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1. Following members of the Institute shall only be eligible to borrow / refer books.

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2. Entry to the Library shall be permitted on showing ID Card issued by the ITPI. The Institute reserves the right of entry into the Library.

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   (b)   Perfect silence shall be maintained in the Library.

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   Yellow   :   For students appearing in AITP examination.

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MALADIES OF HILL REGIONS: SUSTAINABLE REGIONAL DEVELOPMENT APPROACH

DIWAKAR S. MESHRAM

President, ITPI and Chairman All India Board of Town and Country Planning, AICTE, New Delhi

ABSTRACT

Each hill region has its own problems and potentials because of its peculiar settings and conditions but some of the common problems faced by the hill regions, among others, are indiscriminate felling of trees and exploitation of other natural resources, soil erosion, shifting cultivation, less extent of cropped land, fragmented and small holdings, heavy pressure on agricultural land, least diversified economy, large extent of uncultivated wasteland, inaccessibility of certain areas, uneven development of urban system, deficiency of infrastructure, etc. But hill regions in general are ecologically rich but economically less developed. The hill areas with natural endowments have large economic potentials but need to be utilized in rational and sustainable manner. Therefore, there is a need to formulate economic development plans for hill regions as distinct regional plans which are bold in conception and of higher urgency.

1. INTRODUCTION

Hills as the natural bio-sphere reserves are of special significance to human kind but human interventions, economic interests and influx of people to hill areas have increasingly endangered the hill regions through destruction and degradation of forests, indiscriminate building and construction activities, environmental pollution and damage to the fragile eco-system. Uncontrolled, unplanned and haphazard development of hill regions is creating serious threat not only to the heritage of hill settlements but their existence itself. These issues mainly can be attributed to the intensive development activities taking place due to rapid expansion of hill towns to accommodate ever increasing influx of migrated population from surrounding areas. In fact hills and mountains, from time immemorial, have influenced the life, culture and economy of the people in the country. They contain about 10 percent of total population. Almost half of the country's population is living in or adjacent to the hilly and mountainous areas depending directly or indirectly on the resources of the hills.

With the increasing pace of industrialization and denudation of natural resources in the plains, hills are becoming the frontier regions of the country. Despite rich natural resources of forests, hydel power, minerals, etc; hill areas have generally remained poorly developed. On the other hand, increasing pressure of human activities has considerably damaged the ecology and environment of the hill areas. Excessive exploitation of natural resources and implementation of ill-conceived development projects have been threatening the eco-system. It has also shown discernible destructive impact in the plains by way of flash floods, siltation of water bodies, loss of soils and crops, damage to human habitat, etc; leading to irreversible human and economic loss. Although considerable awareness has been created about the deteriorating environmental quality and conditions in the hilly regions, however, even after Stockholm Conference on Human Environment in 1972, the remedial measures have not kept pace for coping up with this situation.

Hill areas are distinguished primarily by their relief, and factors like slope, heterogeneity of climate, vegetation, flora and fauna, and land use pattern. Hill areas have also the unique ecosystem that is rich in biodiversity and visual resources. It is well known fact that developmental policies in agriculture and tourism sectors during the post-independence era (1950-2000) have resulted in extensive deforestation causing adverse environmental impacts and consequential ecological imbalances. As a consequence, most of the hill areas in the country have been listed as ecologically sensitive zones by the Ministry of Environment and Forests (MoEF), Government of India.

2. SUSTAINABLE DEVELOPMENT

The World Commission on Environment and Development, set up by the General Assembly of the United Nations in 1983, in its Report defined sustainable development as one 'which meet the needs and aspirations of the present generation,

without comprising the ability of future generations, to meet their needs'. Popular expression of the concept was first given in the Brundtland Report in 1987. It contains three key concepts: (a) the concept of 'needs', in particular the essential needs of the world's poor to which over-riding priority should be given (b) the idea of the vicious circle of poverty, rapid population growth and over exploitation of the resource base, leading to environmental degradation and thirdly (c) the trade-off between environment and development. It requires merging of environment and economic concerns in decision making. The Commission called for a faster economic growth (at least 5 percent per annum) for the countries which are caught in a vicious circle of economic decline, increasing poverty and environmental degradation. The Commission felt that the growth need not be environmentally degrading and that growth, in fact, creates the capacity to solve environmental problems, and is also absolutely necessary to overcome mass poverty. Sustainable development understood in this way is 'growth which respects the limits to environmental resources such as clean air, water, forests and soils; growth which maintains genetic diversity, growth which uses energy and raw materials efficiently'. Imperatives of sustainable development are far more complex than conventional concept of economic development. The Report concluded by highlighting that sustainable development requires a political system that secures effective citizen participation in decision making; an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis; a production system that respects the obligation to preserve the ecological base for development; a technical system that can search continuously for new solutions; an international system that fosters sustainable patterns of trade and finance; and an administrative system that is flexible and has the capacity for self-correction. The challenges of sustainable development are most immediate and pressing in the cities, especially in the third world. In conditions of rapid urban expansion, cities and towns struggle to cope with the enormous demands placed upon them by explosive population growth.

The term 'sustainable development' itself however, has different connotations to different professionals because it encompasses a variety of contexts.

Hence, it is not only difficult to define as to what exactly comprises sustainability, but what may be found sustainable in one context may not necessarily be sustainable in another context. It is, however not denying the fact that the concept of sustainable development refers to environmental sustainability, economic sustainability and social sustainability. While planning to achieve sustainable development in hill areas the major objectives, which merit consideration, are:

•   To conserve natural resources and scenic beauty for the benefit of present and future generations;

•   To bring sustainable, social, institutional and economic development to local people; and

•   To develop tourism in such a way that it will have minimum negative impacts on the environment at the same time provides positive benefits of economic development to communities.

3.   COMMITTEE ON DEVELOPMENT OF SMALL TOWNS IN HILL AND BORDER AREAS

The Committee set up by the then Ministry of Health, Government of India in 1965, in its Report highlighted that the small towns in hill and border areas suffer from three handicaps. In the first instance, they are backward themselves, secondly, they happen to be located in regions which too are the victims of the same malady and lastly, most of the states in which hill areas form a larger proportion of land and population are relatively less better off than the rest of the country. There certainly is a logical consistency and inter-relation in the synchronous backwardness of hill towns, hill regions and hill states which adds a touch of tragic irony to their plight. The inescapable logic of all this is that the problem of hill and border towns is multi-dimensional and can be neither treated in isolation nor by limited efforts in any particular direction. The problem basically is one of effecting an all-round development of the hill areas of which the small towns form the important focal point (Government of India, 1965: 26).

Advance preparation for the anticipated urbanization in the hill towns must begin with the

preparation of master plans with reference to the outlying regions with which it has intimate socio-economic interactions, and due note will also have to be taken, of the problems of water supply, sewerage and drainage, power supply, roads, community facilities like schools, hospitals and dispensaries, parks and playgrounds and social and cultural amenities like libraries, clubs, and community centers, etc. Town development programmes of hill towns should be made an integral part of the Regional Plans in the State Five Year Plans. Therefore, the Committee argued that the problem of hill and border towns can not be treated in isolation. Any attempt to raise hill towns without a similar corresponding effort in their hinterlands and wider regions will be but artificial and they will not be able to sustain the economic boost given to them (Ministry of Health, Government of India, 1965: 26). Their development therefore, has to be an integral part of a larger programme for the overall development of hill regions themselves and the problem has to be tackled with utmost inter-departmental collaboration, co-ordination and understanding (Ministry of Health, Government of India, 1965: 51)). It further recommends that there is a need to formulate economic development plans and programmes for hill and border areas as distinct regional plans which are bold in conception, of higher urgency in terms of priority and more liberal in terms of financial and technical assistance from central and state governments.

4.   DEFINING HILL AREAS
Considering the topographic features, 10.7 percent of India's total land area i.e. 81.26 crore acres lies in mountains, 18.6 percent in hills, 27.7 percent in plateaus and 43 percent in plains. The word 'mountain' has been used by 1951 Census as 'steep land at a very high elevation and generally excludes all land below 7,000 feet above sea level'. Nearly two third of the mountainous area is in Jammu and Kashmir and the remaining one-third is distributed in three zones, namely, East India, North-West India (excluding Jammu and Kashmir) and North India. In South India about 5 lakh acres of land is under mountains whereas, in Western and Central India there are no mountains in the strict sense of the term. The hill areas have been defined as 'all kinds of weathered high lands', (except mountains) without reference to the level at which they are situated. This term includes

practically the entire area of all ranges other than the Himalayan and also the foothills of the Himalayan range up to the limit of 7,000 feet above mean sea level. Land under hills comprises 1,509 lakh acres distributed in East Central, South and West India. The plateaus include all relatively flat land in 1,000 and 3,000 feet above mean sea level. Almost half of all land under plateaus is found in Central India and the remaining one-half is distributed in North-West, South East and East India (Committee on Development of Small Towns in Hill and Border Areas, 1951: 4)

The Planning Commission defines a hill area as an area located more than 600 meters above the mean sea level. Accordingly, in the country, addition to the nine hill states – Arunachal Pradesh, Himachal Pradesh, Jammu and Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura – there are designated hill areas in Assam, Goa, Karnataka, Karla, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bengal and the union territory of Daman and Diu.

5.   HILL REGIONS
Himalayas in the north and Deccan Plateau in the south form important physiographic areas of India. Himalayas are the young fold mountains and longitudinally they constitute the greater Himalaya (Himadri) the lesser Himalaya (Himachal) and the other Himalayas (the Shivalik ranges), while based on regional characteristics they are sub-divided into western Aravallis, Vindhyas and Satpuras are the important hill ranges and in the Deccan Plateau, Western Ghats and the Eastern Ghats are the prominent hill ranges. All these hill ranges form part of broad physiographic divisions or sub-divisions but for planning purposes, delineation of hill regions as well as their sub-regions need to be undertaken based on the criteria of altitude, slope, rainfall and other related factors. As stated earlier, in 1981, the Planning Commission, while delineating the hill regions, accepted that any area about 600 meters in height from mean sea level may be classified as hilly. Later on in 1985, it was also recommended that any area with average slope of 30 percent and above may be classified as hilly. But in practice, 1981 classification is being used for the purpose of Hill Area Development Programme. Accordingly, hill areas have been grouped into two categories. Firstly, those areas which are co-extensive with

the boundaries of the states are called as hill states and comprise Jammu and Kashmir, Himachal Pradesh, Sikkim, Manipur, Meghalaya, Nagaland, Tripura, Arunachal Pradesh and Mizoram. The second category includes those areas which form part of the state and are termed as 'designated hill area' by the Planning Commission. This includes two districts of Assam, 8 districts of Uttar Pradesh (now in Uttarakhand), major part of Darjeeling district of West Bengal, Nilgri district of Tamil Nadu and 163 taluks of Western Ghats, comprising parts of Maharashtra (62 taluks) Karnataka (40 taluks) Tamilnadu (29 taluks) Kerala (29 taluks) and Goa (3 taluks).

The above delineation of the hill regions is not, in real sense, the delineation of the region on a multitude of factors where interactions are normally taken for delineation of a viable region for comprehensive planning. A wide range of variables may be employed for the delineation of a region but such a need would depend on the primary objectives of the exercise. The hill areas identified by the Planning Commission may not meet all the requirements of a planning region but are taken for a special purpose. The 'designated hill areas' are used for allocating special central assistance for their development. Taking taluk as a unit of study, the central Town and Country Planning Organization prepared a Regional Plan for Western Ghats. The region identified comprised Western Ghats spines and adjoining areas adjusted to the administrative boundaries of taluks. The region so identified included 135 taluks for which a plan was prepared, while for operational purposes, hill area development programme continued in 163 taluks of Western Ghats Region.

6.   MALADIES OF HILL REGIONS

Hill regions in general are ecologically rich but economically less developed. The hill areas with natural endowments have large economic potentials but need to be utilized in rational and sustainable manner. From the snow clad tops of the Himalayas to the denuded hills of Aravallis, problems and potentials of hill areas vary from region to region based on their geo-physical settings and pace of development. For planning considerations, there are some common set of problems faced by the hilly regions. A comprehensive exercise on Western Ghats

Regional Plan carried out by the TCPO during the Sixth Five Year Plan period has identified certain constraints of development in various sectors and areas of development which could be taken as indicative of the nature and gravity of problems in the hill areas.

However, each hill region has its own problems and potentials because of its peculiar settings and conditions but some of the common problems faced by the hill regions, among others, are indiscriminate felling of trees and exploitation of other natural resources, soil erosion, siltation in the downstream areas, flooding of foothill and plane areas, shifting cultivation, faulty agricultural practices, less extent of cropped land, fragmented and small holdings, heavy pressure on agricultural land, least diversified economy, mainly rural and agrarian, large extent of uncultivated wasteland, inadequate irrigation facilities, scarcity of buildable land, emergence of linear urban corridors, inaccessibility of certain areas, uneven development of urban system, deficiency of infrastructure in hill settlements, and lack of preventive measures for ecological damage caused due to mining operations. The hill areas, with basically low density zones, are however experiencing rapid increase in their population. In the hill states like Nagaland, Mizoram, Arunachal Pradesh, Tripura, Meghalaya, growth of population, was much higher than the all India average growth rate. Although hill areas are endowed with abundant renewable and non-renewable natural resources, by and large, they are dominated by subsistence agrarian economy. In fact, poverty thrives amidst resource plenty hill areas which suffer from lack of adequate means of irrigation and wasteful, faulty, and age old agricultural practices.

The hill regions generally suffer from inadequacy of rural roads, marketing facilities and other supporting services, which come in the way of proper development of agriculture and overall economic development. Although animal husbandry is next in importance to agriculture, husbandry, livestock, poultry and dairy farming are the least developed branches of agriculture in many hill tracts. Similarly, hill regions are rich in minerals but they are not exploited scientifically, causing degradation of hill environments. The

industrial development in the hill areas has, by and large, been very poor and whatever industrial development has taken place has remained confined to only few pockets leading to wide spatial imbalances. Tourism, although has been emerging as an important economic activity has not been developed in an integrated manner. Forest is being used as the major fuel wood because of lack of alternative sources of energy, causing large-scale destruction of forests.

Urban scenario is dominated by a large number of small sized settlements and there is a wide gap in the existing urban system, leaving large tracts of hills ill-serviced. However, in some of the hill states growth of urban population is recorded at a higher rate than the all India average. However, most of these areas are under heavy pressure of economic exploitation and urbanization, indicating a change from rural to urban economy. The settlement pattern presents a scenario where there is an excessive concentration of population in a few cities, which in many cases are state capitals. The environment in and around these places is threatened because of building activity, and road construction, Indiscriminate exploitation of natural resources and cutting and blasting of hill slopes are resulting in landslides, soil erosion, silting of reservoirs, clogging of natural drains and flooding. All these, cause ecological disturbances including micro-climatic changes and their affect on flora and fauna. Agriculture still remains the main occupation of the hill people. But, the net sown area is only 1 to 10 percent of the total area, which with low productivity can hardly meet the requirements. The forest areas are being lost because of, among others, shifting cultivation, cutting of trees for timber, and industrial development. The people are generally poor with per capita income below the national average. The only positive indicator of development in these areas is in the health and education sectors. The literacy rate and number of hospital beds per 1,000 population are generally higher than the national average in most of the hill states.

7. DEVELOPMENT APPROACH FOR HILL REGIONS IN VOGUE

Hill areas have been receiving the attention of central and concerned state governments from time to time. The Planning Commission is aware of the problems of hill areas but the efforts since the Fourth Five Year Plan have been more on policy than action. A Hill Area Development Programme (HADP) was introduced in the Fifth Five Year Plan. The thrust of the Sixth Five Year Plan was on the development of hill areas and promotion of the quality of life of the hill people. However, the development approach of the hill states was ad-hoc with little concern for eco-restoration, eco-preservation and eco-development. The 7th Five Year Plan emphasized socio-economic growth and promotion of a secure basic life support system including judicious utilization of land, minerals, water and biotic resources, development of infrastructure, and preservation of ecology. The 8th Plan, endorsing the 7th Plan objectives, has declared the hill states as 'Special Category States' for giving central assistance (Table 1).

Table 1 Programmes / Activities for Hilly Regions

Year	Programme / activities	Major Highlights
1974	Hill Area Development Programme (HADP)	• The main objectives of the programme are eco-preservation and eco-restoration with emphasis on preservation of bio-diversity and rejuvenation of hill ecology.
1974	Western Ghats Development Programme (WGDP)	• The programme adopts an integrated watershed development approach in the Western Ghats prioritizing eco-development, eco-restoration and meeting the basic needs of food, fuel and fodder.
1992	National Policy for the Integrated Development of the Himalayas	• An Expert Group was set up by the Planning Commission to formulate a policy for the development of the Himalayas • Based on the recommendations of this Group, six sector-

Year	Programme / activities	Major Highlights
		specific sub-committees have been set up in the State of the Himalayan Region to formulate and implement Schemes in the following areas. - Environment and Forests - Agriculture and allied activities - Industry and Industrial Infrastructure - Social and Health and Family Welfare sectors - Transport, Communications and Tourism - Non-conventional Energy and Science and Technology.
1992	Ministry of Environment and Forests Notification on restriction of certain activities in specified areas of the Aravalli range	• Issued under the Environment (Protection) Act, 1986, the notification restricts certain activities causing degradation in the Aravallis • The activities that were prohibited in these specified areas include location of any new industry, new mining operations and mining in sanctuaries and national parks and deforestation. • Environmental Impact Assessments and Environmental Management Plans are mandatory for carrying out any of the restricted activities in this region.
2001	Notification on protection and improvement of quality of environment in the Himalayas	• Issued by MoEF under the Environment (Protection) Act 1986, specifically for environmental protection in the Himalayan States • The activities related to location and planning in urban areas. • Rainwater harvesting and guidelines for construction of hill roads.
Before 2001	Activities undertaken by the Botanical Survey of India (BSI)	The activities undertaken by the BSI include • Survey of plant resources of the country • Undertaking taxonomic studies of all flora of the country • Enlisting endangered species • Preparation of a national database of herbs
Before 2001	Activities under taken by the Zoological Survey of India (ZSI)	The primary objectives of the ZSI are: • Exploration and Survey of faunal resource • Taxonomic studies • Status survey of endangered species • Publication on fauna of India • O & M of national zoological collections.
Before 2001	Activities undertaken by the Forest Survey of India (FSI)	• The FSI undertakes assessment of the forest resources of the country through parameters such as forest cover, growing stock, annual increment, species composition, bio-diversity, non-timber forest products, etc.
Before 2001	Activities undertaken by the Indian Meteorological Department (IMD)	The mandate of the IMD includes: • Taking meteorological observations and providing meteorological statistics • Warning against adverse weather phenomena such as cyclones and heavy rains • Detection and location of earthquakes and evaluation of seismic city.

Sources: Ninth Five Year Plan, 1997-2002; Planning Commission (2001b) and Ministry of Environment and Forests (2001)

A perusal of various components schemes being implemented under the HADP, however, would reveal that most of such schemes are mainly either activity specific or target group-oriented and are sectoral in nature, generally lacking in physical and spatial dimensions. In order to have a tangible affect of these programmes and schemes in achieving the major objective of ecological balance of hill areas, there is a need to integrate all the programmes and schemes both horizontally and vertically. Development strategy followed in the plains may not be fully applicable for hill environments; rather, conservation oriented integrated development approach, would be more suitable for planning and development of hill areas.

The development approach followed in Hill Area Development Programme mainly relates to providing Central Assistance for various components and helping in socio-economic and eco-development of hill areas. Under the programme, hill states are classified as special category states which receive Central Assistance to the tune of 90 percent grant and 10 percent loan. For the designated hill areas forming part of state, two separate programmes are being implemented (i) covering the hill areas of Assam, Uttar Pradesh, West Bengal and Nilgri district of Tamilnadu, called hill area development programme, and (ii) covering 163 taluks of Western Ghats Region called Western Ghats Development Programme. The programme also states that schemes under both HADP and WGDP should be properly dovetailed and integrated with State Plan Schemes. The approach and strategy for hill area development enunciated in the Eighth Five Year Plan has identified 37 programmes emphasizing various issues in different sectors of development. Most of these programmes are activity specific, particular action oriented relating to specific groups and do not form part of an area based integrated plan. There is also an element of overlapping in some of the programmes. Under the Western Ghats Development Programme separate set of guiding principles are given, emphasizing ecological balance and restoration of ecological damage caused by human interactions. All these programmes and schemes already in operation need to be continued under Hill Area Development programme but the

governing principle should be to derive maximum benefits by dovetailing them in well conceived integrated area development plans for hill sub-regions of the country.

8. THE UDPFI GUIDELINES

The Urban Development Plan Formulation and Implementation (UDPFI) Guidelines, as a general principle, recommended that Urban Plans should not be conceived in isolation from its region because each urban centre is part of a regional system of settlements which in term play respective role as a whole (Ministry of Urban Development and Poverty Alleviation, 1996: 21).

While examining the legislative support, taking the case study of Himachal Pradesh, Guidelines state that the Himachal Pradesh Town and Country Planning Act, 1977 is in force in Himachal Pradesh. It is a comprehensive planning and development Act and provides for the preparation of Regional Plans, Urban Area Plans and Zonal Plans, and prescribes development control regulations and use of land. It also envisages preparation of Town Development Schemes by the development authorities constituted under this Act. The legislation also provides for levy of development charges. Six Urban Development Authorities and five Special Area Development Authorities have been set up under the Act.

Under the Act, Planning Areas has been constituted and the Director of Town Planning is entrusted with the task of preparation of Interim Development Plans and Development Plans are to be followed by Sectoral Plans in consultation with the local authorities concerned. The Interim Development Plan is submitted to the State Government, which may approve it with or without modifications. The State Government notifies the Interim Development Plan in the official gazette as approved by it and local authorities are required to follow the Plan. The Development Plan which is detailed in nature and contents are prepared and notified for public objections, suggestions and the Director of Town Planning is required to consider all these objections and suggestions within a period of 90 days from the date of publication and make necessary modifications and submit to the state government

within 6 months of the publication of a Draft Development Plan. The State Government may approve the Development Plan with or without modifications and notify in the official gazette. Thereafter the Development Plan finally comes into operation and it is binding on all development authorities and local authorities functioning within the planning area. The development plan is further followed up by the preparation of sectoral plans by the Director of Town Planning.

This Act also contains provisions for undertaking a review and evaluation of the development plans and sectoral plans. The Act also contains provisions for the constitution of Town and Country Development Authorities for preparation of Town Development Schemes. There are also provisions for the constitution of Special Areas and Special Area Development Authorities for the preparation of Development Plan for such areas. Thus the State Town Planning Act is quite comprehensive (UDPFI Guidelines; Page 86).

9. CRITICAL ISSUES

All hill areas are not alike, because majority of them are attractive but fragile, some of them may be ecologically degraded and might have become derelict besides each hill region has its own potentials and problems. Therefore, they require special care and attention while attempting to preserve their natural state. The critical issues that need to be addressed on priority are:

- How to check immigration to hill towns from nearby areas and how to cater to the infrastructure requirements of migrated population;

- Should the industrial development be allowed in the hill regions and if yes, which kind;

- Should intensive development of buildings and construction activities be allowed to continue unabated ;

- As the development in hill regions remained confined to only few pockets, how to address the issue of spatial imbalance;

- What should be the basic unit for development of hill regions because Planning Commission suggested *taluk* as unit for regional plan for Western Ghats Region;

- How to enhance the visual environmental qualify of the hill regions;

- Whether to allow liberal tourism activities or put some restrictions because tourism strengthens the economy of towns and also creates employment opportunities;

- What measures should be taken to preserve eco-system of the hill regions;

- How to address the inadequacy of rural roads, marketing facilities and other supporting services;

- How to address the issue of ecological damages already caused due to mining operations;

- Adequate measures to augment and upgrade infrastructure and measures to fill the existing deficiencies in infrastructure like water supply, sewerage and drainage power supply, roads, community facilities like schools, hospitals and dispensaries, parks and playgrounds and social and cultural amenities like libraries, clubs and community centers, etc. should be met;

- Whether inaccessible hilly terrains should be made accessible and opened to for further intensive development;

- Whether fragmentation of small holdings in hill regions should be allowed to be further sub-divided;

- Whether indiscriminate felling of trees and exploitation of natural resources be allowed to continue unabated ;

- Whether large scale cultivation should be allowed in the wastelands;

- Whether to follow the norms and standards prescribed for plains in the hilly regions, if not, what approach should be followed?

10. SUSTAINABLE REGIONAL DEVELOPMENT APPROACH

In spite of poor state of hill area development and persistence of large scale environmental and ecological problems, hill areas in India have vast potentials, which need to be harnessed properly in order to have sustainable development of hill regions on a wider scale. By adopting proper land development measures there is a large scope of bringing more areas under agriculture and forests. The hill slopes are specifically suitable for large scale

plantations and horticulture corps. With good scope of fodder production, dairying has considerable scope for development in the region. A sound development of forest would not only help in eco-restoration but would also provide industrial timber if exploited scientifically and also be a good potential for bee keeping, sericulture and minor forest products. The optimal exploitation of minerals would help in setting up of mineral resource based industries, thereby leading to diversification of hill economies. Hill areas endowed with vast natural assets have immense potential for tourism development as well.

The basic approach to hill area development should be to arrest further damage to the fragile mountain eco-system and to promote development without destruction. The plan for hill development should attempt to highlight the role of each and every sector of development in bringing economic benefits to the region and in maintaining the vital ecological balance by co-ordinating various economic and social activities in space through the creation of a systematic settlement system. There is an intimate and inseparable relationship between environment and development and the objective of sustainable development can not be achieved by ignoring the environmental pollution aspects. In order to have development without destruction, all the socio-economic and physical activities need to be planned within an ecological framework. The Western Ghats Regional Plan attempts to identify environmental sensitive areas, which provide an ecological framework to take up various types of developmental activities in different sensitive zones. Five indicators, namely altitude, slope, existing vegetation, soil types and average annual rainfall have been taken to determine the environmental character of hill areas. Based on these factors, it was noted that taluks with higher cumulative weightage of environmental character were more sensitive to erosion and accordingly 5 types of environmental sensitive areas or taluks, ranging from extremely sensitive, very high sensitive, highly sensitive, medium sensitive and low sensitive zones were identified. Considering the physical features and characteristics of various environmental sensitive areas, strategy and proposals for eco-development and other measures for development have been suggested. Such an approach is akin to watershed

management which is considered to be an ideal approach for hill area development.

Keeping in view the broad objectives of eco-development and conservation for hill area development, a watershed appears to be an ideal unit for planning, and accordingly, while delineating planning regions for hill area development, it is necessary to take into account the whole of watershed area including high altitude of hills, plateaus, valleys and plains. A watershed is a clear conceptual unit comprising hydrology, physical geography and other natural resources and hence it will be of great advantage for hill area development if watershed is taken as a unit for planning. Within the watershed, all development programmes could be made area specific to a large extent which would help in achieving the economic growth at a desired level.

A policy perspective plan for larger regions should identify the broad development issues and imperatives and set out well-defined goals and objectives. The integrated plans at sub-regional level or for typical hill sub-region should identify the priorities for development programmes spatially and temporally. At this level, physical plan should also be integrated with the socio-economic development plans of state government or other agencies at various levels to work out the financial implications and order of priorities, considering availability of funds from various sources vis-à-vis development needs. At the lowest level i.e. the sub-watershed level, action area plans, indicating the specific area based programmes of development with stages of implementation in a co-ordinated manner, should be prepared in consultation with other development agencies and involvement of local people. Integrated development approach for hill areas thus calls for co-ordinated action in all aspects of development at various levels. Such an approach would ensure planning from the bottom and action where the problem exists. Considering the broad objectives at regional level, development programme for the specific areas at lower level be worked out to have a top-down linking with similar programmes at lower level and be adjusted in such a way that they fit well with the objectives and resources indicated at the higher level plans to have bottom-up linkages. Horizontally, all the programmes need to be co-ordinated in the detailed plan for sub-watershed at the local level in line with the broad objectives and available resources.

Land use planning should be based on land capacity and suitability studies at sub-watershed level should be conducted. Very steep slopes should be used for forests while the moderate slopes should be put to a mix of horticulture plants of energy, fodder and economic importance. Valleys and plain flat lands in the hills should be under cultivation of food crops. All these should be supported by a proper land development programme such as terracing, contour bonding, trenching of hill slopes, construction of check dams, etc. Encroachments on forest land should be checked and removed and forest should be enriched by planting on denuded and sparsely forested zones. Hills and mountains have vast scope of hydel power and water resource development for irrigation and other purposes. In view of sensitive nature of hilly areas, preference should be given for creation of minor irrigation schemes. This will also help in augmenting groundwater table by more recharge that will in turn intensify the vegetative cover. Non-polluting high tech industries as well as local resource based industries could be developed in the hill regions in the selected growth centers. For development of tourist infrastructure such as construction of new roads, hotels, cottages and allied activities care should to be taken so that they do not affect the hill environment and should be developed in harmony with the surrounding environment. While developing human settlements, both urban and rural, it should be seen that limited availability of flat and buildable land is optimally utilized. The level of facilities and services need not necessarily be on the basis of population unit and distance norms but be provided as per needs of the hill people. The norms and spatial standards as prevalent in the plains may be required to be scaled down. Detailed guidelines on erosion control measures in the construction of hill roads laid down by the Ministry of Transport (Road Wing) should be strictly followed while constructing new roads.

