

Research Methodologies and Role of GIS in Social Science Research

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Abstract: *This paper entitled “Research methodologies and role of GIS in social science Research” provides a broader knowledge about the research methods and Role of GIS in social science Research. At present time GIS plays a very important for the research perspective. Research is as old the academic consciousness of human mind. Present has its roots in the past and seeds of the future are sown in the present itself. Men argue to understand the present has obviously induced him to look into his past. It is served two- fold purpose of intellectual sharpening and evolving new theories to explain diverse phenomena through which the mankind has survived to its present form. in this point of view GIS also plays a very important role as we can use so many software like Arc GIS , Arc view , Map info ,etc for preparing the maps and for the statically calculations we can use SPSS, SPX etc software’s and they shows the application of GIS modeling at present times.*

Keywords: Research methods, GIS, decision support system

1. Introduction

Research is a process and a means to acquire knowledge about any natural or human phenomena. Rapid social, economic and technological changes of modern times are cause as well as effects of new discoveries, inventions and findings in various walks of life. Research is as old the academic consciousness of human mind. Present has its roots in the past and seeds of the future are sown in the present itself. Men argue to understand the present has obviously induced him to look into his past. It is served two-fold purpose of intellectual sharpening and evolving new theories to explain diverse phenomena through which the mankind has survived to its present form.

According to John Best¹ “ Research is a more systematic activity directed towards discovery and the development of an organized body of knowledge”. He gives some characteristics of research methods in social sciences. (1) Research is directed towards the solutions of the problems. It may attempt to answer a question or to determine the relations between two or more variables². (2) Research emphasis the development of generalization, principles of the theories that will be helpful in predicting future occurrence (3) Research is based upon observable experiences or empirical evidences. (4) Research demands accurate observation and description. (5) Research involves gathering new data from primary or firsthand sources or using existing data for a new purpose. (6) Research requires

expertise. The researcher knows what is already known about the problems and the how others have investigated it. Research plays two roles:-1) it contributes to the general funds of knowledge .2) it helps solve many complex problems of the society. Research is often classified as pure and applied. The pure basic fundamental research³ “involves the asking and answering of the questions that do not involve immediate solutions of pragmatic problems”. It is generated because one gets intellectually involved in it.

2. Objective

- (1) To identify the role of research in social science research.
- (2) To assess the role of GIS in social science research.
- (3) To assess the role of scientific research in social science research.

2.1 Types of Research

The present Research is categories into different types these are;

(1) **Ex-post Facto Research** is a systematic empirical inquiry in which the scientist does not have directed control of independent variables because their manifestations have already occurred or because they are inherently not manipulated. Inferences about relations among variables are made, without direct investigation, from concomitant variations of independent and dependent variables. In ex-post facto Research, the research’s control on the behavior of independent variables is very weak and in many cases no control is possible.

¹John Best¹: Research in education, prentice Hall –new delhi , 1977-78.

²Variables : Input and outputs data of an research methods

(2) Laboratory or Experimental Research this type of research is confined to laboratory experiments alone. The basic feature of such research is that there exists a possibility of exercising control over independent variables and isolating their influences for plausible explanation. "A laboratory experiment is a research study in which the variance of all or nearly all of the possible influential independent variable not pertinent to the immediate problem of the investigation is kept at a minimum.

(3) Field Investigation Research "A field experiment is a research study in a realistic situation in which one or more independent variables are manipulated by the experimenters under as carefully controlled conditions as the situation will permits. Where the laboratory experiment has a maximum of control, most field studies must operate with less control a factor that is often a severe handicap to the experiment".

(4) Survey Research this type of research has become very popular these days as a scientific method for discovering relevant impact and inter-relationship of social and psychological variables from given populations. Survey research studies large and small population by selecting and studying sample chosen from the population by selecting and studying samples chosen from the population to discover the relative incidence, distribution and interrelations of sociological and psychological variables.

