to collect data

- Increases speed and accuracy

- Save time, money and energy

Elements of Questionnaire

- Title

- General Information

- Specific instruction

- Questionnaire items

- Additional Information

- Thank You at end

Characteristics of good Questionnaire

- It should be comparatively short and simple.

- Easily understood.

- Questions should proceed in logical sequence moving from easy to more difficult

- Personal and intimate questions should be left to the end.

- It should be attractive looking

- Repetition of questions should be eliminated

  - **Pilot study**

- It is a process of testing the questionnaire before it is finalized, the questionnaire before it is finalized, that is after the questionnaire is drafted, to decide whether it is comprehensive or not, it is used with a few respondents.

- Their responses are studied to determine the need for restructuring the questionnaire, re-sequencing the questions, addition or deletion of questions, giving more instructions for filing up etc can also be decided. It will bring to light the weaknesses of the questionnaire.
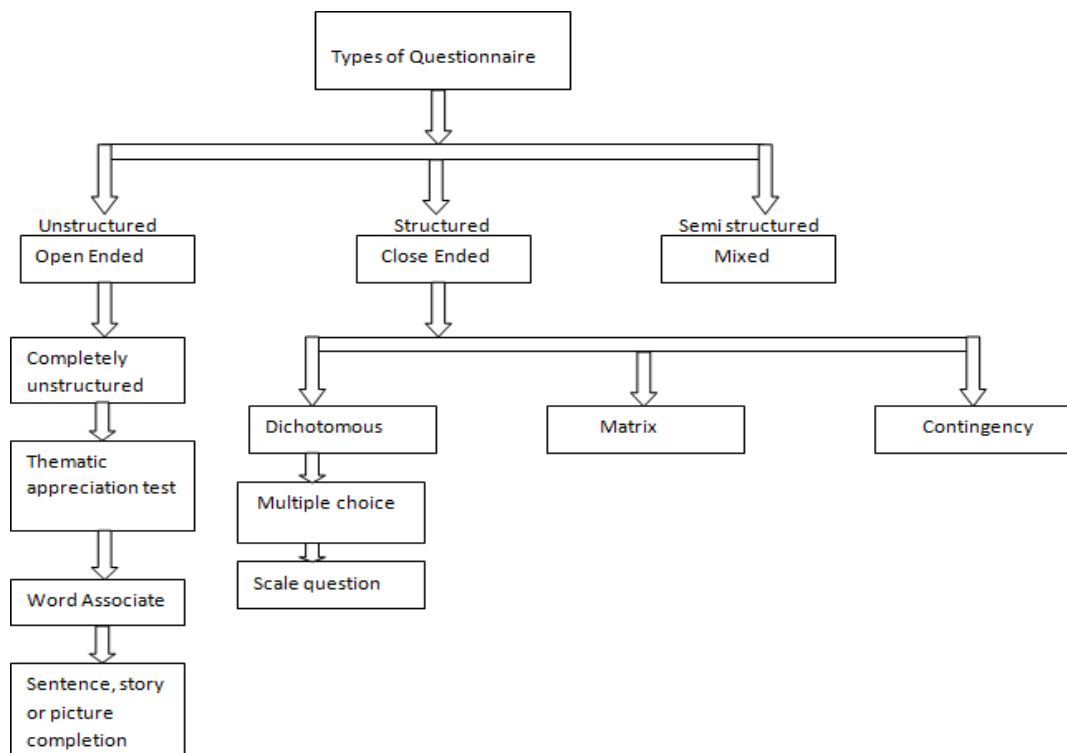
Open-ended/ Unstructured questions

- Open-ended questions are questions that allow someone to give a free-form answer.

- It requires more than one word answers. The answers could come in the form of a list, a few sentences.

- Ex: How satisfied or dissatisfied are you with this process?

- How would this fit into your work?

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[Type here]

- A projective test designed to reveal a person's social drives or needs by their interpretation of a series of pictures of emotionally ambiguous situations.

- In this sequence of pictures shows to respondents. The respond may be analyses in terms of any theme, conflicts, motivation, etc.

Word Association test

- Words are presented and the respondents mention the first word that comes to mind.

- Ex: Exam-Tension, Mother-Love

Sentence, story or picture completion

- The respondents complete an incomplete sentence, stories or write an empty conversation balloon in a picture.

Closed-ended / Structured questions

- Closed-ended questions can be answered with "Yes" or "No," or they have a limited set of possible answers.

  - **Dichotomous**

- It has only two possible answers like Yes or No, True or False, Agree or Disagree.

- Ex**: Have you ever purchased a product or service from our website? Yes No**

- **Multiple Choice**

- Multiple choice questions allow respondent to choose more than one answer.

- Ex:

- What is your favorite pizza topping?

- (a) Pepperoni (b)Mushroom (c)Sausage (d)Anchovies.

Scale question

- I would recommend this product to my friends

- Very Likely

- Likely

- Neutral

- Not Likely

- Very Unlikely

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Matrix

• **Contingency (Dependent Questions)**

Mixed (Semi structured

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In some situations, you may have a partial list of answer choices, but you may still have some doubt or uncertainty about other possible responses. You can create a partially structured question such as the following:

Example of a Partially Structured Question
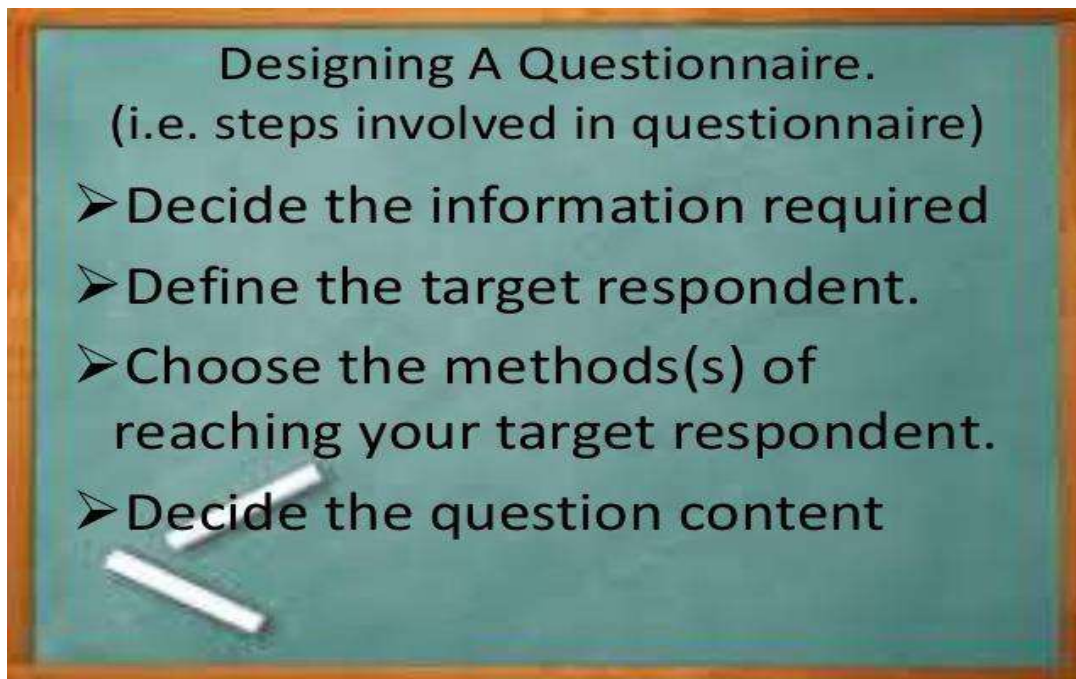
What purpose do you use web based resources?

