



# UGC-NET

## Management

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# INDEX

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## Unit –VIII

1. Statistics for Management	1
2. Data Collection & Questionnaire Design	2
3. Sampling	43
4. Hypothesis Testing	47
5. Correlation and Regression Analysis	57
6. Operations Management	65
7. Facility Location and Layout	70
8. Enterprise Resource Planning	76
9. Scheduling; Loading, Sequencing and Monitoring	82
10. Quality Management and Statistical Quality Control, Quality Circles, Total Quality Management	85
11. Operation Research	99

## Unit –IX

1. International Business	115
2. Foreign Direct Investment	147
3. Multilateral regulation of Trade and Investment under WTO	153
4. International Trade Procedures and Documentation	155
5. Role of International Financial Institutions	173
6. Information Technology	179
7. Artificial Intelligence and Big Data	190
8. Data Warehousing, Data Mining and Knowledge Management	199

## Unit – X

1. Entrepreneurship Development	205
2. Intrapreneurship	207
3. Women Entrepreneurship and Rural Entrepreneurship	212
4. Innovations in Business	222
5. Business Plan and Feasibility Analysis	224
6. Micro and Small Scale Industries in India	229
7. Sickness in Small Industries	238
8. Institutional Finance to Small Industries	243

## Unit –VIII

### Chapter 1

- \* Statistics for Management: Concept, Measures Of Central Tendency and Dispersion, Probability Distribution – Binominal, Poison, Normal and Exponential
- \* Data Collection & Questionnaire Design
- \* Sampling – Concept, Process and Techniques
- \* Hypothesis Testing – Procedure; T, Z, F, Chi-square tests
- \* Correlation and Regression Analysis

### #Concept of Statistics

Business statistics is the science of good decision-making in the fact of uncertainty and is used in many disciplines such as financial analysis, econometrics, auditing. Production and operations including services improvement and marketing researching Business statistics is an applied science where the principles of statistics are applied and business it is a methodology, *i.e.* used to solve the problems that usually arise in the firms. It is science to make good decisions in the business. It is very important agriculture, transportation and other types of business

### Significance of Business Statistics

- \* It deals with uncertain situations by assisting the management in forecasting general economic foundation, seasonal and other cyclical scenarios.
- \* It also supports in making sound decisions by giving accurate approximations the demand prices, costs, sales etc.
- \* Business statistics assists the top level management in planning on the basis of and assumptions and predictions.
- \* Statistics for management compares various business units, sales team, sales products and thus identifies which unit has been more productive and efficient.
- \* It also helps in establishing and identifying the relation between diverse variable such as what is the impact of counselling on the performance of the worker, hence, various aspects can be quantified and measured with the help of statistics,
- \* It validates the theoretical and generalized concepts that have been formulated by the top level managers.

Thus, statistics deals with collection and presentation of data, its analysis, and communication of the results. Data are the raw facts and figures. They can be arranged in various forms such as tables, charts, pie charts, bar graphs etc. However,

in order to make decision, a manager requires summary statistics. These are more exact measures that assist in making decisions. The four characteristics that are important to any data are central tendency, dispersion, skewness, and kurtosis. Before studying the methods of analysing data, we will focus on methods of data collection.

## #Data Collection

As it is known that the quality of input determines the quality of output, hence it is crucial to understand how the data should be collected in order to make it reliable. Data is the key Ingredient in research. Data collection enable researcher to collect the crucial data for conducting research *It is divided into primary and secondary data*

### Primary data

It is the data which has been freshly collected and for the first time *i.e.* the data is original in nature. Data is very specific to research and primary data is most reliable as it is collected by the researcher himself.

#### Advantages of Primary Data

- \* It is original data
- \* The reliability and credibility is high.
- \* The researcher can control the quality of data.

#### Disadvantages of Primary Data

- \* It is time consuming method.
- \* The cost of collecting data is high.

### Primary Data Collection Methods

Primary data is usually gathered by directly communication, observing or conducting experiments when the research design is of experimental research, then the research conducts experiments. However, for casual and descriptive research, the researcher collects data from census or surveys.