(5) Evaluation Research is a recent addition to the type of research. It would be appropriate to call this category of research as a product of development programming which has been adopted on a very large scale in the recent years, more particularly after Second World War when the most of the third world countries emerged on the development scene. This type of research is primarily directed to evaluate the performance of the development projects and other economic programs that have already been implemented.

3. The Research Process

The research paradigms vary in their contents and substance, their broad approach to inquiry is similar to sciences as well as social sciences. Although the basic logic of scientific methodology is the same in all fields, its specific techniques and approaches will vary, depending upon the subject matter (Festinger and Katz, 1966, p.vi). Therefore the eight step model (Fig 1.1) developed is generic in nature and can be applied to a number of discipline in the social sciences, which is based upon a practical and step by step approach to a research enquire and each step provides methods, model and procedures (Kumar, 2005)

individual. The scientific method is intricately associated with the logical thinking and the process of human inquiry that provides the modern era on many levels of logical abstraction. While the method appears simple and logical in description, there is perhaps no more complex question than that of knowing how we come to know about thinking. The scientific method attempts to minimize the influences of bias or prejudice of any kind in the experimenters when testing an hypothesis⁵ or a theory. Scientific methods could be defined as consisting of 4 major parts⁷

- (1) Identification of the problem
- (2) Formulation of an hypothesis
- (3) Systematically collecting, classifying and analyzing data
- (4) Either acceptance or rejection of the Hypothesis

5. Types of information / Data and Data Processing

In social science we have two types of approaches for the data collection these are the Quantitative and Qualitative approaches. Research methodology or the logic of inquiry,

⁵ hypothesis is a tentative, conjecture, explaining an observation, phenomena or scientific problems that can be tested by further observation, investigation and experimentation

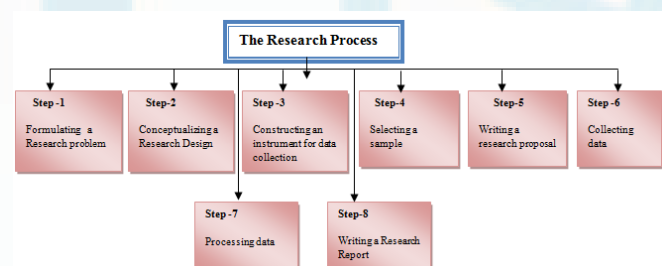


Figure 1.1: The Research Process

4. Scientific Research Methods

In scientific method, quantitative³ research methods are employed in an attempt to establish general law or principle. Such as a scientific approach is often termed nomothetic⁴ and assume social reality in objective and external to the

³ quantitative data are numerical data. It is a formal, objective systems process which numerical data are utilized to obtain information about the world.

⁴ nomothetic is published in the department of education, 1977-1978, and it also related the scientific laws of research.

that legitimizes and determines the manner in which research is conducted generally denotes a combination of (i) technology of data collection, namely tools and methods of research such as the questionnaire, schedule, interview guide, case study, life history, survey, and participant observation methods and contents analysis. (ii) Analytical tools such as statistical tests and imperative⁶ methods (iii) Philosophy, theory and epistemology⁷ of social science guiding the conduct of research in the definition and understanding of the problem and the logic of inquiry.

Two basic approaches for data processing in social science;

- 1) Qualitative Approach
- 2) Quantitative Approach

Qualitative approach: Qualitative Research method is an interpretation, subjective; systematic process and meaning that are not rigorously examined or measured –if measured at all in terms of quality, amount intensity or frequency. The qualitative data is conducted by interview, observing people, or undertaking secondary analysis of archival sources.

Quantitative approach: Quantitative data are numerical data. It is a formal, objective systems process which numerical data are utilized to obtain information about the world. This approach emphasizes the measurement and analysis of causal relationship between variables not process.

6. Hypothesis Building and Testing

Hypothesis may be defined as a proposition or a set of proposition set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation or accepted as high probable in the light of established facts. Quite often research hypothesis is a predictive statement, capable of being tested by scientific methods, these relates an independent variable to some dependent variable. These are hypothesis capable of being objectively verified and tested.

