



## From Chairman's Desk

It is my proud privilege to introduce the current issue (Volume - 10, Number - 4) of the refereed, "ITPI Journal", a quarterly journal of the Institute of Town Planners, India, which includes articles on varied issues like Environmental management of urban lakes: the case of mysore, India; Redefining wellbeing through slum inhabitants' perspective; Effectiveness of environmental clearance process in India : case of building, construction and township projects; Integrated planning for metropolitan and district regions; National transport policy of India: organization, issues and bottlenecks for implementation; Environmental protection, conservation and its management : A challenge for policy planners and impact of road transport in the development of Gaya district written by the senior professionals, academicians and researchers.

It is heartening to note that we are receiving accolades from our members, and readers and also from other institutes, organizations both Government and parastatal agencies, and reputed libraries in the endeavour of our efforts to bring out the referred journal which is not only refereed by the students community but also by the professionals, researchers and educationists.

As a Chairman of the 'Editorial Board'; I assure all readers, about the commitment of ITPI, to always endeavour to upgrade and update the quality of ITPI Journal. In this regard, I call on the esteem authors, readers and members of ITPI, besides students community to give their suggestions on improving 'ITPI Journal' not only on articles, but its presentation and formatting. It is further underlined that your suggestions would receive our utmost attention, because we believe that there is always a scope for improvement.

It is hoped that this issue would be useful to our readers specifically to the members of ITPI and students community, as we would like that students community inculcate the habit of writing research papers, which would go a long way in building a treasure of knowledge in the field of Town and Country Planning.

(K.S. Akode)  
Chairman, Editorial Board



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## Editorial



In this issue of the Journal, the first article on “Environmental Management of Urban Lakes: The Case of Mysore, India” which is authored jointly by Prof. Krishna Gowda and Prof. M. V. Sridhara it is highlighted that at present, there are about 5 major and 20 smaller water bodies in Mysore greatly contributing to the city’s ecology within the Local Planning Area. However, over the years, these lakes have deteriorated as a result of urbanization pressures and changing land use patterns. Loss of freshness in lake waters for long has made them highly eutrophic. The lakes have thus become unsustainable for aquatic fauna. In turn, the symbiotic chain has snapped. All these have made potable water scarce. Therefore, the focus of the paper is on an assessment of the existing situation; besides some suggestions have also been given for environmental improvement of lakes.

The second paper jointly authored by Charumitra Bouddha and Dr. Krishna Kumar Dhote on the theme “Redefining Wellbeing through Slum Inhabitants’ Perspective” underlines that “Well Being” is a subjective term which, differs from the nation to nation, person to person and even within varying economic and social strata of society. It depends on how satisfied a person is, satisfaction of life includes health, economic attainments, social status, immediate surroundings, and above all aspirations and achievements. In a developing country like India, where 27% of urban population is slum inhabitants, the perception of “well being” needs to be redefined from their perspective. This paper attempts to review the prevalent definitions to assess human development; to quantify happiness; to measure success of policy; and to decide upon interventions to improve quality of life.

The third paper examines the rationale of threshold value of Built up Area (BUA) whether have been considered or not while granting Environmental Clearance (EC) to number of real-estate and construction projects, by respective State Governments and also examines the efficiency of the EC process, in terms of project appraisal, impact assessment, and monitoring. In this study, EC for real estate and construction projects from two states namely Gujarat and Maharashtra has been examined by analyzing secondary as well as primary data and detailed case study. The major findings of the paper on “Effectiveness of Environmental Clearance Process in India : Case of Building, Construction and Township Projects” authored jointly by Subhrangsu Goswami and Vidula Kulkarni suggest that, the concept of threshold need to be re-examined at the policy level.

After two decades of introduction of 74th Constitution Amendment Act, the progress on the follow up action for integrated planning is far from satisfactory, as observed by Dr. K. K. Pandey in his paper on the theme “Integrated Planning for Metropolitan and District Regions”. The basic reason is reluctance of States to devolve powers and authority for decentralized governance. A bottom up multiple perspective plan is not in place for the region as a whole, besides regional planning is confined to a top down project based planning, depending upon soft loans and inter-governmental plan funds which have their own constraints in size and



volume and are not linked with a gradual and systematic reduction of backlog. The paper also suggests specific action areas to implement the constitutional provision of MPC/DPC to carry out regional planning in a bottom up, inclusive, realistic and sustainable manner.