Various methods for casual and Descriptives researches are presented below

#### Interview Method

Here, interview is conducted which involves one to questions and interrogation. This method is generally used while conducting telephonic interviews. The method enable

the researcher in carrying out the investigation intensively. The collection of data occurs in structured way as there are pre-set questions used for conducting interview. The key advantage of this method is interviewer can motivate and help the other person in overcoming the unwillingness to reply. Also information can be gathered in depth. Another advantage is the interviewer can switch the language according to the requirement of respondent.

## Observation Method

Here, the researcher directly observes the other person without asking any questions. The key advantage here is that the bias of the respondent is reduced, if the researcher accurately observes him. Another advantage is the respondent's willingness to answer does not affect the data gathered. Generally, this method is used while studying consumer behavior. The disadvantage of observation method is that the information received is generally limited and it is expensive to perform this method.

### Observation method is further divided into

- \* Participant: When the observer becomes a member of the group which is to be studied, then it is participant method. Here, the researcher can himself feel and understand what the other members experience.
- \* Non-participant: When the researcher does not become a member of the group, then it is non-participant type.
- \* Disguised: It is a variant of non-participant method where he conducts the observation in such a manner that his presence is unknown to the other members.

## Questionnaires

Here, the researcher prepares a set of questions in the form of a questionnaire. It is useful when a large sample is to be studied. The researcher must ensure that the questions are carefully framed so that they reflect all the information which is required to carry the research. Questionnaires are provided to respondent. The researcher can ask them to fill the questionnaires in their presence or in their absence. Questions can be asked over phones or directly, this is called the direct method. When the questionnaires are handed over to the respondents to be filled on their own, then it is called indirect method.

## Warranty Cards

They are generally used by the seller of consumer durable to gather information about the product. The questions are placed on a small card and put inside the package. This is required to be filled by the consumers and post them back.

## Pantry Audits

Business researchers often conduct these audits to ascertain and estimate the consumption pattern of a given basket of commodities by consumers. The information comprise of price quantities and types of goods consumed.

Thus, the objective of pantry audit is to ascertain what types of consumers purchase a specific commodity or certain brand. However, the limitation is that sometimes consumer's preferences are not identified credibly.

## Store Audits/Distributor Audits

They are performed by the manufacturers and distributors with the help of salesman. The retail stores are audited with the assistance of salesperson. The information generally comprise of market share, purchase pattern during the season etc. Here, the data is not obtained with questions but by observation.

## Mechanical Devices

Various devices such as motion picture camera, psycho galvanometer, pupillometry cameras etc. are used to collect relevant information.

Thus aforementioned were the methods used for carrying primary data However, in case of non-response, the researcher can use methods like call backs. Over sampling - incentives to the respondents and convincing the pendants

## Secondary Data

This is the data which has been previously acquired by me other researcher and then published. Thus, it is not an original data. The quality of data cannot be controlled. Various secondary sources of data include published records, newspapers, syndicated data within the organization etc. Thus, secondary data is second hand data.

## Advantages of Secondary Data

- \* It is easier to collect secondary data.

- \* It is quick and consumes less time in collection.
- \* Sometimes the data can accurate entirely, thus it Provide answer to all the research questions,
- \* It is cheaper to collect in comparison to primary data.
- \* It plays an important role when the research is in an exploratory phase, as it expands the analysis of data Research.
- \* Secondary researches are generally done by large agencies or government. Thus, the sample size is huge in Comparison to primary data. This increases reliability it help in defining what type of sample is to be drawn and from which population.

### **Disadvantages of Secondary Data**

- \* The definitions used in the research must be carefully read as it must reflect that the data was carried for another purpose. Terms may have entirely different meanings which may not be relevance for research.
- \* The original data, previously collected may have got biased. The data may represent more pessimistic or optimistic sets of data. Thus, it may distort the research
- \* Secondary data is published in a specific year. This signifies that the data was collected for a specific time scale which may not be relevant for the current research project. Hence, researchers must find latest data.