Importance of hypothesis;

- 1) Hypothesis facilitates the extension of knowledge in an area. They provide tentative explanation of facts and phenomena, and can be tested and validated.
- 2) Hypothesis provide the researcher with rational statements, consisting of elements expressed in a logical order of relationship which seek to describe or to explain conditions or events, that have not yet been confirmed by facts.
- 3) It provides direction to the research
- 4) Hypothesis provides the bases for reporting the conclusion of the study. The researcher will find it very convenient to test each hypothesis separately and state the conclusion that is relevant to each.

7. Hypothesis Testing

To test a hypothesis means to tell whether or not the hypothesis seems to be valid. In hypothesis seems to be valid. In hypothesis testing the main question is: whether to accept or the null hypothesis or not to accept the null hypothesis? There are so many steps involved in hypothesis testing these are:

- 1) Making a formal statement.
- 2) Selecting a significance level
- 3) Deciding the distribution to use
- 4) Selecting a random sample and computing an appropriate value.
- 5) Calculation of the probability
- 6) Comparing the probability

⁶Imperative methods imperative methods are explaining the basis for the social science research and the benefited for the fair or structured research.

⁷Epistemology is a theory of knowledge, as a field of study or pertaining to knowing or cognizing, as a mental activity.

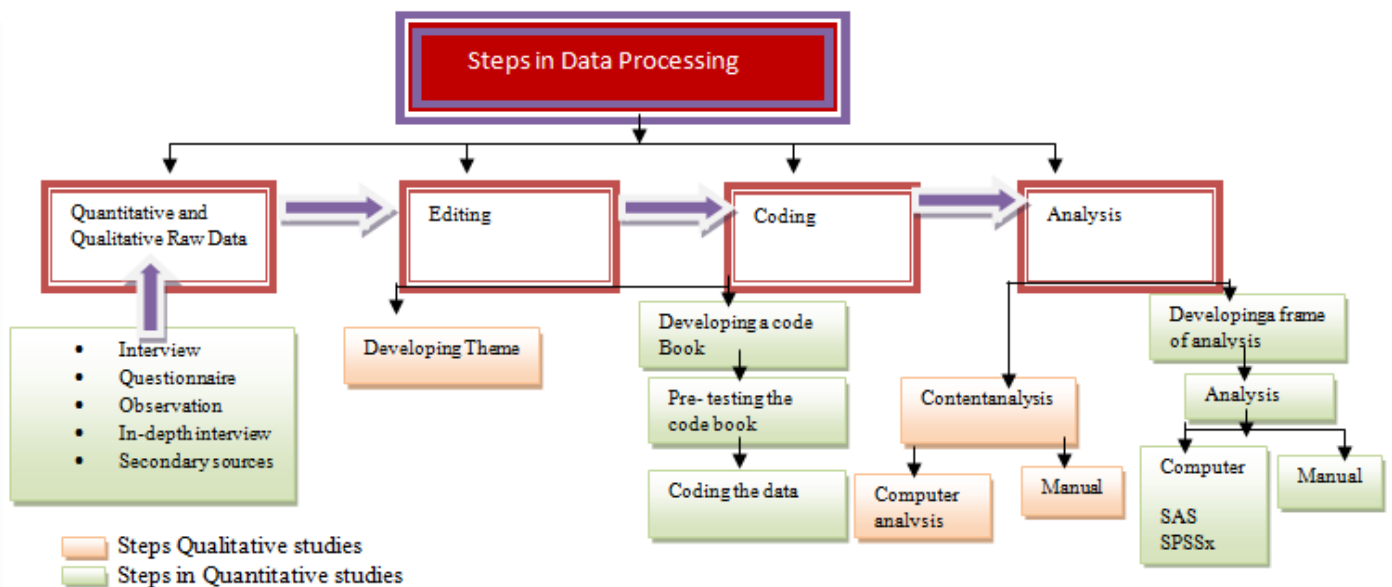


Figure 1.2: Steps in Data Processing

8. GIS as a Research Method in Social Science

The field of earth observation (EO) has seen remarkable development over recent time owing to the increasing quality of the sensor technology and the increasing number of operational satellites launched by several space organizations and companies around the world. The growing number of applications of the available remote sensing data is in turn feeding the appetite for new and improved technologies. While remote sensing (RS) made enormous progress over the last years in terms of better resolution, data accessibility and public attentiveness, a vast majority of applications rely on basic image processing concepts developed in the 70s per-pixel classification of data in a multi-dimensional feature space. Since the first Landsat Multispectral Scanner System (MSS) was launched in 1972, which began the modern era of land remote sensing from space, large volumes of satellite image data have been collected, which are invaluable to many applications including environmental assessment and monitoring, agriculture, renewable natural resources, and mapping.

Aerial imagery has been one of the standard data sources for geographic information systems (GIS) for more than three decades. Most spatial features in GIS (such as manmade objects) can be extracted automatically from images. Road data in GIS are of major importance for applications such as

traffic control, transportation flow analysis, vehicle navigation, travel guidance, and fire or medical emergency services. Building data in GIS are also important for security purpose. Therefore, acquisition of accurate and up-to-date road network information building extraction from aerial imagery is necessary. Automatic road extraction from digital imagery has been a major research focus in the Photo grammetric and computer vision fields for more than two decades. Open Aerial images particularly of cities, fields typically contain geometric figures depicting, buildings, roads, field boundaries, and car parks. Now to recognize those real objects from such images it needs a mechanism which will recognizes geometrics figures of such objects from the imagery. This information is very valuable particularly in measurements, population densities, etc type of statistical data.

