MAPPING INFRASTRUCTURE USING GEOMATICS MODEL IN MGNREGA IN INDIA

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ABSTRACT

Technology can help microfinance institutions to reduce costs, improve efficiency, and increase outreachs. Modern technology based solution proves proficient in enabling micro financing institutions to conceptualize, develop and operate projects for financial inclusion. It supports sector initiatives, which are aimed at enabling rural and remote un-banked areas to enjoy the benefits of formal financial products and services. The entry of technology has opened more options in the field of finance that lead to lower costs, greater efficiency, real time information and better customer service. Micro finance offers a great, largely untapped market for modern technology and a chance to make a big difference in outreach, sustainability and its impact. MGNREGA is the largest program for financial inclusion by the Central government. MGNREGA includes several components that may serve as the basis for a quantifiable definition of success in terms of Financial Inclusion.

E-governance emphasize on all aspects of monitoring and evaluation, physical and financial planning, management of social and physical infrastructure, and enhancement / restructuring of existing facilities, facility management. In all these areas, there is a special emphasis on spatial dimensions. Geomatics, is the synergy of multiple disciplines, has evolved as a separate discipline dealing with spatial and non-spatial information, its method of acquisition, organization, classification, analysis, management, display and dissemination. It provides not only the answers for macro-level planning but also state-of-the-art models to the government in the context of decentralized planning for sustainable development in rural areas. The present work focuses on developing a Web GIS integrated framework for planning infrastructural facilities up to village level under MGNREGA. The spatial utility maps for infrastructural facilities existing at village level have been created using GIS. The spatial gaps in the existing facilities have been examined to plan for the new facilities. This not only helps to create annual plan for each location but also perspective plan for longer period.

The proliferation of geographic information system (GIS) conveys the need for research to provide a greater understanding in the area of ecommerce. The present study integrates the advantages of Geomatics technology and the man power of MGNREGA for the rural development activities.

KEYWORDS

Geomatics Model, Geo-ICT, Infrastructure mapping, MGNREGA etc.

INTRODUCTION

Information and communication technology (ICT) has proved to be a program that has changed the social, economic and knowledge dimensions of people. There is a high impact of ICT adoption on processes of government, living conditions of people, improvement of quality of life and building a healthy sustainable environment. The development of various ICT policies across various nations gives a global perspective of looking at issues and resolving them across various demographic locations.

The technology transfer process comprises of four generations of models (Williams and Gibson, 1990) which includes appropriability model, followed by dissemination model and subsequently by knowledge utilization, model and ending with elicit communication & feedback model. These models need to be incorporated in the process of diffusion of technology. The process of diffusion is considered to revolve around four key elements: an idea or innovation (technology), channels of communication to spread knowledge of the innovation, time during which diffusion takes place, and a social system of potential adopters (Rogers, 1955). There are a variety of models that seek to represent how these elements interact with one another. Technology adoption process comprises of five stages (Rogers, 1962).

The first stage is awareness level of the respondents that help them to be exposed to any set of innovation accompanied with a complete set of information; The second stage is Interest stage wherein the end user is interested in novel ideas and seeks extended information about it; The next stage is Evaluation stage which helps the users to apply a particular set of innovations mentally to their present and future situations in a controlled area and then take a decision whether it is useful for them or not; The fourth stage is Trial stage when these end users utilizes these innovations to the maximum capabilities while the last stage is defined as Adoption phase that helps the end users to take an informed decision regarding their future use of a particular innovation or not.

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The recent advances in technological domain with respect to spatial technology have proved to be of greater impact as far as planning and implementation is concerned. The planning phase for developing countries; for example India includes various geographical areas, variation in culture and a different set of ideologies of people. The benefit of using GIS is simple as it would add a data dimension, which would indirectly help in bringing an inch closer to visualize and optimize the relationship between the existing dimensions of planning and its execution.

The advancements in spatial analysis may comprise of a mix n match of different layers of data. The next level will include boiling our limits at a low level, which will include panchayats, blocks and service providers as well. In GIS the layers of data can be used to have a performance of a certain area. In other words, the availability of statistical information by any GIS will help us in analyzing the data and do reforms efficiently.

Many works have been carried out in this aspect as "Block level agro-regional planning integrating Remote Sensing and GIS technology, "Geographical Information System for planning rural development programmes” and "GIS approach to suggest land use alternatives for sustainable rural development" (Arun Chaturvedi et al (2001); Baburaj K.B (1996); Murthy Y.V.S et al (1997 ). There is a limited benefited sect of people actually benefited as the implementation of GIS for central programs are limited. To enhance the public programs for the enhancement of arena of people being benefited, Planning Commission has tried to incorporate policies. The measures for improvement have been cited and taken into consideration in order to issue a proper amount of funds in this section (Planning Commission, 2007). Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is yet another initiative where Central Government initiates GIS.