*Researches must use multiple sources and check the consistency of data*

### **Factors Affecting Choice of Data Collection Method**

- \* The method must gather all information required.
- \* The chooses method must be as per the resources available and budget.
- \* The time constraint should be also considered.
- \* The researchers must check whether respondents are available and what is the geographical spread of the he sample.

### **Secondary Data Collection Methods**

There are wide variety of data that can be collected from different sources. Some of the sources are classified into internal and external data, which are as follows



## Internal Sources of Data

They are the sources of data that have been published and generated within the business. The examples are customer database, sales performance record, and trade association data. Accounting records etc. such data can be analyzed from the perspective of research problem.

Some of the sources of internal data include

**Storage Data:** This is the rate of assessing the efficiency of various operations, inventory handling case, inventory turnover etc. By assigning more reliable accounting system. The data can be refined and used for research.

**Sales Data:** The companies collect various information from its daily activities. This comprises of when the orders were received and when were the deliveries made. It is maintained in the form of purchase orders, bills and invoices and a sheet representing amount of goods returned. Thus, such valuable data must be used for conducting business research.

**Financial Data:** Companies generate various financial statements like balance sheets, cash flow statements and profit and loss statement. They also include variables like total cost of production, storage, transportation, and marketing financial. This is specifically done for each service and product various employee benefits, expenditures and salaries and other operational costs can be analyzed to conduct research.

**Transport Data:** Various companies collect and maintain record of data such as which is the most profitable transport route, the best cost effective routing pattern. This data helps the firm in analyzing the trade-off between the cost and benefit of a specific business route and making decisions thereby.

## External Sources of Data

Various agencies and government organization provide secondary data. Some of the sources are listed below

**National and Local Government:** Various quasi government agencies, research institution, local government and national government agencies, universities and trade associations along with financial institution provides key information.

**Externally:** Published Data: Data of various brokerage firm, research firm and trade associates.

**Directories:** Relevant, secondary data is also obtained from various ideas, guides, and directories.

**Consultancies:** Various consultancies track the trends in financial markets along with consumer markets on regular basis.

**Literatures:** The traditional source of collecting secondary data is from books, magazines, and journals.

**Government:** Government alone conduct census of the entire population and publishes it on the website. The data comprises of statistics about industrial development, farming production, growth of population, income groups, and pollution data. These data are used for exploratory research. These are various sites like 'www.indiastat.com' give data about the economic and demographic aspects of Indian population

**International Institutions:** Various international organizations such as IMF, World Bank, International Labor Organization also generate secondary data.

**Syndicated Data:** Various research firm collect large amount of data and sell it to other business houses for fees. This is known as syndicated data.

**Internet Big Data:** Various universities and public libraries provide research reports handbooks, encyclopedia, periodicals that give relevant secondary data. However, now there are various search engines specifically meant for research. Various search engines include Google scholar and Bloomberg, Bloomberg provides information with reference to international and local financial information. Given data about management and economic publications

**Social Networks:** Various social networking sites are used to collect data, especially when it relates to consumer tastes and preferences.

## #Questionnaire Design

Questionnaire is a data collection instrument which comprises of a formalized set of questions to obtain information from the respondents. The questionnaires must be formulated in a way that it provides information which is required by the researcher. Every question must be evaluated for its reliability and accuracy. If the questions is vague then this will lead to vagueness in answer also.

## Objectives of Questionnaire

- \* It provides standardization of data collection this helps in drawing generalized conclusions. Standardized data is collected and organized in a well-planned manner which helps in presenting data in table and other diagrams.

- \* It also helps in presenting the information that is required to obtain specific questions. It ensures that all the necessary data is collected by preparing a target questionnaire
- \* A well prepared questionnaire encourages and motivates the other person to become involved in the research. It aims at arranging questions in such a manner that the respondents do not get tired or bored. While filling it.
- \* A questionnaire is developed in a way that it minimizes the response error.

## Hierarchy of Questions

There is a prescribed hierarchy of questions which must be followed to prepare a quality questionnaire. The hierarchy is given as follows

**Management Questions:** Management face lot of questions when it comes to framing policies and making strategic decisions. These questions comprise of strategic question like what they actually want to perform." Example Why there if. A fall in the number of customers for landline.

