Development of Spatial and Attribute Database for Planning and Managing Rural Service Centers, in Kendrapara District, Orissa, India: A GIS Based Information

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Key words: Spatial and Attribute Database, GIS and Rural Planning.

SUMMARY

At present, the decentralized planning process is a conspicuous feature in India having planning machinery operating at the state and district level. Block is the micro level unit, used for implementing different kinds of rural-regional development programs. There is certainly a strong need for data and information base for the successful planning and development operations at different levels. The decision making at appropriate places and time as a part of planning exercise. It is very much dependent on what kinds of data and information available. The rapid growth and quick development of information technology in developed nations have created awareness in developing world to have such a data base system at the district level on various planning issues and problems needed for the multi-faceted development programs. An attempt is made in this paper to illustrate the resource, types and quality of data and information available at the district level for development planning purposes. Kendrapara district of Orissa state in India is illustrated as an example.

¹ This paper is based on part of an M.Sc thesis by MrRanjan Kumar Mallick(1998) carried out at AIT, Bangkok, Thailand.
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1. INTRODUCTION

Planning in India started in 1951 in the form of centralized and macro-level economic planning. A multilevel decentralized planning developed in later stage. A number of planning functions, such as the provision of services and other infrastructure, are being transferred to these bodies. Planners in the country now widely recognize that the location of services and infrastructure facilities play an extremely important role in promoting development in rural areas of the country.

The decentralization thinking has further gone down to the level of Gram Panchayat (GP) below the block in India and emphasis has been made by the government to further strengthen and energize the decentralized planning process in the eighth five year plan period (1990-1995). Efforts to be reconsolidate to revitalize the Panchayati Raj institutions to fulfill the promises and expectations of the people, at the lowest level with multifold objectives of reduction in economic and social disparity and participation.

It depends very much on the quality as well as quantity of database available. The objective of the paper is to make a review of different sources of data and information system with types and level of availability in order to create an attribute and also spatial database to identify rural service centers with the aid of GIS tools.

2. DATA COLLECTION

Essentially two types of investigations were made to study the existing situation of service facilities and planning prospective of rural development in the district level. The first type was of an exploratory nature and consisted of the collection and review of relevant published and unpublished literature on the development of service center in India (Table-1). It provides orientation on and familiarity with the existing situation and problems and was helpful in preparing for the actual survey. There are various types of digital data prepared by using GIS software. The digital data are in points, lines and aerial units in Kendrapara district, India (Table-2). The data sources are quite large and deal with varieties of phenomena and problems of different spatial and attribute data levels in the district (Table 3).
**Table 1** Source and Types of Data (Government and other Agencies)

<table>
<thead>
<tr>
<th>Source</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>District Agricultural Office</td>
<td>Agricultural extension center service facilities</td>
</tr>
<tr>
<td>District Veterinary office</td>
<td>Livestock census, health services, etc</td>
</tr>
<tr>
<td>District Chief medical office</td>
<td>Location of health center and services</td>
</tr>
<tr>
<td>Circle Inspector of Schools/ District Inspector of the Schools</td>
<td>Primary and secondary educational facility</td>
</tr>
<tr>
<td>District Statistical Officer</td>
<td>All types of statistic relating to different sectors</td>
</tr>
<tr>
<td>District rural Development Agency</td>
<td>Types of development program</td>
</tr>
<tr>
<td>Superintended of Post and Telegraph</td>
<td>Post, telegraph facilities and service center</td>
</tr>
<tr>
<td>District road and buildings department</td>
<td>Types of road and their maintenance</td>
</tr>
<tr>
<td>District collector office</td>
<td>Information about administration</td>
</tr>
<tr>
<td>District Panchayatraj Office</td>
<td>Administrative system of the village</td>
</tr>
<tr>
<td>District Public Relation office</td>
<td>Cultural and recreation data</td>
</tr>
<tr>
<td>Manager, Lead bank Regional (rural credit)</td>
<td>Credit Loan</td>
</tr>
</tbody>
</table>

