INDIAN SCENARIO IN THE APPLICATION OF GEOGRAPHICAL INFORMATION SYSTEM AND GEO-INFORMATICS

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ABSTRACT

The usefulness and importance in the application of Geographical Information System (GIS) is well understood in India and is being further developed for use by a larger community sector. With the rapid stride India has made during the last two decades by launching its own land resources satellites, like Indian Remote Sensing Satellite (IRS) – 1A, 1B, 1C and 1D, data from these have been well received by international community and perhaps used extensively all over the world. The Indian Remote Sensing Communities are exposing the State of the art situation of various natural resources very effectively, and adding a touch of the socio-economic data also incorporated in the form of G.I.S. based on the 1:50,000 scale topographical maps that are available. The intensity of information and the positional accuracy needed with a large scale, cartographic database is still not well understood for integrating all data more purposefully. While Satellite Remote Sensed data is easily available at a price, by any one who needs it, aerial photographs are not easily made available to all private individuals. It must also be understood that creating an accurate cartographic database decides the final accuracy of G.I.S. operation and solutions arrived at.

The gist is, recognition of the importance of (1) Using Aerial photographic techniques for map making for producing accurate large scale cartographic database, which as of now cannot be expected to be produced by satellite data, for some more years to come, (2) Appreciate that Remote Sensing is only a descriptive technology and it cannot by itself prescribe solutions, (3) Closer linkage and discussion with the society who can use them has to be intensified with capacity to teach them 'do how' rather than 'know how', (4) Adapt to facilitate its detailed usage for precision agriculture, detailed urban facility management and produce information with a view to solve specific problems, and (5) We should realize that it is necessary to recognize the strengths and short coming of each technology as most of them are complementary.

1 INTRODUCTION

1.1

Usage of Geographical Information System for various uses and Applications, such as management and optimal use of natural resources is well recognized in India. There are several organizations who have been using the standard GIS software, such as Arc-Info, Map-Info, Illwis, and other similar ones besides developing specific ones needed for certain uses in projects. This development is the accelerated due to Satellite Remote Sensing data availability during the last two decades and particularly so, after the launch of various Indian Remote Sensing Satellites (IRS) such as IRS 1A, 1B, 1C and 1D. Data from IRS 1C and 1D have been very well received world over as its Panchromatic data at a spatial resolution of 5.8 meters and its steerability in space to providing over - lapping pairs, such as in the case of French SPOT Satellite system, made it particularly useful, being the best of its kind. In addition data from these two satellite are also received for world wide distribution by USA with whom India had special contracts. These two satellites had the facility of on board tape recording for very special needs and detailed description of the various wave bands have already been published in the ISPRS congress in 1996, which can be found in the Archives, as such these are not being detailed out here.

1.2 GIS Usage

Use of GIS picked up very fast not only in the case of natural resources, but also for various business and commercial applications and gave a big thrust into the area of Facility management. The Cartographic data bases needed in all cases were drawn from the existing topographic maps on 1:50,000, published by the Survey of India. The Survey of India, the national mapping agency has a record of over two and half centuries and has to its credit a complete coverage of 1:50,000 scale topographic maps, with a contour interval of 20 meters, matching International specifications and standards. India is covered by over 5000 sheets on 1:50,000 scale and is also mapped on 1:250,000 scale by compilation from 1:50,000 sheets. Recently, Indian mapping effort has also extended to map at a scale of 1:25,000 scale, in selected regions and perhaps in the coming years, a complete coverage may result, particularly where development possibilities are visualized. Being a large country with nearly 3.5 million sq.kms in area, to keep these maps up to date is not a very easy task and needs considerable resources.

1.3

As a result complete coverage of base maps on 1:50,000 scale being available and as a result of complete coverage of IRS 1C & 1D satellite data, including higher resolution PAN data, and 24 meter resolution MSS data, merging of these have been found very useful particularly when these are Geo-Coded to fit in within the frame work and boundaries of the 1:50,000 scale topographical base maps, already available, to evaluate and analysis of various natural resources and monitoring changes as and when required. This possibility and availability of a variety of GIS packages have resulted in integration of several types of data including socio-economic data for very effective planning in the case of several development projects, including its usage as a decision support systems.

2. SHORTCOMINGS AND DIFFICULTIES

2.1

In spite of all above mentioned advantages, there has been several difficulties and problems that have been encountered, which has resulted in the large non utilization of remote sensed data as well as finding effective solutions through GIS usage, as most essential condition in GIS is availability freely accurate cartographic data bases. Unfortunately all 1:50,000 scale or 1:25,000 scale topographical maps are not freely available to all users, particularly the private enterprises, except those which fall in the non-restricted zone. Secondly for large scale data bases, where it is required essentially, such as in the case of urban management, small water shed development mostly needed for improved agricultural practices, is not available with close contours. There has not been an organized effort to produce them either, as a result, people try to enlarge existing 1:50,000 or 1:25,000 scale topo sheets, which carries with it large inherent positional errors. Beside these, digitizing the official topographical maps on 1:50,000 scale is authorized to only about 8 or 9 organizations, which again is a great disadvantage. While everyone understands the power of remote sensing and GIS, many have wrong notions on using positionally accurate cartographic data bases for accurate GIS development and consequent reliable usage as an effective planning mechanism, for a variety of developmental projects.