The Government of India launched the “Mahatma Gandhi National Rural Employment Guarantee Act” (MGNREGA) in 2005. The scheme strives to improve the economic and social condition of the poor people residing in the rural areas. The introduction of MGNREGA is seen as a giant leap towards making available the right to employment to every individual in a developing country context. It initially came into force in 200 districts with effect from February 2006. An additional 130 districts were notified under phase II with effect from 15 May 2007 and the remaining 266 districts have been notified under phase III with effect from 1 April 2008. The act guarantees 100 days employment to any person willing to do casual manual labour at the proposed minimum wage for enhancing livelihood of the poor rural households3. The basic objective of the Act is to enhance livelihood security in rural areas by providing guaranteed wage employment. It also aims at serving other objectives like creation of useful assets in rural areas, empowering women, reducing rural- urban migration and changing the power equations to bring in a more equitable social order.

Geographic Information Systems (GIS) are a powerful set of computer-based tools used to collect, store, manipulate, analyses and display spatial referenced information (Burrough and McDonnell 1998). They transform data into knowledge and present this knowledge in various formats for supporting decisions. GIS are usually portrayed as knowledge-based and free from bias, but in fact GIS is a socially constructed technology (Warren 1995). The process of GIS production, from data creation to analysis to visualization and use of GIS output, is characterized by political, economic and social motivations that bias their use. It is thus important that GIS practitioners are aware of issues such as: access to data and the political economy of information, and multiple coexisting perceptions of reality and epistemologies that dominate or, alternatively, might usefully inform applications of GIS.

Entering the 8th year of its implementation, there has been a lot of debate on whether the scheme has been a successful endeavor or not. A comprehensive analysis of the implementation status countrywide reveals that even though, the scheme has many deficiences, there is still a lot of scope for improvement. As Aruna Roy has said, “Corruption is eating into the scheme, but we have to guard against this” (Laskhman, 2006). This legislation has brought about a new ray of hope among the people and the civil society organizations. Comparing the initial period of implementation with the current position, the act has a power direction in the state and things have started falling in line. However, there still lie a number of implementation issues in the field which need to be looked into and improved to bring about effective implementation of the Act. Consistent findings through studies and field reports indicate that operational leakages in the scheme primarily pertain to low awareness about the Act among people and implementing agencies. Thus, issues like passive efforts at higher levels of administration to implement the Act, lack of incentives at lower level of administration; low incentives of local official’s vis-à-vis increasing awareness, proximity to the block/ Gram Panchayats and people’s awareness regarding specific aspects of MGNREGA exist in the field.

**SCOPE AND STATEMENT OF PROBLEM**

Technology development has taken a giant leap forward in the region; there is a widening gap between theory and practical aspect of gains realized from advanced and emerging technologies for financial inclusion in rural areas. The body of literature review reflects that there are gaps in technology use for financial inclusion in rural areas. In order to bridge the gaps, planning has proved to be an important and widely accepted way to allocate resource and thereby incorporate proper decision-making. It is a sync of collective intelligence and a correct direction to move ahead. An information system is thus required for handling the data, analyzing it and thereby predicting the issues to cater to the needs of the problem. With the advancements in technology, human interface has been considerably reduced and innovation techniques have replaced it. The issues with handling data with minimum interference by humans can be taken care by Geographic Information System (GIS). It can be defined as a computerized and organized information storage system which can be used for processing and revival of data to deliver a tangible output to balance with spatial data and information best suitable for corresponding attributes. With the integration of geographically referenced data with attribute data, it then becomes possible for the resources planner to examine the interrelationship between various data and
get answer to many “what if” situations. The most important feature of GIS is its analytical function, computer-aided mapping and database management support. There is an immense need to understand how GIS is being used for Financial Inclusion in rural India. In depth exploration are required to bridge the gap between available technology and its adoption for Financial Inclusion in rural India. This study is with special reference to MGNREGA, which is one of the biggest programs for Financial Inclusion in India.

**OBJECTIVES OF STUDY**

The main objective of the study is to create a Management Information System for Rural Planning for decision making by the administrators of MGNREGA. The above objective is proposed to be accomplished in the following steps:

- Creation of Database on Natural Resources, Aspatial data,
- Development of query shells for decision support system,
- Customize the query shell to provide interface to different databases,
- Synthesis and analyze the multi thematic information in conjunction with socio-economic data and spatial data,
- Statistics and report generation at various levels of selected themes,
- Extract and present information on user specified decision rules and scale,
- Composite Land Development Unit for the user to derive his action plans.

