Urbanization in India by using Remote sensing and GIS techniques

S.Anandharaj, Dr.C.Sulaxna sharma

Research scholar, Assistant professor, Department of Geological Science,
Bharathidasan University, Trichy.

Abstract

    In India, the complication in the process of urban development is so rapid that it demands quick response and perspective view of planning of the cities and towns. Consequently, it is essential and important for policy makers to integrate remote sensing into urban planning and management. Remote sensing is the surveillance and measurement of objects from a distance, i.e. instruments or recorders are not in direct contact with objects under exploration. Remote sensing mainly depends upon determining some kind of energy that is produced, transferred, or revealed from an object in order to decide certain physical properties of the object. Photography is the one among the important types of remote sensing techniques. The result of a remote sensing system is commonly an image demonstrating the scene being perceived. Meanwhile remote sensing may not afford all the information desired for a full-fledged assessment; many other spatial aspects are necessary to be incorporated with remote sensing data. This process of assimilation of three-dimensional data and their combined remote sensing is broadly in Cartographic assessments. This paper proposes the remote Sensing techniques are enormously useful for selection of sites for specific facilities such as dispensaries, restaurants, solid waste clearance area and industry. Urban planning needs a large volume of data both at the time of planning and at the time of application of the plan to decide the status of the available abilities. Thus remote sensing techniques provide precise, orderly and reliable information for planning and management of a town or a city. Remote Sensing techniques are very useful for change detection analysis and selection of sites for specific amenities such as hospitals, restaurants, solid waste disposal and industry.

Keywords: *Urban development, remote sensing, GIS, Cartographic surveys.*

I. INTRODUCTION

    The Current and sustainable urban management progressively needs innovative techniques to acquire numerous and up-to-date information on the pattern, state, features, and growth of an urban environment. Remotely sensed imagery is an effective data source for urban environment analysis that is inherently suited to provide information on urban land cover characteristics and their changes over time at various spatial and temporal scales. In the past decades, remote sensing has been widely used in various applications, such as urban structure extraction, urbanization monitoring, change detection, and so on. With the development and modernizations in data, technologies, and concepts in the wider arena of earth statement, urban remote sensing has promptly increased popularity among a wide range of societies from many features such as Land Use/Land Cover mapping, Urban Heat Islands exploration, impermeable surface area appraisal and urban environmental security valuation.

    Development is an extensively recognised way to handle difficult problems of possessions allocation and decision making. It includes the use of collective intelligence and anticipation to chart direction, order coordination and make growth in public activity concerning to human environment and common welfare. In order to offer more operative and meaningful direction for best planning and improvement essential to support the organization has become crucial. Hence the requirement for appropriate information system is progressively being felt in all planning and developmental accomplishments, whether these are for urban or rural areas. Urban areas of today are more precisely defined as straggling regions that become interrelated in a dendritic fashion. The progressive aspects of urbanization have often been surpassed by weakening in the physical environment and quality of life caused by the broadening gaps between supply and demand for essential services and infrastructure. Urbanization is inevitable, when pressure on land is high, agriculture incomes are low and population increases are excessive, as is the case in most of the developing countries of the world. Urbanization has become not only of the principal manifestation but also an engine of change, and the 21th century which has become the centre of urban transition for human society. In a way urbanization is desirable for human development.

    On the other hand**,** uninhibited urbanization has been in authority for many of the difficulties, our cities experiences today, resultant in insufficient living environment, acute harms of drinking water, noise and air pollution, disposal of waste, traffic congestion etc. To develop these environmental

humiliations in and around the cities, the technical development in relevant fields have to cracked these problems instigated by rapid urbanization, only then the results of development will spread most of the depressed ones. The recent technology of remote sensing which contains both aerial as well as satellite based systems, allow us to gather lot of physical data rather simply, with speed and on tedious basis, and organized with GIS assists us to examine the data spatially, offering prospects of producing various options, thereby enhancing the whole scheduling process. These information systems also propose elucidation of physical data with other socio-economic data, and thus providing a significant relation in the total planning process and making it more effective and meaningful. Modern technological progresses made in domain of spatial technology cause significant influence in planning activities. This domain of planning is of primary significance for a country like India with varied geographic patterns, cultural activities etc. The determination of using GIS is that, maps offer an added dimension to data analysis which fetches us one step closer to imagine the complex patterns and associations that describe real-world planning and policy problems. Visualization of spatial patterns also supports variation exploration, which is essential in observing of social indicators. The intentions of this paper are to describe remote sensing and GIS applications in various stages of planning, implementation and monitoring of the urban area.