Development approach for hill areas should emphasize, among others, sound land use planning, development of alterative sources of energy to reduce dependence on forest fuel, planned development of tourism activity, rational urban settlement system and optimal utilization and development of resources. All these parameters need to be well knitted to the integrated plan. Two such models of development followed in other countries are the European model and Japanese model. About 150 years ago in the European Alps in places like Switzerland, Bavaria and Austria, similar conditions prevailed as in the Himalayan Region today. The problems of conservation and development of mountain region in the above European countries have, over the years, been tackled by adopting sound practices of land use planning with the help of land tenure system, development of hydro-electric power as a major alternative source of local energy for development; secondly, preventing the destruction of forest cover; and thirdly, by adopting development of planned and dispersed tourism. All the three factors have been blended to achieve the objectives of conservation and development. This model is considered to be useful in other mountain regions of the world as well. In the Japanese model, hill areas have been kept as very sparsely populated where only two percent of the large population of over 100 million is living in the hills which cover 75 percent of the land area. This has been achieved partly by conserving the hills as resource regions for forestry, hydro-electric power, tourism and partly by having economic development in the plains. However, it has some adverse impact in terms of acute congestion and pollution in the remaining 25 percent of the land area containing 98 percent population. Nevertheless, hill areas have been treated on the basis of conservation development factors as in Europe. Despite different physical and socio-economic conditions in our hill areas, it would be interesting to explore to what extent we can draw on these experiences.

For preserving the eco-system of hill areas the important aspects which merit consideration are:

- Landslide zoning map prepared by geologists which could have landslide potential rating from nil, very low to moderately high and very high could help planners in identifying suitable surrounding areas of hill towns for future development;
- Soil map indicative of solid productivity – areas suitable for agriculture, grazing, forestry, and development could be identified;
- Slope analysis map can further contribute to the identification of the above mentioned areas;

- Hydrology map indicating streams, water bodies and ground water tables;

- Surface drainage map also showing erosion potential and siltation;

- Transport network and settlement pattern.

Besides these, there are certain other parameters that need to be considered before preparing land use plans for these areas.

To preserve and maintain the genetic pool of special flora and fauna in the hill regions, biosphere reserves such as national parks, wildlife sanctuaries, reserve forests and scenic spots have to be maintained. The wide public awareness programme for environmental protection and conservation, legislative measures and appropriate machinery are needed to tackle the situation. The operational and planning and development machinery should be strengthened appropriately to evolve and implement the eco-development plans at various levels.

An integrated development approach needs reliable, timely, accurate, complete and useful data and information on land use, natural resources, socio-economic activities and other parameters of development. Remote-sensing techniques have proved to be very useful in inventory, development management and monitoring of land, water and other natural resource data and information. This technology offers a wide opportunity for integrated study of hill areas particularly in terms of land and natural resources. Remote sensing technique can help to a great extent in analyzing the environmental changes in hilly areas and prepare an integrated development plan. A sound data base and information system particularly at sub-watershed level in the form of various thematic maps and attribute data would facilitate planning and development of hill areas.

In the 52nd National Town and Country Planners, Congress held at Shimla in December 2003 on the theme 'Development of Hill Capitals: Shimla – Vision 2025', it was recommended that the Integrated Development Plan for Hill Areas should be prepared highlighting the role of each and every

sector of development in brining economic benefits to the Region and in maintaining the vital ecological balance. Such Integrated Plan needs to be prepared at sub-regional level identifying the priorities of development. It may further be stated that the Congress has given specific and focused recommendation on Shimla - 'In Giving shape to sustainable development, Shimla is required to be planned in the regional context by integrating the main human settlements around Shimla'. Thus, planning and development of hill settlements in the regional context have been brought into focus by various agencies and committees.

11. CONCLUSIONS

The UDPFI Guidelines, as a general principle, have recommended that Urban Plans should not be conceived in isolation from their regions as each urban centre is part of regional system of settlements. In addition the 52nd National Town and Country Planners' Congress held at Shimla emphatically recommended that - 'In giving shape to sustainable development, Shimla is required to be planned in the regional context'. Beside the Committee on Development of Small and Medium Towns in Hill and Border Areas also emphasized that there is a need to formulate economic development plans for hill regions as distinct regional plans which are bold in conception and of higher urgency. However, the basic philosophy of development of Hill Regions should focus on sustainable development within the parameters of the World Commission on Environment and Development's definition i.e. sustainable development is the ability to meet the needs of the present generation without compromising the ability of the future generations to meet their own needs.

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INCLUSIVE PLANNING AND DEVELOPMENT IN THE NATIONAL CAPITAL TERRITORY OF DELHI

DR. ASHOK KUMAR

Proffesor and Head, Department of Physical Planning, School of Planning and Architecture, New Delhi

ABSTRACT

Economic growth and the level of urbanization in the National Capital Territory of Delhi are positively correlated. Per capita income and percentage of workers in gainful employment on one hand and level of urbanization on the other have grown together. But the nature of economic growth has changed over a period of time as has levels of urbanization. Levers of economic growth are identified. The author views that economic growth and increasing level of urbanization on their own are not sufficient conditions for Delhi to become a world city. What is most important is the fact that economic growth must be made inclusive by public policy design. Some suggestions are offered for the future inclusive urbanization of the National Capital Territory of Delhi.

1. INTRODUCTION

Delhi is the third largest metropolis of India. It has been growing demographically, physically and economically. Its urban population has grown from 2.38 million in 1911 to 12.81 million in 2001. In 2005 it is estimated to touch 16 million. The city was spread over 43.3 sq km in 1911 and in 2001 it covered an area of 792 sq. km. Economically too the city has not lagged behind. Per capita income of the city was over Rs.44,222 in 2001-2002 at current prices, double of India's average per capita income (Government of the National Capital Territory of Delhi, 2004a: 10; Government of the National Capital Territory of Delhi, 2004b: 71). The city has recently acquired a world class mass rapid transit system, Delhi Metro. It is frantically preparing itself for the Commonwealth Games to be held in 2010. Delhi therefore seems to be on its way to becoming a buoyant world class city.

Economic growth of Delhi is led by sharply rising employment in the tertiary sector, steeply rising property prices, fast improving transport infrastructure and enhanced spending capability of the Delhites due to higher per capita incomes. There is a particular focus on commercial property development. The geography of the city is rapidly changing into the city of malls and it is now host to some of world's most up markets. It will be argued later that this economic buoyancy could be hastened by encouraging enterprises to make more invests in tourism and the service sectors.

This paper contains a discussion on the economic condition of the National Capital Territory of Delhi.

The paper also identifies some of the major contributors to this upturn and makes proposals for the sustainability of inclusive economic growth, planning and development. After introduction, the second section accordingly examines the present population and economic condition of the city state. The third section reviews important economic levers of economic growth. In the fourth section, a major threat to inclusive planning that is the process of neoliberalization is discussed. It is in the fifth section that the author discusses dimensions of inclusive planning as a way forward for sustaining and enhancing economic buoyancy before providing concluding remarks in the last section.

2. POPULATION GROWTH AND BUOYANT ECONOMIC CONDITION

2.1 Population Growth

Population growth of Delhi has two main characteristic features. First, its total population has grown over 35 times since the last 100 years (Table 1). However, the largest increase took place during 1971 to 2001. It increased from 4.07 m in 1971 to 13.78 m in 2001, an increase of over three and half times. Natural increase coupled with large scale immigration from the states of Uttar Pradesh, Bihar, Madhya Pradesh, and Haryana, etc; has contributed almost equally to the population increase of the city. Second, like other three mega cities, population growth of Delhi's core has been less than that of its new extensions during the last two decades. Delhi core grew at the rate of 3.59 percent in 1981-1991 while its periphery grew at the rate of 3.8 percent during

Table 1 Population Growth of Delhi, 1901-2001

Year	Total Population	Total Urban Population	Percent Urban Population	Decennial Growth (Absolute)	Decennial Growth (Percent)	Annual Exponential Growth Rate (Urban)
1901	4,05,819	2,14,115	52.76	—	—	—
1911	4,13,851	2,37,944	57.50	23,829	11.13	1.1
1921	4,88,452	3,04,420	62.32	66,476	27.94	2.5
1931	6,36,246	4,47,442	70.33	1,43,002	46.98	3.9
1941	9,17,939	6,95,686	75.79	2,48,244	55.48	4.4
1951	17,44,072	14,37,134	82.40	7,41,448	106.58	7.3
1961	26,58,612	23,59,408	88.75	9,22,274	64.17	5.0
1971	40,65,698	36,47,023	89.68	12,87,615	54.57	4.4
1981	62,20,406	57,68,200	92.73	21,21,177	58.16	4.6
1991	94,20,644	84,71,625	89.93	27,03,425	46.87	3.8
2001	1,37,82,976	1,28,19,761	93.01	43,48,136	51.33	4.1

Source: Census of India (2001: 15)

the same decade. Similarly, Delhi core in 1991-2001 grew at the rate of 3.09 percent, while Delhi periphery grew at the rate of 4.18 percent (Sivaramakrishnan, Kundu and Singh, 2005: 43). The data are important despite the fact that population bases of the periphery have been small and settlements such as NOIDA were new towns (Census of India, 2001). It is also important to note that 'pool of population remaining in rural and regional areas (including urban population in the regions) is still large enough to generate high rates of mega city growth through migration' (Jones, 2004: 127).

2.2 Assets, Liabilities and Income

Delhi indeed is a rich city state according to the debt and investment survey report prepared by the Directorate of Economics and Statistics (Government of the National Capital Territory of Delhi, 2006a). Based on the 59th round of National Sample Survey (State Sample) carried out in 2003, the survey found that a family in Delhi owns 2.4 times more assets than the average Indian and is six times less in debt. On average, every family in Delhi owns assets worth Rs.7.3 lakh as against the national average of Rs.3.07 lakh. However, everyone is not rich in Delhi. Nearly one third of the total households have assets of a value of less

than Rs.50,000 reflecting the sharp contrast in income levels and standard of life between the rich and the poor. Delhi is also rich when compared with all India average. Delhi ranked third in the country in respect of average value of assets (Rs.7.47 lakh) per household in urban areas after Jammu and Kashmir (Rs.10.67 lakh) and Kerala with Rs.7.62 lakh. On average a household owns assets worth Rs.7.47 lakh and Rs.7.14 lakh in urban and rural areas of Delhi as against the all India average of Rs.4.17 lakh and Rs.2.65 lakh respectively. Land accounted for 59 percent and buildings 29 percent of the total assets. Transport equipment (4.08 percent), durable assets (3.79 percent) and deposits 2.98 (percent) formed the other major asset components.

Distribution of assets across various groups is somewhat skewed though. While 31 percent of the total households have assets only valued at less than Rs.50, 000, thirty seven percent have assets between Rs.50, 000 to Rs.5 lakh. However, about 13 percent of the households have assets in the range of Rs.5-10 lakh, 14 percent in the range of Rs.10-30 lakh, three per cent between Rs.30-50 lakh and about 1.4 percent between Rs.50 lakh to one crore. Only 0.72 percent of Delhi's families were estimated to own assets worth

Rupees one crore or above. According to this survey, the self-employed people are the richest, having highest average value of assets of Rs.11.6 lakh as against Rs.5.07 lakh per family in the case of wage and salaried persons.

Out of the total loans transacted, 37.11 percent were institutional and the rest non-institutional in nature. In case of non-institutional category, about 47 percent loans were taken from relatives and 16 percent from professional institutions. About 76 percent of loan amount was taken to meet the household needs. This clearly shows some rise in consumerist tendencies of the Delhites.

But in general Delhi has few liabilities. The average amount of debt per family in the capital was Rs.1,366 as against the all India average of Rs.8,694. Debt per household was highest in the self-employed category (Rs.2,924) followed by wage or salaried persons (Rs.620). This probably shows that salaried middle class is the prime mover as far as consumption in the city is concerned. The debt assets ratio, which reflects the burden of debt of any particular group of household, was 0.12 in urban areas of Delhi, the lowest in the country. At the national level, it was 2.82.

Delhi has become richer even if we examine time series data. For example per capita income in Delhi has increased from Rs.44, 222 in 2001-2002 to Rs.51, 664 in 2003-2004 at current prices; and

the average value of assets per household increased from Rs.92, 000 in 1981 to Rs.2.84 lakh during 1991 and thereafter to Rs.7.47 lakh by 2002.

3. LEVERS OF ECONOMIC GROWTH

3.1 Growing Economy and Employment

Delhi has 45,45,234 total workers out of which only a small portion i.e. 2,27,718 are marginal workers. But the city has a staggering 67.18 percent of non-workers of the total workforce. Most of the workers pursue their jobs in urban Delhi and most of the non-workers are also located in urban Delhi. Over 14 lakh workers are engaged in the household industry (Government of the National Capital Territory of Delhi, 2004b: 17 and 37).

Provisional results of the Fifth Economic Census for Delhi were published in July 2006. It showed that there were 7,53,795 enterprises in the NCT Delhi in 2005. Out of this over 96 percent are located in urban areas and only 3.67 percent are located in rural areas. There has been substantial growth in the number of enterprises between the Fourth Economic Census 1998 and the Fifth Economic Census 2005 (Table 2). Average employment has increased from 5.10 to 5.41 workers per enterprise between 1998 to 2005. Delhi has 1.79 percent of total enterprises of the country with employment of 4.12 percent workers being employed by all enterprises in the

Table 2 Number of Enterprises under the Fourth Economic Census and the Fifth Economic Census

Rural/Urban	Sector of Economy	Fourth Economic Census, 1998	Fifth Economic Census, 2005	Percent Growth
Rural	Agriculture	786	3,011	-73.90
	Non-Agriculture	26,909	26,516	1.48
	Total	27,695	29,527	-6.20
Urban	Agriculture	4,542	4,122	10.19
	Non-Agriculture	7,21,558	6,52,203	10.63
	Total	7,26,100	6,56,325	10.63
Total of Delhi	Agriculture	5,328	7,133	-25.30
	Non-Agriculture	7,48,468	6,78,719	10.28
	Total	7,53,795	6,85,852	9.91

Source: Government of the National Capital Territory of Delhi (2006b: 8).

Table 3 Net State Domestic Product by Economic Activity at Current Prices (Rupees in Lakhs)

S. N.	Sector	Year		
Primary Sector		2001-2002	2002-2003	2003-2004
1.	Agriculture, Animal Husbandry, Forestry and Fishing	79,225	76,971	81,753
2.	Mining and Quarrying	317	319	322
Secondary Sector				
3.	Manufacturing	5,83,680	6,29,703	7,03,290
4.	Electricity, Gas and water Supply	22,904	718	783
5.	Construction	5,92,447	6,58,526	7,33,598
Tertiary Sector				
	trade, hotel and restaurants	13,99,388	14,91,381	16,89,735
	transport, storage and communication	5,71,881	6,70,004	8,23,364
	financing, insurance, real estate and business services	20,10,071	22,66,913	24,99,113
	community and social and personnel services	9,92,001	10,81,533	11,86,593
	Net State Domestic Product	62,51,944	68,76,068	77,18,551

Source: Government of the National Capital Territory of Delhi (2004a: 85).

country (Government of the National Capital Territory of Delhi, 2006b: 7, 11, and 15). Most of the jobs are being generated in the non-agriculture sectors.

The main economic lever remains the territory sector, which includes trade, hotels and restaurants, transport, storage and communication, financing, insurance, real estate and community and social services. The Government of the National Capital Territory of Delhi is planning to make Delhi as the service sector capital of the country (Table 3).

3.2   Transport Infrastructure

Transport infrastructure is the backbone of the city's economy because it enhances accessibility, which directly contributes to the accumulation of wealth. Faster movement of goods and people creates its own economies of scale leading to efficient overcoming of frictions of space. Comfortable and affordable movement of people forms a major part of the transport policy makers of any city and Delhi is no different. Since the last 50 years, Delhi has made various efforts to ensure that Delhites are able to travel comfortably at affordable prices. Till recently Delhi was serviced

only by buses being operated by Delhi Transport Corporation. But private bus operators in the early 1990s were also allowed to ferry passengers on the roads of Delhi. While private operators added to the inadequate number of buses and generated additional capacity, untrained drivers and lack of a regulator unleashed terror on the roads of Delhi, which continued for over a decade. Number of fatal accidents rose exponentially. Not only this, the cost of travel also increased as politician-business conglomerates in the guise of private operators continually demanded and secured rise in bus fares almost every year.

Then the city received the good news of being chosen as the venue for holding the Commonwealth Games 2010. Among other efforts to prepare the city for the mega sports event, a joint venture between the Government of the National Capital Territory of Delhi and Government of India was established to implement much delayed Delhi mass rapid transit system. Delhi Metro project is to be implemented by the new organizational entity called Delhi Metro Rail Corporation. As a consequence, the first phase comprising of over 60 km metro track has been completed in time and functioning well. All this

comes at cost of over Rs.11,000 crores for the first phase. The second phase of Delhi Metro is likely to be completed soon.

There is no doubt that a world class transport facility has been created. Trains are pollution free and run on time. Over five lakh people commute daily in a comfortable environment. Delhi Metro is a big money spinner also as its earnings have sharply risen. However, when such huge investments are being made from the public exchequer, the first and most important question to ask is who will benefit from this world class transport facility. David Harvey has long answered this question. He states: 'The cost, speed and capacity of the transport system relate directly to accumulation because of the impacts these have on the turnover time of capital. Investment and innovation in transport are therefore potentially productive for capital in general' (Harvey, 1981: 113; also see (Harvey, 2006: 100). The CEO of DMRC views that the Metro is meant for economic growth. 'Mobility is an important requirement for the economic growth of any city. Economic activities flourish in areas where accessibility is good and mobility fast. Thus urban transport infrastructure is the most important factor for the development of urban economy' (Sreedharan, 2006: 16). However, the National Urban Transport Policy, 2006 notes that one of its objectives is to encourage 'access to livelihoods, education, and other social needs, especially for the marginal segments of the urban population ...' (Ministry of Urban Development, 2006: 3). Therefore the issue of transport equity needs to be resolved.

3.3   Historical and Imperial Tourism

Delhi is a Metropolis of heritage. It represents the rise and fall of India during the last 1,500 years. Still older history of India all the way from Mahabharata times is build around and in Delhi. Within a few meters from wherever one is in Delhi, there is a monument that reminds the rise and fall of empires: Hindu, Buddhist, Moslem, and Christian. The forts, palaces, mosques, temples, churches, tombs and mausoleums, dot each and every corner of the city and tell boldly that Delhi can absorb not one but many shocks and 7return to its vibrant original self.

Delhi therefore is a host to a large number of monuments of historical and architectural significance including the Red Fort, Kutab Minar, India Gate, etc. Old Delhi itself presents the built form of the yesteryears. A large number of tourists throng onto the city every year and contribute greatly to city's economy and also help in sustaining a significant number of jobs.

4.   NEOLIBERAL EXCLUSION

While the city of Delhi experiences sustained economic growth, there is a large percent of population, which remains on the margins. One reason for this marginalization is the unabashed adoption of neoliberal policies adopted by the government over the last one and half decades. Neoliberalism turns every thing into commodities for transactions in the market, from physical provisions such as housing and infrastructure to culture, heritage, poetry and history. Let us first take up the physical aspect of the argument, which is the chief concern of urban and regional planning.

All of us know how physical and social infrastructure under neoliberal market environment gets privatized, apparently based on the alleged inefficiencies of the public sector. Even basic infrastructure, like roads, water, power and education, which were earlier not part of the market, is converted into tradable commodities in the hands of the private sector. This has serious consequences for the public in general and the poor in particular. This process of the shift of public assets from the public sector to the private sector allows access to only those users who could afford to pay for the services, and thus sets in exclusionary tendencies and production related bottlenecks for the majority working classes. The majority working classes or the proletariats could face congested public roads, whereas the 'affording classes' move efficiently on the privatized road networks without hindrance. The issue is not why the bourgeoisies move efficiently on the exclusive and privatized roads, the issue is also not whether the poor are excluded from these spaces because of their income poverty; the main issue is that this process of neoliberalization postpones quality public provision of basic services to all its citizens forever. This has disabling impact

on the abilities of the poor rather than the uncritically accepted view of the market empowering everyone. Procedural access is meaningless without citizens' ability to obtain access. Similar argument holds good even for other services such as provision of privatized power, potable water and education. In all cases not only disabilities of the poor are accentuated, abilities of the rich get a positive boost at the cost of public policy displacement.

Equally forcefully, culture is also being targeted and appropriated by the market for capital accumulation ends. A recent advertisement on the television by a giant telephone company shows its head reciting poetry of Ghalib, the famous Urdu poet. '*Dile nadaan tuje hua kiya hi, ziada profit banane ki dava kiya hi*'. Making more and more profit apparently seems to be the chief motive of the capitalist mode of production, the only difference being that now even poetry is being appropriated. Cultural and social relationships are being monetized too by the market. For example, another advertisement on the television shows a child helping the old lady carry vegetables to her house. When leaving, the young boy is given a rupee coin by the lady, which the boy takes to his father who seems to be attending a board meeting. The young boy tells his father that this is his first salary. But the voiceover remark is telling 'we know the value of your money'. Even childhood gets appropriated by the market. Our lifeworlds are truly being overwhelmed and dominated by the neoliberal markets.

Privatization of physical spaces and societal relationships also get embroiled in the neoliberal markets. National Geographic television channel showed a program pertaining to mobility in cities. The argument unfolds with highlighting vehicular congestion as the main reason for low mobility. The problem of congestion on the roads is tackled by making a case for the construction of separate and exclusive toll roads. Two types of road systems are visualized, normal roads with or without congestion depending on the time of the day, and roads with low or no congestion but with high tariffs. It is argued that if one's wife is pregnant and if one loves one's wife, one would certainly like to pay higher tariff and move on less congested roads to reach the hospital faster.

Rapped in the highest of human emotions 'love', this argument displaces and completely erodes the critical argument of provision of efficient public transport where there is very little need of the private vehicles with exclusive transport spaces intended to keep the urban poor inefficiently mobile forever.

Exclusionary spaces by the market under the neoliberal regime could be produced in different forms with diverse implications. Gated communities of the bourgeoisies are threateningly isolating and isolated, and exclusionary and protectionist. Gates have complex opening and closing times. Apart from the overarching physical design of these spaces such as gates and walls, these exclusionary regimes are sustained by the residents' welfare associations, the quasi legal private governing structures run with the overt state support. Gated communities could be viewed in two ways. One, these communities have isolated themselves from the outside world, which is more pronounced in the night than during the day. It obstructs the free movement of people and vehicles, old and children, men and women alike. This is the view that one gets from the outside. From inside, gated communities view themselves as encircled by people who make them physically and culturally unsafe and uncomfortable both during the day as well as the night. The crucial point however is that gated communities neither intend to dismantle these threatening spaces around them nor permanently displace people living in these spaces because of their indispensability in cleaning their utensils and toilets, washing their clothes and floors, painting their walls and brushing aside dust from their carpets. Even before they are ready to move, cheap labour is needed for manicuring their hands and pedicuring their feet, ironing their clothes and baby sitting, etc. The list is endless and works could get as arduous as possible with wages as low as possible and alienation from the work as complete as possible. Real exclusion is that there is no relation between quality and quantity of work and level of wages, the kind of alienation leading to low wages.

To sustain capital accumulation, the neoliberal markets continue to innovate relentlessly. One avenue gets replaced with yet another. Sadly even spaces of exclusion, such as squatters, have been

turned into 'spaces of spectacle' under neoliberalism. Squatters are frequented by the foreign tourists and misery, deprivation and dispossession is heightened to be photographed and researched for writing articles in the foreign newspapers. Of course there are groups ready to oppose this market adventurism through non-governmental activism, many times these movements themselves oiled by foreign funds or the state financial support, which, by the way, also supports neoliberalism.

These stories are narrated with the sole purpose of making one crucial point: we must train ourselves to critically understand spatial implications of neoliberal market dominance on our 'lifeworlds'. In these spaces also, understanding of the excluded people and their spatial implications are of paramount importance, if moral desire of inclusive planning and development by eradicating income and cultural poverty has to be fulfilled. We must also focus on the fact that spaces are not merely receiving changes made to them by markets and other institutions; these institutions also get transformed by interacting with people and spaces. This duality of relationship requires closer examination for assessing consequences of neoliberalism on spatial planning and design, and more importantly on the urban poor.

Economic consequences of neoliberal economic growth are clearly exclusionary. According to an economic survey of the Government of the National Capital Territory of Delhi, only 8.3 percent population of Delhi i.e. 1.14 million people live below poverty line. Understandably, this is only extremely income poor group of people. The same government survey also notes that there are 4.7 million people living in slums and squatter settlements (Government of the National Capital Territory of Delhi, 2002). Another study of Delhi Government further reveals that 3 million people lived in slums in 2003 (Government of the National Capital Territory of Delhi, 2004a). Whatever may be the accurate figure of the poor, this data imply that a majority of the people living in slums and squatter settlements are not income poor. This conclusion of the government may be correct in terms of poverty defined as minimum calorie intake, but larger groups living in slums and squatter settlements certainly could be considered

poor in respect of non-availability or lack of basic services such as water, sanitation services, education, and solid and liquid wastes' management because paucity of these services form the very basis for defining a certain area as slum or squatter settlement. Based on the above, it could be safely assumed that Delhi has at least 4 million or 30 percent poor people who have little or no access to basic services.

5. FUTURE IN PROMOTING INCLUSIVE PLANNING AND DEVELOPMENT

Common political rhetoric is that involvement of everyone in the prosperity of Delhi is a precursor to sustained buoyancy. Inclusive planning and growth requires that everyone have a share in the increasing wealth of the city. Rising income of the few may push up the average per capita and gross state income, but there are a large number of low income families who continue to remain on the economic and social margins. For example, there are nearly 4 million people still living in slums and squatters where conditions for human habitation are not exactly acceptable by any standards. In these areas, people do not have unhindered access to basic facilities such as decent housing, potable water, power, schools, local hospitals, etc. Delhi must therefore urgently address this problem of skewed economic growth. Large number of people staying on the margins could dampen economic growth in the long run. However, if the same people are properly educated and trained, they could productively contribute to the ongoing economic buoyancy of the city. This inclusive planning argument is couched in neoliberal rhetoric, which does not focus on structural changes that create spatial inequalities (see UN-Habitat, 2003, particularly chapter on inclusive planning).

That said, removing structural inequalities is not an easy task. Under the conditions of unbridgeable economic inequality and long standing religious and caste prejudices ingrained in the psyche of the people, lives of the poor run parallel to those of their richer neighbors without any point of meeting in the foreseeable future. I believe that by implementing the current Master Plan policies on low income housing, the poor may make marginal economic gains. However, social

integration may not be achieved solely through physical planning policies because that requires one to confront structures that create social inequalities of religion, culture and caste, which are not prone to physical determinism. Solely relying on physical interventions, I suspect, we may end up adding to the existing large army of, what some euphemistically call 'the service population'. We could however make a reasonably good beginning by focusing on equity in primary and secondary education, and tolerance of the differences of castes and religions along with equitable distribution of housing and land through statutory public policies. As Emily Talen has also pointed out that place vitality, economic health, social equity, and sustainability could make significant contribution to integration of different communities (Talen, 2006).

5.1 Dimensions of Inclusive Planning

No doubt, benefits of urban planning are generally unevenly distributed among areas and populations within cities. The articulate classes (richer and middle income groups) are able to benefit more from planning efforts involving provision of housing and utilities. The luxurious mansions and moderately constructed high income habitats not only contrast between them, there is even greater contrast between higher income habitats and lower incomes residential areas. Slums and squatters therefore are never far away from rich and middle class habitats. Physical proximity however is no guarantee of spatial integration of these areas. On the contrary, physical proximity accentuates segregation because of unbridgeable economic, social and physical differences.

However, inclusive urban planning intends to spread the net wider and promotes inclusion of the groups such as 'urban poor' by installing processes, which are capable of bringing about social transformations in terms of institutions and outcomes. Here interventions in the built environment are intended to benefit all citizens but with a focus that each household among the urban poor are provided with a bundle of 'primary goods' above a certain minimum threshold so that everyone could live a dignified life. While inclusive planning practice accepts a certain level of inequality in the distribution of land and properties

among the city dwellers, it intends to close this gap in the medium and long run.

The primary feature of inclusive urban planning is that it involves democratization of planning practice invoking principles of empowerment and emancipation of all citizens of a settlement or region. Needless to say that democratization warrants participation. But participation in planning decisions without empowerment is tokenism because of the very inability of such practices to bring about social transformations permitting changes in the nature of decisions benefiting intended groups, particularly the excluded groups.