**RESEARCH METHODOLOGY**

**Target Area**

A similar picture is unveiled in Mewat district, an extremely poverty stricken district in the prosperous state Haryana which stands way behind all the other districts in the state in terms of development indicators. The geographical location of the region is such that it falls at a distance of around 30 kilometers from Gurgaon. However, despite the proximity, Mewat is untouched by development and lags behind other districts in the state on almost all indicators of growth and development. The region falls under the Sub- Tropical, Semi-arid climatic zone and the agriculture in Mewat is mostly rain fed. The agro-climatic conditions makes Mewat region more resource poor leading to subsistence farming, limited alternative livelihood options and hence poverty.

**Spatial Database Organization**

The spatial database has been created on ARC/INFO workstation and the total spatial database organization involved the process of identifying the contents of spatial data and the actual process of creating the database in ARC/INFO. In order to obtain the information sets, Different types of primary input data sets have been identified most of which are on 1: 50000 scale are prepared using remotely sensed data and the ancillary data. The primary elements of spatial database are as follows:

- **Administrative Map**
  Administrative boundaries (district, taluk, panchayat village) were delineated using district, taluk and census village maps cross-verified with the adangal register of the village.

- **Land use / Land cover Map**
  The term Land cover relates to the type of features present on the surface of the earth. Cornfields, lakes, maple trees and concrete highways are all examples of Land Cover types. The term Land use relates to human activity or economic function associated with a specific piece of land. This theme was prepared from IRS IC LISS III imagery by Visual Interpretation. The classification was done up to second level.

- **Geomorphology Map**
  It depicts the landforms, it is an input layer to derive ground water potential map. It was prepared by using remote sensing data on 1:50000 scale.

- **Soil Map**
  Shows the different soil types on 1:50,000 scale. This was prepared in consultation with the district soil survey report apart from satellite data.

- **Slope Map**
  It shows the sloping categories at 1:50000 scale. This derived module from contour and spot heights (Elevation map) taken from Survey of India topo sheets.

- **Drainage Map**
  Showing the details of drainage and the water bodies. Which are prepared from SOI topo sheets?
- **Geology or Lithology Map**
  It involves the identification of landforms, rock types and rock structure (folds, faults, fractures) and the portrayal of geologic units and structure on a map or other display in their correct relationship with one another. This theme was also prepared from satellite data.

- **Watershed Map**
  It is a hydrological unit area draining the runoff into a river or reservoir or a pond or a common point having its own natural drainage system and respond more effectively to the various management techniques to maximize production. This map is a derived map from drainage theme delineated up to micro-level watersheds.

- **Transportation Network Map**
  At 1:50,000 scales the map shows the different road network available in each panchayats village. Details of national highways, state highways, major district roads, other district roads, panchayats union road and panchayats road are plotted on the map.

- **Composite Land Development Unit**
  The composite land development unit categorizes resources into one category for development of particular land use. This has been achieved by discussions with various resource scientists and the local officials for appropriate grouping of the polygons of different resources. The limitation factors are also considered for this purpose. This theme is prepared by the union of land use, groundwater potential, slope and soil map.

**Aspatial Database Organization**

The aspatial data is organized on Microsoft Access. It consists of demography, health, drinking water, cattle, education, employment, electricity, irrigation, household, industry, roads, collected from each panchayats village by circulating questionnaire.

**Customization of MISRP**

Application development environment to program the user requirement and bundle the application with the user specific functionalities is supported by Arc View’s programming interface, Avenue, a compiled language is a versatile environment to develop and distribute applications. Avenue is fully integrated with Arc View and the work done will run on any of the platforms for which Arc View is available. It provides the necessary customization and language environmental tools in an easy to use framework to see the results right away. The graphical user interface (GUI) provides some graphical controls that the user will interact with, fine tune the behavior and appearance of those controls provided by the Management Information System for Rural Planning (MISRP).

**CASE STUDY**

The Model MISRP (Management Information System for Rural Planning) created can be used for any district of Haryana. The case study was carried out in 3 aspects for Identifying the villages that are satisfying the norms for MGNREGA and selecting the particular village for development, for this case study Mewat district with its 386 panchayats villages, 32 town panchayats, 3 municipalities and 1 corporation was taken.