The paper authored by Paulose N. Kuriakose on the topic 'National Transport Policy of India: Organization issues and bottlenecks for implementation' attempts to look in to the main reason of slow progress for the implementation of National Transport Policy; specifically the creation of Unified Metropolitan Transport Planning Authority and observes that out of 53 million cities only two metropolitan cities are equipped with this. Adherence to the national policy is very minimal on the implementation side.

S. K. Banerjee in his paper titled as "Environmental Protection, Conservation and its Management : A Challenge for Policy Planners" mainly deals with conservation and protection of environment and its management which is becoming a challenge to policy planners both at national and state level. The author observes that industrial and economic developmental projects are prime polluters of the ecological system of the planet and have created an intense human-nature conflict giving rises to the issue of conservation and protections of environment.

Last but not the least the paper written jointly by Dr. Krishna Kumar and Anjan Sen on the theme "Impact of Road Transport in the Development of Gaya District" analyzes the role of road transport in development of Gaya district in Bihar. The study determines connectivity and accessibility of surface network, and delineates the transport region, thereby, correlating road transport with the socio-economic development in the district.

**Dr. Sandeep Kumar Raut**  
Editor



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## Environmental Management of Urban Lakes: The Case of Mysore, India

**Krishne Gowda and M. V. Sridhara**

### Abstract

*At present, in Mysore there are about 5 major and 20 smaller water bodies, greatly contributing to the city's ecology within the Local Planning Area. However, over the years, these lakes have deteriorated as a result of urbanization pressures and changing land use patterns. Loss of freshness in lake waters for long has made them highly eutrophic. The lakes have thus become unsustainable for aquatic fauna. In turn, the symbiotic chain has snapped. All these have made potable water scarce. The city's major water bodies, like Karanji, Kukkarahalli and Lingambudhi lakes have been taken up for restoration in many ways for several years now, which was successful only to a limited extent, due to inadequate, resources as well as uncoordinated services of technical persons like - biologists, engineers and environmentalists. Amidst other priorities and exigencies, these efforts of government have remained halting, rather inadequate in continuity and intensity. This study mainly focus on urban water bodies of Mysore city, assessing the existing situation; and it also suggests ways for environmental improvement of these water bodies.*

### 1. INTRODUCTION

Though Mysore has developed into a modern city, still moves at a gentle, unhurried and leisurely pace. Mysore has a good green cover and has a few lakes that add to the beauty and sightliness of the city. These lakes are popular picnic spots and are frequented by nature lovers as they attract a number of migratory birds. The area around these lakes is lush green and therefore a good place to relax and rest after a hectic day's work.

In Mysore, most of the lakes and tanks were man made for purposes of drinking water, irrigation and also served as places where washer men have traditionally used them for washing clothes and drying them. Lakes have also favorably influenced the microclimate of the city and served to replenish ground water resources in the vicinity, which are tapped through the present day tube wells for drinking water. Lakes support different types of wildlife, with deep water supporting birds such as ducks and pelicans and shallow water supporting birds such as sandpipers and stilts. The lake supports many other types of wildlife as well, from plankton to beetles, frogs and snakes. The health of the lake can be judged by the presence of certain sensitive organisms.

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## 2. THE STUDY AREA - MYSORE CITY

Mysore is known for its magnificent palaces (Fig. 1) and majestic buildings, many well laid gardens, tree lined boulevards, and water bodies; the 'City Royale' almost always figures in the tourist's itinerary. The city has to grow in an orderly and environment-friendly way and should be filled with aesthetic content in the form of parks, public squares, pretty sidewalks, waterfront promenades and green concourses. Mysore is currently undergoing extensive and often unplanned contingent urban expansion. There is a need for a strategic vision involving adaptive and realistic policies and new urban planning practices.

Mysore city is having more than a million population at present (0.98 million as per the 2011 Census). The urban population growth has already exceeded general population growth of India. Urban growth is due to both intrinsic population growth and in-migration from the surrounding and other areas and absorption of rural enclaves into the nearby urban centers. Increase in population and unbridled urbanization of Mysore city has nibbled away green spaces and encroachment of lakes as the city continues to expand horizontally.

Mysore is located at an altitude of 770 meters above mean sea level and situated in the larger south central part of the Indian Deccan Plateau at 12° 18' North latitude and 76° 12' East longitude. The gradient within the city ranges from 1 to 100 m to 1 to 50 m. Its situation amidst beautiful sylvan surroundings with majestic Chamundi Hill (1085 m) in the south southeast as a backdrop is indeed unique. The northern part of the city drains into the river Cauvery and the southern part into the river Kabini, a tributary of the Cauvery.