•For research work
•To write assignments
•To improve subject knowledge
•For the purpose of seminar presentation

Any other (Please specify): 1._____
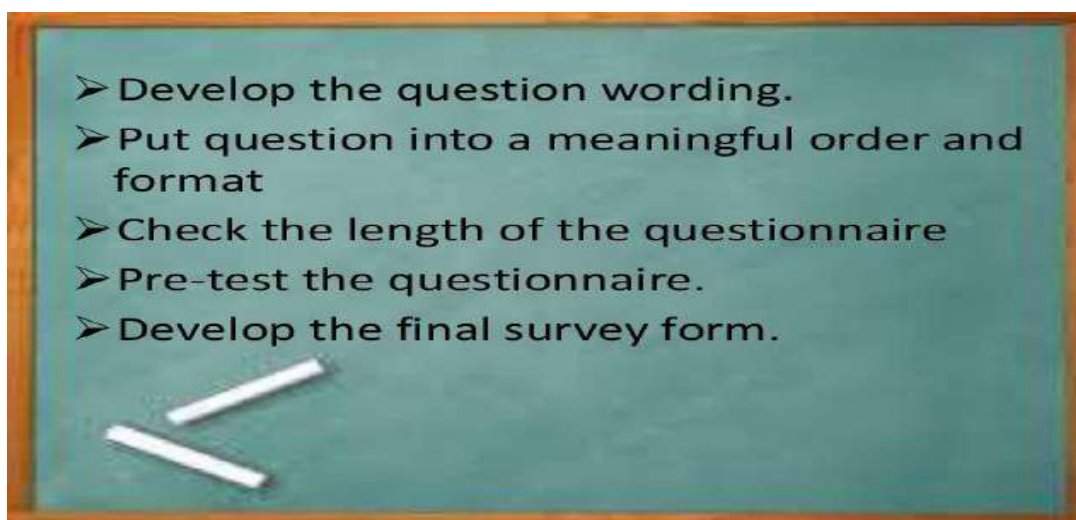
2. _____

Steps in questionnaire Development

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1. Decide the information required.

The first step is to decide' what are the things one needs to know from the respondent in order to meet the survey's objective?

2.Define the target respondent.

At the out set, the researcher must define the population about which he/she wishes to generalize from the sample data to be collected.

Choose the methods(s) of reaching your target respondent.

- Personal interviews

- Group or focus interviews

- Mailed questionnaires

- Telephone interview

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4.Decide the question content

Researcher must always be prepared to ask," is this question really needed??

There are only 2 occasions when seemingly "redundant" might be included:

- Opening questions that are easy to answer.
- "Dummy" question can disguise the purpose of that survey and/or the sponsorship of the study

4.Decide the question content

Researcher must always be prepared to ask," is this question really needed??

There are only 2 occasions when seemingly "redundant" might be included:

- Opening questions that are easy to answer.
- "Dummy" question can disguise the purpose of that survey and/or the sponsorship of the study

5.Develop the question wording.

- It provide the respondent with an easy method of indicating his answer- he does not have to think about how to articulate his answer.
- Responses can be easily classified, making analysis very straight forward
- It permits the respondent to specify the answer categories most suitable for their purpose.

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6. Put question into a meaningful order and format.

- Opening questions.
- Question flow
- Question variety
- Closing question

7. Check the length of the questionnaire.

- In general it is best for a questionnaire to be as short as possible.
- A long questionnaire leads to a long interview and this is open to the dangers of boredom on the part of respondent.(and poor considered, hurried answers)

8. Pre-test the questionnaire.

- Test the questionnaire on a small sample of your subject first this is possible at least it on colleagues or friends.
- The aim here to detect any flaws in your question and correct these prior to main survey.

10. Develop the final survey form.

It means designed questionnaire will be administered among the selected sample respondents to the study.

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The advantages of questionnaires

- Practical
- Large amounts of information can be collected from a large number of people in a short period of time and in a relatively cost effective way
- Can be carried out by the researcher or by any number of people with limited affect to its validity and reliability

- The results of the questionnaires can usually be quickly and easily quantified by either a researcher or through the use of a software package
- Can be analyzed more 'scientifically' and objectively than other forms of research

The disadvantages of questionnaires.

- Is argued to be inadequate to understand some forms of information - i.e. changes of emotions, behavior, feelings etc.
- There is no way to tell how truthful a respondent is being
- There is no way of telling how much thought a respondent has put in
- The respondent may be forgetful or not thinking within the full context of the situation
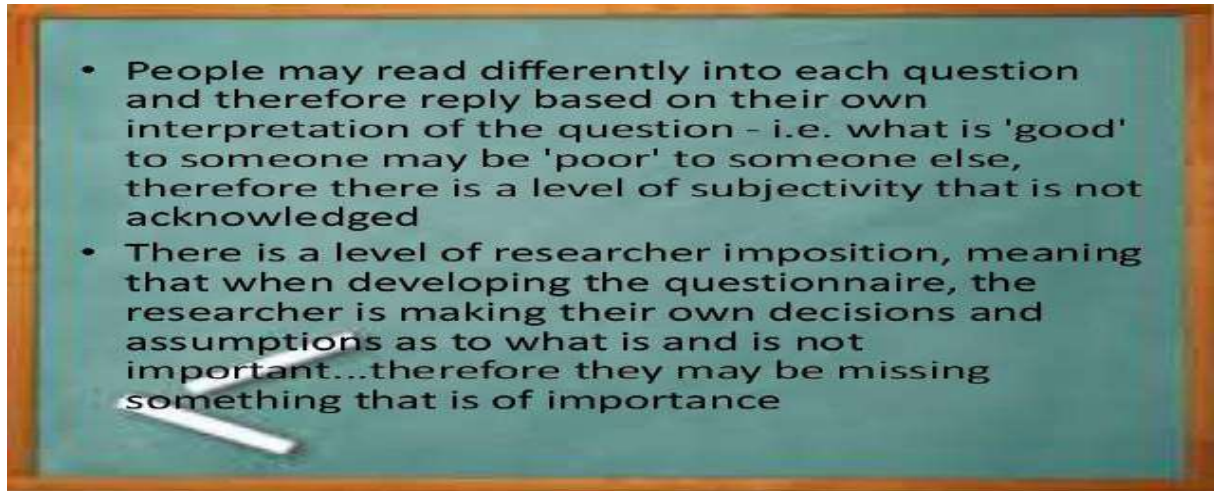
Sampling - Sample Size

Sample size is the number of items to be selected from the universe. It should be optimum. Formulas, tables, and power function charts are well known approaches to determine sample size.

The Factors Considering While Deciding The Size Of The Sample

 a) Nature of the population.

b) Complexity of tabulation.

c) Problem relate with collection of data.

d) Type of sampling.

e) Basic information.

f) Degree of accuracy required for the study.

Criteria of Selecting a Sampling Procedure

1. Nature of the problem.

2. Goal of researchers.

3. Geographical area covered by the survey.

4. Size of the population under study.

5. Extent of fact available about population.

6. Availability of funds

7. Available time for study.

8. Desired reliability of the result.

Criteria Used For Selecting Sampling Techniques

- The purpose of the survey.

- Degree of precision.

- Information about population.

- The nature of the population.

- The geographical area covered by the survey.

- Fund availability.

- Time.

- Economy.

Sampling Design

- Sampling is concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population. A Sample design is a definite plan for obtaining a sample from a given population.

  - **Definition**

- According to Gerald Hursh "a Sample Design is the theoretical basis and the practical means by which we infer the characteristics of some population by generalizing from the characteristics of relatively few of the units comprising the population.

  - **Steps in Sampling Design**

- 1. Define the population or universe

- 2. State the sampling frame

- 3. Identify the sampling unit

- 4. State sampling method

- 5. Determine the sample size

- 6. Spell out the sampling plan

- 7. Select the sample

  - **Sampling Plan/ Sampling techniques/Classification**

- A **sampling method** is a procedure for selecting **sample** members from a population. The common methods are given below.