II. PROPOSED SYSTEM

A. Key Elements and Features of Urbanization

Urbanization or urban drift is the physical growth of urban areas as a result of rural migration and even suburban concentration intocities, particularly the very largest one. It is closely linked to modernisation, industrialisation, and the sociological process of rationalisation. The rapid urbanization of the world's population over the twentieth century is described in the 2005 Revision of theUN World Urbanization Prospects report. Urbanization has been considered as a problem in India till recently and the city governments in the country have always struggled to solve the problems. But in recent years the perception has changed. With the towns subsidising more than 70 per cent of the Gross Domestic Product in the recent years, the government has instigated to look at the urban areas as engines of growth. With rapidly increasing population in the urban areas, urbanization has emerged as one of the most serious challenges before the planners. The principal appearance of cities and urban growth in India was around 2500 BC with the beginning of the Indus Valley civilization. In India, Urbanization was primarily flourished after freedom, due to acceptance of mixed system of economy by the country which gave increase to the growth of private sector.

Development is taking place at a faster rate in India. Population residing in urban areas in India, according to 1901 census, was 11.4%. This count increased to 28.53% according to 2001 census, and crossing 30% as per 2011 census, standing at 31.16%.After independence, India faced many indispensable situations like poverty, unemployment and economic backwardness. The architect of modern India, Pandit Jawaharlal Nehru, focused on the domain of science and technology, for economic development. The mixed economy system was adopted, which resulted in the growth of the Public sector in India.
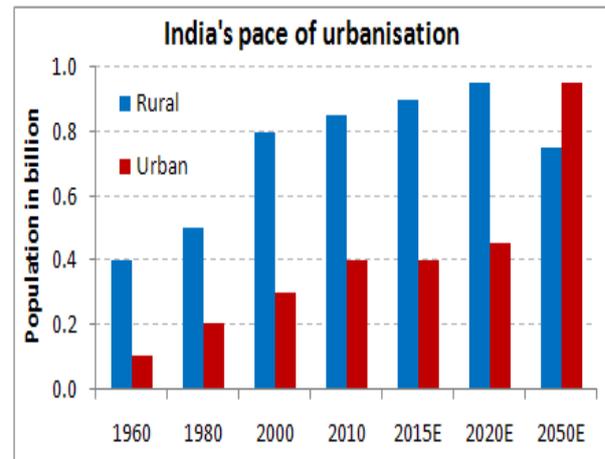

Fig.1: Urbanization in India

B. Causes of Urbanization
The main causes of urbanization in India are:

- Expansion in government services, as a result of Second World War.
- Migration of people from Pakistan after partition of India.
- The Industrial Revolution
- Eleventh five year plan that aimed at urbanization for the economic development of India
- Economic opportunities are just one reason people move into cities
- Infrastructure facilities in the urban area
- Growth of private sector after 1990

Various reasons have led to the growth of cities. They are as follows:

1) Industrial Development
Industrialization is a main cause of urbanization. It has stretched the employment opportunities. Rural people have wandered to cities on account of better employment opportunities.

2) Social Factors
Many social factors such as attraction of cities, better standard of living, better educational facilities, need for status also induce people to migrate to cities.

3) *Employment Opportunities*

In rural sector people have to depend mainly on agriculture for their livelihood. But Indian agriculture is depending on monsoon. In drought situations or natural calamities, rural people have to migrate to cities.

4) *Modernization*

Urban areas are characterized by sophisticated technology better infrastructure, communication, medical facilities, etc. People feel that they can lead a comfortable life in cities and migrate to cities.

C. *Problems in Urbanization*

There are many problems are in effect due to the modern way of urbanization. Lack of civic amenities is yet another problem. As per 2001 slum census only 65.4 per cent of the households in the cities and towns had access to drinking water within their locations. Residual households either had the water supply source outside their premises or away from their houses. Some of the major problems in India due to urbanization are explained as follows as

1) *Urban Straggle*

Urban straggle or real extension of the cities, both in population and geographical area, of promptly growing cities is the origin reason of urban complications. In most cities the economic base is incompetent of dealing with the problems created by their excessive size. Enormous settlement from rural areas as well as from small towns into big cities has taken place almost dependably; thereby adding to the size of cities.