India is vulnerable to natural and manmade disasters. All disasters are spatial in nature. GIS techniques act as a decision support tool. Decision making can possible by analysis of different GIS layers. Currently socio-economic and geo-spatial data is useful for management and planning of disasters as well as tackling of disastrous condition. Various departments and agencies who are stakeholders using GIS in the disaster management process. GIS, RS & GPS is useful in disaster management applications & for decision making. Evolution of computer technology and

availability of hardware is helpful for rapid expansion of GIS in both disaster research and practice.

GIS is useful for hazard zone mapping and during emergency conditions mitigation of people can easily possible using this maps. GIS and RS much beneficial in mitigation strategies and preparedness plans. Real time geographic data can improve the allocation of resources for response. GIS technologies is much useful in modeling of disaster risks and human adaptations to hazards. It is also provides decision support system in disaster management.

9. GIS as a Decision Support System

Cowen (1998) describes GIS as a decision support system involving the integration of spatially referenced data in a problem –solving environment. Others, who argued that GIS Technology fell short providing decision analysis capabilities, quickly disputed this definition. Another perspective, which we offer later, argues that GIS might be a step backward due to its positivistic, encouraging rational planning in the decision process rather than opening the decision process to participatory behavior. Considerably progress has been made over the past two decades if we measure the progress in terms of tool development.

The basis of geospatial decision support is the GIS technology. The basic decision aid of GIS includes data management to extend human computing performance. beyond these common GIS decision aids, special features includes modeling ,optimization and simulation functions

required to generate , evaluate and test the sensitivity of computed solutions . Other functions, such as statistical, spatial interaction, and location model, can be found in special GIS software packages. However, instead of expanding a GIS toolbox up for modelers by providing application programming interfaces (API), which allow enhancement of the decision support function of GIS by adding models that support various capabilities. Examples of such decision –aiding models linked with GIS include various environment models and multiple criteria decision making (MCDM) models used for evaluation of land planning decisions. Developers of special GIS decision support software – often called spatial decision support system (SDSS) – have pursued various strategies of linking analytical models with GIS. They range from file exchange mechanisms; data exchange protocols, such as dynamic data exchange; all the way down to implementation of predictive models and decision support functions in GIS toolbox. the possibilities of rapid SDSS development through linking analytical models with GIS have been recently expanded by various software technologies , including the open sources programming language python and the sun Microsystems enterprise java beans technology . Approaches to object linking and embedding foster integrated application support for data management and can only help with integration of data management, analysis techniques, and visual representation – the three core functions of SDSS. The special development of GIS into SDSS over the past several years has motivated commercial packages to expand as well.