The climate of Mysore can be described as 'tropical monsoon type'. Mysore manifests a very hospitable climate all through the year, where temperatures vary between 20°C and 30°C. Neither too hot nor too cold, it's always pleasant although some climatic changes have become common as the surrounding forest areas have become greatly destroyed. The city lies in the rain shadow region of the Western Ghats and, therefore, receives not more than 850 mm

Fig. 1: Amba Vilas Palace, Mysore





**Table 1: Land use in Mysore 1995 and Land Use Analysis for 2011 AD**

Sl. No	Land Use	Area (ha)		% Developed area	
		1995	2011	1995	2011
1	Residential	3075.30	6097.87	40.40	43.45
2	Commercial	182.23	344,07.00	2.41	2.45
3	Industrial	1021.01	1855.05	13.40	13.22
5	Public / Govt. Offices	856.45	1180.78	11.32	8.41
6	i. Parks and Open Spaces	415.77	1055.05	5.49	7.52
	ii. Chamundi Hill	-	1634.82	-	-
7	Traffic and transportation	1530.73	2380.56	20.22	16.96
8	Water Bodies	182.68	178.95	2.41	1.27
9	Public Utility	37.26	43.35	0.49	0.31
10	Agricultural purposes	285.34	898.99	3.73	6.41
11	Total Area	7568.77	15,669.49	100.00	100.00

Source: Mysore Urban Development Authority, Mysore.

(semi-arid tropics) rainfall per annum mainly between the months of April and November. Even in the rainy season, relative humidity does not exceed 60 percent. April and May are the hottest months.

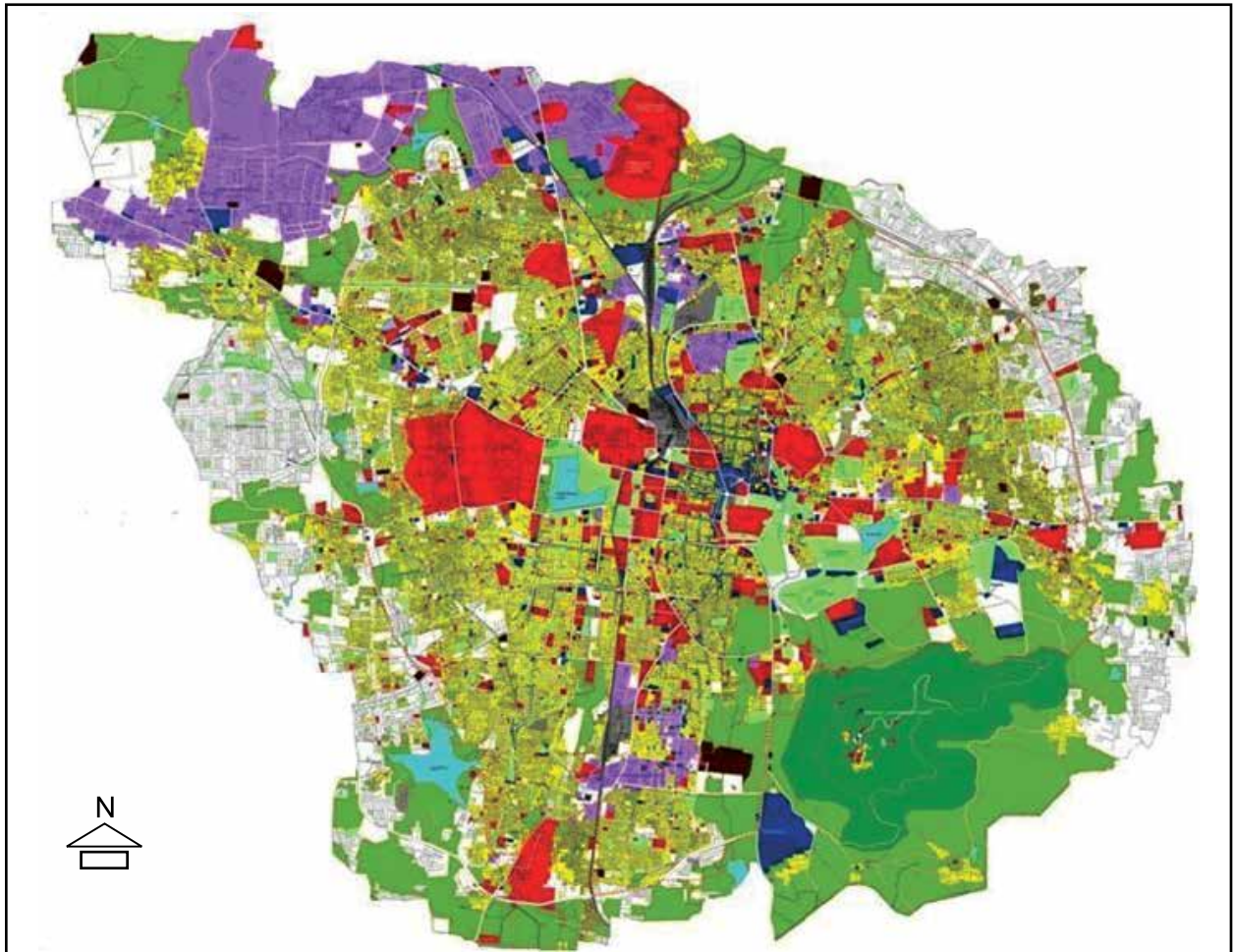
In order to promote health, safety and the general well being of the community, it is necessary to enforce reasonable and facilitatory norms on the use of land for buildings and other structures /constructions. This is to ensure that the most appropriate economical and healthy development of the city takes place in accordance with a land use plan. For this purpose, the City is divided into a number of use Zones, such as residential, commercial, industrial, public, semi-public, etc (Table 1 and Fig. 2). Each zone has its own regulations and features as the same set of regulations may not obviously be applied to all of them.