Apart from its egalitarian nature, inclusive urban planning is also aimed at addressing the issues of understanding the questions of distribution of power within the society, planning organizations and the public policies. It presumes that power could reside in institutions; dominant ideologies only reinforce these norms. It is expected that inclusive urban planning does not allow any particular ideology to dominate the planning practice. Therefore, it tries to overcome the dualism between neoliberalism and socialism by keeping a check on dominant ideologies. Equity among social classes is promoted but the first concern remains with achieving provision at a certain level of threshold for all social classes.

Justice remains pivotal concern of inclusive urban planning. Needs of the poor citizens have priority over neoliberal capital accumulation without getting into the debate whether capitalism is superior to socialism. State may help the private sector but local governments would let the people know what is being offered by the private sector to the city and citizens in return. For example, urban renewal projects may be good for the city, but the citizens (particularly poor) must benefit from such projects in the form of employment, housing, new shopping areas, enhanced accessibility, etc.

By taking inclusive turn, planning practice also becomes more concerned with the issues of identity based on gender, caste, ethnicity and religion. How policies on built environment promote integration of different social classes remains one of the chief concerns of inclusive planning.

Exclusionary master plan and zonal plan policies are not encouraged at all. Efforts are made that criminalization does not get associated with certain kind of people living in certain kind of areas. Slums and squatters become more than 'physical improvement exercises' for the urban planners.

Inclusive cities may be vulnerable to various human and natural disasters, but these cities are not scared because the built environment in these cities is not divisive. Fewer gated communities and squatters dot such cities. Inclusive urban planning practice is at peace with itself and its citizens are peaceful.

6. CONCLUSIONS

Inclusive planning engenders transformative abilities in its citizens by promoting inclusion, which is effective at the level of structural change. In inclusive planning practice, economic injustices are addressed by economic policy measures and social injustices by policy social measures. At the same time planners understand that these two types of injustices are not reducible to one another (Fraser, 2000). Inclusive planning and development therefore promotes both economic and social justice for all its citizens not as rhetoric but through concrete policy regimes.

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SOCIO-ECONOMIC STATUS OF PARATRANSIT OPERATORS IN THE CITIES OF ASSAM

DR. M. ALI AHMED

Assistant Professor, Department of Architecture and Regional Planning, IIT Kharagpur, West Bengal

ABSTRACT

The socio-economic characteristics of paratransit operators in the cities of Assam have been investigated in this paper. Three cities of Assam namely Barpeta, Dibrugarh and Guwahati have been studies for detailed examination. Information was collected both from primary and secondary sources. Three types of paratransit modes – cycle rickshaws, auto rickshaws and taxis exists in the cities of Assam. Normally the economically weaker section of the society operates the paratransit vehicle. The cycle rickshaw pullers migrate to the urban area from the rural areas for their livelihood. The auto rickshaw operators are mainly permanent city dwellers and literate. Many of them are migrated from the nearby rural areas. The taxi operators are normally permanent resident of the city and won a vehicle themselves. The sensitivity of usage of paratransit modes with respect to the travel cost has been analyzed in this paper. The sensitivity analysis revealed that the socio-economic condition of the paratransit operators can be improved by increasing the fare of the modes and by providing relevant facilities for the operators.

1. INTRODUCTION

Paratransit modes are widely used in the cities of Assam. The unplanned development coupled with narrow and irregular street patterns limits the feasibility of conventional public transit systems in a majority of the cities in Assam. Inadequacy of public transit system, low levels of automobile ownership, unplanned narrow street systems combined with sparse population density have further increased the demand for paratransit in the cities of Assam.

The paratransit operations provide a large job opportunity for the people of Assam. Normally the economically weaker sections of the society operate the paratransit vehicles. Recently a large section of educated unemployed youths are engaged in paratransit operations, particularly auto rickshaw and taxi operations. Thus the paratransit operations in the cities are creating job opportunities in addition to providing transportation services to the urbanites.

In this paper the socio-economic characteristics of the paratransit operators have been discussed in the contest of three cities of Assam namely Barpeta, Dibrugarh and Guwahati. The cities have been selected on the basis of their usage of paratransit, physical extent and population. Barpeta is a small township with population of about 0.05 million. Cycle rickshaws are the predominant mode of public transport in this town. Dibrugarh with a population of about 0.13 million is the administrative headquarters of Dibrugarh district. Both cycle rickshaw and auto rickshaw play important roles in movement of people in the city. Guwahati, the capital of Assam, with a population of about 0.825 million, acts as the nodal center for the seven states of the northeastern region of India. Though city bus service plays a major role in urban passenger movement in Guwahati, the services rendered by paratransit modes is also significant. The cities have distinct characteristics in terms of usage of paratransit. In Guwahati paratransit modes mainly serve as feeder to regional transit terminals whereas the modes are operating at the city level in Barpeta and Dibrugarh serving all types of trips. They are also used for work trips in varying degrees in the cities of Assam. They are the only public transportation mode operating in the fringe areas of the cities.

2. SURVEYS AND DATA COLLECTION

Paratransit operators' survey was conducted in addition to the secondary sources of information collected from different government offices and organizations for this study. The number of cycle rickshaw operators surveyed was 30 in Barpeta, 40 in Dibrugarh and 40 in Guwahati. Similarly, number of auto rickshaw operators interviewed was 6 in Barpeta, 40 in Dibrugarh and 40 in Guwahati. Taxi operators were also interviewed: 5 in Barpeta, 10 in Dibrugarh and 10 in Guwahati. Owing to resource and time limitations, it has been necessary to restrict the sample size during primary surveys. However, efforts have been made to collect representative samples as far as practicable.

Paratransit operators' survey was carried out to understand the socio-economic status of the paratransit operators, performance and some of the techno-economic characteristics of paratransit vehicles. The survey was conducted at the parking lots and garages when the operators were resting or waiting for passengers. The questionnaire was prepared keeping the objective of the survey in view and the questions were simple and respondents were asked in the form of 'yes' or 'no' so that the respondents can reply to the queries very easily. The questions were put to the operators in local language and the investigator recorded the feedback. The questionnaire contained 9 questions. Questions 1 to 4 are about the location where the vehicle is parked and about the ownership of the vehicle. Question 5 contains 13 queries about the performance and techno-economic characteristics of the vehicle. Question 6 contains 3 queries regarding the facilities available for the vehicle and the operator. Question 7 aims at evaluating the type of service provided by the paratransit vehicles. Question 8 attempts to understand the socio-cultural background of the

paratransit operators. Question 9 was about the monthly income of the operator. A 'no response' option was also kept in this question. The overall responses from the operators' survey were positive and encouraging.

3. PARATRANSIT IN THE CITIES OF ASSAM

Three types of paratransit modes are operating in the cities of Assam for urban passenger transportation. These are discussed in the following paragraphs.

Two-seated cycle rickshaw, 2.85m x 1.20m x 1.70m in size, is found in all urban areas of Assam. Cycle rickshaw is predominant mode of public transportation in the smaller urban areas. It is equally popular in the larger urban areas and caters to the short distance trips (trip lengths of about 2 kms or less are assumed to be short distance trips). In the hilly cities like Shillong, Aizwal, and Jowai, cycle rickshaw can not operate because of its grade limitations. The number of cycle rickshaws operating in Barpeta, Dibrugarh and

Table 1 Socio-Economic Characteristic of Cycle Rickshaw Operators

Items		Barpeta	Dibrugarh	Guwahati
Average age of the operator (in years)		29	31	30
Average hours of operation (in hours)		8.23	8.25	8.35
Average monthly income of the operators (in rupees)		2,300/-	3,225/-	3,700/-
Vehicular Ownership	Own Vehicle (%)	7	20	20
	Vehicle on leased (%)	93	80	80
	Average leased amount per day (in rupees)	14/-	15/-	20/-
Residential Status	Permanent Residence (%)	100	30	15
	Migrated from other place (%)	0	70	85
	Staying alone (%)	0	15	62
	Staying with family (%)	100	85	38
	Stay in own house (%)	100	35	20
	Stay in rented house (%)	0	65	80
	Average rent per month (in rupees)	-	200/-	170/-
	Number of family members	5.6	3.93	4.55
Educational Qualification	Illiterate (%)	80	60	73
	Under Matric (%)	20	40	27
	Matriculate (%)	0	0	0
	Under Graduate (%)	0	0	0
	Graduate (%)	0	0	0
	Post Graduate (%)	0	0	0

Source: Primary Survey conducted by the researcher, 2001

Guwahati are 1,200, 2,500 and 16,900 respectively. It is also found that about 80 percent of the cycle rickshaws are operated on lease and the operators themselves owned only 20 percent of the vehicles (Table 1). Trips served by cycle rickshaws in the cities of Assam are - short distance trips for door-to-door service, trips confined to central areas, shopping trips and short distance socio-cultural trips, short distance work trips particularly for women, who prefer to travel by cycle rickshaw, feeder service to and from other transit services with luggage and school trips particularly at the elementary standard.

Automated three-wheeler vehicles (auto rickshaws) carrying three (2.55m x 1.33m x 1.68m in size) to six (3.50m x 1.49m x 1.83m in size) passengers are found in the cities of Assam. This mode is widely used between trip lengths ranging from 3 kms to 10 kms. Auto rickshaws are normally used for feeder trips to railway stations, bus terminals and airport. The mode is also used for shopping trips, social visits, recreational trips and some other specialized trips. Auto rickshaws are operated for door-to-door movement as well as for shared travel service. In Dibrugarh, the mode is used for shared travel mode in addition to door-to-door service. In Guwahati, the mode is mainly used for door-door services but in some areas it is also used as a shared travel mode. In Barpeta, the mode is not so popular as in Dibrugarh and Guwahati. There are 12,401 and 10,352 number of auto rickshaws operating in the cities of Barpeta, Dibrugarh and Guwahati respectively. Important trips that are being served by auto rickshaw in the cities of Assam are feeder services to regional transit terminals, door-to-door services and fixed route shared services.

Taxi service is not popular in the cities of Assam because of its higher cost of operation. It requires larger population base for its existence. The usage of taxi increases with the city size. Auto rickshaws in smaller cities are substituting the taxi services. Taxis are used for specialized trips such as feeder trips to airport and railway station, trips made by tourists, long trips made for movement of patients and elderly persons and some occasional trips. The number of registered taxis operating in the districts of Barpeta, Dibrugarh and Guwahati are 5, 30 and 2,196 respectively. It was really difficult to identify the taxis on the roads, as they were similar to the private cars. The only difference was the color of the number plate of the vehicles.

4. PARATRANSIT OPERATORS

Normally the economically weaker sections of the society operate paratransit vehicles. Cycle rickshaw pullers migrate to urban area from rural areas for their livelihood. Auto rickshaw operators are mainly permanent city dwellers and literate. A considerable section of unemployed youth is employed in auto rickshaw operation.

Paratransit operators' survey was conducted in all the three cities to understand the socio-economic characteristics of the operators. The survey results are summarized and discussed in the following paragraphs.

4.1 Cycle Rickshaw Operators

Socio-economic characteristics of cycle rickshaw pullers are indicated in the Table 1. Cycle rickshaw pullers in general can not afford to own a vehicle and they generally take these vehicles on lease from owners. It is found that 93 percent cycle rickshaws in Barpeta and 80 percent in Dibrugarh and Guwahati are on lease. Leased rate of Rs. 14 per day, Rs. 15 per day and Rs. 20 per day prevailed in Barpeta, Dibrugarh and Guwahati respectively. The rickshaw puller has to do the minor repairs whereas the major maintenance cost is borne by the owner. The pullers generally operate their vehicles for about 8 hours a day with two and half hours rest in the midday. It is observed that the average earnings of the pullers per month are about Rs. 2,300, Rs. 3,225 and Rs. 3,700 in Barpeta, Dibrugarh and Guwahati respectively.

Most of the cycle rickshaw pullers in Barpeta are permanent residents of villages around the town. They come to work in the morning and return home at the end of the day. It is seen that about 70 percent of the pullers in Dibrugarh and 85 percent in Guwahati have migrated to the cities from others parts of the state and the country. They usually come alone and stay in rented house in groups near the owner of their vehicle. Although the average family size of the pullers is found to be about 4.5 members, the family members do

not stay with him in the city. About 70 percent of the pullers are illiterate whereas the remaining 30 percent are school dropouts.

4.2 Auto Rickshaw Operators

Auto rickshaw operators are better off compared with the cycle rickshaw pullers. Most of the auto rickshaw operators in Barpeta and Dibrugarh are permanent residents of the city staying with family in their own house. In Guwahati only 50 percent of the operators are permanent residents of the city and the remaining half have migrated to the city for their livelihood from different parts of the state particularly from the nearby districts. Most of the migrant operators do not own vehicles and they operate the auto rickshaws on lease. They operate the vehicles at an average of 8 hours a day with midday rest of about two and half hours. Sometimes different operators operate the same auto rickshaw in Guwahati in two different shifts. The owner may operate in one shift and the vehicle is given on lease for the other shift. Average monthly income of operators is found to be Rs.

3,500, Rs. 4,860 and Rs. 5,500 in Barpeta, Dibrugarh and Guwahati respectively.

Auto rickshaw operators are normally literate. About 70 percent of the operators are matriculates. Five percent of the operators in Dibrugarh and 2 percent in Guwahati were found to be graduates. It was also learnt during the survey that there are some postgraduate unemployed youths operating auto rickshaws in the city. Many of the auto rickshaw operators do not have driving license. All of them were self trained drivers without any formal driving training. The socio-economic characteristics of auto rickshaw operators are summarized in Table 2.

4.3 Taxi Operators

Economic condition of taxi operators was better compared to the auto rickshaw and cycle rickshaw operators. Their monthly incomes were found to be about Rs. 5,000 in Barpeta, Rs. 5,500 in Dibrugarh and Rs. 6,500 in Guwahati. Most of the

Table 2 Socio-Economic Characteristics of Auto Rickshaw Operators

Items		Barpeta	Dibrugarh	Guwahati
Average age of the operator (in years)		35	30	31
Average hours of operation (in hours)		8.67	8.13	8.63
Average monthly income of the operators (in rupees)		3,500/-	4,860/-	5,500/-
Vehicular Ownership	Own Vehicle (%)	100	85	45
	Vehicle on leased (%)	0	15	55
Residential Status	Permanent Residence (%)	100	85	50
	Migrated from other place (%)	0	15	50
	Staying alone (%)	0	0	35
	Staying with family (%)	100	100	65
	Stay in own house (%)	100	78	48
	Stay in rented house (%)	0	22	52
	Average rent per month (in rupees)	-	400/-	285/-
	Number of family members	6.00	4.73	4.53
Educational Qualification	Illiterate (%)	0	10	0
	Under Matric (%)	67	15	28
	Matriculate (%)	33	28	43
	Under Graduate (%)	0	42	27
	Graduate (%)	0	5	2
	Post Graduate (%)	0	0	0
Driving License Status	Have Driving License (%)	100	100	100
	Self-learning (%)	100	100	100
	Trained by driving school (%)	0	0	0

Source: Primary Survey conducted by the researcher, 2001

Table 3 Socio-Economic Characteristics of Taxi Operators

Items		Barpeta	Dibrugarh	Guwahati
Average age of the operator (in years)		39	35	33
Average hours of operation (in hours)		10	9.5	9
Average monthly income of the operators (in rupees)		4,900/-	5,490/-	6,500/-
Vehicular Ownership	Own Vehicle (%)	100	95	85
	Vehicle on leased (%)	0	5	15
Residential Status	Permanent Residence (%)	100	95	86
	Migrated from other place (%)	0	5	14
	Staying alone (%)	0	0	25
	Staying with family (%)	100	100	75
	Stay in own house (%)	100	85	65
	Stay in rented house (%)	0	15	35
	Average rent per month (in rupees)	-	500/-	450/-
	Number of family members	6.00	4.50	4.38
Educational Qualification	Illiterate (%)	0	0	0
	Under Matric (%)	60	48	32
	Matriculate (%)	40	28	45
	Under Graduate (%)	0	24	21
	Graduate (%)	0	0	2
	Post Graduate (%)	0	0	0
Driving License Status	Have Driving License (%)	100	100	100
	Self-learning (%)	100	100	99
	Trained by driving school (%)	0	0	1

Source: Primary Survey conducted by the researcher, 2001

taxi operators were permanent residents of the respective cities owning a vehicle themselves. All the taxi operators were found to be literate and many of were matriculate. Although all of them said to have a valid driving license, none of them were trained from an authorized driving school. Socio-economic characteristics of taxi operators are indicated in Table 3.

5. EARNINGS OF PARATRANSIT OPERATORS

Average monthly earnings of different paratransit operators are indicated in Table 1, 2 and 3 and have been discussed above. In this section I try to evaluate the possibility of enhancing the income of the operators by increasing the fare of the paratransit modes. It is observed that the minimum fare of cycle rickshaw is about Rs.2 to Rs.3 per km for first km and thereafter Rs.2 per km for subsequent distance travelled in all the cities under this study. Similarly auto rickshaw operators charge a minimum of Rs.20 for the first km and

Rs.10 per km for the subsequent distance travelled.

Usage of the paratransit modes (amongst all the available modes in the cities under consideration) was studied by using a multinomial logit model. Eight variables such as trip length, travel cost, travel time, number of person in group, amount of luggage carried, comfort, reliability and safety were used in the model to estimate the usage of paratransit modes. The sensitivity of usage of paratransit modes with respect to the travel cost is being analyzed in this study. The sensitivity of usage of cycle rickshaw and auto rickshaw with the increase in travel cost (fare) of the modes are indicated in Fig. 1 and 2. The average travel cost in a city for a paratransit mode is assumed to be the base value. Subsequently, the travel cost of the mode is increased at the rate of 5 percent and up to 50 percent over the base value.

It is observed that the usage of cycle rickshaws is marginally decreased with the increase in travel cost in all the three cities (Fig. 1). With 50 percent

increase in travel costs, the usage of cycle rickshaw is reduced only by 4.39 percent in Barpeta and about 0.5 percent in Dibrugarh and Guwahati. It indicates that even if the fare of cycle rickshaw is increased by 50 percent in the cities under consideration, the percentage of the mode users will marginally reduce. Subsequently the earnings of the cycle rickshaw operators will be increased by about 50 percent.

It is observed from Fig. 2 that the percentage reduction in auto rickshaw users varies considerably in the cities with the increase in auto rickshaw fare. With 50 percent increase in travel cost, the usage of auto rickshaw decreases considerably in Barpeta (from 12.22 percent to 3.82 percent). But the reduction in users is nominal in Dibrugarh (from 61.50 percent to 55.10 percent) and Guwahati (from 13.08 percent to

Fig. 1 Sensitivity of Cycle Rickshaw Use to Travel Cost
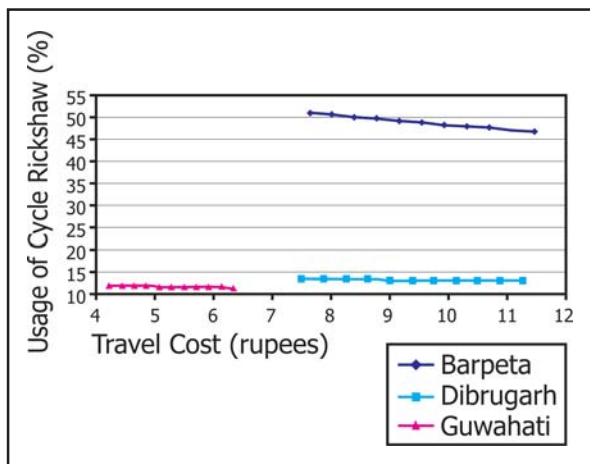
Fig. 2 Sensitivity of Auto Rickshaw Use to Travel Cost
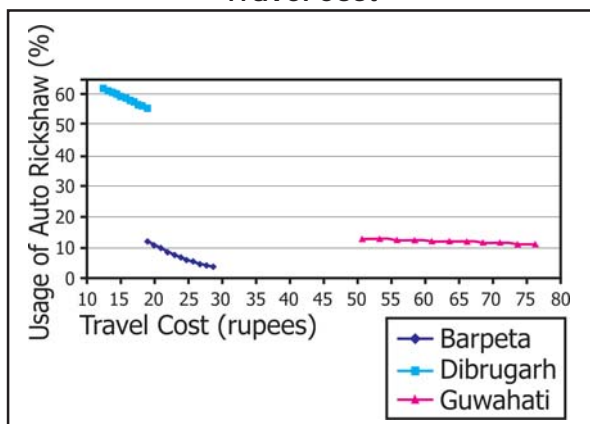
11.22 percent). As such the travel cost of auto rickshaw should not be increased uniformly in all the cities but a city specific increase may be recommended to increase the earnings of the operators.

Due to lack of sufficient data, the sensitivity analysis for taxi users could not be performed. However, it is understood from the field survey that slight increase in travel cost will not affect the taxi users in Guwahati significantly. But there should not be an increase in taxi fare in Barpeta and Dibrugarh presently.

6. FACILITIES FOR THE OPERATORS AND THE VEHICLE

Supporting facilities for the paratransit operators were almost zero. Paratransit vehicles were found to be parked near the activities where the demand for the mode was high. In general parking lots are unorganized and parking within them is haphazard. Municipalities do specify locations for parking of paratransit vehicles, but they are insignificant compared to the requirement. Most of the vehicles are parked on the side of the busy streets making the narrow street even narrower. It is observed that most of the paratransit vehicles are parked near retail markets, public bus stands, railway stations, hospitals, theatres, important government offices and important public places. Parking lots were not provided with the basic amenities such as toilets, garages, eating places, telephones, filling stations etc.

7. RECOMMENDATIONS

The following recommendations are made on the basis of the findings of the study and to improve the facilities and socio-economic condition of the paratransit operators:

- Paratransit operators in the cities of Assam can be mainly placed in unorganized sector. The local authority should form an independent body to look after the various issues related to paratransit operations' management such as amount of leased rent of the paratransit vehicles, their fare structure, operation zone and route selection, parking area management, etc.

- As the paratransit (particularly cycle rickshaw) operators are to pay a good sum of their hard

earned income as rent to the owners of their leased vehicles, the local authority with the help of NGOs, should arrange soft loans through financial institutions for such paratransit operators so that they can purchase vehicles for themselves. Subsequently, the paratransit operators can refund the loan amount over years.

- Cycle rickshaw operators are normally poor and migrated to urban areas for livelihood. Normally they reside in slum areas of the city where the accommodation is very cheap but crammed and unhygienic. Proper national housing scheme can be implemented for accommodating these people within their affordable limits.

- Paratransit operators are found to have learnt driving themselves without proper training in the formal driving school. They do not have much knowledge of traffic rules and regulations, traffic sign, signal, etc. Normally they are found to drive recklessly and violate traffic rules. Paratransit operators are found to be directly or indirectly involved in most of the traffic accidents in the urban areas in Assam. As such, sufficient driving schools should be established to train the existing operators as well as the new operators. Strict and compulsory driving tests should be conducted by District Transport Authority before issuing driving licenses to the aspirant operators. Same procedure may be followed to renew the driving licenses of the existing operators. Special workshops, seminars, lectures may be conducted to create awareness about traffic rules and regulations, etc; for the paratransit operators.

- Fares of cycle rickshaws may be increased by 50 percent in all the three cities under consideration. Auto rickshaw fares may be increased by 50 percent in Guwahati, 30 percent in Dibrugarh and 10 percent in Barpeta. In the near future, taxi fare should not be increased in Barpeta and Dibrugarh but there may be 10 percent increase in Guwahati. This measure will definitely increase the earnings of the paratransit operators without reducing the number of users.

8. CONCLUSIONS

This study has shown that paratransit operators are mainly from the economically weaker sections of the society. Many of them have been migrated from the nearby rural areas in search of livelihoods. In general, they do not own paratransit vehicles but they hire on leasehold basis (daily or monthly). Motorized paratransit are mainly operated by city dwellers, many of them own the vehicle themselves. As a whole the paratransit operations serve the society in two folds: first they serve as the carriers for urbanites and secondly they generate large number of job opportunities for the urbanites. Earnings of paratransit operators may be increased by increasing the fares of the modes and thereby operators' socio-economic condition may be improved. Facilities related to paratransit operations as parking places, garages, and toilets at parking lots, telephone at parking lots, eating places, etc; have to be provided to make the service more easy and comfortable. Providing a control room with telephone facilities at the parking lots may easily provide 'dial-a-paratransit-ride' concept in the urban areas under consideration.

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CHANGING HOUSING TYPES AND THEIR IMPACT ON URBAN DESIGN: A CASE STUDY OF PUNE CITY

PARAG GOVARDHAN NARKHEDE

Lecturer, BKPS College of Architecture, Pune

ABSTRACT

Housing types play a vital role in defining a character of city. Housing form affects the quality of urban aesthetics and urban design extensively. Changing housing types also change the character of city. Characteristics of housing types in Pune have undergone many changes from seventeenth century up till today. Housing types have been changed not only in terms of exteriors but also in terms of planning. Housing is a continuous process and changes with time. Not only these factors but also technological developments are responsible for changes in the character of housing. This paper discusses the relationship of changes in housing types, its influence on urban character of the Pune city and reasons thereof.

1. INTRODUCTION

There are various kinds of buildings in a city. They vary according to their use and form. Most of the buildings in a city are under residential use. As these residential buildings belong to different periods and societies, they influence the character of a city over a period of time. Pune city is a good example to study this aspect as it has a history of almost 900 years and has undergone many changes in terms of its architecture and planning of houses.

2 STUDY OF HOUSING TYPES IN PUNE: UPTO 1604 A.D.

Pune city was a hamlet in 613 A.D. consisting of about fifteen huts. Probably, Pune was a small village situated on a high ground, slightly away from the Mutha River. Location of oldest temples - Narayaneshwar, Puneshwar, Kedareshwar and Kasaba Ganapati suggest that the original nucleus was at some distance from the river Mutha. The houses of the earliest '*Patils*' and '*Watandars*' of Pune, were probably the simple individual dwelling units constructed of the building materials like mud and kutcha bricks with slightly sloping and flats roofs.

From 1100 A.D. to 1290 A.D. Pune, city was under Yadavas' rule. In the year of 1294 A.D. Allauddin Khilji from Delhi invaded Pune city and took away southern Maharashtra from Yadavas. And from 1294 A.D. Pune city came under the Muslim rule. In this era Pune was known as 'Punwadi' or 'Punewadi'. The two temples of Narayaneshwar and Puneshwar were converted to Muslim Shrines or *Darghas* The fort of Mutha River was used as military base. The settlement was fortified and a mud wall was built around the town

Upto 1604 the period Pune came under the Muslim rule of 'Saranjamshahi' or feudalism. An Arab called Mir constructed 'Killsae Hissar' near Mutha River, where Hindus were not allowed to stay inside the walled area or the Juna Kot. It was a rectangular space within which lived the garrison and a few Muslim villagers. The Hindu cultivators, traders, village officials and Brahmins lived outside the fortification. Thus upto 1604, housing of Hindu society was concentrated around Killae Hissar under rulers residing inside the Fort. All housing units inhabited by Hindu villagers were probably individual dwellings with single storey, load bearing and constructed of mud or *Gandi-Mati* having flat roofs.

During 1200-1600 the city of Pune was just beginning to take a shape of a town evolving out of a small hamlet of Zarokhas or smaller wooden windows with and without shutters is also a feature of those days housing types. The materials like stone and *Gandi-Mati* or Mud and *Kutcha* brick had strong building material together buildings were monotonous as far as their form is concerned. The entrances and doorways were made of wood and had extra strength and durability. Housing had simple rectangular form with flat or slightly sloping roofs. They were normally single storey and load bearing

3. HOUSING TYPES IN PUNE: 1604 A.D. TO 1713 A.D.

3.1 Political Influence

The town even in its initial stages of growth was a victim of conflicts between the ruling dynasties. In 1631, Murar Jagdeo (Adilshahi Sardar) attacked Pune and destructed houses, wadas town wall, etc. In 1637, the dilapidated town came into final possession of Shahaji. In 1637, the city consisted of four wards, Kasaba – the original town wall within the old town wall, Murtazabad the present Shaniwar founded by Murtaza Nizam Shah, Malkapur – the present Raviwar and Somwar Peths (founded by Malik Amber.) The Shaniwar ward was located along the river banks. The Raviwar and Somwar wards were located along the two banks of Nazari while the Kasaba ward had access to both the Mutha River and Nazari.

The Kasaba, as it was inhabited by the ruling family of Bhonsles, became the focal point of urban landscape of Pune during 1660 – 1663. In 1664, Chatrapati Shivaji shifted his capital to Rajgadh and resided there only. Thus it brought a change in housing types in terms of its massiveness and external appearance, etc. Prohibition to *Tatbandi* also led to integration of housing areas of different classes of people together.

3.2 Socio – Economical Impact

During the first half of seventeenth century, the conditions were unstable due to the conflicts between ruling dynasties. The occupation of Pune by the Muslim rulers did not promote the growth of the town. It gave rise to religious edifices like mosques and changed the demographic structure of the population in which the Muslim population increased progressively.

When the city came under the rule of Marathas, the status of Pune again began to take a different shape. Agriculture was encouraged in the surrounding land. Rent free land for five years was given to cultivators. Law and order was gradually established and everything possible was done to resettle the city. During the Marathas Period, housing areas were established without any barriers like *tatbandi* or town wall. The people from all classes and castes lived close to one another.