Figure 1.3: Spatial Analysis and GIS Modeling

10. Future of Research Methods and GIS Technique in Social Science

Massive increases in the availability of informative social science data are making dramatic progress possible in analyzing, understanding, and addressing many major societal problems. Yet the same forces pose severe challenges to the scientific infrastructure supporting data sharing, data management, informatics, statistical methodology, and research ethics and policy, and these are collectively holding back progress.

Research methods are very important at present time because they expand the area of research in social science. Research methods are classified as qualitative as well as quantitative. Both the methods provide a broader knowledge about the area. The GIS techniques will help for the mapping and framing the policies of most vulnerable sites in the world. GIS techniques are also very helpful for the identification of the problems and management of the problems in any area. So the future of Research methods and social science research is vast and bright.

GIS database include following information which is beneficial in disaster management.

1. Use of different satellite imageries (Remote Sensing data) ex. Quickbird, SPOT, IKONOS for GIS data creation.
2. Preparation of base map of different themes using satellite imageries.
3. Thematic maps such as hydro geomorphologic map, slope map, terrain map, and DEM generation in GIS. It is used for disaster planning.
4. Macro and micro level maps used for identifying vulnerability and threat condition
5. Identification of safe locations and zones for rehabilitation
6. Road and location maps used for finding alternate routes, shelters and locations
7. Planning of evacuation and operation
8. Management of Rehabilitation and post-disaster reconstruction.
9. Suitable locations identifying scientifically for construction of houses and shelters
10. No construction areas identified and rehabilitation of existing people can be done.
11. Hospitals and medical facilities identification for injured people.

11. Conclusion

Research is a broad based and provides for a well meaningful investigation into any field of academics.

Research is a structured enquiry that utilizes acceptable scientific methodology to solve problems and create new knowledge that is generally applicable. Scientific methods consist of systematic observation, classification and interpretation of data. Although we engage in such process in our daily life, the difference between our casual day-to-day generalization and the conclusions usually recognized as scientific method lies in the degree of formality, rigorousness, verifiability and general validity of latter. Research is a process of collecting, analyzing and interpreting information to answer questions. But to qualify as research, the process must have certain characteristics: it must, as far as possible, be controlled, rigorous, systematic, valid and verifiable, empirical and critical. Research methodology is a way to systematically solve the research problems. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying in his research problem along with the logic behind them, whether mode the median or the standard deviation or Chi-square, how to apply particular research techniques in the research problems. The basis of geospatial decision support is the GIS technology. The basic decision aid of GIS includes data management to extend human computing performance. Beyond these common GIS decision aids, special features include modeling, optimization and simulation functions required to generate, evaluate and test the sensitivity of computed solutions. Other functions, such as statistical, spatial interaction, and location model, can be found in special GIS software packages. GIS methods can be put to use quite effectively in several perspectives about urban regional decision support situations. Five techniques are part of the conventional regulatory approach to decision support system (1) Community Plans (2) subdivision regulations and plans (3) capital improvement programs (4) Zoning ordinance (5) public participation.

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Author Profile



Seema has completed her B.A (Hons) in Geography from Bhim Rao Ambedkar College, Delhi. She has done her M.A in Geography from Department of Geography, Delhi School of Economics, University of Delhi in 2012. Presently she is pursuing her M.Phil programme from Department of Geography, Delhi School of Economics, University of Delhi. Women Issue, Conflict, Crime, Corruption, Politics and Development Issues are areas of her Interest.

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