An analysis of the land use pattern of Mysore shows a thrust towards residential development which covers a greater portion of the city, and this is expected to increase in the next few years.

### 3. EXITING PROBLEMS OF LAKES

The topographic setting of Mysore city has radial slopes towards east and south with a smooth ridge running west to east and south; rainfall over the ridge area gets divided and flows east or south along gentle slopes. These naturally undulating terrain and valleys, lend themselves perfectly to the development of lakes that can capture and store rainwater. A series of shallow tanks varying in size are developed (Fig. 3). The gentle flow topography has also good potential for ground water development.

Fig. 2: Existing Land Use Map of Mysore City (2009)



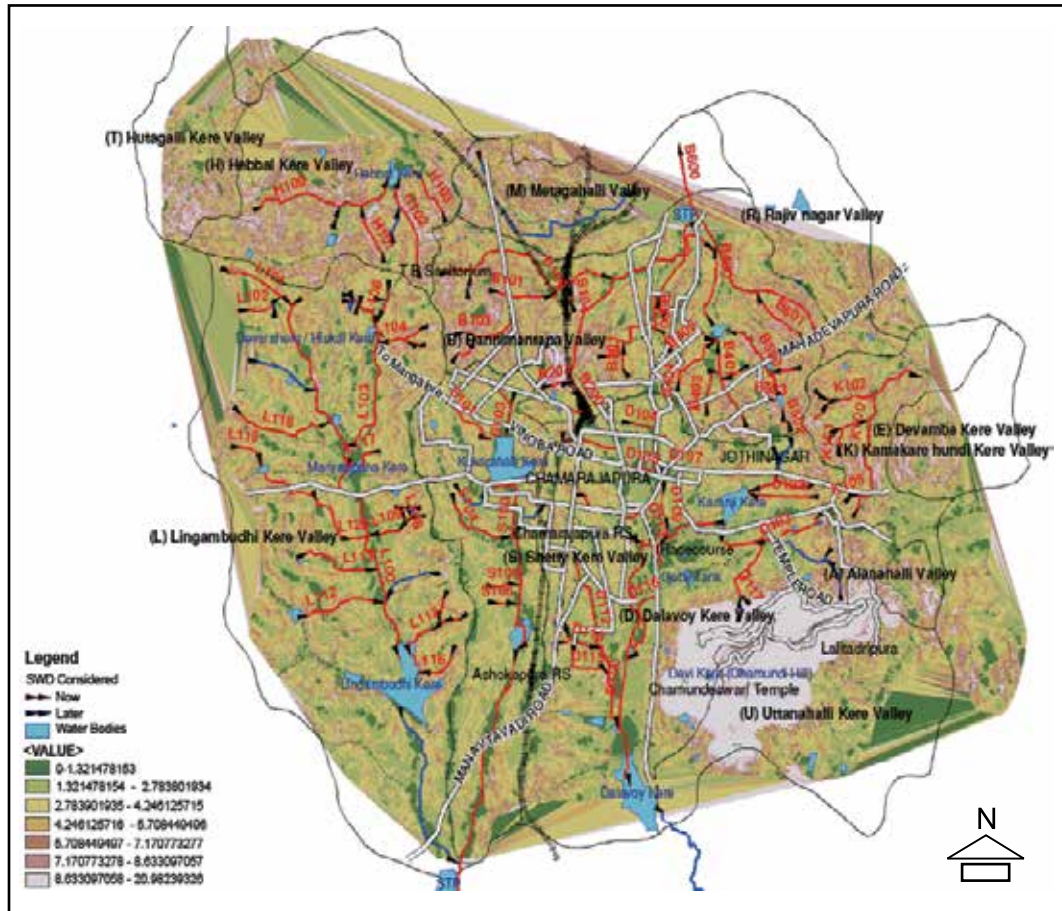
Source: Mysore Urban Development Authority, Mysore