Similarly social amenities were increased. Another ward was added in 1703 when Aurangjeb founded the Mohiyabad ward, the present Budhawar. Thus the area of town also increased.

During the weakening of Mogul Empire in the late 17th and early 18th century, the control over the town came to be disputed. The Moguls and Marathas, both claimed control over the town, however, the city suffered under dual control. From 1713 onwards the whole Maratha Empire came under the Peshawas rule and in 1720, Bajirao - I, during his rule, the city grew in terms of area and population.

3.3 Architecture And Technology

The 'Wada' type housing began to take shape under the Marathas. Material used to build houses or Wadas during the Maratha era were chira for the plinth and flat bricks for the walls. Chira is a kind of laterite stone, which is durable and strong enough to bear load of walls and roofs. In the second half of the century, the flat roofs (Dhabe) were supported over horizontal timber members further supported by brick walls and stone foundation. Walls had thickness of about three feet at its maximum. Most of the houses were concentrated in wards like Raviwar and Budhawar wards. Windows were made at lower height from the floor level with wooden frames fixed in the brick walls. Windows had larger dimension and shutters of wood. Openings had no bars in between the span.

Normally the plinths were higher upto 7-10 feet constructed in stone or chira masonry interlocking type or with mortar of *gandi-mati*. Houses situated nearby and along the river side had higher plinths while those away from water streams had lower level plinths. Buildings were not higher than ground and two storeys above, with floor to floor height of about 12 to 15 feet.

4. HOUSING TYPES IN PUNE: 1713 A.D. TO 1818 A.D.

4.1 Political Influence

Pune was made the capital during the Peshawas Period. This was time of economic prosperity as the Peshawas began to reside permanently in the

town and the town came to possess all the prestige and advantages of the capital. In 1730, the Peshwas Bajirao-I built a palace called Shaniwar Wada for himself.

After 1950, Pune city expanded considerably, mainly to the south of the original kasaba. Nagzari stream on the east prevented further growth due to difficulties in communication. But the city developed towards west as the present Ambil Odha was diverted from Parvati by constricting a dam near Parvati Lake. After the War of Panipat in 1761 A.D., the city was burnt and rampaged by Nizam in 1763 A.D., and was reduced to insignificance.

Rise of the British rule in 1786 and the declining of the Peshawas in the early nineteenth century made conditions unstable for the rulers of the city, but the city was still fairly prosperous. During this time, the streets were very narrow. Houses were often three or four storey high but without symmetry. They differed from one another in shape or color. Due to disturbed political situation, the development of city remained stagnant. The Peshawa King, Bajirao – II thought of beautifying the city and built four new palaces.

4.2　Socio – Economical Impact

After 1720 A.D. during the Peshawas rule, many traders and artisans came to the city and settled permanently and with the available royal patronage they developed industries. A period of comparative peace and stability led to the building of wadas. Social amenities gradually increased and improved. The town by now (1735) had grown to a city with six wards – Kasaba, Raviwar, Shaniwar, Budhawar, Mangalwar and Somwar. A new and prominent element in the morphology of the town that appeared at this time was Royal Palace, the castle of Shaniwarwada, which in due course became the centre of political as well as socio – economic life of the town.

The influx of artisans and craftsmen continued till 1734. To Shukrawar ward Hindus, who first settled here occupied the central wards like Kasaba, Shaniwar and Budhawar. Muslims resided in new eastern wards. To accommodate the increasing population, the town grew towards its east beyond Nagzari bringing about the development of present Bhavani ward. The expansion to the south and west resulted in the best laid out parts of the town, the present Sadashiv ward which was then largest ward in city. The city grew and had a population of about 150,000 in 1780. To satisfy growing water needs, Rasta aqueduct was constructed. The Katraj aqueduct was already completed in 1755.

At the close of 18th century, the city had grown considerably. Proper drainage system was provided and underground masonry drains were constructed for the first time in 1782. Around 1802 Fadanvis aqueduct was constructed. All these amenities and services led to boost for housing development. All the prime locations for housing were acquired by Brahmins. Although immigrants of various castes, communities with different languages came to Pune, it was essentially the stronghold of Brahmins who controlled the Government and held all the important civil and military posts.

4.3　Architecture and Technology

Pune city came under stable administration of the Peshawas in 1713. A period of peace and stability led to the building of new palaces or wadas in Pune. As far as the architectural character is concerned, housing types changed considerably in terms of size, exteriors and internal elements. Wada type housing units with large enclosures had more than one entrance way. Walls were quiet thick. The lower portion of walls was constructed in bricks. Wooden frame work is another element which was developed. Due to framed structure number of floors in main residential building of wada enclosure also increased.

The wadas constructed in the second half of eighteenth century shows composition of two styles – Peshawas and British character. Budhawar Wada which was constructed by Bajirao-II in 1810 is the example of composite architectural style. It has a tower with pyramidal roof top and a watch on its sides. The wadas of Peshwas era consist of beautiful carvings on supporting columns and decorated brackets. Corbelling in bricks was done

at floor to floor levels externally. The roofs were of both types flat supported over timber joints and slant or sloping covered with country tiles. In royal houses like Shaniwar Wada, there were paintings on the walls. The enclosure walls or tat were higher than 8-10 m. These were constructed in stone masonry. The shutters of huge entranceways were made of wooden members thicker than even 60 cm. The bricks used for construction were of dimensions 7" X 12" X 2".

4.4 Examples of Housing

Wada is a form of domestic architecture emerged in specific response to the prevailing social characteristic of seventeenth and eighteenth centuries. Wadas were not merely residences but often contained administrative offices entrusted. Prominent wadas were:

- Shaniwar Wada

- Budhawar Wada

- Vishram Baug wada

- Raste wada

- Natu Wada

- Naik Wada

- Puranadre Wada

4.5 Typical Character of Houses

Situated on deep, narrow plots, the wadas are generally two or three storey high structures. The rooms look out onto the court yards. Design of wada followed a specific concept in respect of the location of particular areas such as official, private for cooking, dining or worship. A huge gateway flanked by 'dewadis' meant for the gate – keeper gave entry to the wada. A smaller dindi darwaza within a larger gateway was normally used by all. The entire gate opened only on ceremonial occasions.

The entrance led to the main hall to durbar where activities ranged from entering guests for carrying out official functions related to the profession of the owners. The durbar led to the first courtyard in case of two or three courtyard houses. Common characteristics of these courtyards were

in the open verandah like spaces called sopa. Normally wadas rarely exceeded 20 m of street frontage. The depth however ranged from 80-100 m. A composite structure of timber frame and masonry arranged about modest courtyards formed the basic vocabulary of this house type. The timber frame carried the load of the intermediate floors and about a meter thick on the ground floor, built in the locally available basalt stone, their thickness reducing on upper floors. Brick used for walls on upper floors was of a flatter variety compared to those available today. The older wadas were roofed in plot or tiles. Partition walls were traditionally of wattle usually plastered with lime or cow- dung.

The fronts of wadas were often ornately carved with a stylized peacocks, parrots or pigeons as later additions on exposed beam ends. Timber brackets supporting balconies were also carved in themes of exotic flora and fauna. The decorative Tirana or foiled arch at the entrance was protection against evil spirits and hence located at critical threshold. All these features and typical character of old and native housing types are required to be conserved to preserve the original character of Pune city.

5. HOUSING TYPES IN PUNE: 1818 A.D. TO 1947 A.D.

5.1 Political Influence

From 1818 the British rule began in Pune. The British paid more attention towards the cantonments and virtually neglected the city. In the British era, the city depended for its growth on the needs of the royal court and army. The British developed cantonments at Kirkee and Pune. They neglected the old core of the city during the first few years, the city was presenting dismal and impoverished appearance.

5.2 Development of Cantonments

Pune cantonment: By 1820, societal peace and political tranquility was restored. After this Pune Cantonment began to get developed on the sites of four villages Ghorpade, Wanowari, Mali and Mungeri. The Cantonment with its permanent troops ensured protection to the city and latter

started growing fast. The Cantonment came into existence primarily to serve one purpose that of the British military. In 1922, Koregaon Park Estate, a part of the Pune Cantonment came to be developed between the railway line, which was constructed in 1856 to connect Pune with Mumbai and Chennai on South and Mula-Mutha River on the north. The area developed largely by some princely families but leading business houses of the western type turned this into annex of the Pune cantonment. Even today the area represents an upper class residence.

Kirkee cantonment: Kirkee cantonment grew almost simultaneously with the Pune cantonment. The Kirkee Cantonment was founded in 1822 and the Ammunition Factory was built in 1869 on the site of old Kirkee village. Apart from a large number of officers and soldiers residing at Kirkee, a large number of officials and employees of Arsenal and Factory also made it their permanent place of living. Compared to the city the cantonment was better planned on an orderly basis and avoided over crowding.

Late during the 19th century, efforts were made to improve the conditions of Pune city. Redevelopment of existing areas was given priority under British policies. They established a municipality in 1850. Improvement of water supply, drainage and sewerage systems was undertaken by this municipal government body. In 1851, there were in all 10,245 inhabited houses having a population of 73,209 giving an average of seven persons per house. The 1851 Census reveals that there were 18 miles of roads. All these were narrow short and interrupted. By 1882, the city had 32 miles of modern metalled roads.

Growth of population in the second half of the 19th century allowed the establishment of a permanent market. The first market place was in Kasaba peth. Afterwards, this market was shifted to Shukrawar Peth and this ward started developing rapidly.

The opening years of 20th century were marked by the terrible plague epidemic, during this period also came the First World War which diverted all the attention to the War rather than to the growth of city. The Post War years, however, brought some relief. A number of schemes concerning basic amenities were taken up. The introduction of an underground drainage scheme in 1919, introduction of electricity in 1920 and construction of important arterial roads like the Laxmi Road and Tilak Road in 1925 considerably influenced the growth of city positively.

Political stability and improvement in law and order situation during the British period led to further population increase. The city which was already overcrowded became more congested and took a leap onto the other bank of river Mutha. The old concept of communal neighborhood was put at the backburner. All communities which could afford a higher standard of living came to this area. Town planning schemes were introduced by the Pune Municipal Corporation in 1930. These schemes encouraged the planned development of new areas like Shivajinagar and Erandwana. Shivajinagar and Erandwana areas today cohere more to neighborhood unit which is an entity and a miniature city in itself containing all institutions so essential to good livings. The Second World War once again diverted attention. The British went to participate in War but this time the influence was less as far as the development of city is concerned. The installation of the defense industries near Pune during the Second World War resulted in the sudden spurt of the population of city. There was an additional influx of the refugee population as a result of partition of India into two separate nations, immediately after the Independence from the British rule in 1947.

5.3   Socio-Economical Impact

Development of cantonments by British changed the character of city considerably. The cantonments with its permanent troops ensured protection to the city and latter started growing fast. A market and general shopping center became a necessity. The present Mahatma Gandhi road thus came into being and developed as a grain market and merchants of all castes and communities opened their establishments their. Schools, Libraries, Public, Gardens, Hospitals,

Clubs, Gymkhana, Race courses, Libraries, Public gardens, Bandstands, all these were necessary in a growing community.

Within two decades (1860 – 1880) the cantonments enlarged considerably not in areas but in terms of number of religious and educational institutions, business, establishments and private bungalows. A number of churches and chapels were opened during British rule. Pune developed rapidly as an educational city as institutions came up. By 1870, the city though grown, occupied a small area surrounded by cultivable and cultivated fields. Only the northern part of Sadashiv ward had been planned and laid out in Peshawas times. The southern parts of Sadashiv and Shukrawar wards were uninhabited and composed of large fields.

The first few years of 20th century were rather gloomy for the city because of terrible plague epidemic between 1896 and 1910. Because of the epidemic and severe famine of 1897, population in the city municipal area decreased by about 7,000 during the decade 1891–1901. There was an actual increase in population of suburban municipal area and also of the suburbs, due to the fact that people fled from the city to the surrounding parts in order to escape from the epidemic, especially to Bhamburda and Erandwana. These were small villages across the river Mutha. Now due to the enforcement of strict rules and regulations has made possible the growth of a really good residential locality whereby people may enjoy all the benefits of an urban civilization without encountering too many of its evils. Thus this area came to be an upper middle class locality.

The eastern part of the city occupied today by Bhavani and Nana wards bordering the cantonment remained undeveloped for long with the result, there was a definite breach between the city and the cantonment a kind of barren strip or no man's land. Socially this area is an extension of cantonment but morphologically it is a link between the city and the cantonment.

The Second World War in 1939 necessitated expansion of ammunition factory at Kirkee. There was a sudden increase in floating population of Pune. To work in the defense establishments and to serve the army personal, there was a large-scale immigration from the surrounding rural area to the city increasing the population considerably, which gave rise to enormous demand for housing while the scarcity of building materials slowed the building activity considerably resulting in acute shortage of housing accommodation.

5.4   Architecture and Technology

The native design of housing types began to change gradually with the establishment of the British rule in India which influenced the indigenous style by introducing Classic and Gothic designs. During the period of reconstruction after the First World War, functionalism became dominant factor in architecture as the reconstruction had to be done with the lowest investment. Architects evolved an entirely new concept of architecture which relied more on composition, massing and sweeping lines than on intricate carving and decoration.

In the beginning of the 20th century, with changes in social set up and consequent breaking up of joint families, the average family became smaller encouraging the construction of multi family buildings. These are two or three storey structures and rectangular in shape but instead of central open square, there is a small open courtyard in the front or rear. These buildings generally have wooden frames with brick infillings with large windows and tin sheet roofs. From ventilation point of view, these are slightly better than wadas. Front or rear courtyard is generally enclosed with a high, thick wall and gate. Such buildings are very common in the southern and eastern wards of old core and in the Suddar Bazar.

Character of buildings in its exteriors and facades changed considerably. Use of arches was introduced by the British in the facades of housing as well as other buildings. Various types of arches, flat, semi-circular and circular were also used extensively by the British. All these arches were constructed in stone and centering was done in timber. The standard British Brick Size was changed and it differed in all its dimensions than those of in

the Peshwas Era measuring 9" X 4.5" X 3" during the British period.

Use of whole timber structures and timber framework was begun by the British. It also included use of trusses and long spans were also provided with roofs of timber trusses. Thus there was a change in technology also. The external and outermost cladding of roofing was done in GI sheets or country-tiles. Thus use of Gothic elements, stone arches, wooden framework, varied brick size, intricate carving and decoration are the remarkable features of housing types constructed during the British period. All these changes considerably showed the influence on the character of the city and skyline of Pune.

5.5 Examples of Housing

Many of these buildings are graceful fusion of Venetian Gothic elevations to a typical Maratha Wadas. These elevations made use of pointed arches cornices, pilasters all rendered in the local grey basalt. But the figures at the key stones and springier were derived from Hindu mythology and the flora and fauna. Both Hindu and Islamic themes with the lime stucco molded Corinthian Pilasters were used.

The British bungalows were other housing types with sloping roofs made of timber framework and cladding over with country tiles and Mangalore tiles. These bungalows were single or double storey and varied according to the status of specific group of society. The main building material used to construct these houses was basalt stone dressed or rough textured. Following are the various examples of housing types during 1818 A.D. and 1947 A.D.:

- Nagarkar Wada (Raghunath Niwas)
- Sangam Bungalow
- Aga Khan Palace
- Governor's Bungalow
- Nana Wada
- Jer Mahal
- Anandashram Wada
- Various Bungalows at Pune Camp, Prabhat Road and Bhandarkar Road, Nana Pet

At the same time the houses in old core which were constructed during 1818 A.D. – 1947 A.D. are to be considered:

- Typical Houses in Lonar Ali
- Typical Houses in Badhai Ali
- Typical Houses in Shukrawar Peth
- Typical Houses in Budhawar Peth

In addition to all these larger wadas, hundreds of smaller wadas were built by merchants, money lenders and various agents. Today about 350 wadas remain in various states of disrepair in Pune, surrounded by new contemporary buildings and houses.

6. HOUSING TYPES IN PUNE: 1947 A.D. – 2000 A.D.

6.1 Political Influence

Post independence influence is dependent on activities happened during 1939-1946. The Second World War started in 1939, which had necessitated expansion of ammunition factory at Kirkee. Political strategies of the British led to large scale immigration from the surrounding rural areas to the city for working in the defense establishments and to serve army personnel resulting in acute shortage of housing shortage.

On 15th August, 1947 India got independence from British rule. In 1950, the country came into existence as a Republic of India, a democratic nation. All the political strategies and polices were subjected to change. Efforts were made to reduce the acute housing problems. Improvement in the supply of building materials encouraged to pick up the building activity. But it was not able to keep pace with the increase in demand due to increase in population, resulting from large scale immigration following massive industrialization and arrival of large number of immigrants from Pakistan.

In 1961, large number of old structures from the old core of the city was washed away by the Panshet flood. Government came forward with funds and encouraged formation of co-operative housing societies which failed to take into account

the consequences of rehabilitation work on overall development of Pune.

Because of the new industrial policies by Government of India, and establishment of a large number of industries in the vicinity of Pune, the population continued to increase giving rise to enormous demand for housing. The gap between demand and supply continued to increase making housing problem more acute and serious. Privatization of building industry and number of non-government and private building firms increased after 1970-1975 and contemporary housing, higher apartments, well designed bungalows came up very rapidly in Pune. After 1970 till now Pune has been growing very fast in every sphere of development including housing. The major residential zone of Kothrud area has set world record of the most rapid growing suburb in Pune city.

6.2   Socio-Economical Impact

Industrial growth of city during the post-independence period gave rise to a pattern of industries, influenced by means of transport, like railways and highways. Mumbai-Chennai railway line became the favorite ribbon for industries with a concentrated growth on the side of Mumbai. Secondary industrial clusters evolved along the Pune-Mumbai, Pune-Satara, Pune-Solapur highways. Maharashtra Industrial Development Corporation offered many incentives in the form of providing land for factories in industrial estates and making available other concessions. State Government policy of dispersal of industries has brought too many industries to Pune.

Industrial development gave rise to plenty of job opportunities inviting large scale migration. With increase in number of educational institutions, a university was established in 1949. Establishment of Pune Municipal Corporation in 1950 along with a number of central government institutions like the National Defense Academy, National Chemical Laboratory, Central Water and Power Research Station, etc; contributed to the rapid growth of Pune city. New developing areas of the city have better housing facilities to attract people. Yet the

old core of the city provides attractions in the form of other facilities such as proximity to the shopping area, nearness to Pune railway station and better old educational institutions, etc.

Congestion in old areas acts as a push and availability of better housing in outer new areas acts as a pull simultaneously. New developing wards like Bund Garden, Erandavana and Shivajinagar are preferred by the upper middle classes or the richer class of people, whereas Parvati and the western half of the old core are the areas which are preferred by lower middle classes. Low income group families, because of their limited rent paying capacity, either preferred the eastern half of the old core or outer undeveloped semi-rural wards.

Because of its mediaeval origin, when functional segregation was not known, many areas and even buildings in Pune are multi-functional. About one sixth of the total buildings in the city are used for commercial purposes. Only 64 percent of housing units are used exclusively for residential purposes.

People having similar incomes, similar thinking or status have come together to form neighborhoods in different parts of city. Business community came to settle in the central trading wards. Artisans, petty traders, laborers, cultivators and socially depressed classes of people preferred the eastern half of the old core. Western half of the old core is inhabited by middle class Brahmins while the richer class of people has settled in new developing wards of Shivajinagar, Parvati, Erandavana and Bund Garden. Pune cantonment is preferred by retired civil and military officers while the eastern wards of the old core on the cantonment boundary is preferred by non-Hindu religious groups like Muslims, Christians, Sikhs, etc.

All these socio-economical impacts and segregated activities are responsible for giving various characteristics to housing types of Pune city in its various parts and wards. In turn all these various housing types create impact on general skyline and urban aesthetical elements of Pune city. Thus Pune has an interesting skyline of manifold housing forms viewed from various places.

6.3   Architecture and Technology

Up to 1947, the most important category of houses was clearly that of houses of brick or stone with earth used as the binding material. Such houses with a plinth and roofed over either by country tiles or corrugated iron sheets were most characteristic of Pune housing types. After independence, due to new industrial development and advanced architecture and technology of housing types in Pune has undergone various changes in terms of functions and aesthetics.

Some of the buildings constructed in post independence period are buildings containing self-contained blocks attached to each flat. Such buildings are very common in the new developing areas. They maintain the modern concept of housing. They are well planned and descent in appearance. These are occupied by middle and higher middle income group families.

Private bungalows are other kind of housing types constructed in post independence era. They have proper light and ventilation and sanitary arrangements. These are very common in newly developing areas. With varied architectural designs, such bungalows are occupied by high income group families who can afford to stay away and abstain from urban nuisance. Spacious, airy with independent compounds, such bungalows are structurally and hygienically very sound.

Depending on the age, class of occupants or functions for which they are meant, the buildings and houses in the city vary considerably from one area to the other in their characteristics. They varied in their height, building materials and architectural style. Height of buildings considerably influences the skyline of the city as well as overall character. Pune is not a city of skyscrapers. Generally the buildings are double storey and this trend continues even today except in case of multi-storey apartment houses. Because of adequate land available for expansion on the outskirts, buildings in Pune are not very tall. Five storey structures are also rare in old core. In old core of the city, two or three storey buildings are very common. In the newly developing wards like Shivajinagar and Bund Garden, multi-storey buildings are rare and almost absent in the outer undeveloped wards like Aundh, Pashan, Bopodi or Parvati. But nowadays in newly developing areas, buildings upto ten or twelve storey high are coming up such as Karishma Society of Erandwana, Konark-Puram at Kondava, etc. Such buildings stand identical in skyline of city.

Type of construction varies with the age and the economic status of the owners. At first upto 1960-65, houses and buildings in Pune city have wooden frames and brick and stone walls. But majority of the buildings built in last 30 years have RCC frames. Advanced developments in RCC prefabricated construction have offered a lot of scope to achieve various building forms and facades. Technological advancements like curtain walls, textured paints, aluminum structures, space frames have considerably influenced the character of housing types. New trusses, sloping roofs with cladding materials, various tiles also influenced new housing types. In turn all these characterize of city. Areas like Prabhat Road, Deccan Gymkhana, part of old cores have mixed kind of housing types. These areas have old houses constructed in stone as well as new good looking RCC apartments also. But at some places uniformity in terms of urban aesthetics and skyline could not be achieved. Old core is undergoing vast changes in its character. Thus in post-independence period, due to advanced technology, increasing population and commercialization, the housing types in Pune are undergoing many changes very rapidly influencing overall character of the city.

6.4   Example of Housing Types

As far as the character of housing types is concerned, the bungalows and apartments, row houses and mass housing schemes shows striking changes in their form. The skyline of newly developed areas is different than that of old core.

- Clover Village: A scheme containing row houses (Wanawadi-Pune) and buildings
- Bungalow at Padmavati: Individual residences
- Aruriodaya Apartment: Ownership flats (Bhandarkar Road, Pune)

- Everest housing Society: Row houses, buildings and bungalows (Kondwa, Pune)

- Konark Housing Schemes

- Karishma Apartments: Kothrud, Pune

7. CONCLUSIONS

Housing types in the city of Pune have gradually changed from traditional mud brick buildings to modern high technology based buildings. The Peshawas, the British and the modernist architects and urban planners all have had their share of influence on the skyline of Pune city. Pune has gradually developed as a modern education and industrial city.

But today the city faces the problem of slums and squatters. Urbanization and industrialization cause progress of a city in terms of conveniences, amenities and facilities. Living standards rise in terms of technical and physical aspects of living. But urbanization also causes chaos, indifference and congestion in a city. The cityscape begins to get profiled by random sprawl of spontaneous hutments and slums or squatter settlement.

Low income unplanned settlements have been a feature of Pune from its earliest period when the *Mahars* settled along the flood prone banks of the Mutha River where Nagzari and Manik drains meet. Some of the oldest unauthorized settlements are located in Kasaba Peth and Mangalwar Peth on the banks of the Mutha River. Settlement of the *dalits* in Bhavani, Mangalwar and Nana Peths is not new and dates back to the Peshawas period.

However, many illegal settlements grew in post independence times around the old Pune city on wastelands or reserved public areas. Squatters in south west Pune on the banks of the Amboli Nala and across the river in Erandwana and Kothrud were originally engaged in quarry works. During 1970s and 1980s these nodes expanded.

Squatters have moved further up the Parvati hill and on the hills skirting Mutha River. Slums, which are also one kind of housing, have always left adverse impact. Nowadays skyline of Pune city seems to be spoiled and dotted with slums on the hills. Slums have also spoiled the beautiful composition of natural heritage elements such as hill slopes, river fronts and lakesides in the city.

As far as urban aesthetics elements are concerned, hill slopes and river fronts play vital role in giving interesting skyline to the city but slums in Pune city in the areas like Parvati, Warje, Model Colony, Kasaba Peth and on the outskirts of the city have left adverse impact on overall character of the city. The sprawling slums and their rapid spread is required to be controlled at the earliest to restore Pune city's character and beauty.

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MONITORING PHYSICAL GROWTH OF RANCHI CITY BY USING GEO-INFORMATICS TECHNIQUES

RUPESH GUPTA

Research Scholar, Department of Geography, Delhi School of Economics, University of Delhi, Delhi

Dr. ANJAN SEN

Lecturer, Department of Geography, Delhi School of Economics, University of Delhi, Delhi

ABSTRACT

The paper analyses the expansion of urbanized areas of Ranchi between 1928 and 2004, based on comparison of old topographic sheets, recent satellite images and other similar information of the intervening years. A digital and visual-based classification method is applied to find out the areal extent of the city. The average annual increase is about 1 sq. km. (0.64 percent) during 1928-2004. During the past one century, Ranchi's population grew at an average annual rate of 3.5 percent between 1901 and 1941, 14 percent between 1951 and 1971 and 8 percent between 1971 and 2001. Based on the multi-temporal and multi-resolution satellite data and existing map, spatial and temporal changes of land use and road networks have been detected. It is found that main conversion has taken place from agriculture land to built-up land and road networks. This growth is subsequently discussed with levels of development, with focus on the unplanned and haphazard nature of growth.

1. INTRODUCTION

Most developing countries are urbanizing very fast, much faster than the advanced countries, which are already predominantly urban. Most of the South Asian countries are largely rural in character, and are experiencing this phenomenon, particularly related to their metro cities. Even after sixty years of independence, villages in our country do not have good road connectivity. As a result effective implementation, execution and monitoring of development schemes sponsored by government and non-government organizations are not possible. The state of Jharkhand was formed in the year 2001 with Ranchi as its capital. There has been a noticeable change in the urban infrastructure scenario of Ranchi City.

The present paper aims to identify spatial, environmental and socio-economic consequences of the rapid and haphazard expansion of Ranchi City in the surrounding rural areas primarily in the last few decades. Geo-informatics techniques like satellite remote sensing and GIS has been used to assess the rate of the spatial expansion, seen in the perspective of last four decades. In this paper an extension of new built-up area is mapped from recent medium-scale satellite imagery using a classification algorithm based on visual and digital method. These areas constitute the rapidly expanding frontier of Ranchi City into its rural

surroundings. The updated land use map is compared with satellite-based maps to check their suitability for urban settlement analysis. Recent trends in urban development are analyzed with a focus on the haphazard nature of the spatial development, for example, road network and built-up land (1928-2004) due to lack of planning and poor land management.

This study was carried out in Ranchi City located within co-ordinates of latitudes 23015′ N and 23030′′N and longitudes 85015′E and 850 30′ E. The municipal area of Ranchi City comprises 37 wards. National highways NH-23 and NH-33 pass through the city area. The aerial extent of the study area is 177 sq. km (Fig. 1).

2. GROWTH OF RANCHI CITY

Geographically Ranchi city is heterogeneous and due to its varied topological features, development process disturbs-land, village forests, and natural resources. Use of land and steep slopes for cultivation, and heavy engineering works can easily activate ecological degradation. Since natural resources are important base for subsistence, some means should be devised for planned use of these resources. Jharkhand region needs much more attention due to regular occurrences of deforestation and improper urbanization.

