Basics of Statistics
Module-1

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Origin, Definition, Importance, Limitation and Function of Statistics

Origin and Definition of Statistics

The term statistics is believed to have been derived from the Latin word "Statistic". In early days, it was used only of the collection of the information of the population of the state military. But in the modern time it is used in almost all aspects of human related activities

Definition of Statistics

1. Statistics can be defined as the collection presentation and interpretation of numerical data.
- Croxton and Crowed.

2. Statistics are numerical statement of facts in any department of enquiry placed interrelation to each other.
- Bouly.

3. Statistics are measurement, enumerations or estimates of natural or social phenomena systematically arrangement to exhibit their inner relation.
- Conner.

4. By Statistics we mean quantitative data affected to a marked extend by a multiplicity of causes.
– Youle and Kendal.

5. The science of Statistics is essentially a branch of applied mathematics and can be regarded as a mathematics applied to observation data.- R.A fisher.

Statistics can be defined in two sense i.e singular and plural. In singular sense it may be defined as the various methods and techniques for attaining and analyzing the numerical information.

Different economists have different view about statistics. According to Boddingtons Statistics is, "the science of estimates and probabilities". The techniques and method means the collection of data, organization, presentation, analysis and interpretation of numerical data.

The above definition covers the following aspects of statistics.

1. **Collection of data:** The collection of data is the first step of statistical investigation. It must be collected very carefully. So, the data must be covered, if not the conclusion will not be reliable.
2. **Organization:** The data may be obtained either from primary source or the secondary source. If the data is to be obtained from the primary source, then it needs organization. The data are organized by editing, classifying and tabulating them.
3. **Presentation:** After the collection and organization of data, they are presented in systematic form such as table, diagram and graphical form.
4. **Analysis:** After the collection, organization and presentation of data, the next step is to analyze the data. To analyze the data we use average, correction, regression, time series etc. The statistical tools of analysis depend upon the nature of data.

5. **Interpretation:** The last step of a statistical method is the interpretation of the result obtained from the analysis. Interpretation means to draw the valid conclusion.

Plural Sense

A plural sense, statistics means the aggregates of numerical facts collected systematically. The most popular and acceptable definition is given by Horace and Secrist. According to them, "Statistics means the aggregate of face affected to a market extent by multiplicity of course, numerically expressed, enumerated or estimated according to reasonable standard of accuracy collected in a systematic manner for pre-determined purpose and placed in relation to each other." According to this definition statistics in plural sense should have following features:

1. Statistics are aggregate of facts : Single number or unrelated number can not be statistic. The facts and figures should be related to each other. For e.g.: the population of Nepal in 2058 is 23151423 not statistic. So to be a statistics there should be group of facts.
2. Affected by multiplicity of causes: The aggregate of facts and figures should be affected by a set of causes. For e.g. the unemployment rate of country has increased by 5% are the last year due to the low economic growth, political instability civil markets.
3. Numerically express: All the statistics must be expressed in numerical form.
4. Enumerated or Estimated according to reasonable standard of accuracy: For investigation, statistical data can be collected either by enumeration or by estimation. If the data are collected by enumeration the result will be exact and accurate. But if the enumeration is not possible data will be estimated but 100% accuracy is not possible in this method.
5. They are collected for the pre-determined purpose: Before collecting the data objectives of enquiry should be clearly specified. The data collected without any pre-determined purpose may not be useful for enquiry.
6. Collected in a systematic Manner: Before collecting the data, well plan of data collection should be followed because haphazard collection of data may give error.

Scope of Statistics:

1. *Statistics and planning:* Statistics in indispensable into planning in the modern age which is termed as "the age of planning". Almost all over the world the govt. are re-storing to planning for economic development.

2. *Statistics and economics:* Statistical data and techniques of statistical analysis have to immensely useful involving economical problem. Such as wages, price, time series analysis, demand analysis.

3. *Statistics and business:* Statistics is an irresponsible tool of production control. Business executive are relying more and more on statistical techniques for studying the much and desire of the valued customers.

4. *Statistics and industry:* In industry statistics is widely used inequality control. In production engineering to find out whether the product is confirming to the specifications or not. Statistical tools, such as inspection plan, control chart etc.

5. *Statistics and mathematics:* Statistics are intimately related recent advancements in statistical technique are the outcome of wide applications of mathematics.

6. *Statistics and modern science:* In medical science the statistical tools for collection, presentation and analysis of observed facts relating to causes and incidence of dieses and the result of application various drugs and medicine are of great importance.