Each lake stores rain water from its catchments with excess flows spilling downstream into the next lake. The storm water runs off through drains only. These drains often carry sewage in them which results in the lakes getting highly polluted.

The undulating topography of Mysore is lending enough scope to the system of man made lake chains. The practice of building upon and encroaching lakes has led to the problems of flooding, since overflow was previously managed by flowing water from the upper lakes of a lake series further down at lower levels. These lakes are facing other problems too, such as pollution from sewage and heavy metal contamination, the negligent attitudes of short-sighted politicians and an indifferent bureaucracy. Faulty governance and overcrowding of the city beyond its infra structural carrying capacity are to blame for the imminent death of city's lakes.



Fig. 3: Topography of Mysore and Valley Regions.



All lakes / tanks are man-made, built so that the deepest zone lies closest to the bund, surrounding which the water grows progressively shallower. Storage is naturally seasonal; inundated during the monsoon and then dry by summer through a combination of evaporation and draining off of water for irrigation and other uses. Both these factors, the structure and seasonality, are needed to maintain its ecological health.

Concomitant to the phenomenal growth of Mysore, many of the city's lakes are getting encroached for the development of housing and for other purposes, thus depriving the city from the benefits of strategically located lakes and open spaces. This has also contributed to the deteriorating water quality and significant deterioration in local climate. By the Passage of time, many of the city tanks have disappeared due to poor urban planning and the tendency to grab land for non-traditional or urban purposes. As the city grows denser in population and buildings, the critical importance of lakes as social, cultural and ecological spaces is being felt. To cite an example, the famous Doddakere Lake is now the

venue of Dasara Exhibition and football grounds. The Jeevanna Rayanakatte near City Railway Station and Subbarayanakere adjacent to the Chamaraja Double Road have both dried up and have become playground and parks (Fig. 4 and 5). There are many lakes small and big which have met their end due to lack of will and greed for urban land on the part of authorities and citizens. At present, there are about 5 major and 20 smaller water bodies greatly contributing to ecological wholesomeness within the Local Planning Area (LPA). Mysore's lakes are on the verge of extinction and the dissolved oxygen content of the water in the city's lakes has gone below the desired level of 4 mg / liter due to organic pollution, a study conducted by the Karnataka State Pollution Control Board (KSPCB) has revealed.

The authors have found out that most of the lakes are infested with weeds and the area near the lakes has heaps of garbage thereby making the water bodies completely unfit for constructive or creative use. Rather, the people are driven out from the precinct of water bodies. Lakes are getting degraded beyond the point of recovery. Encroachment, siltation, weed infestation, discharge of effluent both industrial and domestic are knelling the death of lakes, where besides being polluted due to sewage contamination, a major portion of the lake is infested with a variety of weeds. The field study revealed that the unplanned or unauthorized areas do not have proper sewerage systems and thus, discharge the

**Fig. 4: The Jeevanna Rayanakatte near City Railway Station Concerted to Football Ground**



**Fig. 5: Subbarayanakere on the Chamaraja Double Road Concerted to Parks**



sewage into the drains. Farther and shallow parts of lakes have been converted to residential localities, while some have been used by the State and Central Governments for public purposes; one such is the Anthropological Institute, sports ground, etc; are the other instances.

With this happening, some of the lakes in Mysore are in an advanced stage of eutrophication - an increase in the organic and inorganic nutrient content of the water body, resulting in a dis-balanced or unsustainable environment for the aquatic fauna. The adverse effect is depletion of dissolved oxygen affecting aquatic life, mosquito breeding causing health hazards, growth of water hyacinth and other aquatic weeds which cut off sunlight affecting photo-synthetic action.

