

**Credit IV****❖ Quantitative Techniques and their Relevance in Geography.**

Quantitative techniques are the techniques that are concerned with collection, organization, presentation, analysis and interpretation of data. The quantitative techniques in geography are a recent development. To understand and interpret the complex phenomena properly, the statistical methods have been introduced in the field of geography.

Geographical analysis of some phenomenon begins with the identification of its salient feature which are thereafter compared and contrasted in different situations. The quantitative techniques are firmly based on empirical observations and are readily verifiable. The statistical techniques help in reducing a multitude observations, data and facts to a manageable number of facts. These techniques help in the estimation, interpolation and simulation of data which are necessary for forecasting.

As mentioned earlier, quantitative techniques are the techniques that are concerned with collection, organization, presentation, analysis and interpretation of data.

These five stages are summed up as follows:-

1. **Collection of data**
2. **Organization**
3. **Presentation**
4. **Analysis**
5. **Interpretation**

- **Collection of data:-**

This is the first stage and involves the collection of data. In collection of data one has to be very careful because they form the foundation of statistical analysis. Geographers use both primary as well secondary data. For collections of primary data, field surveys are conducted. Secondary data is obtained from different offices, libraries offices etc.

- **Organization :-**

A large mass of figure collected from survey often needs organization. This is the second stage and involves arrangements of raw data in a well organized manner i.e. editing of the data through which the omission, irrelevant answers and wrong computations in the survey may be corrected or adjusted. The edited data then are arranged according to some common characteristics of the items of data. Then after the arrangement of the data the final step is tabulation of the data. In this, final step data is arranged in columns and rows.

- **Presentation :-**

The organized data is presented in an orderly manner to facilitate statistical analysis. In this stage data is represented in the form of maps, graphs and diagrams.

- **Analysis :-**

The purpose of analyzing of data is only to get some information for making decision. In this stage the various characteristics of data are carried out by using different statistical methods like

- (a) Measures of central tendency (mean, mode, median, quartiles, percentiles etc).

(b) Measures of dispersion (mean deviation, standard deviation etc).

(c) Correlation

(d) Regression

(e) Relationship measures and

(f) Measure of spatial pattern etc.

- **Interpretation :-**

This is the last stage of statistical investigation. It is difficult task and requires a high degree of skill and experience. This stage involves drawing conclusions from the analyzed data.

- ❖ **Relevance Quantitative Techniques in Geography.**

So far as the relevance of **quantitative techniques** are concerned in geography. There is no exaggeration to say that quantitative techniques play an important role in the discipline of geography that highlighted as follows:-

1. Quantitative techniques are essential tools for analysis and synthesis of data.
2. Geographers have used the quantitative techniques for identification, explanation and decision making.
3. Quantitative techniques are used to measure phenomenon with highest degree of accuracy.
4. It is with the help of quantitative techniques geographers had been in a position to collect a data over a large area by the method of sampling in such a manner that the analysis with the sample become unit of universe.
5. It is with the help of quantitative techniques that geographers started concentrating more on field studies, collecting primary data and utilizing secondary data.
6. It was after the **quantitative revolution**, there was a turning point in the discipline of geography. Because geographers started making models, theories and laws.

7. It is with the help of quantitative techniques that the validity of geographical data is assessed for theory building and model making.

### ❖ Quantitative Revolution in geography

**Introduction** : After the second world war, the empirical & descriptive approaches in geography were discarded and greater emphasis was laid on the formulation of abstract models and use of statistical techniques to make past geography and its theories more precise in order to have better knowledge of geographical systems and that is process is known to be “ QUANTATIVE REVOLUTION” IN GEOGRAPHY. It was I. Burton who published a research paper, 'The Quantitative Revolution and Theoretical Geography' in 1963.

In other words the application of statistical techniques and mathematical techniques theorems and proofs in understanding geographical systems is known as quantitative revolution in geography.

➤ The statistical methods were first introduced in geography in the early 1950. The methods were employed in geography for generating and testing hypothesis using empirical data.

➤ The mathematical techniques and theorems were used for deriving models.

#### **Main features of Quantative Revolution:**

The main features of quantitative revolution are:

- Widespread adoption of both statistical techniques and abstract models and theories

- Displacement of the old **Idiographic geography** (which emphasis on areal differentiation and regional geography) by a new **Nomothetic geography** (Spatial Science) seeking to establish laws, models and theories of spatial structure.