2) *Overpopulation:*

Overpopulation is a condition in which too many people live in too little space. It is a logical significance of over-population in urban areas. It is obviously predictable that cities having a large size of population clutched in a small space must suffer from overcrowding. This is well demonstrated by almost all the big cities of India.

3) *Accommodation shortage:*

Shortage of housing problem is definitely more acute in those urban areas where there is large entry of unemployed or underemployed immigrants who have no place to live in when they enter cities/towns from the surrounding areas. Several aspects are responsible for the miserable state of affairs with respect to housing problems faced by the urban people. The main causes are shortage of building materials and financial resources, inadequate expansion of public utilities into sub-urban areas, poverty and unemployment of urban immigrants most of the vacant land for new construction is located.

4) *Unemployment*

Urban unemployment in India is projected at 15 to 25 per cent of the labour force. This percentage is even higher among the educated people. One of the most important reasons of urban unemployment is the large scale migration of people from rural to urban areas. Rural-urban migration has been enduring for a pretty long time but it has not always been as great a problem as it is today. The general poverty among the rural people pushes them out to urban areas to migrate in search of livelihood and in the hope of a better living.

5) *Transport and water problem:*

With traffic restricted access and traffic jamming, almost all cities and towns of India are suffering from severe form of transport problem. Transport problems increase and become more complex as the town grows in size. With its growth, the town accomplishes varied and complex functions and more people travel to work or shop. Some relief is expected with the achievement of metro rail. But specialists fear that by the time the metro rail becomes fully functioning, the demand for transport facilities will outpace the capacity of both road and rail transport. In many cities people get water from the municipal sources for less than half an hour every alternate day. In dry summer season, taps remain dry for days together and people are denied water supply at a time when they need it the most.

6) *Urban Crimes:*

The problem of crimes rises with the increase in urbanisation. In fact the increasing fashion in urban crimes tends to disturb peace and serenity of the cities and make them insecure to live in particularly for the women. Rising materialism, consumerism, competition in everyday life, egocentrism, luxuriousness, atrocious socio-economic discrepancies and rising unemployment and feeling of loneliness in the mass are some of the primary causes responsible for alarming trends in urban crime.

7) *Urban Pollution*

With rapid pace of urbanisation, industries and transport systems grow somewhat out of proportion. These expansions are predominantly responsible for pollution of environment, mainly the urban environment. In consequence, cities encompass the backbone of economic expansion and urbanization is being seen in a positive light as an engine of economic growth and agent of socio-political transformation.

D. *Consequences of Urbanization*

The way of Rapid growth in urban population, in India, is prominent to many complications like increasing slums, decrease in standard of living in urban areas, also causing environmental damage. The Industrial Revolution in

the 18th century caused countries like United States and England to become superpower nations but the present condition is deteriorating. India's urban growth rate is 2.07% which seems to be substantial compared to Rwanda with 7.6%. India has around 300 million people living in metropolitan areas. This has seriously affected slum glitches, with so many people over gathering cities and compelling people to live in insecure circumstances which also comprises illegal buildings. Water lines, roads and electricity are lacking which is instigating fall of living standards. It is also adding to the difficult of all types of pollution. Urbanization also effects in a inequality in the market, in consequence of the large anxieties of the growing population and the primary sector struggling cope with them.

III.   PLANNING OF STAGES IN THE URBANIZATION

Urban extents may face many peculiar environmental difficulties which are demonstrated at the time of calamities. To evade such existences the prime requirement is quantification which necessitates a comprehensive Urban Information System (UIS) to be established to provide the developmental needs of the increasing urban areas. Chronological steps followed by urban information system:

1. Thematic map preparation from satellite data using visual interpretation techniques.
2. Generation of spatial framework in GIS for perspective and development plans.
3. Integration of thematic maps using GIS techniques for urban sprawl analysis and urban land use change analysis.

