The Quantitative Revolutions in Geography

Geography (Hons.) B.A Part III Unit II

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Introduction

• The late 1950s and early 1960s revealed the beginnings of a paradigm shift in Geography. This shift included a movement from descriptive to theoretical emphasis, and a consequent (and necessary) extension of geographic methods into the quantitative realm.

• Traditionally labeled the “Quantitative Revolution,” I have always believed that it was equally a theoretical revolution as much as a quantitative revolution. My reasons are straightforward:

• The late 1950s saw the introduction of agricultural, industrial, and urban location theory into Geography;

• Coincidentally, Walter Isard published an important book on Location and Space-Economy (1956) in which he examined the nature and potential applications of location theory in a spatial and regional context.
• The Quantitative Revolution: Geographers, for more than two hundred years, had been confronted with the problems of generalisation and theory building. After the Second World War, the geographers, especially those of the developed countries, realised the significance of using the mathematical language rather than using the language of literature.

• Consequently, the empirical descriptive geography was discarded and more stress was laid on the formulation of abstract models. The diffusion of statistical techniques in geography, to make the subject and its theories precise, is known as the Quantitative Revolution in geography.
• The earliest use of quantitative techniques started in climatic studies e.g. Koeppen’s climatic classification, RR. Crowe’s The Analysis of Rainfall Probability, M.G. Kendall’s The Geographical Distribution and Crop Productivity in England, H.A. Matthew’s A New View of Some Familiar Indian Rainfall.

• Christaller made a major contribution to location theory, by applying quantitative techniques enormously in his study Central Places in. Southern Germany.

• In other branches of geography, e.g. populations, regional, cultural and economic geography, a range of different statistical methods were gradually brought into use.

• Thus the diffusion of quantitative techniques took place in the 1960s which enabled the geographers to develop more refined theories and models.
Quantitative tool

Statistical techniques
  - Linear (space time forecasting Model)
  - Non-Linear (Spectral Analysis)

Mathematical Model
  - Social Physics
  - Economics
    - Distance decay & Gravity Model
    - Perraux Growth pole theory
    - Rostow economic growth
    - Weber’s least cost
    - Christaller’s Central Places theory
Objectives of Quantitative Revolution in Geography

• Main Objectives of Quantitative Revolution in Geography
  Some of the main objectives of the quantitative revolution in geography were as under:
  • Geography for more than two hundred years was confronted with the problems of generalization and theory-building. In all other physical and social sciences theory-building has a long tradition. After the Second World 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.
  • Consequently, 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 sophisticated statistical techniques.
• The diffusion of statistical techniques in geography to make the
  subject and its theories more precise is known as the
  ‘quantitative revolution’ in geography.

• 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 of the
  variable character of the earth surface.

• In the words of Yeats, “geography can be regarded as a science
  concerned with the rational development, and testing of theories
  that explain and predict the spatial distribution and location of
  various characteristics on the surface of the earth”.

• In order to achieve this 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 1960s.

• Thus, the most obvious change brought about by the quantitative
  revolution is the change of methods and techniques.
After this revolution, quantitative techniques and general system theory have been used quite extensively in geography. The new electronic devices have made possible the use of complex mathematical computations never before attempted.

The application of statistical and mathematical techniques, theorems and proofs in understanding geographical systems is known as the ‘quantitative revolution’ in geography. Statistical methods were first introduced into geography in the early 1950s (Burton, 1963). Consisting mainly of descriptive statistics, there was also some attempt at hypotheses testing using, for example, chi-square.

Bivariate Regression Analysis followed shortly but it was not until the 1960s that the General Linear Model was fully explored. It was I. Burton who published a research paper, ‘The Quantitative Revolution and Theoretical Geography’ in the Canadian Geographer in 1963.
• The statistical methods are employed in geography for the generating and testing hypotheses using empirical data, whereas the mathematical techniques and theorems are used for deriving models from a set of initial abstract assumptions. In other words, statistical methods are used to estimate, and test the significance of, various parameters associated with a given mathematical model such as the distance decay and gravity models.