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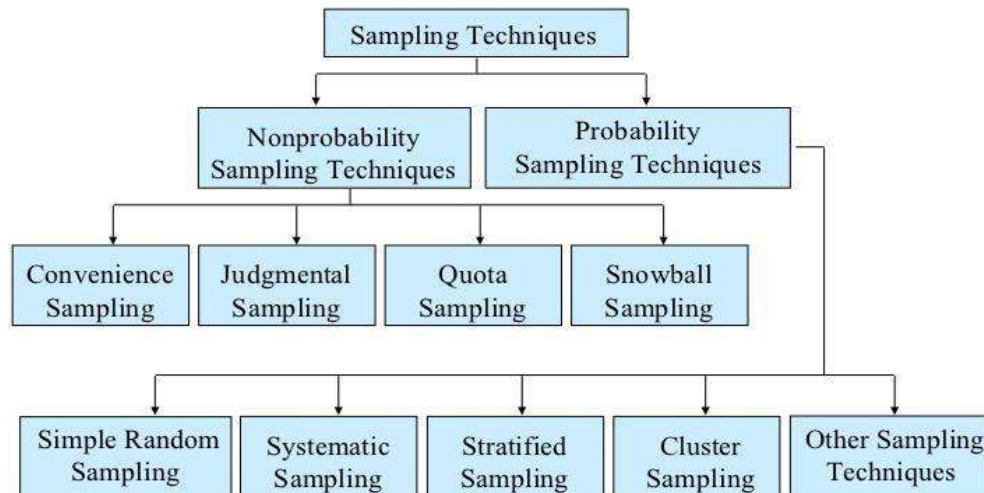
Non probability sampling

Non-probability sampling is a sampling technique where the samples in the population are not equal chances of being selected**.**

Convenience Sampling

Convenience sampling is probably the most common of all sampling techniques. With convenience sampling, the samples are selected because they are accessible to the researcher. Subjects are chosen simply because they are easy to recruit. This technique is considered easiest, cheapest and least time consuming.

- **Judgmental Sampling**

Judgmental sampling is more commonly known as purposive sampling. In this type of sampling, subjects are chosen to be part of the sample with a specific purpose in mind. With judgmental sampling, the researcher believes that some subjects are fit for the research compared to other individuals.

- **Quota Sampling**

- Quota sampling is a non-probability sampling technique wherein the researcher ensures equal or proportionate representation of subjects depending on which trait is considered as basis of the quota.

- For example, if basis of the quota is college year level and the researcher needs equal representation, with a sample size of 100, he must select 25 1st year students, another 25 2nd year students, 25 3rd year and 25 4th year students. The bases of the quota are usually age, gender, education, race, religion and socioeconomic status.

Snowball sampling

Snowball sampling is a non-probability sampling technique that is used by researchers to identify potential subjects in studies where subjects are hard to locate.It is also called Chain Referral Sampling.

Probability Sampling

- **Simple Random Sampling**

- In this technique, each member of the population has an equal chance of being selected as subject. The entire process of sampling is done in a single step with each subject selected independently of the other members of the population.

   - **Systematic random sampling**

- In systematic random sampling, the researcher first randomly picks the first item or subject from the population. Then, the researcher will select each n'th subject from the list.

Stratified sampling

- Stratified sampling is a probability sampling technique wherein the researcher divides the entire population into different subgroups or strata, then randomly selects the final subjects proportionally from the different strata.

Cluster Sampling

- First, the researcher selects groups or clusters, and then from each cluster, the researcher selects the individual subjects by either simple random or systematic random sampling.

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UNIT IV DATA PREPARATION AND ANALYSIS

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Bivariate and Multivariate statistical techniques – Factor analysis – Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Application of statistical software for data analysis.

Data Preparation:
Data Preparation is the process of collecting, cleaning, and consolidating data into one file or data table, primarily for use in analysis.
Data preparation includes editing, coding and data entry.
Data Preparation process:
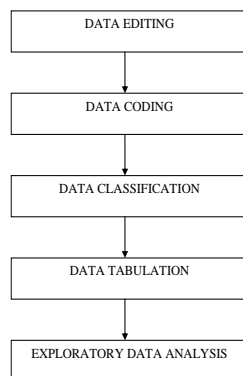
Editing:
The   inspection and correction of the data received from each element of the sample. Editing can be done for the following things.
Incomplete Answers
- What to do?
- General rule

Wrong Answers
Answers that Reflect Lack of Interest

Coding:
"Transforming raw data into symbols".
Coding means assigning a code, usually a number to each possible response to each question.
EX:
Closed-ended items
- Genders
- Scales

Data entry:
After responses have been coded, they can be entered into data base. Raw data can be entered through software program. Ex: SPSS Data Editor

Validity of data: It means How valid are the findings within the study?

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There are two types of validity Internal Validity and external validity.

Qualitative Vs Quantitative data analyses:

Criteria	Qualitative	Quantitative
Purpose	Understand and interpret social interactions	Test hypotheses, check the cause and effect. Develop predictions for the future
Studied group	Small, selected intentionally	Larger and selected randomly
Data type	Words, images, objects	Numbers and statistics
Data form	Open-ended responses, interviews, participant observations, field notes	Precise measurements using structures and validated instruments for data collection.
Type of data analysis	Patterns, features, themes identification.	Statistical relatioships identification
Researcher's role	Researcher may be known to participants in the study and participants's characteristics may be known to the researchers.	Researcher and their biases are not known to the participants in the study. Participant characteristics are hidden.
Results	Particular findings, less generalizable	Generalizable findings, can be applied to the other populations.

What is Bivariate Analysis?

Bivariate analysis means the analysis of bivariate data. It is one of the simplest forms of statistical analysis, used to find out if there is a relationship between two sets of values. It usually involves the variables X and Y.

- Univariate analysis is the analysis of one ("uni") variable.
- Bivariate analysis is the analysis of exactly two variables.
- Multivariate analysis is the analysis of more than two variables.

The results from bivariate analysis can be stored in a two-column data table. For example, you might want to find out the relationship between caloric intake and weight (of course, there is a pretty strong relationship between the two. You can read more here.). Caloric intake would be your independent variable, X and weight would be your dependent variable, Y.

Caloric Intake X	Weight Y
3500	250lbs
2000	225lbs
1500	110lbs
2250	145lbs
4500	380lbs

Bivariate analysis is *not* the same as **two sample data analysis**. With two sample data analysis X and Y are not directly related. You can also have a different number of data values in each sample; with bivariate analysis, there is a Y value for each X. Let's say you had a caloric intake of 3,000 calories per day and a weight of 300lbs. You would write that with the x-variable followed by the y-variable: (3000,300). **Two sample data analysis**

Sample1:100,45,88,99

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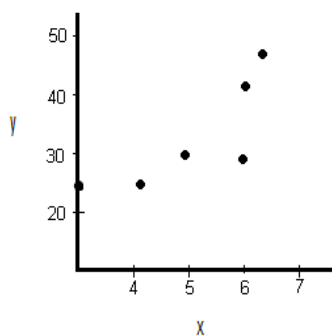Website:www.miet.edu, E-mail:principalengg@miet.edu, contact@miet.edu

Sample2:44,33,101

Bivariate analysis

(X,Y)=(100,56),(23,84),(398,63),(56,42)

Common types of bivariate analysis include:

1. Scatter plots
These give you a visual idea of the pattern that your variables follow.

 A   *simple scatterplot.*

2. Regression Analysis
Regression analysis is a catch all term for a wide variety of tools that you can use to determine how your data points might be related. In the image above, the points look like they could follow an exponential curve (as opposed to a straight line). Regression analysis can give you the equation for that curve or line. It can also give you the correlation coefficient.

3. Correlation Coefficients
Calculating values for correlation coefficients are using performed on a computer. This coefficient tells you if the variables are related. Basically, a zero means they aren't correlated (i.e. related in some way), while a 1 (either positive or negative) means that the variables are perfectly correlated (i.e. they are perfectly in sync with each other).