Process of urbanization in India is not different from that of other countries in Asia and Africa. The proportion of the country's population living in

Fig. 1 Ranchi City – The Study Area
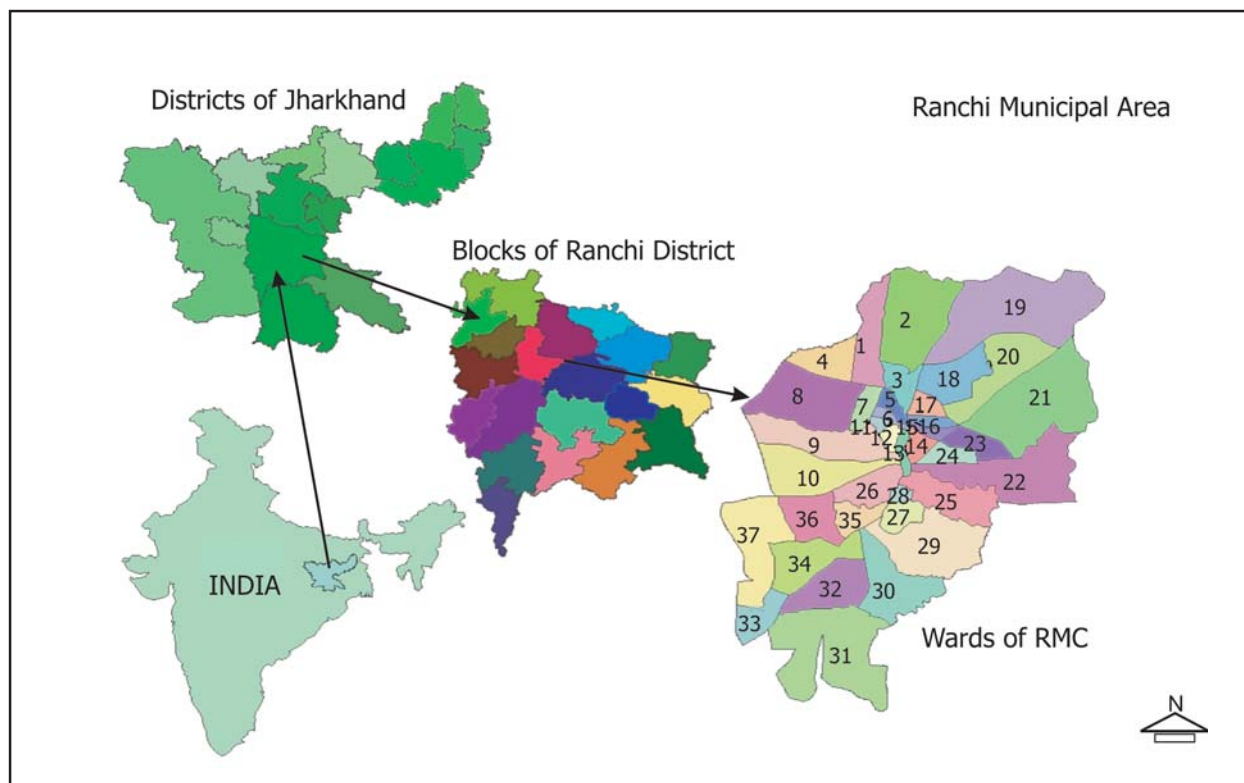
Source: Ranchi Municipal Corporation (RMC)

towns has increased over the years - from about 11 percent in 1901 and 17 percent in 1951 to nearly 28 percent in 2001. Ranchi City is not only the capital and leading city of Jharkhand in terms of population size but also its political, economic and cultural nerve center.

Rapid urbanization has resulted due to several factors. However, natural population growth remains one of the major factors since 1980s. Ranchi City is experiencing a high rate of growth and it is one of the fastest growing cities in India. As per census from 1901 to 1941 the rate of growth was 3.5 percent per annum, whereas it was 14 percent during 1951 to 1971 and 8 percent during 1971 to 2001. After independence, population of Ranchi City in 1951 was only 1,06,849, which increased by over eight times to 8,63,180 in 2001.

3. SATELLITE-BASED METHODS

To find the growth of the city and its built-up area, data were obtained from sources including IRS-1D (LISS-III) and IRS PAN sharpened LISS-III merged data with ground truth verification;

Survey of India topographic sheets of 1928 (1:63,360), 1980 (1:50,000), 1996 (1:25,000); Census of India 1991 and 2001; Vehicular Data for Ranchi District from Central Mine Planning and Design Institute (CMPDI) and city guide map of 1990 (1:20,000). The study was carried out in three phases:

3.1 Phase I – Prior to Fieldwork

IRS-1D pan sharpened LISS-III (Map sheet, based coverage of 15'x15') photo products were used. Based on image features, urban land use, urban sprawl, road information of different time periods was extracted and all the linear details such as roads and canals were updated using topographical sheet information and existing maps. Landuse was interpreted by visual interpretation technique. Unresolved land use units were marked and updated for field verification.

3.2 Phase II – Fieldwork

Limited sample survey was carried out to verify ground realities. Necessary corrections were incorporated in the drawing using field data. Ward-wise survey was also carried out to prepare a level of development index.

3.3 Phase III – Digital Database Creation

Spatial framework of database was organized in GIS format as per the topographical maps coordinates and projection system. A grid was generated in Arc-Info with four tic-points for each map covering the entire Ranchi City. All theme layers of different time periods were transferred to the above grid for commonality. Thematic map drafts were prepared on a sheet-by-sheet basis for digitization. On each sheet, all the required themes were drawn, different for roads and built-up land. Thematic features of spatial data set were scanned and digitized for each map sheet using AutoCAD Map, ARC/INFO GIS package. The master registration points drawn on draft maps were used for registration during digitization. Three different time period land use maps for 1965, 1985 and 2004, were prepared on the basis of topographical sheets and imagery, as shown in the following flow chart.

4. THEMATIC LAYERS

The following thematic layers were created in the database for analysis. Administrative: it contains administrative boundary of Ranchi Municipal Corporation; Urban built-up boundary: it shows Ranchi Municipal settlement area; Road network: it contains national highways, state highways,

Fig. 2 Flow Chart
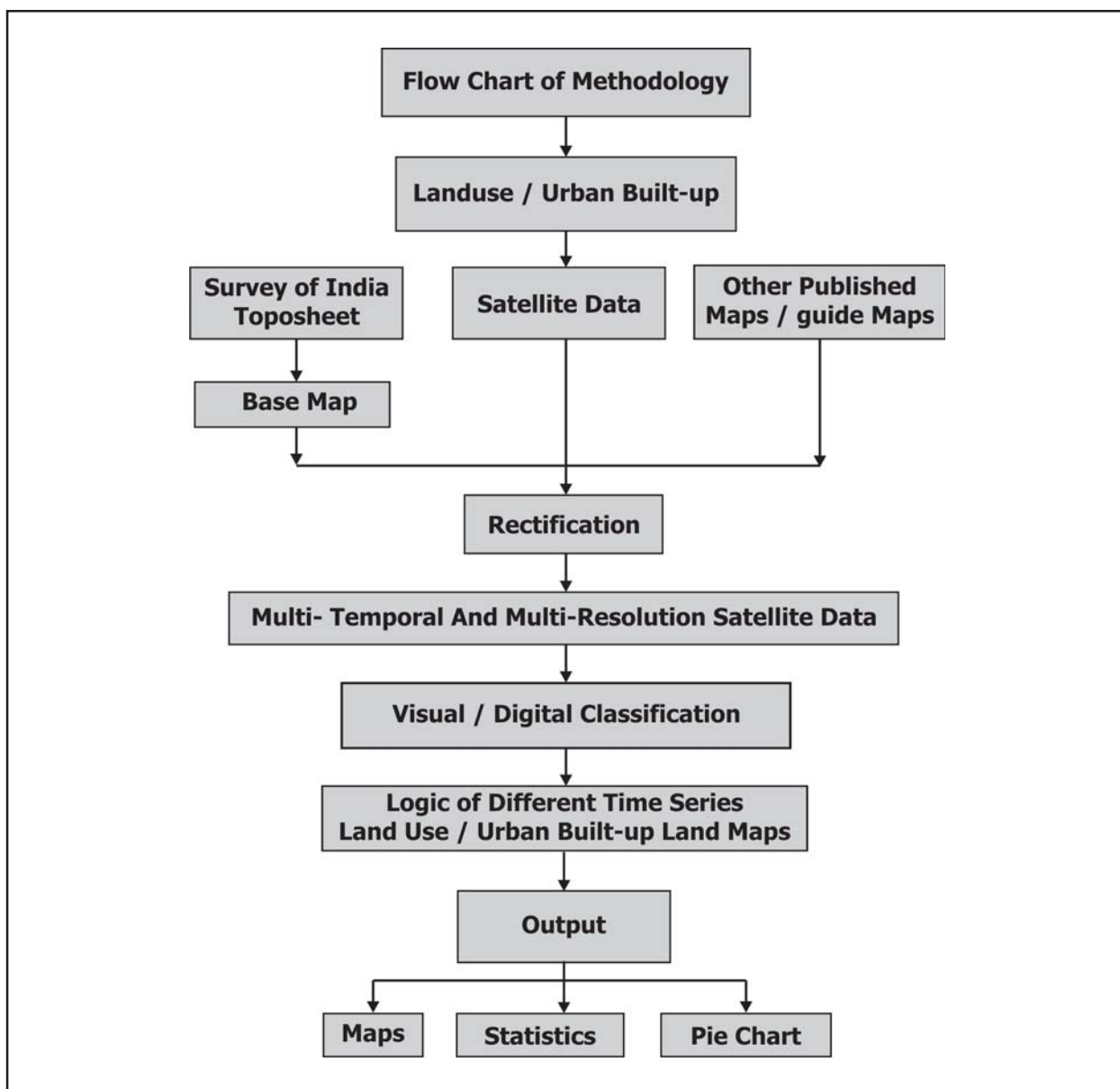
other roads and rails. After digitization of the topographical sheets and imagery, the area under built-up land and road networks of different years was added to the attribute database. It was also compared with master plan of road network.

The road network map has been generated on 1:20,000 scale as prepared by the municipality. This gives detailed information regarding the network of metalled, unmetalled and other roads. These roads connect every lane and major roads in the city centre like Firayelal Chowk with other points. The base map is a major asset for executing a development plan. The present study is limited to preparation of urban land use, urban sprawl and road expansion maps for different time periods.

5. RESULTS AND DISCUSSIONS

There has been a rapid growth of urban population in India over the last four decades.

Nearly 28 percent of India's population lives in about 5,161 urban centres of varying sizes. Ranchi has been a smaller but important urban centre in the state of Jharkhand. Its importance lies in providing space for the summer and commercial capital of Bihar during the British *Raj*. Hence, different population communities played a vital role in its social and economic development. Ranchi City has a varied ethnicity with 31 sub-castes numbering nearly 2 lakh, which played an important role in political and social movements. A majority of these groups are Munda and Oraon, which are dominant in most of the region.

Ranchi started as a small city occupying an area of around 6 sq km in 1869 with a population of approximately 12,000 in 1871. The area gradually increased to 43.44 sq km in 1965, 175.29 sq km in 1985 and eventually stood at 177.19 sq km in 2004 (Table 1). From 1965 to 1985, the city grew

Table 1 Ranchi City – Spatial Growth 1869-2004

Year	Area (Sq Km)	Increase (Sq Km)	Growth Per Year (Sq km)	Growth (%)	Time Periods (years)
1869	6.00	-	-	-	-
1965	43.44	37.44	0.38	21.87	96
1985	175.29	131.85	6.60	77.01	20
2004	177.19	1.90	0.10	1.10	19

Source: Municipality Secondary Data

Table 2 Ranchi City – Population Growth 1871-2001

Census	Total Population	Increase in Population	Decadal Growth Rate (%)
1871	12,086	-	-
1881	18,443	6,357	(+) 52.06
1891	20,306	1,863	(+) 10.01
1901	25,970	5,664	(+) 27.05
1911	32,994	7,024	(+) 27.05
1921	39,628	6,634	(+) 20.11
1931	50,517	10,889	(+) 27.48
1941	62,562	12,045	(+) 23.84
1951	1,06,849	44,287	(+) 70.79
1961	1,40,253	33,404	(+) 31.26
1971	2,55,551	1,15,294	(+) 82.21
1981	4,89,626	2,34,075	(+) 91.60
1991	5,99,306	1,09,680	(+) 22.40
2001	8,63,180	2,64,148	(+) 41.24

Sources: District Census Handbook Abstract, 1981(Village & Town Directories)
    Directorate of Census Operations, Bihar, Parts XIII-A&B, Series-4. Govt. of India

at a rate of 6.6 sq km per annum, with a total growth of almost 77 percent over the 20 year period. Simultaneously, population also grew and it was 25,000 in 1901, crossing 1 lakh after independence in 1951 and reaching to nearly 6 lakh in 1991 and crossing 8 lakh in 2001 (Table 2). Today it may already exceed 10 lakh. Due to population growth, demand of land increased and the City expanded towards fringe areas. Most of the extension occurred at the cost of scanty fertile and plain agriculture land, since the city is surrounded by hills and plateaus.

Demographic history of Ranchi shows that its population grew slowly during 1901-1941. In the subsequent decade of 1941 and 1951, its rate of growth was higher than national average. Due to enhanced importance of the city and its environment, people are attracted towards the city, and occupy land for businesses and residential purposes. The decade 1961-1981 saw the highest growth of population due to migration and attraction of people towards the old summer capital of Bihar. Population increased with 82 percent in 1961-71 and 92 percent in 1971-81. Obviously, people occupied the area where they felt secure in terms of education, hospital, infrastructure, employment, etc.

5.1. Land use Profile

A considerable change in land use has occurred during the last four decades. Change from rural to urban land has been fast as a result shortage of land has led to speculation and increase in land values (Table 3 and Fig. 2). Ever growing difference between demand and supply of housing sites has increased stress on the fringe areas while prices of agriculture land continue to increase for residential and industrial purposes, and the cost of land in the city is rapidly reaching new heights.

Computing the area of all settlements from topographical sheets of 1928 and 1965, and comparing it with the area obtained from the classified satellite imagery; the land use profile can be analyzed over three periods 1965, 1985 and 2004. A change-detection analysis shows that Ranchi City is expanding at the cost of plains, and open areas and built-up land has increased from low and medium density to high density.

Land use in 1965: For the preparation of land use map, municipal boundary of Ranchi was considered. This boundary encloses 177.19 sq km of land. Land use classification result shows that out of the total area, agricultural area including cropped area / fallow, was 75 percent, built-up land 21 percent, open space for public use 1 percent and transport network was 3 percent (Table 4). In 1965 Ranchi was a small town and a majority of land was under forests, plateau and agriculture.

Land use in 1985: After a gap of twenty years since 1965, 75 percent of the total area (177.19 sq km.) remained agricultural (cropland/fallow-land and open space), which decreased by merely 0.5 percent from 1965 due to utilization of agricultural land for settlement or built-up land.

Areal extent of built-up land indicates massive development of the city during this period. Nearly 21 percent of the total area was built-up comprising high medium and low density areas. 3 percent of the total area falls under land transformation category which is indicative of the developmental stage of the city (Table 5 and Fig. 3). City shows spatial growth and physical development in circular form, west and northwest of the city. During this period, the population increased by 4 lakh and the rate of growth exceeded 90 percent.

Table 3 Ranchi City – Landuse Change

Category	1965	1985	2004
Built-up Land	11.73%	21.14%	33.89%
Agricultural Land	77.14%	74.86%	60.89%
Built-up Land(Change)	-	+9.41%	+12.75%
Agricultural Land(Change)	-	-2.28%	-13.97%

Source: Topographical Maps and Multi-temporal Images

Fig. 2 Ranchi City – Settlement Extent 1928-2003
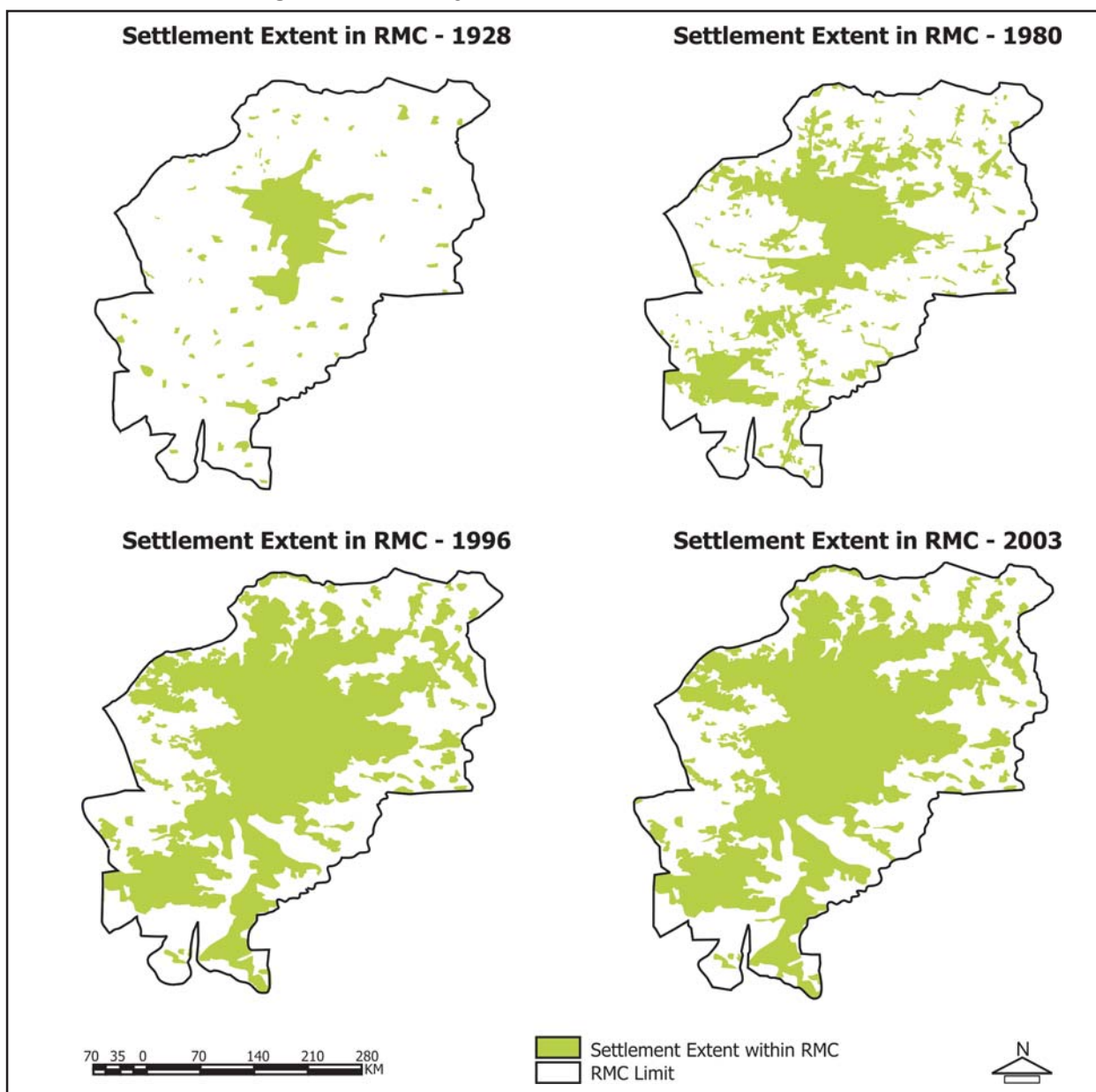
Table 4 Ranchi City – Landuse in 1965

Landuse Classification	Area (in Sq. Km.)	Area (in %)
Developed Area	20.53	20.79%
Residential Area	10.16	
Commercial and Industrial Area	2.05	
Public And Semipublic Use	4.10	
Park, Playground, Public Open Space	2.00	1.13%
Roads	3.60	2.60%
Railways	1.00	
Agricultural Area	133.75	75.48%
Total Area	177.19	100.00%

Source: Municipality Secondary Data

Fig. 3 Ranchi City – Landuse 1985
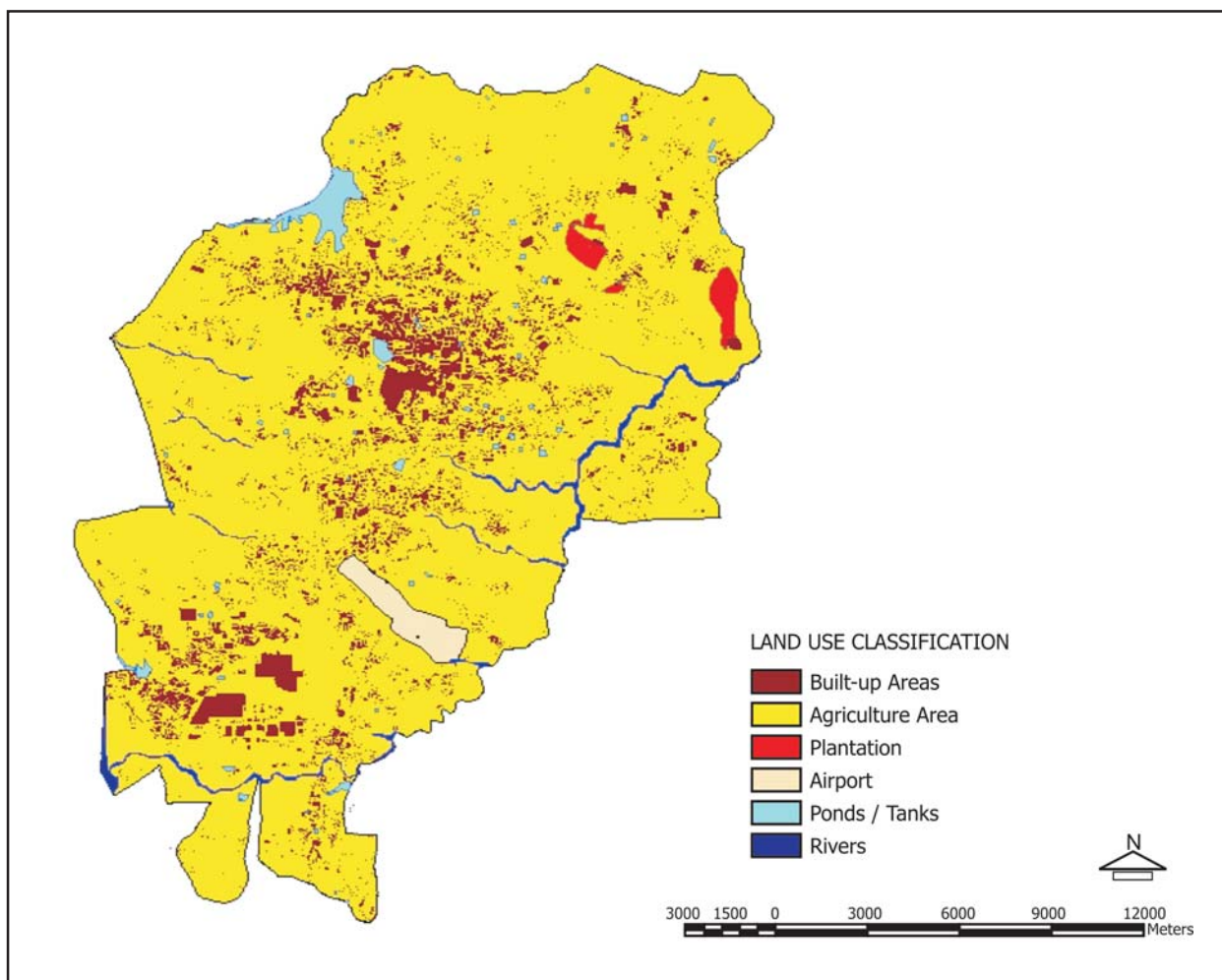
Table 5 Ranchi City – Landuse in 1985

Landuse Classification	Area (in Sq. Km.)	Area (in %)
Agricultural Area	132.90	75.00%
Built-Up Area Airport	37.00 1.87	21.94%
River Tanks/Ponds Plantation	2.25 1.97 1.20	3.06%
Total Area	177.19	100.00%

Source: Municipality Secondary Data

Land use in 2004: During 1985 to 2004, built-up land has grown from 21 percent to 34 percent i.e. an increase of 12.75 percent. During this period agriculture and open area declined and land under other uses also got reduced. This indicates that the city is in growing stage. Due to rapid growth of population to 8.5 lakh in 2001, the demand of land increased tremendously leading to encroachments in the surrounding plains.

Agriculture and fallow-land decreased from 75 percent in 1985 to 53 percent in 2004 due to utilization of agricultural and fallow-land for settlement and commercial purposes (Table 6 and Fig. 4). Most of the growth has taken place towards north and north-west in circular form, encroaching on the nearby agricultural and fallow-lands. During the last decade, area under plantations has increased from 0.67 percent in 1985 to 8 percent in 2004 due to government and public efforts.

It is also observed that three categories of land use have undergone substantial changes. The maximum change has occurred in agriculture land indicating conversion of rich agriculture land to non agriculture uses particularly built-up area in the region. Statistics reveal that settlement area was about 18 sq km in 1928, 48 sq km in 1980, 89 sq km in 1996 and 91 sq km in 2004. The
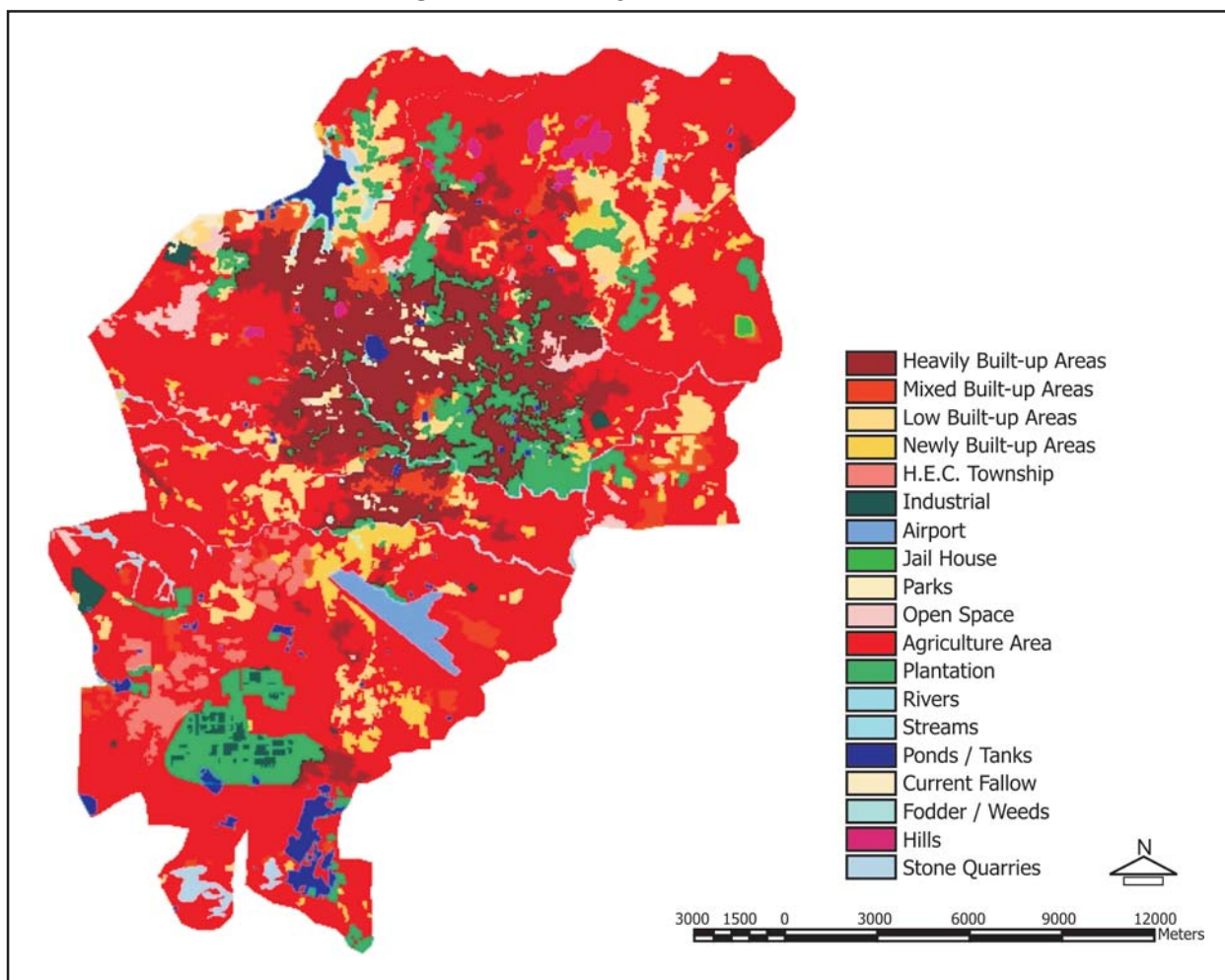
Fig. 4 Ranchi City – Landuse 2004

Table 6 Ranchi City – Landuse in 2004

Landuse Classes	Area (in Sq. Km.)	Area (in %)
Agricultural Area	93.82	53.26%
Current Fallow	0.56	
Heavily Built-Up Area	25.00	
Low Built-Up Area	11.00	
Mixed Built-Up Area	6.10	
Newly Built Areas	5.51	32.95%
Residential Pockets	5.00	
H.E.C Township	4.78	
Airport	1.00	
Plantations	14.00	
Rivers / Tanks / Ponds	6.15	
Hills	2.14	13.78%
Parks / Open Spaces	1.36	
Stone Quarries	0.77	
Total Area	177.19	100.00%

Source: Municipality Secondary Data

average annual increase is about 1 sq km (0.64 percent) during 1928-2004. Main conversion was from agriculture to built-up and road network. Area under agriculture has reduced by about 73 sq km (i.e. from 159 sq km or 90 percent to 94 sq km or 53 percent) during the period 1928 to 2004. It indicates a threat to the rich agricultural land and its conversion to non-agriculture uses (built-up area) in the region.