IV. APPLICATIONS OF REMOTE SENSING AND GIS IN URBAN PLANNING

In India, the complication of urban development is so tedious that it stresses immediate consideration and perspective physical planning of the cities and towns. It is essential and important for policy makers to incorporate like remote sensing into urban planning and management. Novel methodologies are necessary, and new methods must be amalgamated into current practice. Until in recent times, maps and land survey records from the 1960's and 70's were used for urban studies, but now the trend has shifted to using digital, multispectral images assimilated by EOS and other sensors. The fashion towards using remotely sensed data in urban studies began with first-generation satellite sensors such as Landsat MSS and WAS given incentive by a number of second generation satellites: Landsat TM, ETM+ and SPOT HRV. The current arrival of a third generation of very high spatial resolution satellite sensors is motivating. Progression in the technology of remote sensing has been carried out miracle in the obtain ability of the higher and higher resolution

satellite imageries. They are IRS-P6 Resource sat imagery with 5.8 meter resolution in multispectral mode, IRS-1D Pan image with 5.8 meter resolution, Cartosat-I imagery of 2.5 meter resolution with stereo capabilities, Cartosat-II with 1 m, IKONOS imageries of Space Imaging with 4 meter in multispectral mode and 1 meter in panchromatic mode, Quick bird imagery of Digital Globe with 61 cm resolution in panchromatic mode. These high resolutions of the sensors provide a new methodology.

A.   Remote Sensing in Urban Planning

The proficiencies of several sensors reach far beyond the evident benefits available at platforms like Google Earth or Bing. They afford reflective responses all along the electromagnetic spectrum which permits detection of objects or patterns of the earth's surface and their circumstance. The sensors cover many spatial-temporal dimensions, with a flexible recurrence rate and in different scales ranging from spatially detailed exploration on single buildings or building block level to global studies on continental scale.The images presented above are data not information. The strong point of remote sensing with its synoptic impression permits independent, fast, up-to-date, area-wide and reasonably cost-effective alteration of data (or images) into information. Creating use of a massive amount of approaches – e.g. statistical-, neural-, fuzzy classifiers – for instinctive information extraction for precise data sets this alteration leads to application-driven products.With this the basic question on "what" is "where" within the urban environment can be answered: The chief field of application is mapping the urban environment providing an inventory of the urban morphology. Dependent on available data sets, products vary from urban footprint level to a spatial level where individual objects are recognized.

B.   GIS IN Urban Planning

Nowadays, developers use geographic information system (GIS) technology to research, develop, implement, and observe the progress of their plans.GIS offers planners, surveyors, and engineers with the implements they want to design and map their neighbourhoods and cities. Planners have the practical knowledge, political shrewdness, and economic sympathetic to transform a vision of tomorrow into a strategic action plan for today, and they use GIS to assist the decision-making process. Planners have always been elaborated in developing communities everyone would want to call home. In the beginning, this expected designing and maintaining cities and counties through land use regulation and infrastructure support. Agencies have had to equilibrium the needs of residential neighbourhoods, agricultural areas, and business concerns. Now, along with that complex challenge, local governments must factor into these decisions

the requirements of a growing list of regional, state, and federal agencies as well as special interest groups.

Occasionally varying economic circumstances have further problematical the process by frightening the funding needed to carry out these functions. Up to date, local governments have been right sized and economized and have had budgets significantly cut while trying to sustain service levels. Information technology, especially GIS, has proven crucial in helping local governments cope in this environment.

Benefits of using GIS in local government in urban planning include the following:
- Increase efficiency.
- Save time.
- Generate revenue.
- Provide decision support.
- Improve accuracy.
- Manage resources.
- Automate tasks.
- Save money.
- Increase access to government.
- Enhance public participation.
- Promote greater collaboration among public agencies.

V. CONCLUSION

The process of urban development is so rapid that it demands quick response and perspective view of planning of the cities and towns. Developing and managing cities in the new era of globalization and economic liberalization would be a challenging task calling for new skills and approach. Indian cities will have to contend with others to attract investors and so, concerns like quality of infrastructure, energy efficient services provision and environmental situations in a city further economic stability would play an important part in such competition. In general, urban planning profession will have to address these matters and respond rapidly. It is meaningful noting that spatial dynamics of cities is complex to gauge and urban theory is still fixed. In other words, the urban planning consultants and activities in every parts of the country should adopt new technologies like remote sensing and GIS. These have ability to provide essential physical input and intelligence for planning of base maps, for planning proposals and act as monitoring tool during implementation phases. Satellite remote sensing with tedious and synoptic observing competences, as well as multispectral capabilities, is a influential tool for mapping and observing the ecological changes in the urban core and in the peripheral land-use planning, will help to reduce unplanned urban sprawl and the connected loss of natural surrounding and biodiversity. Alternatively, moving further, interfacing of urban planning models with GIS should

now receive due attention. Combination of land-use transportation models, water distribution network analysis, and stimulation of urban activities to appraise different urban development alternatives in the GIS framework needs to be explored for added advantage.

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