Multivariate statistical techniques
Multivariate Data **Analysis** refers to any statistical technique used to **analyze** data that arises from more than one variable. This essentially models reality where each situation, product, or decision involves more than a single variable.
1. Factor analysis (FA):
  • Factor analysis is a multivariate statistical technique in which there is no distinction between dependent and independent variables.
  • In factor analysis, all variables under investigation are analysed together to extract the underlined factors.
  • Factor analysis is a data reduction method.

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- It is a very useful method to reduce a large number of variables resulting in data complexity to a few manageable factors.
- These factors explain most part of the variations of the original set of data.
- A *factor is a linear combination of variables.*
- *It is a construct that is not directly* observable but that needs to be inferred from the input variables.
- The factors are statistically independent.

Uses of Factor analysis:
- Scale construction: Factor analysis could be used to develop concise multiple item scales for measuring various constructs.

- Establish antecedents: This method reduces multiple input variables into grouped factors. Thus, the independent variables can be grouped into broad factors.

- Psychographic profiling: Different independent variables are grouped to measure independent factors. These are then used for identifying personality types.

- Segmentation analysis: Factor analysis could also be used for segmentation. For example, there could be different sets of two-wheelers-customers owning two-wheelers because of different importance they give to factors like prestige, economy consideration and functional features.

Steps in Factor Analysis
There are basically two steps that are required in a factor analysis exercise.
Extraction of factors:
- The first and the foremost step is to decide on how many factors are to be extracted from the given set of data. The principal component method is discussed very briefly here.

- As we know that factors are linear combinations of the variables which are supposed to be highly correlated, the mathematical form of the same could be written as

$$F_i = W_{i1}X_1^* + W_{i2}X_2^* + W_{i3}X_3^* + ... + W_{ik}X_k^*$$

Where,
X_i^* = i^{th} standardized variable
F_i = Estimate of ith factor
W_i = Weight or factor score coefficient for i^{th} standardized variable.
k = Number of variables

- The principal component methodology involves searching for those values of W_i so that the first factor explains the largest portion of total variance. This is called the first principal factor.

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- This explained variance is then subtracted from the original input matrix so as to yield a residual matrix.

- A second principal factor is extracted from the residual matrix in a way such that the second factor takes care of most of the residual variance.

- One point that has to be kept in mind is that the second principal factor has to be statistically independent of the first principal factor. The same principle is then repeated until there is little variance to be explained.

- To decide on the number of factors to be extracted Kaiser Guttman methodology is used which states that the number of factors to be extracted should be equal to the number of factors having an eigenvalue of at least 1.

Rotation of factors:
- The second step in the factor analysis exercise is the rotation of initial factor solutions. This is because the initial factors are very difficult to interpret. Therefore, the initial solution is rotated so as to yield a solution that can be interpreted easily.

- The varimax rotation method is used.

- The varimax rotation method maximizes the variance of the loadings within each factor.

- The variance of the factor is largest when its smallest loading tends towards zero and its largest loading tends towards unity.

- The basic idea of rotation is to get some factors that have a few variables that correlate high with that factor and some that correlate poorly with that factor.

- Similarly, there are other factors that correlate high with those variables with which the other factors do not have significant correlation.

- Therefore, the rotation is carried out in such way so that the factor loadings as in the first step are close to unity or zero.

- To interpret the results, a cut-off point on the factor loading is selected.

- There is no hard and fast rule to decide on the cut-off point. However, generally it is taken to be greater than 0.5.

- All those variables attached to a factor, once the cut-off point is decided, are used for naming the factors. This is a very subjective procedure and different researchers may name same factors differently.

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- A variable which appear in one factor should not appear in any other factor. This means that a variable should have a high loading only on one factor and a low loading on other factors.

- If that is not the case, it implies that the question has not been understood properly by the respondent or it may not have been phrased clearly.

- Another possible cause could be that the respondent may have more than one opinion about a given item (statement).

- The total variance explained by Principal component method and Varimax rotation is same. However, the variance explained by each factor could be different.

- The communalities of each variable remains unchanged by both the methods.

2. Discriminant Analysis:
- Discriminant analysis is used to predict group membership.

- This technique is used to classify individuals/objects into one of the alternative groups on the basis of a set of predictor variables.

- The dependent variable in discriminant analysis is categorical whereas the independent or predictor variables are either interval or ratio scale in nature. When there are two groups (categories) of dependent variable, we have two-group discriminant analysis and when there are more than two groups, it is a case of multiple discriminant analysis

The objectives of discriminant analysis are the following:
- To find a linear combination of variables that discriminate between categories of dependent variable in the best possible manner.

- To find out which independent variables are relatively better in discriminating between groups.

- To determine the statistical significance of the discriminant function and whether any statistical difference exists among groups in terms of predictor variables.

- To develop the procedure for assigning new objects, firms or individuals whose profile but not the group identity are known to one of the two groups.

- To evaluate the accuracy of classification, i.e., the percentage of customers that it is able to classify correctly.

Some of the uses of Discriminant Analysis are:
- **Scale construction:** Discriminant analysis is used to identify the variables/statements that are discriminating and on which people with diverse views will respond differently.

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- **Perceptual mapping:** The technique is also used extensively to create attribute-based spatial maps of the respondent's mental positioning of brands.

- **Segment discrimination:** To understand what are the key variables on which two or more groups differ from each other, this technique is extremely useful. Questions to which one may seek answers are as follows:

  - What are the demographic variables on which potentially successful salesmen and potentially unsuccessful salesmen differ?

The mathematical form of the discriminant analysis model is:

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_2 X_2 + \ldots + b_K X_K$$

Where,
Y = Dependent variable
b_s = Coefficients of independent variables
X_s = Predictor or independent variables

- Dependent Variable Y should be a categorized variable whereas the independent variables X_s should be continuous. (interval or ratio scale)

- Dependent variable should be coded as 0, 1 or 1, 2 in case of two-group discriminant model.

3. Cluster analysis

Cluster analysis is a techniques for grouping objects, cases, entities on the basis of multiple variables. The advantage of the technique is that it is applicable to both metric and non-metric data.

Secondly, the grouping can be done post hoc , i.e. after the primary data survey is over. The technique has wide applications in all branches of management . However, it is most often used for market segmentation analysis.

Usage of cluster analysis:

- Market segmentation – customers/potential customers can be split into smaller more homogenous groups by using the method.

- Segmenting industries – the same grouping principle can be applied for industrial consumers.

- Segmenting markets – cities or regions with similar or common traits can be grouped on the basis of climatic or socio-economic conditions.

Statistics associated with cluster analysis:

- Metric data analysis

$$d_{ij} = \sqrt{\sum_{k=1}^{3} \left(X_{ik} - X_{jk} \right)^2}$$

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Where,

d_{ij} = distance between person i and j.