Quantative revolution thus involved a paradigm shift (a super model about the growth and development of science) given by S.T. Kuhn which provides deductive and inductive rules about the kind of phenomena in geography which focus on application of scientific laws in geography problem and theory building.

#### **Objectives of Quantative Revolution:**

The main objectives of Quantative techniques are as:

- To change a descriptive character of geography and make it a scientific discipline.
- To explain and interpret the spatial patterns of geographical phenomena in a rational, objective & cogent manner.
- To use mathematical language instead of the language of literature like 'Af' in the koeppen's classification of climate this stands for 'tropical rainforest climate'.
- To make precise statements about locational order.
- To test hypothesis and formulate models, theories and laws.
- To identify the ideal locations for the various economic activities so that profit may be maximized.
- To provide geography a sound philosophical theoretical base.

### **Development of Quantative Revolution:**

Quantative revolution began in USA in mid-1950 in a few selected centers and was led by geographers who had studied natural sciences such as physics and statistics.

➤ Major theoretical and methodological development in geography

- Quantative revolution led to the development of locational theory, focus of which was on location of economic activities.

- Central place theory focus of which on size and distribution of settlements within urban systems.

- Locational analysis it focus the study of spatial arrangement of phenomena of spatial science.

### **2 Relevance of Quantitative Techniques in Geography:**

Geography is one of the oldest earth sciences and its roots date back in the works of early Greek scholars like Thales and Anaximander during sixth and seventh century B.C. There is consensus that all civilizations contributed to the development of geographical concepts. In fact geographical knowledge had been a concomitant of civilization.

- Geography for more than two hundred years was confronted with the problems of generalization and theory building. Traditionally, geography was considered to be a description of the earth surface, but in due course of time its definition and nature changed.

Now, it is concerned with providing accurate, orderly and rational descriptions and interpretations variable character of the earth surface.

- In the words of **Yeates**, "Geography can be regarded as a science concerned with rational development and testing of theories that explain and predict the spatial distribution and location of various characteristics on the surface of the earth.

- To achieve the above objective and to obtain the real picture of a region, geographers began to use and apply quantitative tools and techniques to which qualitative geography was opposed, especially till the 1960.

- After the second war, geographers especially those of the developed countries, realized the significance of using mathematical language rather than the language of literature in the study of geography.

- The relevance of quantitative techniques in the field of geography can be drawn from the fact that empirical descriptive geography was discarded and greater stress was laid on the formulation of abstract models. Mathematical and abstract models need rigorous thinking and use of statistical techniques.

- The diffusion of quantitative techniques in geography to make the subject and its theories more precise.

- The most obvious change brought about by the quantitative revolution is the change of methods and techniques.

- With the introduction of quantitative revolution in the field of geography led the major theoretical and methodological development in the subject geography and make the subject more accurate, orderly and rational description in the interpretation of variable characters of earth's surface.

- Quantitative techniques provide a geography a sound philosophical and theoretical base, and to make its methodology objective and scientific.

- **Advantage of quantitative techniques in geographical studies :**

- a) The quantitative techniques are firmly based on empirical observations and readily verifiable.

- b) The quantitative techniques help in reducing a multitude of observations, data and facts to manageable number of factors.

- c) The quantitative techniques help in the estimation, interpolation and simulation of data which are necessary for forecasting.

- d) They also help in describing analyzing and simplifying a geographical system.

- e) Locational theories of industries, agriculture land use intensity and stages of development of landforms can be easily understood and predicted with the help of quantitative techniques.

- f) Finally, quantitative revolution based on positivism distinguishes science from metaphysics and religion thus provides the subject of geography a sound philosophical, scientific and methodological base.

### **Disadvantages of Quantitative techniques in Geographical studies:**

The applications of quantitative techniques in geographical studies have been criticized on several counts such as:

a) The advocates of quantitative revolution pleaded for the language of geometry. Geometry is not an acceptable language to explain the man environment relationship- the main theme of geography.

b) The advocates of quantitative techniques in geography focused on “Locational Analysis”. The main weakness of locational is that promotes capitalism and in capitalistic society there is the exploitation of human and environmental resources which makes the rich richer and the poor poorer.

c) Application of quantitative techniques demands not only considerable mathematical power, they also demand reliable data which is rarely available in developing countries like ours.

d) Making reliable models and universal laws in human geography like other social sciences with the help of quantitative techniques is however not possible.