*Source: Collector Office*

**Table 2** Digital Database of Kendrapara District

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description</th>
<th>Feature type</th>
<th>Map scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Road network</td>
<td>line</td>
<td>1: 50,000</td>
</tr>
<tr>
<td>2</td>
<td>Drainage</td>
<td>line</td>
<td>1: 50,000</td>
</tr>
<tr>
<td>3</td>
<td>Block boundaries</td>
<td>polygon</td>
<td>1: 50,000</td>
</tr>
<tr>
<td>4</td>
<td>Settlements</td>
<td>point</td>
<td>1: 50,000</td>
</tr>
<tr>
<td>5</td>
<td>Police Station</td>
<td>line</td>
<td>1: 50,000</td>
</tr>
<tr>
<td>6</td>
<td>Flood</td>
<td>polygon</td>
<td>1: 50,000</td>
</tr>
<tr>
<td>7</td>
<td>Canal</td>
<td>line</td>
<td>1: 125,000</td>
</tr>
<tr>
<td>8</td>
<td>Services and amenities</td>
<td>point</td>
<td>1: 50,000</td>
</tr>
<tr>
<td>9</td>
<td>Land use map</td>
<td>Polygon</td>
<td>1:250,000</td>
</tr>
</tbody>
</table>
Table 3: Spatial data

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Maps</th>
<th>Source</th>
<th>Year</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Toposheet</td>
<td>Survey of India</td>
<td>1976</td>
<td>1:50,000</td>
</tr>
<tr>
<td>2</td>
<td>Administrative map</td>
<td>Map production and distribution office govt. of Govt. of Orissa, Cuttack.</td>
<td>1997</td>
<td>1:50,000</td>
</tr>
<tr>
<td>3</td>
<td>Road map</td>
<td>Roads and Building Department, Kendrapara.</td>
<td>1995</td>
<td>1:50,000</td>
</tr>
<tr>
<td>4</td>
<td>Village map</td>
<td>Census Office, Bhubaneswar</td>
<td>1998</td>
<td>1:50,000</td>
</tr>
<tr>
<td>5</td>
<td>Land use map</td>
<td>ORSAC, Bhubaneswar, Orissa</td>
<td>1992</td>
<td>1:250,000</td>
</tr>
</tbody>
</table>

3. STUDY AREA

Kendrapara district, one of the coastal districts of Orissa state in India, was chosen for this study. The district has a geographical area of 2180 km² and a population (in 1991) of 1,104,501 which constitutes 3.63 percentage of state population. The population density is 460 persons per square kilometer as against 203 for the state as a whole. The economy of the district is primarily rural and based on agriculture and allied activities. More than 75 percent of the total population earns a livelihood from the primary sector.

4. METHODOLOGY

The study methodology is based on the field visit, primary and secondary data collection, analyze and display the results. GIS is used in different ways, preparation of coverage and interpretation, also for planning and decision-making. All the relevant maps were obtained from the Topographical Survey Division. The GIS software Arc/Info was used to establish the database and Arc View was used for map preparation. The data of the study area have been stored in the form of thematic layers and related attributed tables, using Arc/Info software. This allows one to retrieve, overlay, and present them in map or tabular form. The data can also be retrieved in spatial format with windows-driven Arc/View software. The figure 1 (APPENDIX 1) shows the process of creation of digital database for district level planning process.