k = variable (interval / ratio)

i = object

j = object

Non-metric data

- Simple matching coefficient $= \dfrac{P}{(p+m+n)}$

- Jaccard coefficient $= \dfrac{P}{(p+m)}$

Where

- P=positive matches

- N=negative matches

- M=mismatches

Cluster Analysis Process:
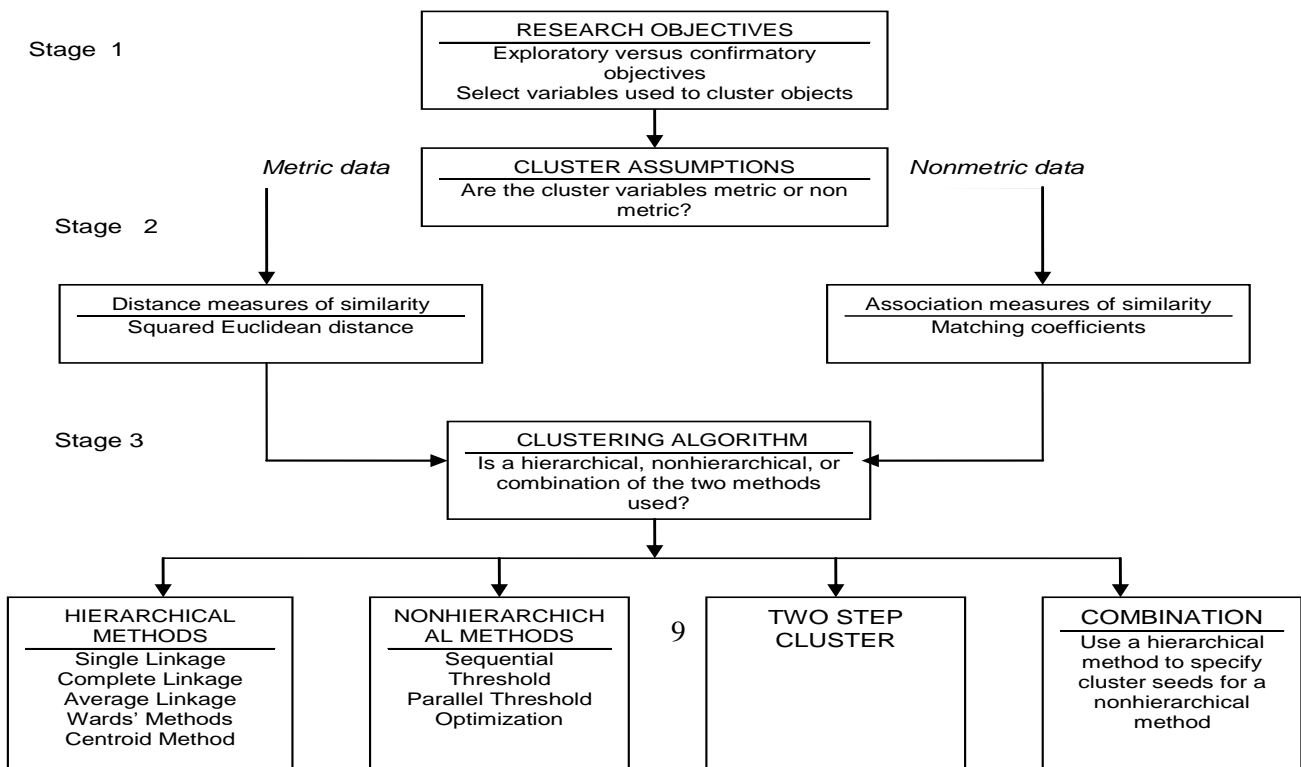
4. Multiple regression and correlation

Correlation measures the degree of association between two or more variables. When we are dealing with two variables, we are talking in terms of simple correlation and when more than two variables are involved, the subject matter of interest is called multiple correlation.

Types:

- **Positive correlation** - When two variables X and Y move in the same direction, the correlation between the two is positive.

- **Negative correlation:** When two variables X and Y move in the opposite direction, the correlation is negative.

- **Zero correlation:** The correlation between two variables X and Y is zero when the variables move in no connection with each other.

In the multiple regression model, there are at least two independent variables. The linear multiple regression model with two independent variables would look like:

$Y = b_0 + b_1 X_1 + b_2 X_2 + U$

b_0, b_1 and b_2 are the parameters to be estimated.

The estimation is carried out using the OLS method which results in the following:

$$\hat{b}_0 = \overline{Y} - \hat{b}_1 \overline{X}_1 - \hat{b}_2 \overline{X}_2 \qquad \hat{b}_1 = \frac{(\sum x_1 y)(\sum x_2^2) - (\sum x_2 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2}$$

$$\hat{b}_2 = \frac{(\sum x_2 y)(\sum x_1^2) - (\sum x_1 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - \sum (x_1 x_2)^2}$$

where,

$$x_1 = X_1 - \overline{X}_1$$
$$x_2 = X_2 - \overline{X}_2$$

5. Multidimensional scaling:

- The most common and useful marketing application of multidimensional scaling is in brand positioning.

- Positioning is essentially concerned with mapping a consumer's mind and placing all the competing brands of a product category in appropriate slots or "positions" on it.

- For example, a product category of shampoos could be identified as having 5 attributes important to the consumer - price, lather, fragrance, consistency and favorable effects on hair.

- If these were to be rated on a 7 point scale for say, six leading brands of shampoo A, B, C, D, E and F, then we could pickup any two attributes and plot the six brands on a map according to the consumer ratings.

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- This is called a perceptual map of consumer perception about competing brands in a product category. This is the type of map useful for deliberate positioning of a new brand, based on "gaps" in the current map, or for finding out the current position of an existing brand on the map. If the desired position of an existing brand owned by our company is different from the one perceived by consumers, an option is to "reposition" the brand.

- The above method may not capture the consumer's mind accurately.

- If we assume that the consumer simultaneously thinks of several product dimensions or attributes rather than one attribute at a time, the above method is only an approximation of that process

- Multidimensional scaling, on the other hand, captures the complex interactions between attributes and brands in a particular way, and then "derives" attributes or dimensions which explain the "positions" given by consumers to various brands.

- There are two basic methods used in multidimensional scaling-Attribute based approach, and Similarity/Dissimilarity based approach

- The attribute-based approach is similar to what we have described in the previous section, except that these input data are then further analysed using either factor analysis or discriminant analysis.

- The second approach is very easy to understand intuitively, and quite useful in gaining a good understanding of consumer psyche, so we will discuss only this (similarity and dissimilarity based) approach.

- In the similarity/dissimilarity-based approach, we need some kind of a distance measure between the brands being rated. The distance measure being input could be a simple ranking of distances between a brand and all other brands by a customer.

- One way to do this is to provide a customer (respondent) with cards, each containing a pair of brands written on it, and asking him to write down a number indicating the difference between the two brands on any numerical scale which can represent distance.

- This is then repeated for all pairs of brands being included in the research. No attributes are specified by which the customer is asked to decide on the difference.

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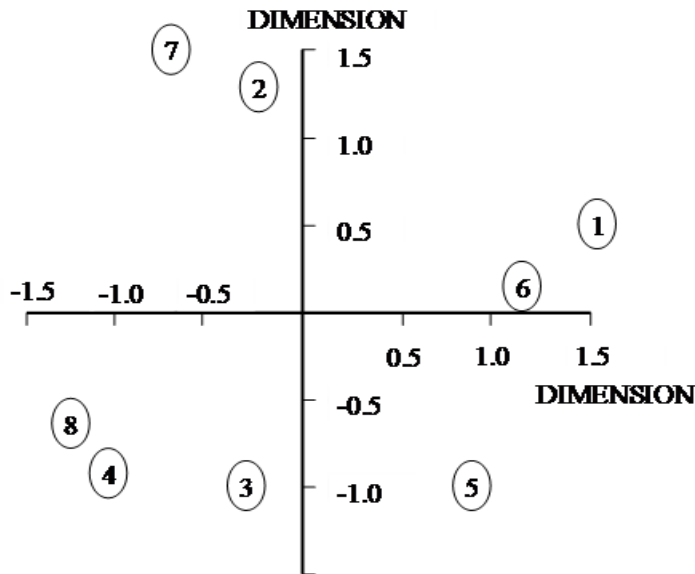
- Fig. 1 takes the example of eight brands of TV available in the Indian market. Both the rows and columns represent brands of TV. E.g.: TV1 is Aiwa, TV2 is Videocon, TV3 is LG, TV4 is Samsung, TV5 is Sony, TV6 is Onida, TV7 is Thomson and TV8 is BPL

- Input data were collected from a sample of respondents each of whom was asked to rate the dissimilarity between all pairs of TV brands on a numerical scale

- We will use multidimensional scaling to determine how these 8 brands are perceived by Indian consumers, and plot a positioning map of the eight brands.