**Research Questions:** Management questions give a reason for conducting research and identifying factors responsible for a particular event Management questions lay foundation for research questions. They state the objective of the research and also define the scope of study the example is continued here. The research question will be "What is the reason for fall in the number of customer and cause of their dissatisfaction.

**Investigative Questions:** These questions are the queries that necessarily required by the researcher to conclude for a given research question. These questions lay down the foundation of what factors are to be studied and the area of study, "The investigative questions ask variety of queries that may support the cause for research questions, Thus, for given research question, which aims at identifying the Cause of dissatisfaction among customers, an investigative query will be 'are the clients' happy with the schemes and speed of the company for broadband services.

**Measurement Questions:** They are framed on the basis of identified in the investigative questions. They are the queries that are presented in the questionnaires and are directly asked from the respondent in reality. The measurement are collected, grouped and then presented collectively. In a formal way to form a standard questionnaires. Thus, measurement question help in formal way to form a standard questionnaires. Thus measurement question help in translating a management question in a measurable form. These questions actually help in measuring the reason.

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On the scale of 5, rate your level of satisfaction with the scheme offered for broadband."

## Process of Designing Questionnaire

### 1. Preliminary Preparation

This step involves collecting information, i.e. required for preparing the questionnaire. It also identifies the target population. Target population must be well defined before questionnaires are designed. This is due to the fact that the questions are designed on the basis of respondents. The target population will define the complexity level of the questions. Another factor that defines framing of questions is the knowledge level of the target population. If the target population is illiterate or has a low level of knowledge, then simpler words and questions will be used.

The method of conducting an interview should be identified beforehand because if there is a direct interview, then difficult and complicated questions can be framed. This is because the interviewer can help the respondent in understanding the question. If the method of interview is indirect such as telephonic, then the language of questions must be kept simple because the person cannot see the questionnaire. If the method is based on distribution by emails or in person, then self-explanatory terms and simple language must be used as respondents have no chance to interact with the interviewer.

### 2. Information Needed

This step ensures that all the data to be obtained from the source is clearly maintained and presented, the data and material must be converted into questions, hence the information required must be known in advance. This can be presented in a form of table where each part of data can be presented with a corresponding representative question which will give information.

### 3. Sharpening Each Question

The above step must ensure that no information is left out. Then the questions are refined and polished. Each piece of data is thoroughly studied and see whether the question represents this piece of information. If any question does not provide the information then such queries are added. It is often required to add multiple questions to provide a single set of data. Any irrelevant question is removed.

## 4. Redefining Questions for Respondents

This is required to ensure that respondents are able to understand the questions. Questions are refined on the basis of willingness and capabilities of the respondents. The ability to respond depends on variety of factors such as the respondent may not have sufficient knowledge for the particular question or is not familiar with the subject of research. This hampers the ability to answer various questions. Hence, the researcher must establish that the respondents have familiarity with the research topic. Example: A healthcare organization wants to learn about the behavior of alcoholics. Hence, the first question should be "Do you consume alcohol?" This will ensure that only relevant respondents fill the questionnaire.

Most of the time respondents are not able to answer few questions because they cannot recollect the answers. Hence, questions must be refined in a manner that helps in memorizing particular events. e.g. "How many times do you use debit card"? This question is difficult to answer. However if the questionnaire specifies a time limit, e.g. in a month or week, then it will assist the respondents. Often, - Respondents feel that the questions are inappropriate and they may also hesitate in providing personal information's like religious beliefs or salary. Hence, the interviewer must ensure that a concrete reason is defined along with the questions which communicate the purpose of question to a respondent. One must keep these questions at the end.

## 5. Selection of Form of Response

It is a crucial step which identifies how the responses will be collected. Form of responses are classified into unstructured and structured questionnaires. *These are.*

**Structured Questions:** These are close ended and have pre-defined set of answers. The questions have standardized response. They help in formalization of answers. They also help the respondents in giving answer.