7. *Statistics, psychology and education:* In education and physiology statistics has found wide application such as, determining or to determine the reliability and validity to a test, factor analysis etc.

8. Statistics *and war:* In war the theory of decision function can be a great assistance to the military and personal to plan "maximum destruction with minimum effort."

Statistics in business and management:

1. *Marketing:* Statistical analysis are frequently used in providing information for making decision in the field of marketing it is necessary first to find out what can be sold and the to evolve suitable strategy, so that the goods which to the ultimate consumer. A skill full analysis of data on production purchasing power, man power, habits of compotators, habits of consumer, transportation cost should be consider to take any attempt to establish a new market.

2. *Production*: In the field of production statistical data and method play a very important role. The decision about what to produce? How to produce? When to produce? For whom to produce is based largely on statistical analysis.

3. *Finance:* The financial organization discharging their finance function effectively depend very heavily on statistical analysis of peat and tigers.

3. *Banking*: Banking institute have found if increasingly to establish research department within their organization for the purpose of gathering and analysis information, not only regarding their own business but also regarding general economic situation and every segment of business in which they may have interest.

4. *Investment*: Statistics greatly assists investors in making clear and valued judgment in his investment decision in selecting securities which are safe and have the best prospects of yielding a good income.

5. *Purchase:* the purchase department in discharging their function makes use of statistical data to frame suitable purchase policies such as what to buy? What quantity to buy? What time to buy? Where to buy? Whom to buy?

6. *Accounting:* statistical data are also employer in accounting particularly in auditing function, the technique of sampling and destination is frequently used.

7. *Control:* the management control process combines statistical and accounting method in making the overall budget for the coming year including sales, materials, labor and other costs and net profits and capital requirement.

Importance and Limitation of statistics

Importance of Statistics

The importance of statistics can be defined in different parts i.e. statistics in planning in economics, in business etc because statistical methods are used in every economic related areas.

1. **Statistics in planning:** Modern age is the age of planning every objective plan depends upon the correct and sound statistical data. Planning is the pre-determined sets of program and policies, which is formulated in order to meet the targeted objectives,. To formulate the plan and details study of the existing situation is needed which is possible only thorough the statistical tools.
2. **Statistics in Economics:** Statistics is very essential to develop and prove the principles and laws of economics. It has great importance to understand the economics problems like production, consumption, distribution etc. as they can be solved by using statistical data.
3. **Statistics in business:** For the smooth operation of the business, statistical information is very useful. It simplifies the complex situation of business. It helps to study about the situation of market demand, supply, price etc. Without a very careful study of market it is difficult to success in business. Therefore the statistics is very essential in business sector also.

Function of statistics

The function of statistics can be defined on the following points:

1. Statistics simplify's complexes
2. Statistics express facts in definite form
3. It facilities comparison
4. It helps in formulating policies
5. Statistics helps in forecasting

Characteristics of Statistics

Some of the most important characteristics of statistics are as follows:

1. It consists of aggregates of facts:

In the plural sense, statistics refers to data, but data to be called statistics must consist of aggregate of certain facts.

A single and isolated fact or figure like, 60 Kgs. weight of a student or the death of a particular person on a day does not amount to statistics.

For a data may amount to statistics it must be in the form of a set or aggregate of certain facts, viz. 50, 65, 70 Kgs. Weight of students in a class or profits of a firm over different times etc. is liable to be effected by multiplicity of causes.

2. It is effected by many causes:

It is not easy to study the effects of one factor only by ignoring the effects of other factors. Here we have to go for the effects of all the factors on the phenomenon separately as well as collectively, because effects of the factors can change with change of place, time or situation.

Here, the overall effect is taken and not of one factor only as in other natural sciences. For example, we can say that result of class XII in board examination does not depend on any single factor but collectively on standard of teachers, teaching methods, teaching aids, practical's performance of students, standard of question papers and as well as of evaluation.

3. It should be numerically expressed:

A data to be called statistics should be numerically expressed so that counting or measurement of data can be made possible. It means that the data or the fact to constitute statistics must be capable of being expressed in some quantitative form as weights of 60, 70, 100 and 90 Kg. or profits of Rs. 10,000, Rs. 20,000 etc. Thus these data must contain numerical figures so that those may be called as numerical statement of facts.