- We will also attempt to find out how many dimensions the consumers seem to be using, when they think of TV brands.

Applications of Statistical Software for Data Analysis

Statistics is the science of making effective use of numerical data relating to groups of individuals or experiments. It deals with all aspects of this, including not only the collection, analysis and interpretation of such data, but also the planning of the collection of data, in terms of the design of surveys and experiments.
Traditional or manual method takes lot of time. Whereas statistical software makes the statistical analysis more simpler and accurate result
Applications of STATISTICAL SOFTWARE

1.SAS/STAT:
SAS/STAT software is designed for both specialized and enterprise wide analytical needs. SAS/STAT software provides a complete, comprehensive set of tools that can meet the data analysis needs of the entire organization.

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Features

Analysis of variance

- Balanced and unbalanced designs; multivariate analysis of variance and repeated measurements; linear and nonlinear mixed models.

Mixed models

- Linear mixed models.
- Nonlinear mixed models.
- Generalize linear mixed models.

Regression

- Least squares regression with nine model selection techniques, including stepwise regression.
- Diagnostic measures.
- Robust regression; Loess regression.
- Nonlinear regression and quadratic response surface models.
- Partial least squares.

Categorical data analysis

- Contingency tables and measures of association.
- Logistic regression and log linear models; generalized linear models.
- Bioassay analysis.
- Generalized estimating equations.
- Weighted least squares regression.
- Exact methods.

Bayesian analysis

- Bayesian modeling and inference for generalized linear models, accelerated life failure models, Cox regression models and piecewise exponential models.
- General procedure fits Bayesian models with arbitrary priors and likelihood functions.

Multivariate analysis

- Factor analysis; principal components; canonical correlation and discriminate analysis; path analysis; structural equations.

Survival analysis

- Comparison of survival distributions; accelerated failure time models; proportional hazards models.

Psychometric analysis

- Multidimensional scaling; conjoint analysis with variable transformations; correspondence analysis.

Cluster Anaylsis

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- Hierarchical clustering of multivariate data or distance data; disjoint clustering of large data sets; nonparametric clustering with hypothesis tests for the number of clusters.

Nonparametric analysis

- Nonparametric analysis of variance. Exact probabilities computed for many nonparametric statistics.
- Kruskal-Wallis, Wilcoxon-Mann-Whitney and Friedman tests.
- Other rank tests for balanced or unbalanced one-way or two-way designs.

Survey data analysis

- Sample selection; descriptive statistics and t-tests; linear and logistic regression; frequency table analysis.

Multiple imputation for missing values

- Regression and propensity scoring for monotone missing patterns.
- MCMC method for arbitrary missing patterns.
- Combine results for statistically valid inferences.
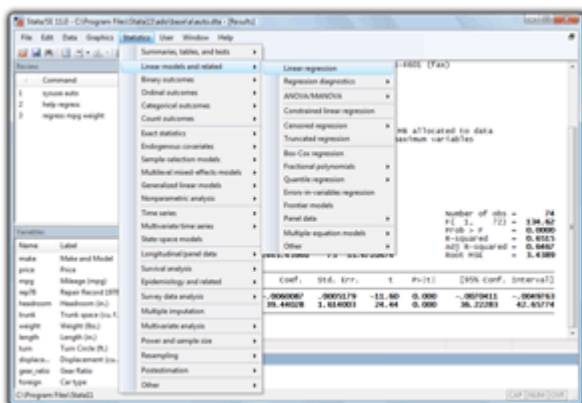
Study planning

- Power and Sample Size application provides interface for computation of sample sizes and characterization of power for t-tests, confidence intervals, linear models, tests of proportions and rank tests for survival analysis.

2. STATA:

Stata is a complete, integrated statistical package that provides everything you need for data analysis, data management, and graphics. Stata is not sold in pieces, which means you get everything you need in one package without annual license fees.

Stata 11 adds many new features such as multiple imputation, factor variables, generalized method of moments (GMM), competing-risks regression, state-space modeling, predictive margins, a Variables Manager, and more. Find out more about these features at New in Stata 11.

Fast, accurate, and easy to use

With a point-and-click interface, an intuitive command syntax, andonline help, Stata is easy to use, fast, and accurate (see certification results and FDA document compliance for details). All analyses can bereproduced and documented for publication and review

Broad suite of statistical capabilities

Stata puts hundreds of statistical tools at your fingertips, from advanced techniques, such as survival models with frailty, dynamic panel data (DPD) regressions, generalized estimating equations (GEE), multilevel mixed models, models with sample selection, multiple imputation, ARCH, and estimation with complex survey samples; to standard methods, such as linear and generalized linear models (GLM), regressions with count or binary outcomes, ANOVA/MANOVA, ARIMA, cluster analysis, standardization of rates, case–control analysis, and basic tabulations and summary statistics.

**Complete data-management facilities**

Stata's data-management commands give you complete control of all types of data: you can combine and reshape datasets, manage variables, and collect statistics across groups or replicates. You can work with byte, integer, long, float, double, and string variables. Stata also has advanced tools for managing specialized data such as survival/duration data, time-series data, panel/longitudinal data, categorical data, multiple-imputation data, and survey data.

Explore all of Stata's capabilities.

Publication-quality graphics

Stata makes it easy to generate publication-quality, distinctly styled graphs, including regression fit graphs, distributional plots, time-series graphs, and survival plots. With the integrated Graph Editor you click to change anything about your graph or to add titles, notes, lines, arrows, and text.

You can choose between existing graph styles or create your own.
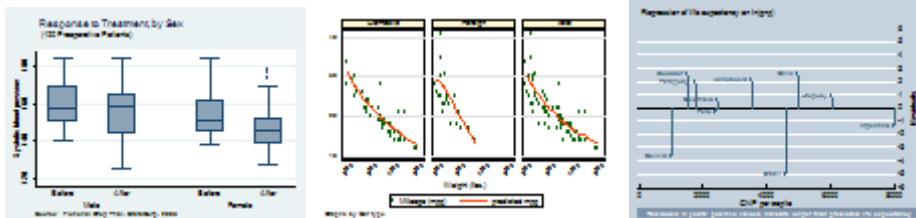
Responsive and extensible
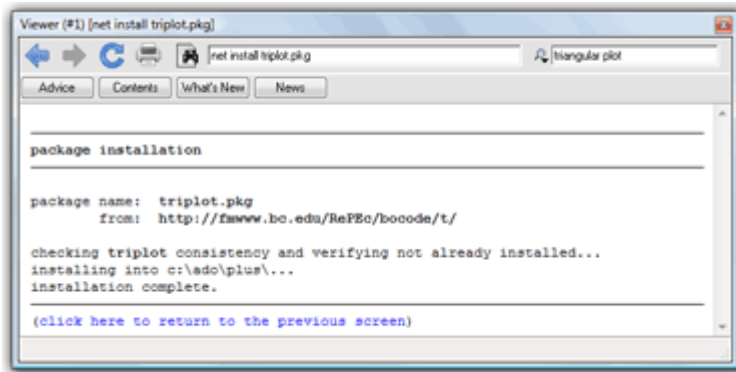
Stata is so programmable that developers and users add new features every day to respond to the growing demands of today's researchers. With Stata's Internet capabilities, new features and official updates can be installed over the Internet with a single click. Many new features and informative articles are published quarterly in the refereed *Stata Journal*. Another great resource is Statalist, an independent listserver where more than 3,200 Stata users exchange over 1,000 postings and 50 programs each month.

Matrix programming—Mata

Though you don't need to program to use Stata, it is comforting to know that a fast and complete matrix programming language is an integral part of Stata. Mata is both an interactive environment for manipulating matrices and a full development environment that can produce compiled and optimized code. It includes special features for processing panel data, performs operations on real or complex matrices, provides complete support for object-oriented programming, and is fully integrated with every aspect of Stata. Learn more about Mata.