### ❖ **Geomorphic field Survey: Meaning, Significance and procedure**

Man and nature is the basic theme of geography. Man's existence on the earth's crust is depends upon the terrain it provides and boundaries it offers. According to **Vidal de La Blache** a famous geographer, "Nature provides the stage and it is for man to act on it".

Geography is often considered as the study of the feature of earth's surface including their spatial distribution and interrelation and the interaction of man with them. The natural or physical geographic elements consist of physical feature like landforms, climate, water bodies' flora and fauna.

Geography is considered to be a scientific discipline. But it is different from Zoology or Botany. In these science subjects practical's are mostly conducted and performed in an indoor lab. Geographers are also engaged in the practical but the real lab of a geographer is the world outside.

The geomorphic field studies have obtained vital importance in geography. Such field studies are not important only to get the first hand information and the data about socio – economic aspects of human life, but these are of even greater importance to develop full understanding about physical features like V-shaped valley, Delta formation by river, U – shaped valley by glacier, Sand dunes by the action of wind etc. existing in the natural field.

#### ➤ **Significance of Geomorphic field Survey**

These field surveys are concerned with the study of location, altitude and space relations of various places. Besides it also studies rock types, their litho – logical and mineral characteristics, various structural features like folds, faults, dips, strikes, thrust etc., various landforms such as mountains, plateaus, plains, valleys, gorges, block mountains etc., various geomorphic processes which are constantly engaged in changing the morphological characteristics of the earth's surface the area under investigation.

There are of course, various techniques of field work and surveying which help in collection of data regarding the geomorphology of the area under study. The information obtained thus is presented in the form of maps – topographical maps, geological maps and many other types of maps. All these maps produce detailed information of the area concerned. Number of instruments is used during the field surveys.

Information about altitude of various places can be obtained with the help of a variety of instruments like Clinometers, Dumpy level, Theodolite. These instruments are called leveling instruments.

**Procedure:** Before going in the field for any Geomorphic field Survey following criteria should be taken into the consideration:

- a) Plan for visiting area to survey
- b) Purpose for surveying
- c) Acquainted knowledge
- d) Well trained / equipments
- e) Execution of plan & skills
- f) Proper observation
- g) Politeness
- h) Compilation and presentation.

❖ **Field survey and its importance in Socio-economic Survey:**

Field survey refers to collection of information by an individual or group of individuals through direct observation in the field. Through a field survey, information about the physical

and socio-economic survey such as relief features, drainage patterns, types of soil and natural vegetation etc (physical features), as well as population structure, sex ratio, literacy, means of transport and communication, urban and rural settlements, etc ( socio-economic)is collected which gives a clear view of the pertaining information. The distribution and growth of any phenomena can be best understood by collecting data from the concerned field mainly by field survey.

Field survey constitutes an extremely important aspect of geographical studies. From the very beginning, the geographers have studied the natural and cultural environment of different parts of the earth through field work only. The study of geography can be done only by personally visiting the concerned area because that gives first-hand information. An area can be remembered better by visiting it rather than by reading about it in the books.

According to a popular saying, “I read, I forget; I see, I remember; I do, I understand.” While emphasizing the importance of field work James Fairgrieve says, “Geography comes through the soles of one’s shoes.” This means that true knowledge of geography lies in the field rather than in the library. Another importance of field survey can be best seen from the remarks of Ratzel (German geographer), I travelled, I sketched, I described.

The importance of field survey in the field of socio-economic aspects of human population is huge and irreplaceable. As we are aware that there are vast differences in social, cultural and economic characteristics between different regions of a country as well

different strata of society within a region in other words regional disparities everywhere which directly influenced by the productivity of land , occupation of people , services and facilities available to them as well as the capacity of the people to utilize the resources all these facts need to be gauged out in order to have coherent knowledge of prevailing heterogenetic nature of socio-economic conditions of the concerned area. All these aspects can best gauged through filed observation rather through learning from any secondary sources in order to collect information of all the facts which might not be available or its authenticity might be in doubt borrowed from any secondary sources. As the published data are often not adequate so it is better to collect information through direct observation in the field and validate its authenticity as much as possible. By examining socio-economic conditions of any area it is important to visit the particular area to gauge out the selective indicators by various means such as through personal investigation, questionnaire/ schedule and other primary ways to have a better knowledge of the concerned phenomena and helped to draw rationalized results.