4. It must be enumerated or estimated accurately:

As stated above that the statements should be precise and meaningful. For getting reasonable standard of accuracy the field of enquiry should not be very large. If it is infinite or very large, even enumeration of data is impossible and reasonable standard of accuracy may not be achieved. To achieve it we have to make on estimate according to reasonable standard of accuracy depending upon the nature and purpose of collection of data. e.g. we may measure the height of buildings in metres but we cannot measure the length of small things like bricks in the same unit of metre.

5. It should be collected in a systematic manner:

Another characteristic of statistics is that the data should be collected in a systematic manner. The data collected in a haphazard manner will lead to difficulties in the process of analysis, and wrong conclusions. A proper plan should be made and trained investigators should be used to collect data so that they may collect statistics. If it is not done, in such cases reliability of data gets decreased. So to get correct results the data must be collected in a precise manner.

6. It should be collected for a predetermined purpose:

Before we start the collection of data, we must be clear with the purpose for which we are collecting the data. If we have no information about its purpose, we may not be collecting data according to the needs. We may need some more relevant data to achieve the required purpose, which we would miss in the event of its ignorance.

Suppose we want to get data on imports and exports, we have to know about various segments such as electronics, consumer articles, grains and such other segregations also. If some person on govt. duty is counting the vehicles passing through a road in a unit time is statistics, but same work done by any other person not related to this field, is not statistics because the former is doing it for the Government which wants to make it four lane road-if needed.

7. It should be capable of being placed in relation to each other:
It is last but not less important of the characteristics of the statistics. The collection of data is generally done with the motive to compare. If the figures collected are not comparable, in that case, they lose a large part of their significance.
It means, the figures collected should be homogeneous for comparison and not heterogeneous. For example, Heterogeneous data like sale of Rs. 20,000 result of 80% cases and mileage of 80 kms can never be placed in relation to each other and compared for analysis and interpretation which is the ulterior motive of the science of statistics. It can be concluded that all statistics are numerical data but all numerical data are not statistics unless they satisfy all the essential characteristics of statistics, depicted as above.

Limitation of statistics
Statistics is extremely useful in economics field but it has some limitations in itself which are as follow:

1. **Statistics doesn't deal with the individual:** Statistics deals with aggregate of facts not with individual. Individual fact or figure is out of its scope. For e.g. if we say Ram's height is 5 feet, is not statistics. For statistics we must say the height of Ram, Hari or any other folk is 5 ft.
2. **Statistics doesn't study qualitative phenomenon:** Statistics study only quantitative statement of fact, numerical numbers, such as income, production etc. It never study qualitative statement such as intelligence, beauty etc..
3. **Statistical laws are not exact:** Statistics gives result only on average. It is not 100 % reliable. Therefore it is the law of average.
4. **Statistics is liable to be misused:** The greatest limitation of statistics is that, it must be used by exports only. If it is used by unskilled or inexperienced person, the result may occur wrong.
5. **Statistics is only means:** Statistics is only the means, which provide a method of studying problem. But is should not be considered as the best because this method should be supplement by other techniques to derive conclusion

Types of Statistical Methods
There are innumerable number of statistical methods which can be broadly classified into five types as thus:
(i) Descriptive methods
(ii) Analytical methods
(iii) Inductive methods
(iv) Inferential methods
(v) Applied methods.
A brief analysis of each of the above methods is made as under:

(i) Descriptive Methods
This type of method consists of all the preliminary steps to final analysis and interpretation. As such this method includes the method of collection, methods of tabulation, measures of central tendency, measures of dispersion, measures of skewness, and analysis of time series. These methods bring out the various characteristics of data and help in summarizing and interpreting the salient features of the data. This method is also otherwise called descriptive statistics.

(ii) Analytical Methods
This type of method consists of all those methods which help in the matter of analysis and comparison between any two or more variables. This includes the methods of correlation, regression analysis, association of attributes and the like. This method is also otherwise called analytical statistics.

(iii) Inductive Methods
This type of method consists of all those procedures that help in the generalization or estimation over a phenomenon on the basis of random observation or partial data. This includes the procedure of interpolation, extrapolation, theory of probability and the like. This methods is also otherwise called inductive statistics.

(iv) Inferential Methods
This type of method consists of those procedures which help which in drawing inferences about the characteristics of the population on the basis of samples. As such, this method includes the theory of sampling, different tests of significance, statistical control etc. This method is also otherwise called inferential statistics.

(v) Applied Methods
This type of method consists of those procedures which are applied to the problems of real life. This includes the method of statistical quality control, sample survey, linear programming, inventory control and the like.