Cross-platform compatible

Stata is available for Windows, Mac, and Unix computers (including Linux). Stata datasets, programs, and other data can be shared across platforms without translation.

You can also quickly and easily import datasets from other statistical packages, spreadsheets, and databases.

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UNIT V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH

Research report – Different types – Contents of report – need of executive summary – chapterization –contents of chapter – report writing – the role of audience – readability – comprehension – tone – finalproof – report format – title of the report – ethics in research – ethical behaviour of research – subjectivity and objectivity in research.

RESEARCH REPORT Research report is a written document through which the researcher intimates to the world the findingsof this study, the design of the study, his conclusions, the suggestion and recommendations based on his findings, the details of data collected, the method he has adopted for selecting the sample, the toolshe used for analysis the hypotheses he has set his set objectives, the limitation of his study etc. It is theend product of research activity.

Objectives of a Report:-

1. Reports provide information to those who are in need of it.

2. It provides information for planning and co-ordination of business activities.

3. Reports give information to investor's speculators, government, customers and the people at large.

4. This provides base to formulate alternative proposals relating to an issue.

5. Reports acts as and a historical document to take decision in future.

6. Report normally presents facts and suggestions to an enquiry.

7. It acts as a tool in conducting performance appraisal.

8. An effective report should be simple, clear, brief and should be based on reliable factual information.

RESEARCH REPORT- TYPE

a Technical Report

In this type of report the scholar should focus on

1. The methods employed.

2. Assumptions made in the course of the study

3. The detailed presentation of the findings.

Output

1. Summary of results (executive summary)

2. Nature of the Study

3. Objectives, hypothesis

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4. Data types, & analysis

 5. Tools of analysis

6. Methodology – sample design, size, selection.

7. Data – Sources, characteristics & limitation

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Analysis of data & presentation of findings.

8. Conclusions

9. Bibliography

10. Technical apprentices

11. Index

The order presented may vary in different reports even the different sections outlined above will not always be the same, nor will all these sections appear in any particular report.

b. Popular Report

The popular report is one, which gives emphasis on simplicity and attractiveness. The simplification should be sought through clear writing, minimization of technical, particularly mathematical details and liberal use of charts and diagrams. Attractive layout along with large print, many subheadings over an occasional cartoon is the characteristic feature of the popular report.

Outline

1. The findings and their implication.
2. Recommendation for action
3. Objective of the study
4. Methods employed
5. Results
6. Technical appendices.

There can be several variations of the form in which a popular report can be prepared, the only important thing about such a report is that it gives emphasis on simplicity and policy implications from the operational point of view avoiding the technical details of all sorts to the extent possible.

c. Oral Presentation

This type of reporting takes place in public viva voce examination. The researcher would present the details of his work orally. He may use different methods of presentation like overhead projector, slide projector, simple presentation on board, printed matter etc.

The flow of language style adopted, delivery speed, gestures and gesticulation, body language etc. will all determine the effectiveness of oral presentation. In such presentation, the researcher should avoid unnecessary elaborations, affecting sentiments, creating controversies attack on any ideals or beliefs and most important details which are not most important details which are not supported by facts or evidences. He should maintain a logical sequence in his presentations.

CONTENT OF THE REPORT

a. **Introduction**
- Objectives of the Study
- Statement of the problem.

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- Hypothesis & definition of concepts
- Review literature & research studies.
- Time, Place and materials of the survey
- Scope, assumptions and limitations.

- Organisation and sampling procedures.
- Methods, tools and techniques employed for data collection.

b. Analysis & Presentation of Results
- Report of facts, nature , volume and dimension
- Statistical analysis of data
- Summary of findings and recommendations.
  -

1. Title Of The Page

The title page must give the title of the research project. It must give information about who prepared it, who supervised it, who sponsored it, date on which it was presented and place where it was presented.

2. Certificate From The Guide

Normally this is issued and signed by the guide/supervisor stating that the theses is the contribution made by the scholar and that the the guide has provided only general guidance in shaping the work.

3. Declaration By The Candidate

This is a certificate submitted by the scholar in which he states, that the thesis is the result of his own efforts and is not a copy of any theses or publication already submitted or published to any agency.

4. Foreword

It is generally given by a person whim the researcher think is highly a expert on the pursued research project.

5. Preface

It gives a general introduction to the project and says a few words about its importance. The researcher express his gratitude to others, he puts his signature, place and date at the end of the preface.

6. Table Of Content

The chapters, sections and other headings used in the report and the pages on which each of them is found

7. List of Tables

All the tables used to present the data must be given along with the pages on which they appeared in the report.

8. List Of Figures

All the figures, charts, diagrams, pictures etc. given within the report must be indicated along with the pages on which they have appeared.

9. List Of Appendixes

In this part of the contents the scholar would specify items included under the appendixes. He would indicate the items in serial order, its title and the page number where it is found eg. Govt policy, questionnaire etc.

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10. Acknowledgement

In this page, the scholar expresses his gratefulness to all those who have helped him in the course his research work.

11. Objectives of the Study

The objectives established and to be accomplished during the research are to be highlighted in this problem.

12. Hypothesis

These are the assumptions the researcher holds regarding the problem.

13. Statement of the Problem

It gives the background of the problem, importance of the problem, dimensionality of the problem. The problem is fully explained here.

14. Review of Literature

A review of earlier researcher done in relation to the research project is given in this chapter

15. Period of Study

This refers to the duration of the study i.e. Whether the study is analysing the fact for a period of 10 years or is it focusing on the current status alone must be indicated.

16. Place or Area Of The Study

The area where the study was undergone should be mentioned. This should also be supported by the reasons why this specific area was taken up for the research.

17. Limitation of The Study

In this section the scholar should be honest to state the limitation of the data used, analyses applied, validity of conclusions etc.

18. Sample Design

It refers to the method of sampling adopted for data collection. He should explain how the sample characteristic was established, how the sample size was determined and how the data was collected.

19. Methodology

It deals with the research design to be used, data collection methods to be used. Sampling techniques to be used, field work to be carried out, analysis and interpretation to be done.

20. Research Design

It gives details about the exploratory, explanatory or descriptive or experimental nature of the research work. Why a particular design is used and what is its importance.

21. Scope

What aspects are to be covered in the research are to be highlights in brief in the section of methodology.

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22. Tools Of Analysis

In this researcher explain the tools that he has adopted for analyzing the data. The researcher should select the tools of analysis by considering the objectives set for the study.

23. Report Of Results, Facts

The researcher will present the results of the analyses he had adopted in his study. Each result will be discussed and interpreted.

24. Statistic Tools

Various statistical tools to be used to analyze and interpret the collected data are mentioned. Eg. Average, percentage, measures of dispersion etc. The advance analysis like factor analysis, cluster analyses are to be used. These must be mentioned and justification for their use must be put forward in this section.

25. Findings

Here results and findings are given and discussed. The information which have bearing on the objectives of the research should be included in the report.

26. Recommendation

The recommendation must not be made just on assumption basis. The resources of the company to which recommendation are being made must be kept in mind. It should not be a very expensive proposition which company cannot implement owing to lack of funds. The recommendations must be such that could be implemented.

27. Appendices

The information which is not directly related to the main body of the research report should be included in the appendices for those readers who want to go in depth of certain aspects of the research work.

28. Bibliography

It will contain the details of journal and books used and referred in the course of the study. The details like, name of the book, author name, title of the book; publisher's name, year of publication, place of publication and edition are all provided.

29. Index

It refers to an alphabetical list of name of author or subject matter provided at the end of research reports. It enables the reader to locate the author of subject matter easily.

30. Glossary

It refers to the definition of the technical terms used in the report.

MECHANICS OF WRITING A RESEARCH REPORT

1. **Size and Physical Design :** The report should have a margin of at least one and one-half inches should be allowed at the left hand and of at least half an inch at the right hand of the paper. There should also be one-inch margin, top and bottom. The paper should be double spaced on one side of the page.