5. MODEL DEVELOPMENT FOR THE CREATION OF DATABASE:

The appropriate Software’s were used for the creation of GIS database. The model 1, 2, & 3 shows the clear picture for the creation of spatial and attribute database. According to the model we created map 1, 2, & 3, 1 (APPENDIXES 2, 3 and 4). In the map it depicts linkage of spatial and attribute database and analysis.
Model 1: Functional and Population Hierarchy of Settlements

N.B- C.I= Composite index Value
**Model 2: Accessibility Analysis of service Analysis**

Diagram:

1. Overlay (Union)
   - Boundary Coverage (line)
   - Settlement Coverage (point)
   - Attribute Fixation

2. Village Coverage
3. Market Coverage (Selected villages with bank)
4. Buffer
   - Buffered Bank Coverage, Accessible area for banks
5. Coverage Viewing in Arc view 3.0
6. Attribute framing Symbol/line/shading
7. Final map displayed
8. Layout map
9. Coverage BMP File
10. Final Map

Additional Analysis:

- Selecting bank, market, Education, etc.
- 1 km
- 2.5 km
- 5 km

TS2 NSDI’s Development
Ranjan K. Mallick
TS2.6 Development of Spatial and Attribute Database for Planning and Managing Rural Service Centers, in Kendrapara District, Orissa, India: A GIS Based Information

FIG Working Week, 2004
Athens, Greece, May 22-27, 2004
Model 3: Process to find out within and Outside Area of Buffer Zone of Service Centers.

6. CONCLUSION

Planning and Development at local level is very much concerned directly with people area and economic activities. It is further complicated when integrated with the higher order areal units in the hierarchical planning system. The planning issues are very much related to the right kind of data information at appropriate place and time. Secondly, the planning and development process is very much influenced (accelerated/retarded) due to the complexity of social and population characteristics in Indian situation. Non-availability of relevant data and information stimulated the politicians, administrators (implementers) to manipulate development in their interested areas and directions. Hence, there is a strong need to create appropriate database at all district levels. The data needs could be fulfilled with proper integration among the various data producers, data managers and data users. The issues discussed in relation to various data producers and managers if taken into proper care would...
certainly help in building a strong database, which is an aid for further GIS information in process of planning and development. This database is helpful for planners, academicians, geographers and government officers.

REFERENCES

PC Arc/info. (1990); Understanding GIS_Manual for GIS analyses
Routray, J.K., (1987), The Decentralized Planning Process and Area Development Practice in Asia, HSD Division, AIT, Bangkok, pp. 43-60.

BIOGRAPHICAL NOTES

I was an M.Sc Student (1998) of Regional and Rural Development Planning, School of Environment, Resources and Development, Asian Institute of Technology (AIT) Bangkok, P.O. Box 4, Klong Luang, Pathumthani-12120, Thailand (Phone +6625245604). After that, I joined as Project Officer (2001) in the Department of Geology and Geophysics, in Indian Institute of Technology, Kharagpur, India. In the year 2003 I joined as Project Consultant and Guest Faculty in Xavier Institute of Management, Bhubaneswar, Orissa, India (Phone+91674-2300688 (Ext-135) Mobile-9861042269).

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Fig 1 General Process for the Creation of Digital Database

Digitized Base Map
Scale 1:50000

Coverage of boundary (Line and Polygon)

Coverage of Roadnetwork (line feature)

Coverage of Settlement location (point feature)

Coverage of river and canal Line feature

Coverage of Landuse (Polygon)

Coverage of Settlement and roadnetwork

Final map

Area of Polygon

Name of the settlement

Point data, Point ID Name of the settlements

Line data From node to node length. Time distance from point to

Node file

Line file

Length of boundary Area of each block and PS

Record of each link; Road ID; from node to node

Record and coordinate of each point ID

Length of rivers

Name of the rivers

Name Of Village

Distance Point ID

Name of Villages
HEIRARCHY OF SETTLEMENTS
(Based on Population Size)
Kendrapara District, Orissa

LEGEND
- District Boundary
- <200 (population size)
- 200 - 500
- 500 - 1000
- 1000 - 2000
- 2000 - 5000
- >5000

Map-1
APPENDIX 2
ACCESSIBILITY TO MULTIFUNCTIONAL NODAL CENTERS
Kendrapara District, Orissa

LEGEND
- District Boundary
- 1 km. Accessibility
- 2.5 km. Accessibility
- 5 km. Accessibility

Bay of Bengal

Map-3