• There has been confusion among the geographers and the public mind about the nature and social relevance of geography, especially after the Second World War. The status of geography as a university discipline was under discussion. It was also a topic of debate that what should be taught as geography at various stages of the educational processes.

• In 1948, James Conant, President of the Harvard University, had reportedly come to the conclusion that “geography is not a university subject”.

• The Department of Geography of Harvard University was closed soon after and the discipline of geography was gradually eased out in many of the private universities of U.S.A. The continual threat of departmental closure or staff reduction also lead to frantic search in American universities for new ideas and research programmes. This resulted into the development of the ‘spatial sciences school’, also called ‘quantitative revolution’ in geography.

• The last three decades have been characterized by an almost continuous debate among human geographers concerning the philosophy, nature and methodology of geography.

• Moreover, the geographers of the post-Second World War suffered from a complex that they did not have standard theories, models and laws like that of other social and biological sciences. Consequently, their efforts and researches were not considered of much social relevance.

• In order to overcome these complexes and to put the subject on a sound theoretical footing, geographers started using quantitative techniques to interpret the organization of space, to generalize and to formulate their own theories and models about the man and environment relationship.
• Formulation of Models and Theories
• In order to achieve these objectives, the preachers of quantitative techniques stressed on field surveys for the collection of data and empirical observations.
• In the formulation of models and theories they assumed:
  • Man is a rational (economic) person who always tries to optimize his profits.
  • Man has infinite knowledge of his space (environment and resources).
  • They assumed ‘space’ as an isotropic surface.
  • There is no place for the normative questions (questions about social values) in scientific research and objective interpretation of the geographical reality.
• They assumed that normative questions, like cultural values, beliefs, attitudes, customs, traditions, likes and dislikes, prejudice, and aesthetic values have no place in geographical research and scientific explanation of geographical patterns.
• Moreover, the main objectives of the quantitative revolution in geography were as under:
  • To change the descriptive character of the subject (geo + graphy) and to make it a scientific discipline;
  • To explain and interpret the spatial patterns of geographical phenomena in a rational, objective and cogent manner;
  • To use mathematical language instead of the language of literature, like ‘After in the Koppen’s classification of climate which stands for the ‘tropical rainforests’;
  • To make precise statements (generalizations) about locational order;
  • To test hypotheses and formulate models, theories and laws for estimations and predictions;
  • To identify the ideal locations for the various economic activities so that the profit may be maximized by the resource users; and
  • To provide geography a sound philosophical and theoretical base, and to make its methodology objective and scientific.
Advantages of Quantitative Techniques:
(i) All the techniques are firmly based on empirical observations and are readily verifiable.
(ii) They help in reducing a multitude of observations to a manageable number of factors.
(iii) They allow the formulation of structured ideas and theories which can be tested under the assumed conditions.
(iv) They help in deriving suitable models to understand the interaction of the evolved factors and their process within the models and with reference to observed facts.
(v) They help in identifying tendencies and desired trends, laws and theoretical concepts.

Disadvantages of Quantitative Techniques:
(i) The theories and models developed on the basis of empirical data, do not take into account the normative questions like beliefs, emotions, attitudes, desires, hopes and fears and, therefore, cannot be taken as the tools explaining exact geographical realities.
(ii) The over-enthusiastic preachers have sacrificed many good qualitative statements which were quite useful.
(iii) They also demand sophisticated data which are rarely attainable outside the developed countries.

(iv) It has been found that generalisation done with the help of these techniques is bringing exaggerated results.

(v) The factorial designs depend on the use of the costly computer time and considerable financial assistance which are rarely available to the individual researcher of areal variation.

Generalisation on the basis of quantitative techniques may prove to be misleading and negative instead of positive. Apart from this, the data used is hardly for a period of about hundred years and that too reflects the modes of production and distribution of the developed societies. Thus, the Quantitative Revolution also could not enable the geographers to formulate the universal laws and paradigms.
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