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2. **Procedure:** The subject matter of a report can be arranged either logical sequence or chronologically.

3. **Layout keeping:** in view the objective and nature of the problem, the layout of the report should be thought of and decided and accordingly adopted eg. Technical, popular

4. **Quotations**: It should be placed in quotation marks and double spaced forming an immediate part of the text. But if a quotation is of a text. But if a quotation is of a considerable length then it should be single-spaced and indented at least half an inch to the right of the normal text margin.

5. **The footnotes :** The footnote serve two purpose viz., the identification of materials used in quotations in the report and the notice of materials not immediately necessary to be body of the research text but still of supplemental value. In other words, footnotes are meant for cross-references, citation of authorities and sources, acknowledgement and elucidation or explanation of a point of view. It should always be kept in view that footnote is neither an end nor a means of the display of scholarship. The modern tendency is to make the minimum use of footnotes for scholarship does not need to be displayed.

6. **Documentation**: Style regarding documentation, the first footnotes reference to any given works should be completed in its documentation, giving all the essential facts about the edition used. Such documentary footnotes follow a general sequence. The common order may be described as under.

   i. **Regarding the single volume reference**
      - Author's name in normal order followed by comma
      - Title of work, underline to indicate italics
      - Place and date of publication.
      - Pagination references (The page number).

   ii. **Regarding multi volume references.**
      o Author's name in normal order
      o Title of work, underline to indicate italics
      o Place and date of publication
      o Number of Volume
      o Pagination references.

   iii. **Regarding works arranged alphabetically**.
   For works arranged alphabetically such as encyclopaedia and dictionaries, no pagination reference is usually needed.

7. **Punctuation and Abbreviations in Footnotes:** The first item after the number in the footnote is the author's name, given in the normal signature order. This is followed by comma. After the comma, the title of the book is given: the article is omitted and only the first word and proper nouns and adjectives are capitalized. A comma follows the title. Information concerning the edition is given next. A comma follows this entry. The place of publication is then stated; it may be mentioned in an abbreviated form, if the place happens to be a famous one such as Lond. For London, N.Y for New York and so on.

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This entry is followed by comma. Then the name of the publisher is mentioned and a comma closes this entry.

8. **Use of Statistics, Charts and Graphs** A judicious use of statistics in research reportsif often considered a virtue for it contributes a great deal towards the clarification and simplification of the material and research results. One may well remember that a good picture is often worth more than thousand words. Statistics are usually presented in the form of tables, charts, bars and line – graphs and pictograms. Such presentation should be self-explanatory and complete in itself. It should be suitable and appropriate looking to the problem at hand. Finally, statistical presentation should be neat and attractive.

9. **The final draft:** Revising and rewriting the rough draft of the report should be done ith great care before writing the final draft. For the purpose, the researcher should put to himself questions like. Are the sentences written in the report clear? Are they grammatically correct? Do they say what is meant? Do the various points incorporated in the report fit together logically? "Having at least one colleague read the report just before the final revision is extremely helpful. Sentences that seem crystal clear to the writer may prove quite confusing to other people; a connection that had seemed self-evident may strike others as non-sequitur.

10. **Bibliography**: Bibliography should be prepared and appended to the research report as discussed earlier.

11. **Preparation of Index:** At the end of the report, an index should invariably be given, the value of which lies in the fact that it acts a good guide to the reader. Index may be prepared both as subject index and as author index. The former gives the names of the subject-topics or concepts are long with the number of pages on which they have appeared or discussed in the report, whereas the latter gives the similar information regarding the names of authors. The index should always be arranged alphabetically. Some people prefer to prepare only one index common for names for authors, subject-topics, concepts and the like ones.

PRECAUTIONS FOR WRITING RESEARCH REPORTS.

Research Report is a channel of communicating the research findings to the readers of the report. A good research report is one which does this task efficiently and effectively. As such it must be prepared keeping the following precautions in view:

1. While determining the length of the report (since research reports vary greatly in length), one should keep in view the fact that it should be long enough to cover the subject but short enough to maintain interest. In fact, report writing should not be a means to learning more and more about less and less.

2. A research report should not, if this can be avoided, be dull; it should be such as to sustain reader's interest.

3. Abstract terminology and technical jargon should be avoided in a research report. The report should be able to convey the matter as simply as possible. This, in other words,

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mean that report should be written in an objective style in simple language, avoiding expression such as "it seems", "there may be" and the like.

4. Readers are often interested in acquiring a quick knowledge of the main findings and such the report must provide a ready availability of the findings. For this purpose, charts, graphs and the statistical tables may be used for the various results in the main report in addition to the summary of important findings.

5. The layout of the report should be well thought out and must be appropriate and in accordance with the objective of the research problem.

6. Appendices should be enlisted in respected of all the technical data in the report.

7. Bibliography of sources consulted is a must of a good report and must necessarily be given.

8. Index is also considered an essential part of a good report and as such must be prepared and appended at the end.

9. Report must be attractive in appearance, neat and clean, whether typed or printed.

10. Calculated confidence limits must be mentioned and the various constraints experienced in conducting the research study may also be stated in the report

STEPS IN WRITING REPORT

1. **Logical Analysis of the subject Matter** It is mainly concerned with the development of a subject. A research subject matter may be arranged in two ways

• **Logical** It is concerned with the mental connections and associations between the one thing and another by means of analysis. Among other things it h develops a material from the simple possible to the most complex structures.

• **Chronological**
It is based on a connection or sequences in time or occurrence. The direction for doing or making something usually follows the chronological order.

2 .Preparation of the Report Outline
Outlines are the framework upon which long written works are constructed. They are an aid to the logical organization of the material and a reminder of the points to be stressed in the report.

3. Preparation of the rough draft.
Here the researcher enumerates what he has done in the context of his research study. Here he explain the procedure adopted by him in collecting the material for his study

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along with various limitations faced by him, the technique of analysis adopted by him. The broad findings and generalization and the various suggestions he wants to offer regarding.

4. Redrafting the report

Here the researcher has to spend more time than the writing of the rough draft. Here the researcher also examines the weakness in logical development or presentation. He should check the mechanics of writing, grammar, & usage.

5. Final Settings including bibliography

It is the last part of the research report which contains almost of books in some way pertinent to the research which has been done. It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts the first part may contain the names of book and pamphlets and the second part may contain the names of magazine and newspaper articles.

6. Preparation of the Final Draft

A researcher has to write the final draft in a concise and objective style and in simple language, avoiding vague expressions. In the final draft the researcher should not use technical jargons.

LAYOUT OF THE RESEARCH REPORT

The layout of the report means as to what the research report should contain. A comprehensive layout of the research report should comprise.

1. PRELIMNARIES

- Title Page
- Certificate from the Guide
- Declaration by the scholar
- Preface, Acknowledgement
- Table of Contents.
- List of Tables.
- List of Figures
- List of Appendixes.
- ☐

2. CONTENT OF THE REPORT

Introduction

- Objectives of the Study
- Statement of the problem.
- Hypothesis & definition of concepts
- Review literature & research studies.
- Time, Place and materials of the survey
- Scope, assumptions and limitations.
- Organisation and sampling procedures.
- Methods, tools and techniques employed for data collection.

Analysis & Presentation of Results

- Report of facts, nature , volume and dimension
- Statistical analysis of data

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- Summary of findings and recommendations.

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3. END MATTER
• Bibliography
• Appendices:
a) Questionnaire
b) Statistical table.
• Glossary of terms
• Index.

ETHICS AND ETHICAL BEHAVORIAL
Ethics

- Ethics
  - A code of moral standards of conduct for what is "good" and "right" as opposed to what is "bad" or "wrong".
- Ethical Behavior
  - That which is "right" or "good" in the context of governing moral code.
  - Ethical behavior is value driven