5.2. Road Network

Area under transportation also increased during the period of analysis. Road length was about 58.5 km in 1928, 121 km in 1980, 207 km in 1996 and 227 km in 2004 (Table 7). The average annual increase is about 2.25 km during 1928-2004. During 1928-1980 the increase was 63 km (1.2 km/per year), 1980-1996 it was 86 km (5.35 km/ per year) and 20 km (2.9 km/per year) in 1996-2004. Road network also expanded at the cost of agriculture and forest land.

Table 7 Ranchi City – Transport Network (in km)

Category	1928	1980	1996	2004
Metalled Road	36.8	103.1	194.7	215.0
Other Road	21.7	18.3	12.4	12.3
All Roads	58.5	121.4	207.1	227.3
Rail	5.2	14.5	14.5	14.5
Total	63.7	135.9	221.6	241.8

Source: Topographical Maps and Satellite Data.

As per our analysis, metalled road accounted 94 percent (215 km) of 227 km of total roads. It was about 37 km in 1928, 103 km in 1980, 195 km in 1996 and 215 km in 2004 (Fig. 5). Average annual increase is about 2.3 km during 1928-2004. During 1928-1980 the increment was 66 km (1.3 km/per year), 1980-1996 it was 92 km (5.7 km/per year) and 20 km (2.9 km/per year) in 1996-2004. Major expansion is observed in western, southern and south-eastern parts and along NH 8, NH 11 and NH 12.

Fig. 5 Ranchi City – Density of Road Network 1928-2003
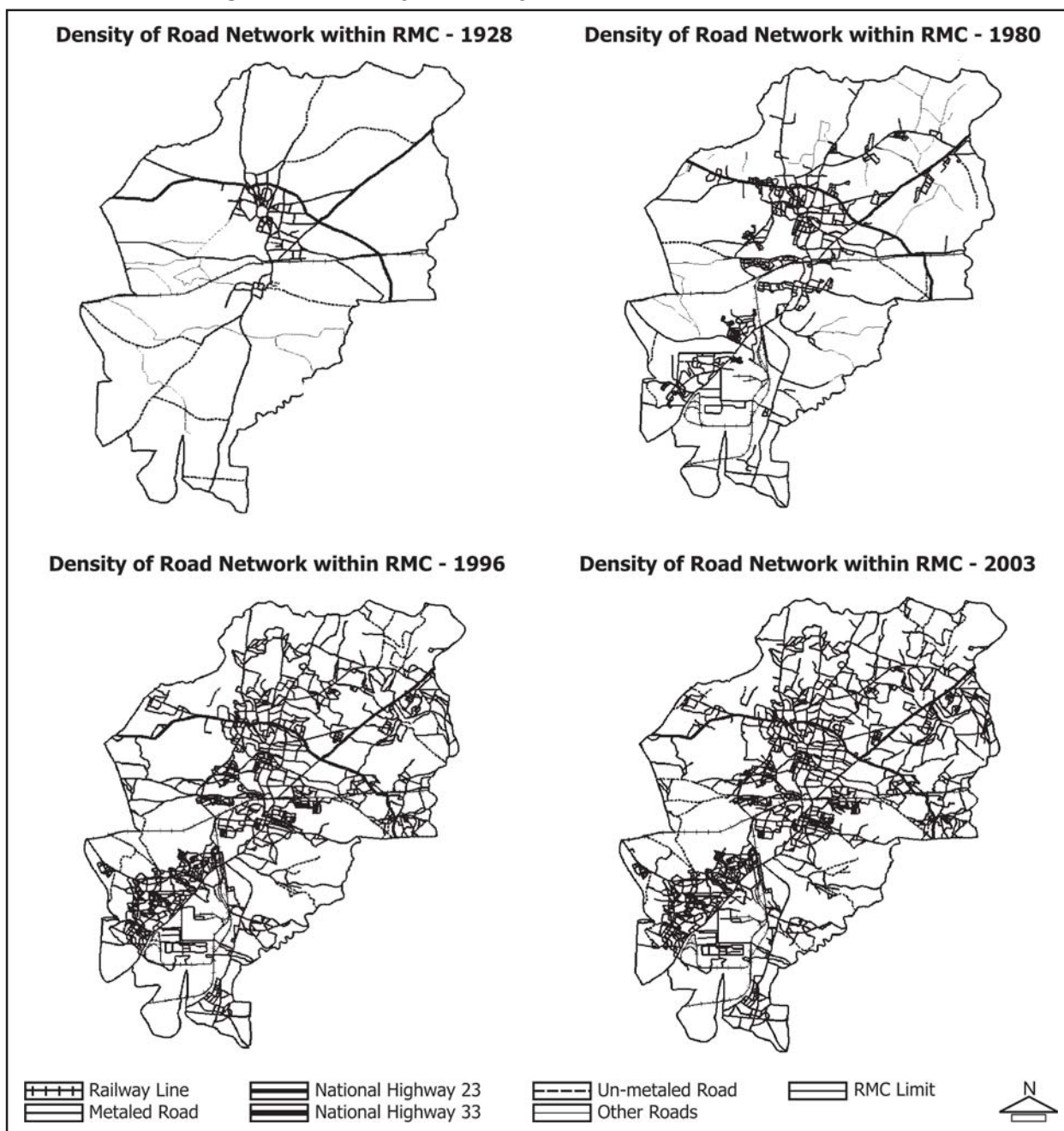
5.3. Levels of Development

Analysis reveals that 55 percent or 22 of the total 37 wards in RMC are undeveloped and less developed, while 45 percent or 15 wards are developed and highly developed (Table 8). On the basis of secondary and primary data analysis, it is observed that only 8 wards are truly developed in terms of infrastructure, whereas rest of the wards lack basic infrastructure and amenities.

Around 22 percent wards are highly developed, 19 percent developed, 43 percent are less

### Table 8 Ranchi City – Development Level (ward-wise)

S. No.	Level of Development	No. of Wards	% of Wards
1	Highly Developed	8	21.62%
2	Developed	7	18.92%
3	Less Developed	16	43.24%
4	Undeveloped	6	16.22%

Source: Primary Survey and Secondary Municipal Data

undeveloped and 16 percent are undeveloped wards (Fig. 6). Among the eight wards comprising CBD of Ranchi City i.e. Main Road and its periphery, two wards are developed and six wards are under-developed. However, development has occurred in following wards: 1 (Shyamsinghtoli, Jawahar Nagar, Rock Garden), 2 (Ranchi University, CMPDI, Vidyapati Nagar), 20 (Kokar Industrial Estate, Bariyatu), 21 (Dipatoli Cantonment), 26 (Mecon Colony), 30 (Hatia, NIFFT, Patel Nagar, Hesag), 31 (Parts of HEC Industrial Area, Hatia, Tupudana Industrial Estate), 34–36 (HEC Colonies i.e. Sector I, II, III, IV), and 24 (Ranchi Railway Station, Lower Chutia, Upper Chutia).

Development has occurred in wards with well planned colonies, public facilities or educational institutions. The process of industrialization has accentuated inter-ward disparities within Ranchi. Setting up of new industries at Kokar and Tupudana has added to the development of the Wards 20 and 31 respectively. Survey indicates absence of basic facilities in many ghettos of

Fig. 6 Ranchi City – Levels of Development
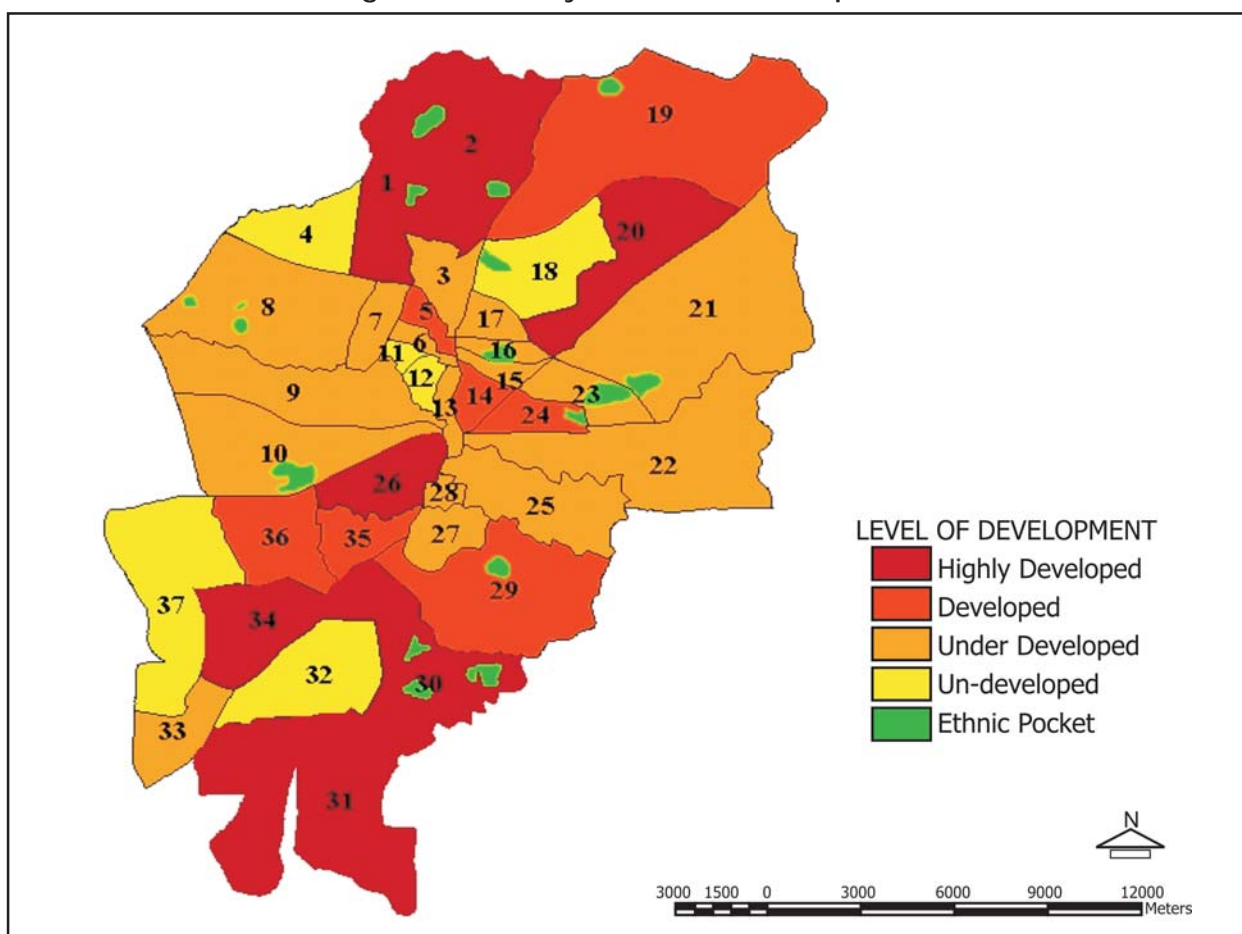
Ranchi Municipal Corporation (RMC). Some of the pockets dominated by Christians (Naya Latma in Ward 30) have a higher level of development in terms of basic amenities like water and electricity in comparison to others. Some samples from the pockets in the peripheral areas reveal that about 78 percent of the respondents demand good street-lighting, drinking water and metalled roads. In reality, piped water supply is better in the central part of the city, whereas set-up of wells and tube-wells is satisfactory in the peripheral parts. However, the public always demands easier and safer mode of water supply.

6.   MAJOR FINDINGS

The geo-informatics techniques are vital for analysis of urban land use sprawl and urban road network. Primary survey and secondary data reveals the following:

- Ranchi City is expanding towards northeast and southwest, encroaching adjacent small towns and engulfing rich agriculture land.

- Ranchi City has put heavy pressure on the ecologically sensitive areas, due to deforestation and loss of cropped area.

- Agricultural land is being gradually converted into built-up land for industrial, commercial, residential and others, uses.

- Land use changes and development of infrastructure especially roads has increased following the formation of new Jharkhand state and Ranchi City becoming its capital.

- Growth in infrastructure has not kept pace with the growth of population, resulting in disequilibrium in the level of development of wards.

7.   CONCLUSIONS

Theme of the paper is urban growth and its haphazard nature, which is obvious while traveling on the streets of Ranchi. Areas are being converted for urban use without any systematic development plan and without a corresponding investment in infrastructure. Poor land management has resulted in urban areas with inadequate services and infrastructure and a corresponding lack of accessibility, that may prove very costly to resolve in future.

While it is not too difficult to pinpoint the magnitude of problems and some of their causes, it is clearly more difficult to pin-point quick solutions that will create a more sustainable growth in the outskirts and fringe areas. Access to computers and e-based means of communication have increased significantly in India during the last few years. Also the tools for analyzing and handling digital spatial information have become potentially more accessible for people who are involved in the planning process. This increases the possibilities for assessing the magnitude of the problems in order to create public awareness and handle issues related to land use pattern, infrastructure and environmental planning. These recent development will facilitate efforts to address the problems in a serious manner.

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SPEEDY IMPLEMENTATION FOR PROVISION OF URBAN INFRASTRUCTURE: A CASE OF MYSORE CITY

H.S. KUMARA

Faculty, Urban and Regional Planning, Institute of Development Studies, University of Mysore, Karnataka

ABSTRACT

This article provides an overview of ways and means for speedy implementation of urban infrastructure with a case of Mysore City. It primarily focuses on those areas that are important from a policy point of view and implementation of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) projects. The article first reviews the trends of urban growth, infrastructure crises, ways and means for speedy implementation – ways to fast track, parallel processing, overcoming the hurdles and Mysore as a case and few case studies of speedy implementation ways followed by key challenges and way forward.

1. INTRODUCTION

Cities play a vital role in promoting economic growth and prosperity. The development of cities largely depends on their physical, social, and institutional infrastructure. Cities must not only meet the needs of the current population but also provide for the needs of those yet to join the urban population. The pattern of urbanization in India is characterized by continuous concentration of population and activities in large cities (Kundu, 1983). This is manifested in a high percentage of urban population being concentrated in Class I Towns and its population has systematically gone up over the decades in the last century. It clearly indicates that population centered in Class I Towns. According to 1991 Census, about two third (65 percent) of the countries urban population lived in Class -1 Towns with a population of more than 100, 000. Whereas in 2001, it has increased to 68.67 percent[1], over the years there has been continuous concentration of population in Class I Towns, and rests of other class towns were constantly decreasing. The urban phenomenon in Class 1 Towns has been increasing constantly whereas the infrastructure enhancement growth rate is not corresponding with the urban tendency. One of the interesting things to note is that out of over 5,000 urban settlements in India, the number of Class I Towns is 393 i.e. less than eight percent. It would attract not only private sector investment but public sector investments

for infrastructure like roads, transport, water and sewerage, solid waste management but also other infrastructure facilities through Jawaharlal Nehru National Urban Renewal Mission (JNNURM) programme.

Infrastructure is the basic essence for smooth functioning of national economy. Investments in infrastructure projects are large, with long gestation periods, because of these reasons; private investments in infrastructure sector are less when compared to other sectors. The prime issues of urban infrastructure are maintenance, rehabilitation and upgradation of current infrastructure. In addition, to this, backlog maintenance and infrastructure damage has resulted in extremely high costs to users, much higher than the investment costs by the government and private. The social and political costs of infrastructure failure would also be unbearable to the society. This seemingly intangible cost is often disregarded in decision making process. There are large gaps between demand and supply of urban services such as water, sanitation, solid waste management, public transport, etc. There is an enormous disparity in quantity of water supplied in Class I Cities. Out of 393 cities, around 77 cities have cent percent water supply converge. In case of sewerage only around 70 cities have partial sewerage treatment facilities. About 62 percent of the urban population has

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1 Census of India (1991 and 2001) According to 1991 Census, percentage of population in Class towns I, II, III, IV, V and VI were 65.2 percent, 10.9 percent, 13.1 percent, 7.7 percent, 2.6percent and 0.3 percent respectively. Whereas in 2001 census, percentage of population in Class I, II, III, IV, V and VI were 68.6percent, 9.67 percent, 12.2 percent, 6.8 percent, 2.3 percent and 0.2 percent respectively.

accesses to toilets, either connected to sewers or septic tanks or to pit latrines and serviced latrines and the solid waste generated in Indian Cities varies from 0.20 to 0.60 kg per capita per day[2]. The National Council for Applied Economic Research (NCAER) estimates that though India's Tier I cities remain the country's richest; those in Tier II are emerging as the new growth centers. While Tier I cities represent 6 percent of the population and contribute about 14 percent of the India's GDP, Tier II cities represent about seven percent of the nation's population and contribute about 13 percent to GDP[3].

No doubt, some cities have initiated reforms in areas such as direct market borrowing, public-private partnership, enhancement of property tax, and e-governance and so on. Still we have a long way to go to reach levels of sound infrastructure and adequate services, especially in the context of globalization. Our cities need to compete with other world-class cities to promote investments. Economic growth of India is closely linked to the sustainable growth of our cities. All these factors will have significant negative economic consequences, if problems are not addressed in a planned manner.

2. SPEEDY IMPLEMENTATION

2.1 Expediting Implementation

Speedy implementation means a process of accelerating project delivery and planning processes. It includes sharing of responsibilities between parastatal and project management agencies for day-to-day service management and mutual comprehension of certain elements and challenges of continuity of infrastructure necessary for delivering services. The following activities should be taken up for fast track implementation.

- Core urban infrastructure linking with quantification of formal techniques plus alignment: first building blocks of core

infrastructure services. The 'core urban infrastructure' commonly refers to drinking water, sewage system, sanitation, electricity and urban transport, etc. Many of these services are in the nature of 'local' public goods with the benefits for improved urban infrastructure in a given city and it is limited to the citizens living in that city. Categorization of core and urban infrastructure is an essential element for speedy implementation. The assessment of infrastructure requirements has to be quantified based on the quantitative and qualitative parameters in the context of infrastructure bottlenecks and service delivery gaps. In many cases, infrastructure services are provided by different parastatal agencies, the quantification has been done comprehensively and collectively from all parastatal agencies with respect to common techniques.

- Non homogeneity - social, cultural, economic and spatial means: Today, cities can not be explained by any single phenomenon as complexes of forces are at work. Looked at one way, they are the outcome of economic and fiscal policies. From another point of view, they are the direct expression of the socio-political forces at work in society. Then, again and perhaps in the final analysis, they are material entities, existing like other pieces of hardware, in a physical world (National Commission on Urbanization, 1992). It is, therefore, important to understand the factors that make cities viable and sustainable through spatial planning.

- The principles of planning that continue to dominate the thinking of urban planners and political decision-makers are based on the concept of 'manageable towns' that is self-contained urban areas with limited population densities, reduced urban congestion, and green belts. The concepts that persist strongly are inspired by the principles of colonial urban planning from an era when the planner could

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2 Assessment 2002: Water Supply and Sanitation – A WHO and UNICEF Sponsored study, Planning Commission, Government of India.
3 National Council for Applied Economic Research (NCAER) -2003

intervene and model the towns according to their will, independent of its realities and dynamics of the market. This planning approach merely enabled a 'physical plan' without the actual social and economic content. Today this kind of planning culture is disconnected from the ground realities.

- Differentiation: This is again confused with scaling depending on the small town to large cities. It would be degree of diversity versus specialization. In general, smaller cities benefit from diversity because they are more vulnerable, whereas larger cities should strive for specialization in activities in which they are globally competitive. The various studies are only interlinked and supporting to make them project sustainable entities. Recognition of agencies or leaders in the development of a quality built environment through research, innovation and the creation of integrated solutions are very essential.

- Prioritization of Sectors: Sector based prioritization of projects for immediate requirements and lesser priority for the rest of infrastructure projects is to be explained before building strategies for investment needs, based on the demand gap assessment and immediate requirements. The project prioritization as followed by the logical sequences and phased investment breakups. It would be taking into consideration availability of local resources, scale, complexity and cost of the project probably means that a phased approach to its implementation is best.

- Environmental impact – NIMBY: As urban centers expand and grow, they require more land, more water supply, and more electricity and generate greater amount of waste, etc. Environmental assessment of plans and policies are critical in urban infrastructure development. The concept of NIMBY (Not in My Back Yard) there are always who attempts to exclude themselves from the consequences of polices which generally they support. For example a house owner might advocate new motorways, a citizen might advocate landfill sites, but not at the bottom of his or her own back garden.

2.2 Parallel Processing

Portfolio and Project management approach: Build a portfolio approaches to various parastatal agencies for speedy implementation of urban infrastructure projects. This means the action plan will clearly indicate which agency is responsible for what, timelines and milestones, expected inputs, outputs and results or impacts. In addition to that, we need proper integration and co-ordination of existing service providers. The core project management team has to be established comprising of various parastatal agencies to review and re-examine project status, quality control, and research and development, etc.

Planning and scheduling of activity: The foremost task is estimating the time planning for small, medium and large sized projects and critical path analysis tools for effective planning. Another point is to review the project status by using planning management methodologies and finally winning support for your projects through stakeholders' analysis and management methodologies. The following incentives and disincentives would be given for speedy implementation consortium:

- Fixed price contracts with appropriate risk premium

- Incentives for on-schedule and to-budget delivery

- Penalties for slippages against schedule

- Audit of project and programme management effectiveness

Use of consensus – end users and institution level: Consensus building about the present situation and future workable solutions of the project with end users and at institutional level. And also re-examine and review the present institutional level, technical capability for the systematic planning and delivering of services. Later, need to be focused on strengthening the service delivery performance at institutional level and policy improvements.

2.3 Overcoming Hurdles

Innovative ways - Land Pooling and Assembly: One of the major obstacles of infrastructure development is land. Techniques like land pooling

and assembly are regarded as the best readjustment techniques for planned provision of urban infrastructure and supply of urban land without external investments. The concept of land pooling and assembly in single word is unification plus partnership. The unification includes consolidation of separate land parcels, the unified design, infrastructure provision and subdivision of these parcels and unified preparation and implementation of the scheme under a single management. The word partnership indicates the partnership between government, private and community for urban land development. Land pooling and assembly are innovative ways for fast track implementation of urban infrastructure. Some of the land pooling success stories is given below:

- Town planning schemes have been successfully tried in Ahmedabad and other large cities of Gujarat and Maharashtra.

- Magarpattam Township in Pune is another example.

- Innovative concepts of Accommodation Reservations and Transfer of Development Rights and use of land as resources have been experimented in Mumbai.

Spatial data – Platform and nerve center decision making: Need for robust spatial information and data depository so as to build a sustainable urban geographical information system. Through the creation, collection, organization and standardization of huge amount of data from various parastatal agencies into mega urban spatial database and make use of this GIS to modify and streamline the planning processes, thereby making it highly efficient. This spatial repository would become a common asset to the stakeholders acting as the 'spatial memory' of the territory.

Using geographic information system tools for rapid mapping of poorly served areas where the households receive less than basic services. This data can be transferred to various parastatal agencies through nerve centered main server for day-to-day operations. The decisions have to be taken based on the ground reality and workable

solutions. Several factors have been associated with it. The data can be used various for parastatal and building accountability for improving the delivery of essential services and for its impacts on the ground. The challenge revolves around the issues like; integration and inter-operability of different systems. In recent days, many agencies are advocating an overdose of technology such as very high-resolution satellite imagery, and costly options, which may not match the actual requirements.

Project Direction - Consensus building and regulatory mechanisms to allow completion: Indicative plan for project direction and consensus building about project deliveries, practicality and sustainability. There is a need for consultative process along with appropriate subject matter experts before designing the spatial solutions. Another issue is urbanization which has been increasing at alarming rates creating more complexity in delivery mechanisms and infrastructure services. In moving towards the goal of sustainable urban communities, three basic issues need to be addressed such as policy and regulatory frameworks, environment and governance.

Engage – Private finance, public knowledge and professional Knowhow: Engage private finance and utilization of public and professional knowledge. In many cases, large firms, particularly multinationals, have enormous resources, including problem solving skills, which can be useful to the community, but they operate in isolation from the local government, having closer relationships with the national government. Government is putting a policy framework under the JNNURM, which would allow large infrastructure projects to come up in Public Private Partnership (PPP). For example, PPP model ports and urban infrastructure in Gujarat and Greenfield Airports of Devanahalli near Bangalore and Shamshabad near Hyderabad are being built on the BOOT basis with Private-Public Partnerships. International airports in Delhi and Mumbai are being restructured and modernized through PPP and Nandhi Infrastructure Corridor Enterprises (NICE) Bangalore – Mysore road in Karnataka is being built, etc.
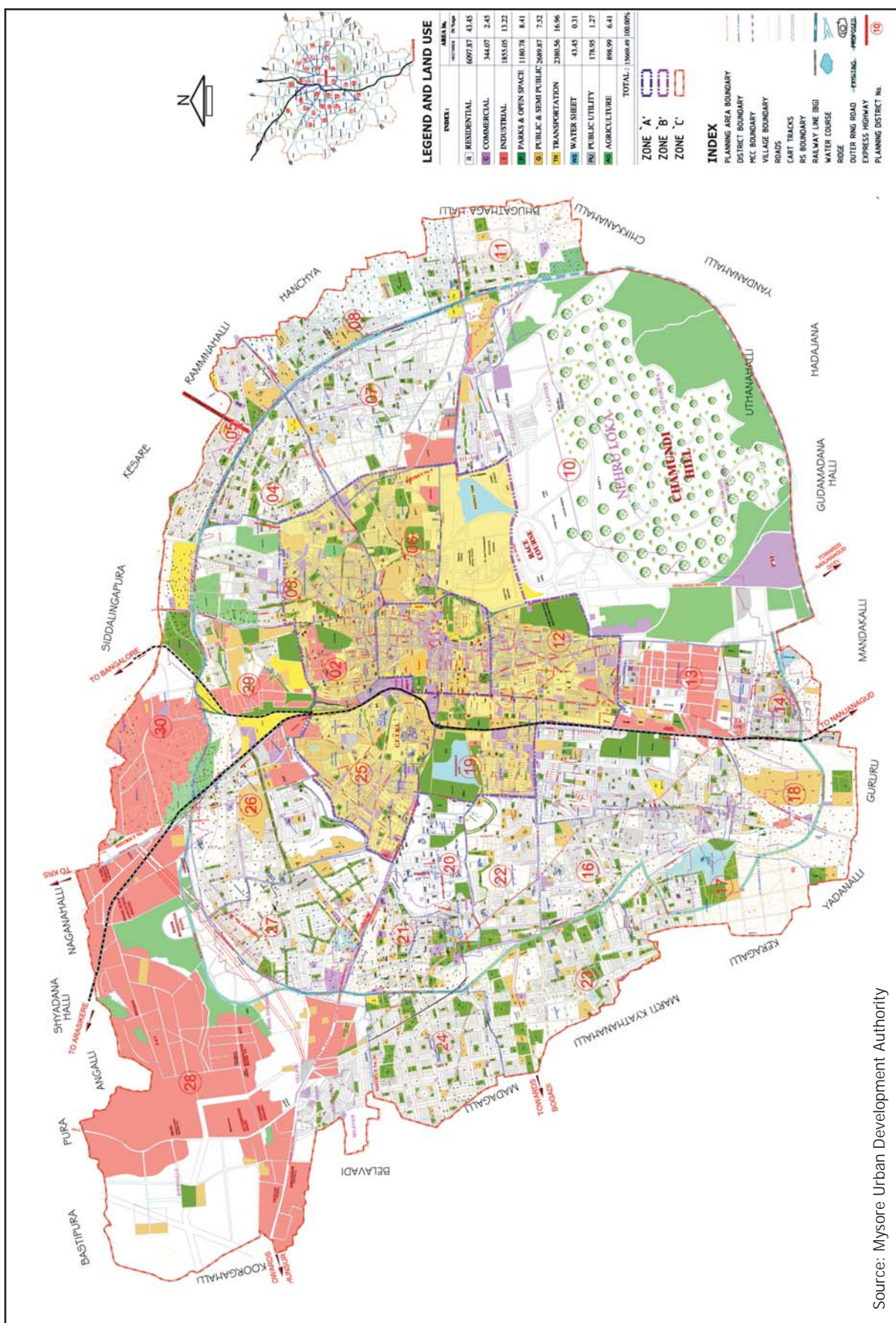
Fig. 1 Proposed Land Use – Revised Comprehensive Development Plan, Mysore – 2011

Source: Mysore Urban Development Authority

Table 1 Key Infrastructure Indicators in Mysore City

S.No.	Particulars	
1	Population (2001 Census)	7,87,179
2	Mysore City Corporation Area	128.75 Sq.km
3.	No. of Municipal Wards	65
4.	Mysore Comprehensive Development Plan Area	165.73 Sq. km.
5.	Total Road -Length in km	1,181.78
6.	Access to portable water: • Coverage • LPCD • Total Water Supply	 85% 125 160 mld
7.	Access to Sewerage: • House hold connection to sewerage • Sewage Treatment Plants	 57% 3 Nos.
8.	Solid Waste Generation & Collection	220 tones/day

Source: City Development Plan for JNNURM Projects in Mysore City, April 2006.