**RESULTS OF MGNREGA**

Among the 386-panchayat villages, 72 panchayats villages were selected for implementing the JGSY scheme using the MISRP model. The farmers are unaware of the potentiality of their land, due to general agricultural practices, which they do not yield much, and their land is kept idle. A scientific approach to the problem may yield better to the farmer with respect to cultivation and income. In MISRP using the natural resources information from satellite data a composite land development unit were created by integrating the various thematic layers like land use, soil, groundwater potential and slope maps. A criterion table was developed for GIS integration and presented. On substitution of the criterion with the CLDU, an action plan was generated. Town Nuh Panchayats of Mewat district having a geographical area of 2399.9 Hectare has been chosen for this study.

**The Various themes used for integration of CLDU are discussed below:**

**Geomorphologic map**

Six kind of landforms were observed as, buried pediment deep, pediment, pediment inselberg, residual hill, structural hill and settlements. Ground water potential map: This is derived map from geomorphologic map, four types of ground water potential zones identified as, good, moderate to poor, poor and nil. Slope map: The demography shows varying slopes like, mild slope (1 to 2%), very gently sloping (2 to 3%), moderately sloping (5 to 10%), moderately steep (15 to 35 %) and very steep slope (> 35%).
Soil map

Texture wise classification has been done, only two categories are observed, in the study area viz., clay loam and clay loam - sandy loam. Land use map: Under these theme five categories of land use was classified as, barren land, forest, settlements, rain fed crop and rock out crop.

Present Land use

The present land use was interpreted from LISS III, satellite imagery dated February 2009. Classification has been done up to second level. Major part of the land use contributes to rain fed crop as 61.91%, Forest area is covered up to 18%, 15.27% is the area covered by the barren land, Rock out crop contributes to about 4.37% and settlement area is about 0.45%.

Proposed Land use by MISRP Model

After integrating the natural resources as CLDU, with the necessary criterion using the criterion of MISRP The action plan is generated. The results of the action plan are as, dry farming with soil conservation measures is proposed for 40.02%, afforestation / forest regeneration with suitable species adaptable to the ecology is proposed for 34.52%, agro horticulture (predominantly agriculture) is proposed for 6.84%, horticulture / fruit bearing trees is proposed for 6.84%, and social forestry (fuel wood & fodder) is proposed for 5%.

Proposed Land use for Rainfed Crop

Among the proposed land use for rainfed crop, about 57% of rainfed crop is proposed for dry farming with soil conservation measures, 18% is proposed for agro horticulture (predominantly agriculture), 10% is proposed for afforestation or forest regeneration with suitable species adaptable to ecology, 8% is proposed for horticulture or fruit bearing trees, 4% is proposed for agro forestry (predominantly agriculture), 2% is proposed for social forestry (fuel wood and fodder).

Proposed land use for barren land

About 15% of land use of town panchayats constitutes of barren land. This barren land can be put into use as, afforestation or forest regeneration with suitable species adaptable to ecology for 48%, agro horticulture (predominantly agriculture), for 24%, agro forestry (predominantly agriculture) for 12%, horticulture or fruit bearing trees for 9% and dry farming with soil conservation measures, for about 6%.

Proposed land use for rock out crop

The rock out crop has poor ground water prospects and it constitutes to about 4% in the total land use. Social forestry (fuel wood and fodder) is proposed for the entire rock out crop.

CONCLUSION

The study has depicted that the PC based GIS has been cost effective for development of the system. The Graphic User Interface turns out to be user friendly for both spatial and aspatial retrieval of data. This would invariably help the users which possess minimal information of handling the PC. This will be helpful across various departments including Engineering, Agriculture and Transport to carry out any relevant field survey in near future. Features like topological querying will help in better and efficient analysis on multiple themes at a time. The primary utilization of the system rest with the user in retrieving information, generating a query on both the sects of data, taking a printable output on maps at customized scales, analyzing the data in various modes i.e. Spatial and a spatial so that a suitable query can be run simultaneously to generate desired outputs. The added advantage of this exercise is that the data as output can be displayed in a tabular form, which can be readily used by researchers to formulate proper decisions in any particular geography of the country.

RECOMMENDATIONS

The MISRP model can be interconnected through the internet by connecting all the blocks (panchayats union), since all of them are computerized. This facility would enable the end user to serve maps on the internet allowing them to update and resolve queries sitting at one place. Frequent updation of the aspatial database has to be done once in a year to keep the system alive. Updation of the land use is recommended for once in two years.

The scale of spatial data can be improved on large scale for micro level planning, as the data products become easily available along with a less cost. Hamlet wise information can be built up to strengthen the database for micro level planning. The MISRP model is developed on a standalone system; this can be further developed for multi-user environment with distributed databases.
REFERENCES


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