**Procedure:** Before going in the field for any socio-economic survey following criteria should be taken into the consideration:

- i) Plan for visiting area to survey
- j) Purpose for surveying
- k) Acquainted knowledge
- l) Well trained / equipments

- m) Execution of plan & skills
- n) Proper observation
- o) Politeness
- p) Compilation and presentation.

#### ❖ Application of Remote Sensing in Land use / Natural Hazardous

Remote sensing is the science (and to some extent, art) of acquiring information about earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing and applying that information. The process involves an interaction between incident radiation and targets of interest.

**Application:** Each application itself has specific demands for spectral resolution, spatial resolution and temporal resolution. Application of remote sensing plays a much greater role in present form of life. With the help of remote sensing we can get the information of an area which can't be imagined from naked eye (Spectral range of human eye 0.4 to 0.7 microns) or to visit that placed by foot or with any other means having inaccessibility. As we are aware and fully satisfied of the fact that earth is not a homogenous in nature.

Application of the remote sensing in land use and land cover: although the terms land cover and land use is often used interchangeably, their actual meaning is quite distinct.

Land cover refers to the surface cover on the ground, whether vegetation, urban infrastructure, water, bare soil or other.

➤ Identifying, delineating and mapping land cover is important for global monitoring studies, resource management and planning activities.

➤ Land use refers to the purpose the land serves, for example, recreation, wildlife habitat or agriculture.

➤ Land use applications involve both baseline mapping and subsequent monitoring, since timely information is required to know what current quantity of land is in what type of use and to identify the land use changes from year to year.

➤ The knowledge will help to develop strategies to balance conservation, conflicting uses and development pressures, issues driving land use studies include the removal or disturbance of productive land, urban encroachment and depletion of forests.

➤ Applications of remote sensing in land use / Natural hazard include the following:

a) Natural resource management

b) Wildlife habitat protection

c) Baseline mapping for GIS input

d) Urban expansion/encroachment

e) Routing and logistics planning for seismic/exploration/resource extraction

activities

f) Damage delineation (tornadoes, flooding, volcanic, seismic, fire)

- g) Legal boundaries for tax and property evaluation
- h) Target detection-identification of land strips, roads, clearings, bridges, land/water

interface.

➤ Application of remote sensing in agriculture includes the following:

- a) Crop type classification
- b) Crop condition assessment
- c) Crop yield estimation
- d) Mapping of soil characteristics
- e) Mapping of soil management practices
- f) Compliance monitoring(farming practices)

➤ Forestry another product of land use is a valuable resource providing food, shelter, wildlife habitat, fuel and daily supplies such as medicinal ingredients and paper etc. international & domestic forestry applications where remote sensing can be utilized include sustainable development, biodiversity, land title & tenure, monitoring deforestation, commercial logging operations, shoreline and watershed protection, biophysical monitoring (wildlife habitat assessment) and other environment concerns. Remote sensing can be used to detect & monitor forest fire.

➤ Application of remote sensing in structural mapping & terrain analysis, a synoptic view of regional scale is a much different perspective than point ground observations when trying to map structural elements. Remote sensing offers this perspective and allows

geologist to examine other reference ancillary data simultaneously and synergistically, such as geo magnetic information. Certain remote sensing devices offer unique information regarding structures, such as in the relief expression offered by radar sensors.

➤ Remote sensing also gives the overview required to construct regional unit maps, useful for small scale analyses and planning field traverses.

➤ Application of remote sensing in hydrology include

- a) Wetlands mapping & monitoring
- b) Soil moisture estimation
- c) Snow pack monitoring/delineation of extent
- d) Measuring snow thickness
- e) River & lake ice monitoring
- f) Flood mapping & monitoring
- g) River /delta change detection
- h) Irrigation canal leakage detection
- i) Irrigation scheduling.