2.2 AERIAL PHOTOGRAPHY

It is well known that aerial photographs as an accepted data to develop positionally accurate maps on various scales and this capacity is available in India since a longtime with official agencies, authorized to do so. Since recently there are some private enterprises come forward to establish infrastructure in the from of analytical photogrammetry systems and developed operating capacity at a very high level, mainly to meet the work offers coming from outside India. Some of these companies have established such high level of expertise that many users outside India has recognized them capable of meeting world standards, and as the prices for such an activity in India is comparatively cheaper due to cheep labor availability. However, the Indian authorities have not recognized this fact and still restrict the availability of aerial photographs covering any part of India for mapping by such private agencies, except in very exceptional cases, under strict surveillance by officially authorized agencies. In addition the producers and suppliers of satellite data have not realized what all goes into producing accurate cartographic or topographic maps, within the national mapping framework. Consequently with these constraints, the accuracy of GIS at detailed level has suffered seriously, which many users have not well understood. The complementary usage of satellite remote sensed data and Aerial Photographic data is not still well understood, as one cannot replace or match the other. How far the recent IKNOS satellite data of 1

meter resolution of Space Image of USA can match aerial photographic data of matching resolution and capable of meeting the positional accuracy standards, is yet to be evaluated, although for some uses, these might meet the requirements, where positional accuracy may not be very important as these data can meet the standards of topology.

2.3 GPS AND ITS USAGE

Use of Global positioning system has proliferated in India, although the receivers meeting the Geodetic accuracy standards are still expensive for many Indian users. Further the coordinates obtainable from such GPS receivers even by differential mode is not match able with the first order coordinate system of Indian mapping framework as the Indian mapping projection and coordinate systems are based on Polyconie projection and Everest spheroid, whereas the GPS is based on its own imaginary ellipsoid. The heights in Indian System is based on mean sea level, where as the GPS heights are based on its ellipsoid, although correcting the heights obtained by GPS is not so very difficult with mean sea level height. However, using Indian mapping coordinates is not very easy to access by all as it is subject to several restrictions. India's coordinate system is yet to be transformed to meet the standards of WGS 84 and in UTM projection system, as such, the main difficulties to be overcome is to enable large scale and effective usage of GIS in India with positionally accurate data base, which many high level people in authority is yet to realize and take bold steps.

2.4 INTEGRATION

Integration of different kinds of data to provide new information is one of the strong charterestic of GIS usage. Besides, simulating new information and its effective usage for taking appropriate decision is still to become popular in India amongst various users of this technology. While everyone talks about GIS as a decision support system, most people are not familiar as to how this is to be done. In addition developing different query system to enable appropriate decision in the GIS domain has not been well developed, except for a small number of software developers, rather than many users. It is necessary to address these points jointly by the developers of software and user together to make GIS as a popular tool in countries like India.

2.5 CONCLUSIONS

In conclusion it is to be stated that unless steps are taken by persons authority the effective utilization of GIS as a technology tool combined with Remote Sensed data as well as other collateral data may continue to be unrealistic although such technology usage may be well known, and competent people may also be available for such usage. The suggested solution may be as follows.

a) Using Aerial photographic technique for map making, either by conventional Analytical photogrammetric machines, but with digital out put facility or by soft copy photogrammetric methods for production of large scale geographically accurate data bases.
b) Realizing that Remote Sensing by far is only a descriptive tool and not a prescriptive tool.
c) Closer linkage with public and low level users in the social fabric be established through Non-Governmental organizational (NGO) in teaching "do-how" rather than "know how".
d) Bring in effective use of GIS, GPS and Geoinformatics in general for developing precision agricultural practices and water harvesting measures in semiarid regions in the country to increase agricultural, horticultural and floricultural productivity.
e) Encourage private entrepreneurs in developing expertise and develop infrastructure as a profitable business, by high level officials and the Government by adopting a partnership attitude.
f) Understanding the strengths and weakness of each such technology by all, to enable optimum usage.
g) India is bestowed with a large population exceeding over a billion as such it is possible to train a large number of young boys and girls to the extent required to do ground surveys, for small areas of 5,000 to 10,000 hectares, on large scales of say 1:1000 to 1:5000 with contours around 1 meter, using most modern digital total stations, laser rangers, digital levels etc., for use in computers directly to meet local requirements rather than waiting in all cases for aerial photographic availability and photogrammetric plotting mechanisms. Such ground surveys in small areas could be supported by national survey coordinates so that real world needs are met and adequate employment generated. This ofcourse, have to be properly designed and supervised by well qualified people, to reduce or eliminate errors. At present some people are doing it but to a very limited extent. We must note that a judicial mix of modern technologies with traditional technologies is not harmful and will perhaps be most suitable for a large underdeveloped country like India, with a large number of poor people.