Orientation for implementation - minimum legal backup and formal techniques for 'messy situations': The higher levels of government do intervene, sometimes to assist, and sometimes to control. The result is that complicated and inter-agency issues such as traffic, land use, metropolitan planning etc., hardly receive the attention they deserve. Conflicting legislations should be removed, clearance processes should be minimized and support garnered for Private Partnership Development friendly acts. More transparency, faster decisions, streamlined procedures and minimum legal backups should be enough for speedy infrastructure implementation.

Conflict resolution processes need to be established to deal with conflicts in implementation of strategic thrusts, to minimize disruptions caused by public disputes and escalation of conflicts, which will undermine the whole implementation process.

Key indicators to monitor results should be refined, based on the specifics of the action plans and formal techniques should be initiated for messy situations. Top level direction has to be given and lower level implementation cell need to be established. Some of the procedures as laid down in the Jawaharlal Nehru National Urban Renewal Mission programme guidelines do fulfill these requirements.

3   A CASE STUDY OF MYSORE CITY

Mysore city is taken up as the case study because it is class-I city and the third biggest city in the state of Karnataka. The advantage of Mysore is that Government of India has selected this city under the JNNURM project. The city is situated in the southern part of Karnataka and has a population of 7.87 lakhs (Census of India, 2001). With an area of 128 sq kms, it is the administrative seat of Mysore district, one of the largest districts and former capital of Karnataka. It is located 140 km away from Bangalore, the state capital. The city is known for its palaces and has several other attractions. Mysore is also well known for its ten day *Dasara* festival and is an educational, commercial and administrative centre and also an important tourist and heritage centre. Mysore is identified as one of the fastest growing IT, ITES and BT center after Bangalore. It is also chosen as South Asia's Regional Center for INFOSYS.

3.1 The JNNURM City

The Jawaharlal Nehru National Urban Renewal Mission or JNNURM is an initiative of Government of India aimed at encouraging reforms and fast track planned development of identified cities. The Mission focuses on improving urban infrastructure and service delivery mechanisms to ensure planned sustainable growth of cities.

Under the JNNURM 63 cities were selected for financial aid, the Mysore city is one of them under the category 'C', which means heritage city. Subsequently, the Mysore City Corporation has taken initiatives to prepare City Development Plan (CDP) with the broad vision of 'Mysore aspires to be an international destination for cultural, spiritual, natural and religious tourism based on the history

Table 2 Assigned Projects and Estimated Costs with Sectoral Allocation in %

S No	Projects	Approximate Cost (Rs. in Crore)
1	Water Supply	284.54
2	Basic Services for Urban Poor	143.57
3	Roads and related infrastructure	589.01
4	Sewerage and Drainage	606.00
5	Solid Waste Management	34.85
6	Heritage & Urban Renewal	141.58
7	Other Projects	88.14
	Total	1887.69

Source: Mysore City Corporation

associated with the town, traditional cultural events and by retaining the historical character and conserving the built and natural heritage' in association with empanelled agency by Ministry of Urban Development. The CDP has anticipated about Rs.1,887 crores required for infrastructure investment for 2007-2012. Meanwhile, the detailed project reports are prepared and some of the projects have been approved by the Government of India. The details of assigned projects and estimated cost under the JNNURM are given in Table 2, and salient feature are given below:

The Mysore City Corporation has initiated some of the e-Governance applications and public participatory governance. These are:

- Citizens' Advisory Committees and booth–level Citizens' Committees: The 'Citizen Advisory Committees' encompass with nine expert sub-committees and followed by polling booth-level committees. The 686 Citizen's Committees will have nine members each, taking the number to over 6,000 stakeholders with representations from all sections, age groups and one third of the membership will go to women.

- Online property tax calculation and payments.

- SMS integrated public grievance and redressal system.

- Creation of nine zonal offices with autonomy for decentralizes administration. Each booth-level 'Citizen's Committees' can get Rs.10 lakh from the JNNURM funds, the zonal offices will obtain plans from the booth committees and draw up the local budget.

- Self-Assessment Scheme has been launched and all the private properties have been brought under tax net;

- Computerization of birth and death registration and issues of certificates, issue of house license, trade license, water billing and collection, payroll, public grievance and redressal system has been introduced;

- Separate engineering cell created for solid waste management, horticulture and quality control;

- Under 'Nirmala Nagara' program door to door collection of garbage has been introduced; and

- Personal information system and computerization of all records has been initiated.

3.2 Case Study 1: Mobile administration: SMS Integrated Public Grievance Redressal System[4]

Mysore City Corporation has implemented the SMS Integrated Public Grievances Redressal System for speedy addressing of public grievance. This means public may send an SMS about any problem concerning the city and at the other end the MCC officials will take steps immediately to address it. The SMS Integrated Public Grievance Redressal System enables the citizens to send SMS to the MCC control room about civic problems. The complaints will be passed onto the mobile of the officer concerned immediately by the computer in the control room. The redressal process begins and the complainer will receive a message after the problem was resolved.

The system is backed by the BSNL. The details of 65 wards in the city, roads, sewages and every other feature are recorded in the MCC control room. The routine civic problems faced by the citizens are divided into three groups and coded as A, B and C (Table 3). When the citizen sends complaint via SMS she needs to mention the code which will be transferred to the mobile of the official concerned. A time limit has been stipulated for addressing every problem (Table 4) and if it was not solved the complaint will be forwarded to the mobile of the MCC Commissioner. The official concerned, if fails to present a valid explanation for failing to address the problem will be accounted for dereliction of duty. The citizens who send messages need to type the stipulated code for the particular problem, their name and complete address. The sender will receive an acknowledgment for his complaint and a reply after the problem was addressed.

The time limit provided for addressing the problems coded "A" is 24 hours, seven days for code "B" problems and ten days for code "C" problems. The detail activities included in the each code are given. To speed up civic services, the MCC has purchased 300 SIM cards and distributed them among the officials and all the Corporators. Every complaint sent to the control room will also be received by the Corporators of the area concerned. This way the Corporator will also be involved in addressing the problems of her area.

Mysore City Corporation has taken up several initiatives in addressing citizen – oriented services in the city and has taken preparatory actions to

Table 3 Grouping of Civic Problems

Problems under Code 'A' (Emergency)	Code 'B' (urgent)	Code 'C'
AG 1 - Stray animals (dead or alive) AG 2 - Garbage clearance AG 3 - Adulterated food AP 1 - Blocked road, bridge collapse AP 2 - Street lights AP 3 - Illegal activities.	BG 1 - Vacant site disputes BG 2 - Maintenance of septic tanks BG 3 - Licences (not renewals) BG 4 - Hygiene in public toilets BP 1 - Pot holes on roads/ bad roads BP 2 - Vacating encroachment BP 3 - Illegal construction BP 4 - Delay in public works BP 5 - Changing of street lights. BP 1 - Illegal water connection BW 2 - Illegal sewage connection BW 3 - Slow paced work BO 1 - Officials failing to provide documents on time BO 2 - Rude behavior by MCC officials BO 3 - Polluted water	Apart from under Code 'A' and Code 'B' fall under Code 'C'.

4   Commissioner, Mysore City Corporation (www.mysorecity.gov.in)

Table 4 Time Limit for addressing the Civic Problems

SNo.	Name of the facilities	Duration of work
1.	Building Licence	10-25 Minutes
2.	Birth & Death Certificate	2-3 Minutes
3.	Renewal of Trade Licence	2-3 Minutes
4.	Khata Changes of Water Supply	5 Minutes
5.	Issue of Completion reports	15 Minutes

formulate technical reports and plans to implement the identified projects, measures to conduct education and awareness programs, setting up of separate project implementation units for each projects which would function and ensure the implementation programs in a time bound and efficient manner.

3.3 Case Study 2: Innovative Technology – Construction of Underpasses[5]

A simple but innovative technology adopted by Bruhat Bangalore Mahanagara Palike (BBMP) is going to revolutionize the construction of underpasses across city roads. The innovation has been tried by BBMP at a test site on the premises of Indian Institute of Veterinary Research on Hebbal Road. Further, the same technology was used by the BBMP two years ago during construction of underpass on the Wind Tunnel road. The BBMP has now proposed seven underpasses on Hebbal road to create a signal free corridor till Hebbal Flyover, all in three days. On a Thursday, the high-level task force on infrastructure inspected the test site, approved the projects to be executed, and commissioned latest by Republic Day - much ahead of scheduled inauguration of Bangalore International Airport. However, fast track of 72 hours took nearly 35 days (840 hours) for actual completion due to shifting of underground utilities.

The Palike has proposed underpasses at KR Circle, Maharani College junction, Windsor Manor junction, BDA junction, Cauvery junction, Sanjayanagar junction and CBI junction on Bellary road. The seven junctions would have underpasses to divert traffic from cross roads (except KR circle and Maharani College) to Bellary road and thus avoid traffic halt at signals. The total cost of all projects is about Rs.18 crore and except for KR Circle project, they would be finished in three days.

These projects will be completed based on the Segmented Element Technology using precast box elements which are assembled on site. Conventionally cutting open the ground and then casting retaining walls and slabs are used to construct the underpasses. However, the pre-cast boxes make things easier as they can be cast on mass scale elsewhere and brought to the site only to be assembled. It is much cheaper than conventional methods. By conventional methods, the seven underpasses would have cost about Rs.100 crore, more than five times they would do now. The technology is developed by L Ram Prakash of Rohini Constructions.

3.4 Case Study 3: Computer Aided Design Software for Conducting Surveys and Damage Analysis on roads and streets[6]

Roadscanners Ltd., a company specializing in software used to conduct surveys and damage analyses on roads and streets, is developing 3D-based CAD software called RoadDoc CAD. With the software the road structures can be easily modeled. Layer thickness data can be collected e.g. by Ground Penetrating Radar (GPR) from moving vehicles (Fig. 2). The results are analyzed with the Road Doctor software and transferred to a CAD program that will calculate a 3D model from the various structures. The model will then be used in road rehabilitation planning. With RoadDoc CAD, each rehabilitation measure can be planned with greater accuracy, which means there will be cost savings without compromising the quality.

The cost savings can be as much as 20 to 40 percent of the total rehabilitation costs. There is a

5 Engineering in Chief, Bruhat Bangalore Mahanagara Palike (BBMP), Bangalore (www.bmponline.org)
6 Tekes, the National Technology Agency, Helsinki, Finland: tekes@tekes.fi, www.tekes.fi/eng/.

Fig 2 Ground Penetrating Radar from Moving Vehicle

potential market for the software in countries where the utilization of IT in road rehabilitation planning is already in advanced stages. In the future it will be possible to transfer planning data directly to automated road works machinery using the software.

4. KEY CHALLENGES

- Innovative and sensible approaches to infrastructure provision are needed to maximize strong synergy in enhancing the potential for long-term sustainability;

- A significant contribution in highlighting the role of infrastructure for linking sustainable growth;

- Unless the private sector investments happen, urban infrastructure sector will not see the sea change or quantum leap necessary in a developing country like India;

- Establishing a visible and sustainable linkage between the supply of urban infrastructure and quality of life of the urban poor;

- To enable commercially viable infrastructure development projects through, policy advice, project advisory and project financing; and

- Speedy implementation of urban infrastructure projects is must and if delayed the projects often lose their significance.

5. CONCLUSIONS

We are thinking about fast growth, quick infrastructure, but forgetting the fundamentals of policy for a stronger focus on competitive market structures, cost covering tariffs, credible governance frameworks and private investors lure.

Government departments, Indian industry and various parastatal agencies needs to work with unity of purpose - a shared vision, backed by policies and popular support is required to enable and pursue innovations in urban infrastructure sector.

Available resources need to be invested more rationally both in terms of the allocation between investment for additional capacity and operation and maintenance on the one hand and clearly prioritized allocation of capital investment expenditure among various projects on the other.

Capital to be allocated and funds should flow to improve productive uses rather than inefficient activities.

Improved productivity and international best practices and bench marking with the best in the world.

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SLUM GROWTH IN BHUBANESWAR: A PROBLEM OR SOLUTION?

NIHAR RANJAN ROUT

Lecturer, Department of Population Studies, Fakir Mohan University, Balasore, Orissa

ABSTRACT

The slum population in Bhubaneswar is found to be more than 30 percent of the total city population, which has shown tremendous growth during the last decade. In this study, landlessness was found to be the major reason behind migratory movements to the slums, followed by economic problem, irregular work and unemployment at their place of origin. Apart from poor living conditions and health related problems, slum dwellers also reported about the problems of poor civic facilities, fear of displacement, irregular work, and insufficient income. According to their perceptions, major problems were related to housing, employment and environment, compared to those related to society and social life. Many researchers argue that slums are not problems that have to be solved; rather they represent a solution of shelter for the poor. Now the challenge for the policy makers is to facilitate the types of movement that are most likely to lead to alleviation of poverty, while protecting the slum dwellers from abuse and exploitation.

1. INTRODUCTION

Deteriorating rural conditions and an expectation of getting better jobs, income and quality of life in the urban areas has generated a huge flow of poor migrants to the cities all over the world. According to Srinivas (1996) this trend has become intensified in the developing countries, particularly during the last three decades. Owing to such massive inflow of migrants to the cities, resulting in rapid growth of urban areas in most of the developing countries, there has been a huge shortfall in many sectors, primarily housing. Unavailability of required number of houses and inability of the poor migrants to afford a house inside the urban area has led to proliferation of slums and squatter settlements in the cities. As defined by the Census of India (2001) slum refers to a compact area of at least 300 population or about 60-70 households of poorly built, congested tenements in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities. This work is an attempt to understand the process of slum growth in the city of Bhubaneswar and the specific objectives of this study are to find out the growth of slum population in the city of Bhubaneswar and to know about the reasons behind migratory movements to the urban slums; and to get an idea about the living conditions and problems faced by the slum dwellers.

2. REVIEW OF SELECTED LITERATURE

There have been a substantial number of studies discussing growth of slums and squatters and features associated with their development. A vast number of case studies at the Habitat Conference at Vancouver in 1976 highlighted the conditions in squatter settlements, calling for a concerted and committed approach towards solving the problem. Abrams (1964) advocated the process of squatting as a 'conquest' of city areas for the purpose of shelter, defined both by the law of force and the force of law. Turner (1976) and Payne (1977) also put some positive views regarding slum growth and its inevitability, and considered the same as highly successful solutions to housing problems in urban areas of developing countries. Although the magnitude of problems related to slums has changed drastically, the scenario has remained all the same, even after 30 years of the Conference.

Regarding the people who reside in urban slums, they are normally migrants coming from economically less advantageous rural areas. In the words of Skeldon (2002) migration is often seen as a flight from poverty. Many studies have indicated that migration occurs mainly for economic reasons (Chandra, 2002). High unemployment rate, low income, high population growth, unequal distribution of land, demand for higher schooling, prior migration pattern and dissatisfaction with housing have been identified as some of the prominent determinants of rural out migration (Hossain, 2001).

Many researchers have suggested that slum settlements used to represent an active, grassroots attempt by the desperately poor to take care of themselves. However, there are equal number of studies, may be even more, discussing

the unhealthy and unhygienic living and vulnerable working conditions of the slum dwellers. They are exposed to abusive working conditions, they are required to work for long hours, they experience non-payment or deferred payment of salary, they lack social security and health protection and they experience maltreatment and violence too. According to Sclar and Northridge (2003) while their physical forms vary by place and over time, slums are uniformly characterized by inadequate provision of basic infrastructure and public services necessary to sustain health, such as water, sanitation, and drainage. Buildings made of flimsy materials are prone to ignite, frequently collapse, and offer scant protection against the elements, leaving their residents vulnerable to injury, violence, illness, and death. Further, since many of these settlements are illegal, slum dwellers often have no official redress system and are commonly denied basic rights and entitlements, including the right to vote, public education, and health care.

3. METHODS AND MATERIALS

To analyze the growth of slum population in Bhubaneswar both published and unpublished data of Bhubaneswar Development Authority were used. A few other studies about the capital city of Orissa were also cross-referred to get some supporting evidence. For achieving the next two objectives, a primary survey was conducted in five slums in the city of Bhubaneswar. As a part of the sampling process, the whole city was divided into five zones, depending upon their geographical proximity and period and type of development. At stage one, one slum from each zone was selected randomly, keeping in mind that all the five selected slums should come from five different zones. The selected slums have mostly a linear pattern of settlement with a line of back-to-back houses separated from another similar line by a narrow road. At stage two, 30 households were selected from each of the slums using systematic

sampling. In total, 144 households were covered in the five slums and a structured interview schedule was used to interview the head of each of the selected household.

4. ANALYSIS, DISCUSSION AND FINDINGS

4.1 Slum Growth in the City

Bhubaneswar, along with Gandhinagar and Chandigarh was re-planned just after the independence for administrative purposes. The Census results have revealed that Bhubaneswar has doubled after every 10 years in terms of its population. Its population was a mere 16,512, when it got the NAC status in 1952. It became a Class III town in the next Census itself (1961) and a Class I city with municipality status in 1971. The city was declared a Municipal Corporation in the year 1992 and according to the 2001 Census it accommodates 648,032 people in the main city area of 135 sq km. The extent of population growth in the city of Bhubaneswar can be well visualized from Table 1.

It has been found that slum dwellers constitute a major part of the city population in most of the developing countries. The capital city of Orissa is no exception to that. As per a study by the Bhubaneswar Development Authority (BDA) considerable population amounting to 200,097 i.e. 30 percent of total population were living in slums in the year 2001. Census 2001 data has provided similar figure too. However, many NGOs working for slums in Bhubaneswar like Ruchika Trust claimed that the figure of slum population is as high as 40 percent or even more. After the super cyclone in 1999, a survey was undertaken by Bhubaneswar Municipal Corporation (BMC) to identify and assist slum dwellers in Bhubaneswar for providing relief. As per the survey 190 slums were identified out of which 59 slums were found on own land or land provided by Government

Table 1 Population Growth in Bhubaneswar

Year	Population	Year	Population	Year	Population
1921	8110	1951	16512	1981	219419
1931	9024	1961	38211	1991	411542
1941	9253	1971	105491	2001	648032

Source: Various Censuses of Orissa

under resettlement process and 131 slums were situated on encroached land of about 300 acre. The last decade has shown tremendous growth of 78 percent of the slum population, which was mainly an outcome of the vast devastation caused by the super cyclone leading to huge migration from the rural hinterland and other areas in search of employment particularly in the construction sector.

The BDA has classified the slum settlements in the city into slum colonies belonging to industrial workers, common slums, population squatting on the land belonging to Indian Railways and other government agencies. But one thing was found to be common among them i.e. lack of civic services, unhygienic living conditions coupled with increase in housing stock deficit has given rise to slum dwellings and its population. Table 2 presents data collected by the BDA on growth of slum pockets, number of slum households and the slum population in Bhubaneswar over the years, which suggest that there has been a very high growth of slum population in Bhubaneswar, compared to the overall population growth of the city. As per the calculated growth rates, the problem has become intensified during the last decade. According to the figures, as shown in Table 2, slum population in Bhubaneswar grew at a rate of 11.82 percent every year, during 1993 to 1999, which was too high, compared to the general population growth rate. Moreover, the population growth in the city slums did not match at all with the rise in the number of households. It was clearly evident form the figures given by the BDA that while population in the slums grew at an annual rate of 11.82 percent, households in the slums grew at a very low rate of 3.89 percent every year during 1993 to 1999.

4.2 Migratory in-flow to the city Slums

It is a well-known fact that slum dwellers are in fact migrant workers who come to the city with an economic motive, find it hard to get a dwelling place inside the city area, at an affordable rate and either move to the existing slums or make their own. According to Srinivas (1996) the vast majority of these men and women are farmers and farm laborers who in their villages lack resources and opportunities for an economically active life. A migrant's to hold in the city may be a squatter shanty or nearby marginal land. They often stay with relatives on undesirable public sites, hoping that the public authorities will not notice their invasion of public or private land. They move for many reasons - to find employment, or to escape calamities like floods, famine and drought. Rural poverty is the most fundamental reason for the great migration to the city. Bhubaneswar is a no exception.

The data collected for this study suggested that all the interviewed slum dwellers were migrants having a rural base. Quite naturally, 108 of them were from Orissa, 29 from Andhra Pradesh, 5 from Bihar and 2 were from Jharkhand. It clearly indicates that movement of population to the city in such a level somehow follows the law of distance. Regarding their origin, most of the migrant slum dwellers were from nearby districts of Nayagarh (19.4 percent), Pulabani (13.2 percent), Khurda (9 percent) and Ganjam (8.3 percent). Cuttack and Puri were the two other districts, though very close to Bhubaneswar, fell a bit low in the rank table. The explanation of such trend might be the presence of cities like Cuttack and Puri in the aforesaid districts respectively, which

Table 2 Trend of Population Growth in the Slums of Bhubaneswar

Year	Number of Pockets	Households	Annual Rate HH Growth	Slum Population	Annual Population Growth rate
1971	7	NA	NA	NA	NA
1981	23	NA	NA	NA	NA
1989	70	17175	NA	86901	NA
1991	86	21003	11.14	110112	13.35
1993	101	24318	7.89	117000	3.13
1999	145	30000	3.89	200000	11.82

Source: Bhubaneswar Development Authority (Cited in Environmental Management Plan Bhubaneswar; OSPCB; 2003)

Table 3 Percentage Distribution of Migrants Based on the Main Reason for Migration

Reason for migration	Percentage
Got a job	03.47
Unemployment	09.03
Landlessness	32.64
Economic problem	17.36
Irregular work	17.36
Natural calamity	03.47
Large family	04.17
Indebtness	06.25
Family tension/ conflict	02.08
Father's death	02.08
Higher aspiration	02.08
N	144 (Multiple Response)

Table 4 Percentage Distribution of Households Against Different Categories of Living Arrangements

Background variables	Percentage
Type of house	
• Kuchha	25.00
• Semi-puckka	69.19
• Puckka	11.81
Number of living room	
• Only One	79.86
• 2 to 4	20.14
Presence of kitchen	
• No	61.81
• Yes	38.19
Source of drinking water	
• Private tap	04.86
• Private well	03.47
• Public tap	69.44
• Public tube well	06.94
• Public well	15.28
• Toilet facility	
• Inside the premise	10.42
• Public/Common	12.50
• Open field	77.08

also could have been acted as labor attracting centers.

Economic disadvantage always appears as the strongest influential or push factor in migration decision of an individual, at least when labor migration is considered. Whatsoever might the response be, most of the reasons (Table 3) could have been clubbed under the category of 'economic motive'. There were 62 percent landless within the sample and landlessness of course was the biggest reason for their migration (32.64 percent), followed by economic problems and irregular work (17.36 percent each) and unemployment (9.03 percent). Indebtedness, large family, lack of a job, natural calamity, family tension or conflict, father's death and higher aspiration were the other reasons.

4.3 Living Condition of the Slum Dwellers

According to the Environmental Management Plan of Bhubaneswar (2003) most of the slums of the city are located on unutilized government land or railway land, which remained temporarily vacant where development could not be done immediately. The report also states that slums are usually devoid of services, prone to all types of natural hazards, have poor housing and living conditions and hence can pose severe environmental problems, including health risks. In the absence of appropriate economic activity, the ongoing urbanization can lead to economically weaker sections of the migrant population settling in slums, thereby further increasing the existing slum population.

It was found from the primary survey that majority of slum dwellers had self-owned kucha or semi-pucca houses without separate kitchen, toilet and private tap or well facility. Looking at the exact distribution (Table 4), there were 25 percent kucha houses, 69.19 percent semi pucca houses and 11.81 percent pucca houses in the sample and as far as type of accommodation was concerned 73 percent of them had own house, while 23 percent had either rented house or houses provided by the employer. Most of the houses (79.86 percent) had one living room and there were 17.36 percent houses with 2 rooms, whereas the average number of persons per living room for the entire sample was obtained to be as high as 3.35 persons.

Having a separate kitchen or a toilet inside the premise was a rare phenomenon. Around 62 percent of the households were not having any

separate kitchen and 77 percent households were using open fields as toilet. Majority of the household (69. 44 percent) were using public tap as the main source of drinking water followed by public well on which more than 15 percent households were dependent.

With increased duration of stay, there was an increase in number of migrants living in own house and there was an overall decreasing trend in case of rented houses. Similarly, probability of having a kitchen increased with increase in stay duration and the case was same for private tap and private well users. It certainly indicated a positive shift in the living conditions of slum dwellers with increase in the duration of stay.

4.4 Perceived Problems

The over all socio-economic aspects of developmental are extremely poor along with low-level of income and productivity in almost all the city slums. Slum provides a gigantic solution for the migrant workers coming to the city; but at the same time, staying in such an awful place, the dwellers suffer from a lot of problems.

As far as health related problems were concerned, 65.28 percent households of the total sample (94

out of 144) reported that at least one of their family members at the place of destination suffered form a disease during a period of 6 months prior to the survey. As mentioned in Table 5, common cold and cough (17.36 percent) and fever (23.61 percent) were the most frequently occurring diseases among the household members, followed by malaria and jaundice (6.94 percent each). Tuberculosis and feeling pain or weakness were the two other responses mentioned by 4.17 percent households.

There was only one migrant for whom the medical expenses were borne by an association and the rest spent the amount from their own pockets. It clearly suggested that employers were never concerned about the health of the migrants or their family members, as far as giving financial assistance was concerned.

Table 6 presents the percentage distribution of households reporting other perceived problems related to housing, environment and society. Regarding those problems, 68.75 percent of the

Table 5 Percentage Distribution of Households Based on the Diseases Suffered by any of the Family Member During Last Six Months

Disease	Percentage
Fever	17.36
Cold/Cough	23.61
Diarrhea/Dysentery	2.08
Malaria	6.94
Jaundice	6.94
Eye problem	0.69
Heart problem	2.08
Tuberculosis	4.17
Physical injury	0.69
Gyneic problem	0.69
Pneumonia	1.39
Pain/Weakness	4.17
Appendicitis	0.69
Headache	0.69
Psychic problem	0.69
N	144 (Multiple Response)

Table 6 Percentage Distribution of Households Reporting about Various Problems (Multiple Response)

Problem	Percentage
Housing	6.94
Civic facility	60.42
Maintenance of gutter	6.94
Water logging	4.17
Prevalence of mosquito	68.75
Garbage accumulation	4.17
Fear of evacuation	39.58
Irregular work	45.14
Low wage	6.25
Insufficient income	37.50
Strainous work	11.11
Hazardous working condition	4.86
Misbehaviour of employer	3.47
Delayed payment	2.08
Isolation	2.08
Homesickness	4.86
Language	0.69
Insecurity	1.39
Adjustment	0.69
N	144 (Multiple Response)

households reported the problem of mosquito bites whereas 60.42 percent reported poor civic facilities and 39.58 percent reported the fear of displacement and evacuation. Over 45 percent of the slum dwellers complained about irregular work, while 37.5 percent complained about insufficient incomes. According to their perceptions, major problems were related to housing, employment and environment.

5. CONCLUSIONS

Unhealthy environment, unhygienic living conditions, structurally inadequate housing, lack of civic facilities, hazardous working conditions and low level of socio-economic conditions are the key features of slum pockets, which further lead to a substantial number of problems related to health, housing, unemployment and social life. In the words of Rath (2003) it is a well known fact that due to uneven development of economy in capitalism, thousands of people from different parts of India are moving hither and thither in search of livelihood. Just to earn their bread they are ready to work under any condition. Compelled by their situation they have no choice but to choose whatever work they get. They do not hesitate to work or live in the worst conditions. All these lead to many problems, notable among which are health related problems, problems related to civic facilities, social and occupational problems. However, many researchers argue that slums are not problems that have to be solved - but are indeed results of lopsided and vested urban policies covering land ownership, infrastructure provision and maintenance, and other socio-economic issues. And for the poor, they represent a solution. According to Srinivas (1996) housing is not only a technical problem; but also a socio-political one. It requires an integrated approach and therefore, we need to decentralize and de-institutionalize the approach to solve the problems of housing. Now the challenge for the policy makers is to facilitate the types of movement that are most likely to lead to alleviation of poverty, while protecting the slum-dwellers from abuse and exploitation.

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CHANGE DETECTION OF LAND USE AND LAND COVER PATTERNS: A CASE STUDY OF MANDIDEEP AND OBEDULLAGANJ AREA IN MADHYA PRADESH

Dr. ARUNA SAXENA
Head, Center for Remote Sensing and GIS, MANIT, Bhopal

RUCHIN AGRAWAL
M.Tech (Remote Sensing and GIS)

ABSTRACT

As human and natural forces modify the landscape, resource agencies find it increasingly important to monitor and assess these alterations because in turn it influence management and policy decisions. Methods for monitoring change range from extensive analysis of remotely sensed data. While aerial photography can detect change over relatively small areas at reasonable cost, satellite imagery has proven cost effective for large regions. Land use and land cover changes are very dynamic in nature and have to be monitored at regular intervals for sustainable environment development. Remote sensing data is very useful because of its synoptic view, repetitive coverage and real time data acquisition. The digital data in form of satellite imageries, therefore, enable policy makers to accurately compute various land uses and land cover categories and helps in maintaining the spatial data infrastructure (SDI) which is very essential for monitoring urban expansion and change detections studies. In this paper remote sensing data is used to provide empirical inputs about urban growth and other spatial information. GIS is used for analyzing spatial-temporal data.