*Structured questionnaires are divided into*

**Dichotomous Questions:** These are the questions where the answers have two alternatives. They are generally "Yes or No. They are also used to refine or filter the respondents in the beginning of the questionnaire, sometimes they also include another response such as don't know which gives a neutral answer. Example "Do you think artificial intelligence can dominate human?"

\* Yes

\* No

- \* Don't know

**Multiple Choice Questions:** Here, questions provides more information as compared to dichotomous questions because they collect information in deep. Here, the respondents are provided with various options to choose from, e.g. "Do you think artificial intelligence can dominate human?"

- \* Definitely
- \* Definitely not
- \* Probably
- \* Don't know

**Scale Questions:** Here, the respondents are provided with a scale and the value is to be selected from it. Measurement scales can be

- \* **Nominal Scale** Where it helps in identifying characteristics, such as gender or religion.
- \* **Ordinal Scale** the two values can be distinguished as bigger value or smaller value. Thus, the data can be ranked or presented in an order. Example Giving ranks on the basis of preference.
- \* **Interval Scale** They provided both attributes of order scale and nominal. There are equal difference between two intervals and the difference between two values given significance result. Example Rate the level of job satisfaction on a scale of 1 to 5, where 1 mean completely unsatisfied and 5 means fully satisfied.
- \* **Ratio Scale** the values are capable of being represented AS a ratio. They also comprise of a true zero value and mathematical operations can be performed example the height of person is 150 cm while for person B it is 170 cm. Here the height has importance alone with the ratio of the two heights has is also important

**Unstructured Questions:** These questions do not give any option or pre-defined value to the customers. These questions provides order, choices to the respondents and there is no forced choice. However, the drawback is that it does help in getting standard and formalized results because each respondent may give unique answers. These questions are generally done in exploratory researches where the researches wants to explore and probe into various aspects of a research problem.

## 6. Selection of Appropriate Words

The words should be simple. The questions must be easy to understand. Also long sentences must be avoided. So that the respondent comprehends the requirement of the query. In order to acquire accurate response, the questions must be kept short in length, simple words must be used

*Some of the techniques of selection of appropriate words are presented below*

**Simple Words Only** conversational language words must be used. Researchers must avoid technical jargons along with acronyms. e.g. "Which of the following reasons lead to high labour attrition rate in the office?" Should be replaced with "Why do employees leave the company?"

**Unambiguous:** Words Researchers must avoid words that various meanings and may lead to confusions. Often respondents interpret the words and meaning as per their judgment. E.g. "How often do you repair your car?" is an ambiguous question because some people will interpret it as how often do they themselves fix the car, while others will interpret it as how often do they get it repaired. Hence such ambiguous sentences must be corrected.

**Unbiased:** Questions sometimes the words lead the answer of the respondent. Researcher must establish that the queries are not biased. Leading questions are the ones which imply a definite response. When the questions are biased then they lead to responses that are not precise. Example "Gal has gifted life to people and humans must treat it as a got Do you think giving death penalty to prisoners justifiable?" Here, the questions itself alters the judgment of the respondent.

**Explicit Expression:** The assumptions of the research should be clearly reflected in the queries. No alternative should have implicit or hidden connotation. Example Do you prefer cooking food? There is an implied assumption that the respondent knows that preference of cooking is being asked over ordering it from restaurant. Thus, the question should be which option do you prefer?

(a)..... cooking                      (b).....ordering from restaurant

Hence, no implied assumption must be made.

**No Double Barreled:** Questions When a single question trig to get multiple data from one single question, then they are known as double barreled questions. This lead to questioning lot of information all at once. e.g. "Do you like the sound and camera of this phone?" instead, there should be two questions "Do you like the sound?" and "Do you like the camera of this phone?"

## 7. Order of Questions

It is an important step to order the questions. This is because an improper flow of questions can demotivate the respondent that they may not answer the questionnaire at all. There must be an opening statement which must emphasize the intent of the questionnaire. Respondent should know in advance what is required from them. This helps them in deciding whether they want to answer the questions or not.