1. INTRODUCTION

Studies have shown that there remain only few landscapes on the earth which are still in their natural state. Due to anthropogenic activities, the earth surface is being significantly altered and man's presence on the earth and his use of land has had a profound affect on the natural environment, thus resulting in an observable pattern in the land use and land cover over time.

Land use and land cover pattern of a region is an outcome of natural and socio – economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use and land cover and possibilities of their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population.

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. Advancement in the concepts of vegetation mapping has greatly increased research on land use land cover change, thus providing an accurate evaluation of the spread and health of the world's forests, grasslands, and making agricultural resources an important priority.

Viewing the Earth from space is now crucial to the understanding of the influence of man's activities on his natural resource bases over time. In situations of rapid and often unrecorded land use changes, observations of the earth from space provide objective information of human utilization of natural landscapes. Over the past years, data from earth sensing satellites has become vital in mapping the earth's features and infrastructures, managing natural resources and studying environmental changes.

Remote Sensing (RS) and Geographic Information System (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of earth - system function, patterning, and change at local, regional and global scales over time. Such data also provide an important link between intensive, localized ecological research and regional, national and international conservation and management of biological diversity (Wilkie and Finn, 1996). GIS and remote sensing data provide a general extensive synoptic coverage of large areas. Thus these technologies provide a system for regularly monitoring the changes occurring in the area with a view to better planning.
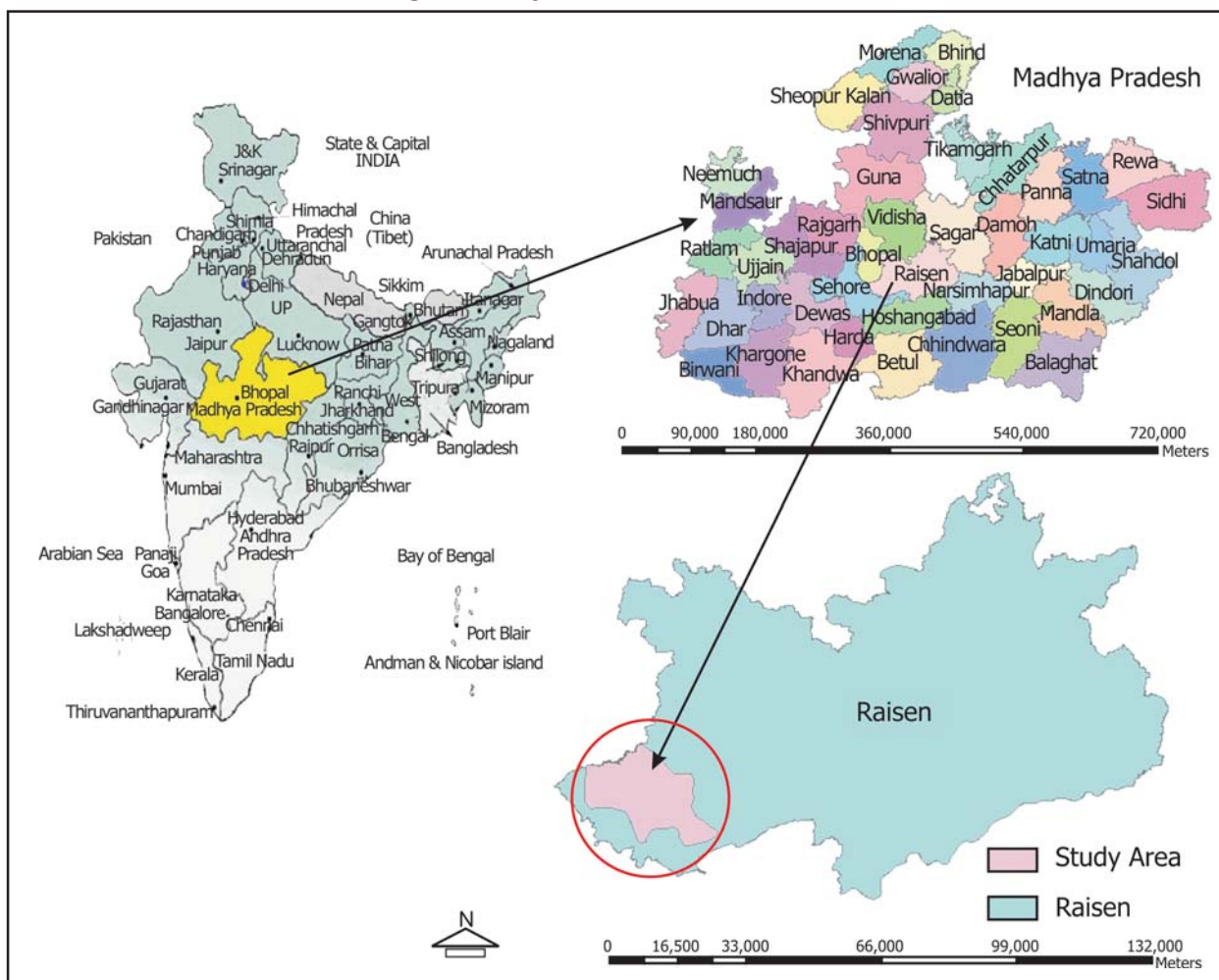
2. STUDY AREA

Mandideep and Obedullaganj are situated in Goharganj tahsil of Raisen district of Madhya Pradesh is the case study area (Fig. 1). The extent of the study area is between latitudes 22Ú 54' 27.54" N and 23Ú 08' 08.48" N, and between longitudes 77Ú 24' 40.24" E and 77Ú 44' 03.17" E. It falls in the Malwa plateau region. It has a good fertile soil cover, which encourages agricultural practices in the region. Agriculture has been a major occupation for the residents. The area is well connected by roads and railways. The National Highway No.12 passes through the heart of the study area, thus giving it an excellent connectivity with the rest of the state. The main Delhi-Mumbai railway line also passes through the study area, thus giving it connectivity to the port. All these factors are therefore cumulatively provide a good environment to the already booming industry and business in the area. Economy of the area is hence growing at a rapid rate, provision of employment

to the local people are also good. Many of the developments have come up in the recent past, which have affected the area in a drastic way. Mandideep and Obedullaganj have witnessed remarkable expansion, growth and developmental activities such as building construction, deforestation and many other anthropogenic activities. This has therefore resulted in increased land consumption and a modification and alterations in the status of the land use and land cover over time without any detailed and comprehensive attempt as provided by a remote sensing data and GIS to evaluate this status as it changes over time. This can act as a basic tool for the planners to make and implement better plans.
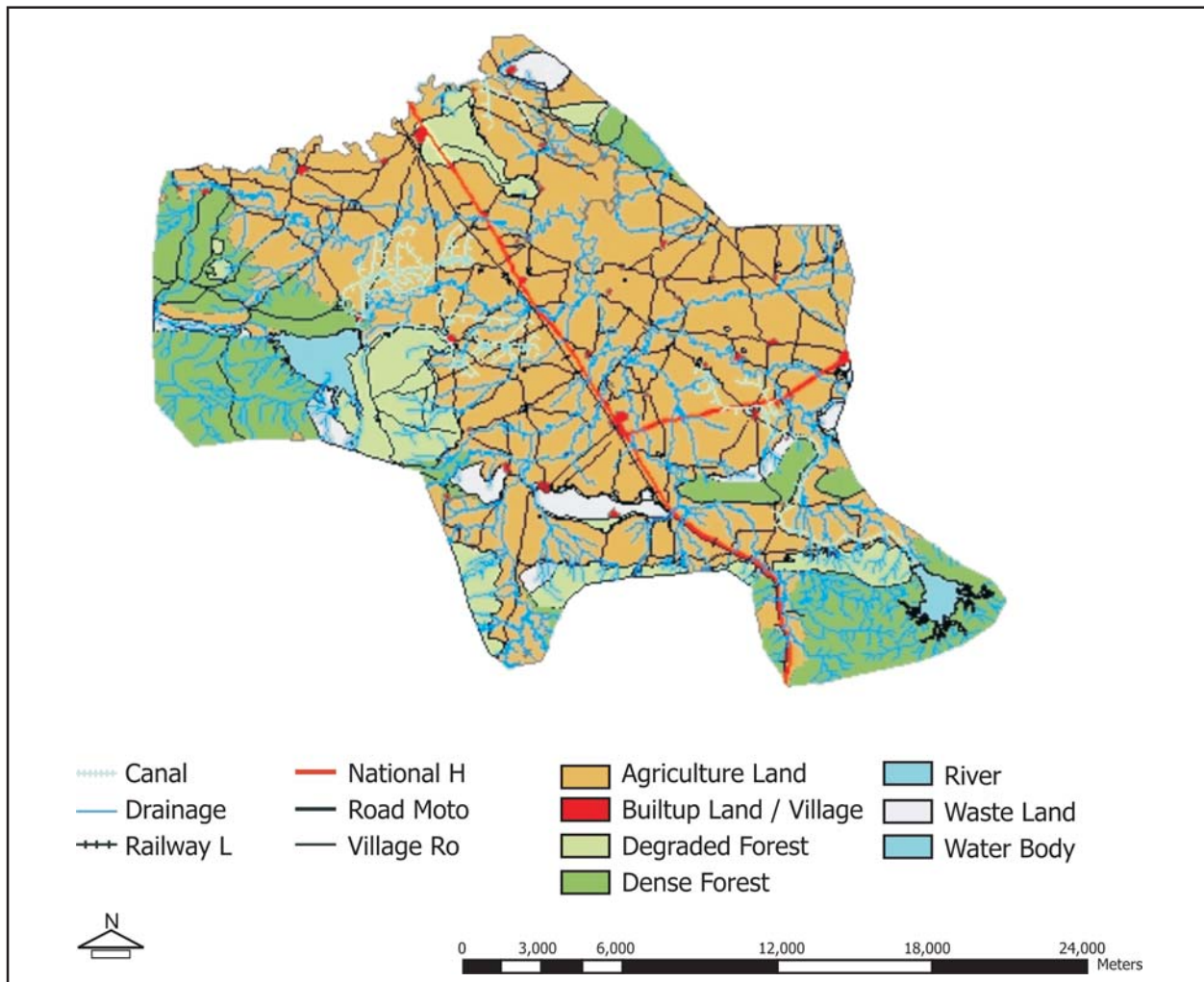
3. DATA USED AND METHODS OF DATA ANALYSIS

Merged Image of IRS 1D LISS III, PAN Sensor of Feb-2007 and LANDSAT 5 TM Sensor of Mar-1992

Fig. 1 Study Area (in the red circle)

Fig. 2 Base Map of the Study Area

were used to prepare land use and land cover maps. These images were in the digital form. The Census data of the year 2001 was acquired from the census department. Topo sheets bearing numbers 55 E/8, 55E/12, 55F/5 and 55F/9 were used to prepare the base map (Fig. 2). Two main methods of data analysis were adopted in this study.

- Calculation of the area in hectares of the resulting land use and land cover types for each study year and subsequently comparing the results.

- Overlay operations

- The methods above were used for identifying changes in land use types. Therefore, they have been combined in this study.

A comparison of land use and land cover statistics assisted in identifying the percentage changes, trends and rate of change between 1967 and 1992, between 1992 and 2007. In achieving this, the first task was to develop a table showing the area in hectares and the percentage change for each year (1967, 1992 and 2007) measured against each land use land cover type. Percentage change to determine the trend of change can then be calculated by dividing observed change by sum of changes multiplied by 100:

$$\text{Trend percentage change} = \frac{\text{observed change}}{\text{Sum of change}} \times 100$$

Overlay operations identifies the actual location and magnitude of change. There are many Change Detection Algorithms that can be employed in change detection analysis. In this study 'Image Differencing' has been used to carry out the analysis. Image differencing involves subtracting the image of one date from that of

another. The subtracting results in the changes that have taken place over the period of time.

4. DISCUSSIONS AND DATA ANALYSIS

The objective of this study forms the basis of all the analysis carried out in this paper. The results are presented in the form of maps, charts and statistical tables. They include the static, changed and projected land use and land cover of each class.

4.1 Land Use Land Cover Distribution

The static land use land cover distribution for each study year as derived from the maps are presented in the table below. Less than 1 percent of the area under built up land or village category depicts the rural nature of social structure of the study area in the year 1967 (Table 1). More than 64 percent of agricultural land shows the dependency of the population on agriculture for livelihood. Total forest cover (both dense and degraded) of the area is about 28 percent which shows the presence of good natural habitat. Also the wasteland was very less (<4percent). Water bodies covered around 2.2 percent of the total area. The river occupied 0.28 percent of the total area. In 1992, the built up land and village category has grown by almost 1.5 times. This is due to the rise of population as well as due to the rise of semi urban centers in Mandideep and Obedullaganj, which are the result of industrial development (0.84 percent) in Mandideep.

Growth of agriculture land is 2 percent which further strengthens the agrarian nature of the social structure. Dense forest category has registered a considerable dip in its share of the total area by about 10 percent. Degraded forest also has registered a cut down by about 3 percent. Wasteland has increased by about 10 percent. Water bodies have a meager increment of 0.07 percent. The pattern of land use land cover distribution in 2007 also follows the pattern in previous years. Agricultural land still occupies a major part of the total land but there exists an increase by 1 percent in the total industrial area.

4.2 Overlay Operations in Change Detection Study

An important aspect of change detection is to determine what is actually changing to what i.e.

Table 1 Land Use Land Cover Distribution (1967)

Landuse/Land Cover categories	1967	
	Area(ha.)	Area(%)
Builtup Land/ Village	362.61	0.89
Agricultural Land	28441.26	64.55
Waste Land	1617.32	3.67
Dense Forest	8276.68	18.74
Degraded Forest	4263.67	9.67
Water Body	970.09	2.2
River	124.07	0.28
Total	44055.7	100

which land use class is changing to the other. This information will reveal both the desirable and undesirable changes and classes that are relatively stable over time. This information will also serve as a vital tool in management decisions. This process involves a pixel to pixel comparison of the study year images through overlay. On the other hand, looking at the nature of change under stability i.e. areas with no change and instability - loss or gain by each class between 1967 and 1992; 1992 and 2007; and 1967 and 2007 particularly in the change in hectares as observable in Table 2 and 3, stability seems to be a relative term as no class is actually stable during this period except when observed from the percentage change. Tables also presents a clear picture about the nature of changes.

5. FINDINGS AND IMPLICATIONS

The built up land and villages category has shown a steady growth over the period of time. This is the result of industrialization of the area. Many new institutional areas are also being set up thus to add to this category. Agriculture land has shown a slight reduction in the period 1992-2007. Wasteland has increased considerably between 1967 and 2007. Proper planning to efficiently utilize waste lands should be employed.

However, the result of the work shows a rapid growth in built up land and industrial area between 1967 (Fig. 3) and 1992 (Fig. 4) while the periods between 1992 and 2007 (Fig. 5) witnessed a steady growth in industrial area. It was also observed that there is a considerable reduction in forest land (Fig. 6).
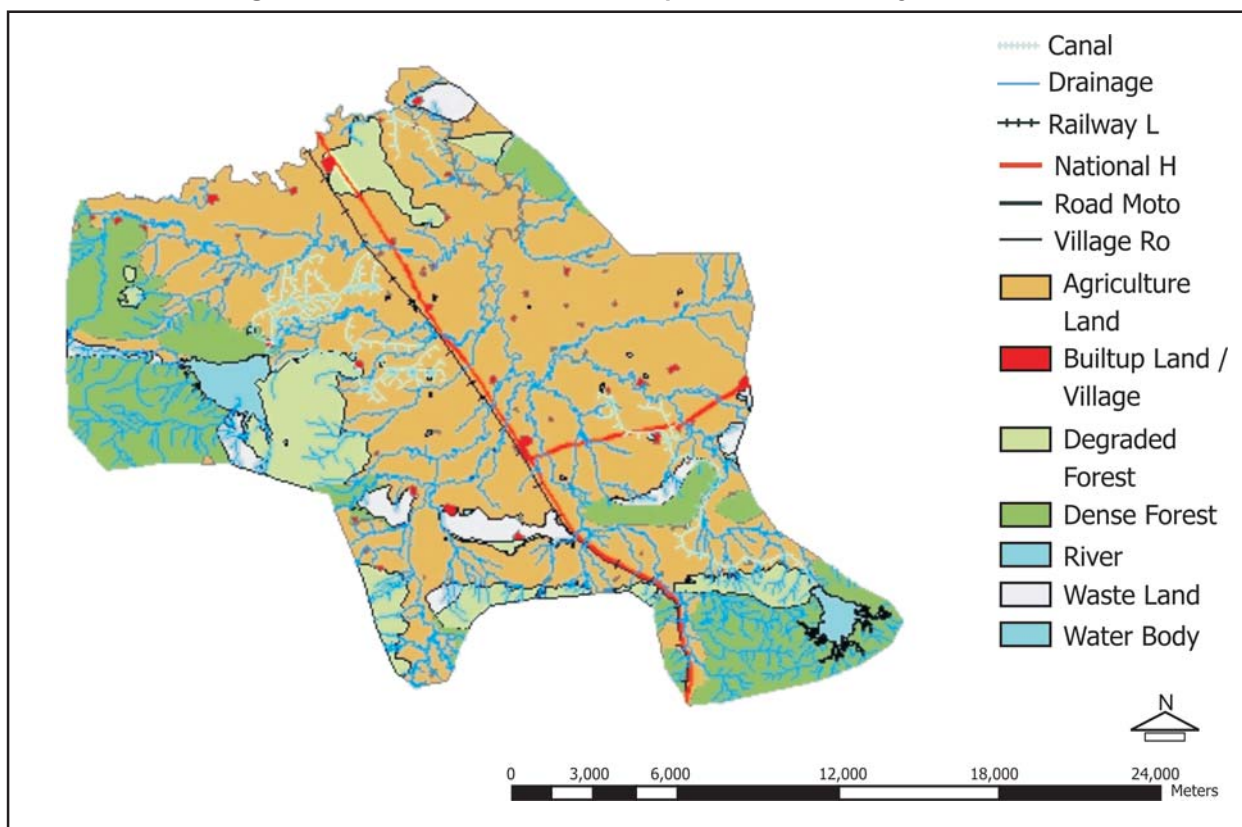
Fig. 3 Land Use/Land Cover Map of the Area for year 1967

Fig. 4 Land Use/Land Cover Map of the Area for year 1992
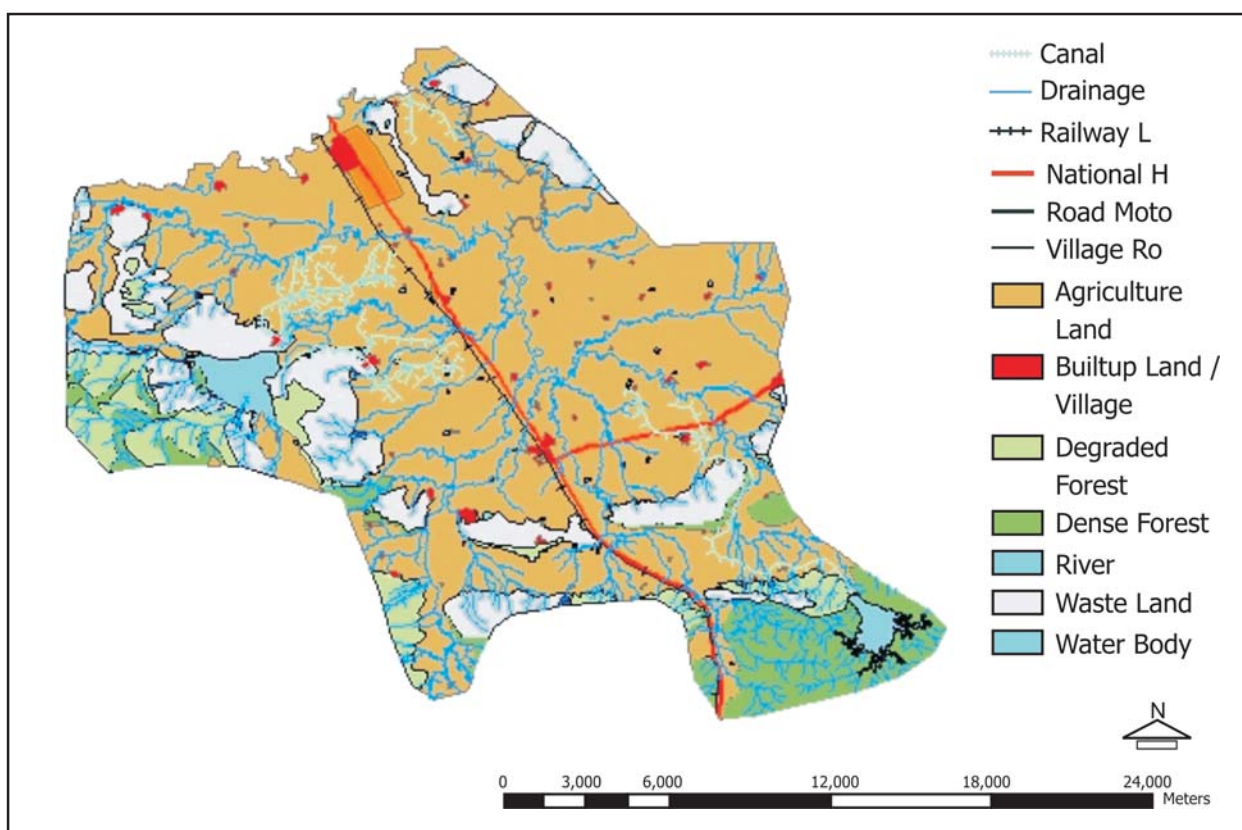
Fig. 5 Land Use/Land Cover Map of the Area for year 2007
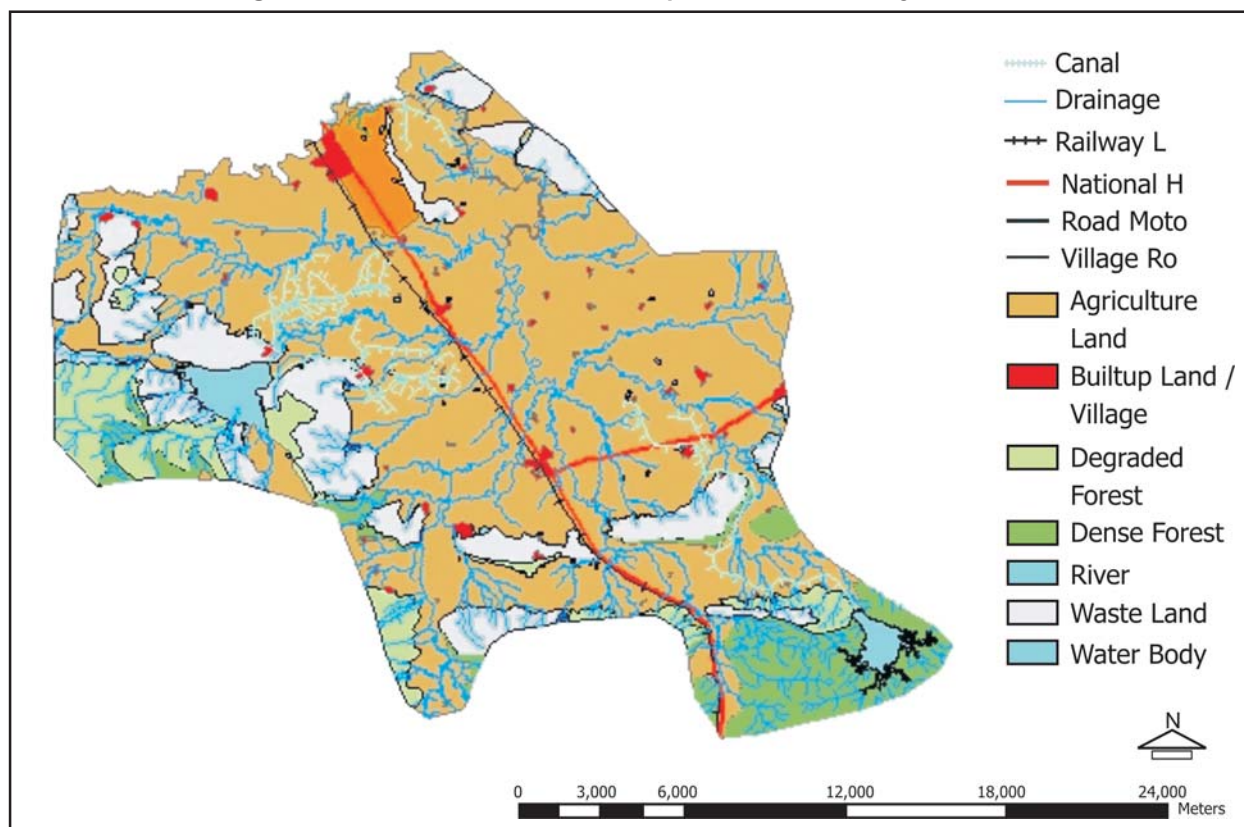
Table 2 Changes in Land Use Land Cover Categories From Year 1967-1992

| Changes in landuse/land cover categories | YEAR 1967-1992 | |
From to	AREA(Ha.)	AREA(%)
Degraded Forest to Waste Land	2157.93	27.81
Degraded Forest to Water Body	14.72	0.19
Degraded Forest to Agricultural Land	458.27	5.91
Dense Forest to Waste Land	2716.32	35.01
Agricultural Land to Industrial Area	160.80	2.07
Degraded Forest to Industrial Area	189.56	2.44
Agricultural Land to Builtup Land/ Village	56.40	0.73
Degraded Forest to Builtup Land/ Village	65.42	0.84
Agricultural Land to Water Body	13.92	0.18
Agricultural Land to Waste Land	0.0017	0.00
Dense Forest to Agricultural Land	486.70	6.27
Dense Forest to Water Body	2.08	0.03
Dense Forest to Degraded Forest	1409.41	18.16
Dense Forest to Builtup Land/ Village	11.39	0.15
Waste Land to Builtup Land/ Village	16.41	0.21
Total	7759.3317	100

Fig. 6 Map Depicting changes from 1967-2007

Year 1967-1992

Boundary
Degraded Forest to Waste Land
Degraded Forest to Water Body
Degraded Forest to Agricultural Land
Dense Forest to Waste Land
Agricultural Land to Industrial Area
Degraded Forest to Industrial Area
Agricultural Land to Builtup Land/Village
Degraded Forest to Builtup Land/Village
Agricultural Land to Water Body
Agricultural Land to Waste Land
Dense Forest to Agricultural Land
Dense Forest to Water Body
Dense Forest Degraded Forest
Dense Forest to Builtup Land/Village
Waste Land to Builtup Land/Village

Year 1992-2007

Boundary
Waste Land to Industrial Area
Agricultural Land to Industrial Area
Agricultural Land to Builtup Land/Village
Water Body to Agricultural Land
Degraded Forest to Waste Land
Dense Forest to Water Body
Waste Land to Water Body

Year 1967-2007

Boundary
Degraded Forest to Industrial Area
Agricultural Land to Industrial Area
Degraded Forest to Waste Land
Degraded Forest to Water Body
Agricultural Land to Builtup Land/Village
Dense Forest to Waste Land
Degraded Forest to Builtup Land/Village
Agricultural Land to Water Body
Degraded Forest to Agricultural Land
Agricultural Land to Waste Land
Dense Forest to Agricultural Land
Dense Forest to Water Body
Water Body to Agricultural Land
Dense Forest to Builtup Land/Village
Dense Forest to Degraded Forest
Waste Land to Builtup Land/Village

N

0   3,000   6,000   12,000   18,000   24,000
Meters

Table 3 Changes in Land Use Land Cover Categories from Year 1992-2007

| Changes in landuse/land coverCategories | YEAR 1992-2007 | |
From to	AREA(Ha.)	AREA(%)
Waste Land to Industrial Area	90.19	14.83
Agricultural Land to Industrial Area	383.77	63.10
Agricultural Land to Builtup Land/ Village	76.53	12.58
Water Body to Agricultural Land	13.18	2.17
Degraded Forest to Waste Land	44.56	7.33
Dense Forest to Water Body	0.0002	0.00
Waste Land to Water Body	0.0002	0.00
Total	608.2304	100

6.   CONCLUSIONS

Remote sensing is very important tool for mapping of land use and land cover for micro, meso and macro level planning. Remote sensing systems have the capability for repetitive coverage, which is very helpful in change detection studies. For ensuring planned development and monitoring the land utilization patterns, preparation of land use and land cover map is necessary. This research demonstrates the ability of GIS and remote sensing in capturing spatial-temporal data. Attempt was made to capture as accurate as possible the land use land cover classes as they change through time. The land use land cover classes were distinctly produced for each study year. Anthropogenic activities affect the classes. For analyzing the change in land use land cover pattern for Mandideep and Obedullaganj digital image processing techniques were used. It is expected to be useful for formulating meaningful plans and policies so as to achieve a balanced and sustainable development in the region. This will help in maintaining the ecological balance and improvement in microenvironment of the region.

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Note:

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