There must be filter questions in the beginning in order to know whether the respondents are familiar with the topic. It should be non-threatening and easy. Then easy and interesting questions must be asked first to encourage the respondents to answer the questionnaire. Unpleasant and complex questions must be kept in later section of the questionnaire. Funnel approach must be incorporated while building the questionnaires. Here, broader questions are placed first in the end narrower questions must be placed at the end. Similarly, sensitive information must be placed at the end.

Questions depicting names and contact details must be placed at last. The respondents must get tired by filling the questionnaires

## 8. Layout and Production of Questionnaire

The layout must be planned so that respondents find it convenient to answer. The number of questions must be kept to minimum. There should be specific sections in the questionnaire and colour coding must be done, so that if the individuals want to skip certain type of questions, then they can skip to another color code. Proper photocopies must be done and questionnaires must be produced in clear print.

## 9. Pilot Testing

It refers to a process of circulating and administering the questionnaires to a smaller number of people to learn and remove any issue in the questionnaires without coding peavey, a questionnaire must not be circulated in the wider sample. Pilot testing helps in learning about the effort and time that will be required to collect the information. Repeated question can be removed.

## 10. Revising and Finalizing Questionnaire

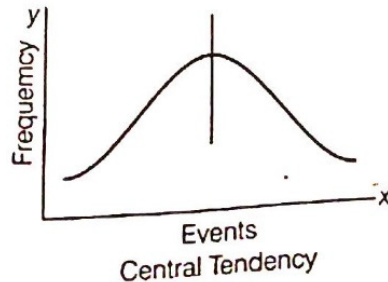
All the loopholes in the questionnaires that are identified during the pilot testing must be removed and refined. This ensures that questionnaire will give reliable results. Then, the final questionnaire is formulated and circulated.



## 11. Central Tendency

This depicts the middle point of any data distribution. The measures of central tendency are also known as measures of location. Thus, it represents the middle of data set.

This is depicted by the following figure



### Measures of Central Tendency

There are various measures to calculate the middle point of the data. They help the manager in getting an overview about the data by looking at the central figure of the data. Central tendency is measured by using various methods that are described in the upcoming sections. They generally comprise of mean, mode, median and others. These are as follow

#### Arithmetic Mean

It is a key of central tendency of measure which is also known as average. It is calculated by the following formula

$$\text{Arithmetic Mean} = \frac{\text{Sum of requeancies}}{\text{No.of frequencies}}$$

It is denoted by  $\bar{X}$  (**X bar**), when it is calculated for samples and  $\mu$  (read as mu) when it is calculated for population.

Data can be a grouped or ungrouped data. Thus, the formulae for AM is different under both conditions. *These are explained below*

#### Ungrouped Data

Here, the data is not categorized in various classes. The standard formula is used for calculating mean.

Example: The frequency of failure of light bulb is 2, 4, 5, 2, 3, 2 Calculate the arithmetic mean

$$\text{Solution } AM = \frac{\sum x^2}{N} = \frac{2+4+5+2+3+N}{6} = 3$$

Thus, the on an average 3 light bulbs fail.

## Grouped Data

Here, the data is presented in groups. Each value forms part of a class. There are various forms of classes. One is inclusive class where upper limit and the lower limit are included, in of inclusive class is 44-48, 49-53, 54-58, here the interval comprises of values upto the upper class limit and upper limit is a part of this group another is exclusive class. Here, the upper limit of the class is excluded from the class. e.g. **49 – 53, 53 – 59, 59 – 63**, thus here the upper limit is not included while calculating the frequency. 53 will be considered as a part of 2<sup>nd</sup> class and not 1<sup>st</sup> class.

The arithmetic mean is calculated under group data by using the following formula.

$$\bar{X} = \frac{\sum(f \times x)}{n}$$

Where,

$\Sigma$  = Summation

$\bar{X}$  = Sample mean

$x$  = Midpoint for each class

$n$  = Number of observation in sample.

Example: - Following is the balance in the bank account of 600 members.

Amount(₹)	Frequency
50-99.99	123
100-149.99	187
150-199.99	82
200-249.99	51
250-299.99	47