The Ganesh festival is a time of joy and celebration. But by Ganesh idol immersions water bodies get highly polluted and clogged. Because these painted idols release harmful lead and other carcinogens into the water and thus poisoning lakes.

The main problems facing these lakes in Mysore are from - the loss of the catchment area, sewage inflow, disturbance from fishing and poor redesign plans and efforts. The tradition of bore well is a significant reason for the deliberate neglect of tank systems in urban areas, and today despite drilling hundreds of feet deep bore-wells water could not be sourced - indicating the consequence of



neglect of the cause. A Major portion of public lands encroached in Mysore has been caused by the elite, the influential and the highly connected.

#### **4. BENEFIT FROM LAKES**

During the past some years, there is a realization that these lakes have to be restored with a view to making them reliable sources of fresh water all through the year. With increased urban activities and population, the need for potable water has diversified as well as gone up.

The lakes are good lung spaces for the city, help recharge ground water, support livelihood by way of fishing and grazing, and quench the thirst of the bovine population and other types of live stock and supply the water needs of wild birds and animals. They control floods and provide a habitat for wildlife, which in turn strengthen symbiotic links in nature. Lakes must be perceived as a part of our natural landscape and also as an accumulation of our memories regarding our cultural habitats. Their current use must therefore be guided by imaginatively deliberated choices that suit our present times while conserving them for the needs of the future.

Simply by harvesting rain water, ensuring its storage and making the overflow seep into the ground, we have the best insurance against water scarcity and also against water logging. Rain water harvesting is a simple common sense practice for protecting one's own living appurtenances and is inexpensive. This should become a popular movement and one should not wait for Government regulations or sheer necessity to force us into adopting such simple ways of securing our water needs.

#### **5. CASE STUDIES**

Mysore city has three fairly healthy and surviving water bodies - Karanji, Kukkarahalli and Lingambudhi, supporting some kinds of bio-diversity.

##### **5.1 Karanji Lake**

The Karanji Lake, situated at the foot of Chamundi Hills, adjacent to the Mysore Zoo, is known for its clearness and provides calm environs. It is famous not only for its natural beauty, but also for a variety of winged visitors from far off lands (Fig. 6).

The 90 hectares lake area, owned by the Mysore Zoo, has a butterfly park, and a walk-through aviary. While water-spread area is about 55 hectares, the foreshore area measures about 35 hectares. This aviary is considered to be the biggest walk-through aviary in the country. Apart from this, there is also the Regional Museum of Natural History on the north eastern banks of the lake.

Some years ago, Karanji Lake was at the verge of eutrophication (getting rich in nutrients, poor in oxygen and therefore unsupportive of aquatic life) as there

**Fig. 6: Karanji Lake adjacent to the Mysore Zoo**



was a high depletion of fresh water flow due to encroachment of the feeder channels from Chamundi Hill. The inflow of untreated sewage from Siddhartha Nagar area had increased the pollution level and the water body was bereft of aquatic life as a result of which birds had abandoned their habitat.

**Restoration:** In order to prevent the destruction of this lake and to renovate it, assistance was sought from the Asian Development Bank (ADB), the Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC) and the Zoo Authority of Karnataka (ZAK). These three organizations came together and undertook the restoration activities of this lake. Financial assistance to the tune of Rs. 12 million was provided by the ADB and the ZAK undertook the restoration work with the coordination of KUIDFC.

The first step undertaken was to stop sewage from entering the lake. Other restoration activities included removal of polluted silt, de-weeding of the entire lake surface, removing 30 cm of silt from the lake, restoration of feeder channels, construction of a jetty to start boating facility and the construction of a bridge to the newly created 'butterfly park'. A watch tower was also constructed for viewing the birds and studying their behavior. A giant fountain which can spew water up to height of 40 feet was added as an attraction. In this eco-complex, a nursery of medicinal plants has also been raised.

**Aviary:** The aviary constructed on the shores of the lake has a height of 20 meters, length of 60 meters and a width of 40 meters making it India's biggest walk-through aviary. The aviary was set up at a cost of Rs. 3.8 million. It includes



an artificial water fall and two small water bodies. Water from Karanji Lake is pumped inside the aviary in the form of a stream while the used water is discharged into the lake. The aviary has about 40-50 birds, a population complex of 17 species.

**Birds of Karanji Lake:** Some of the common migratory birds found here are Grey Pelican, Painted Stork, Ibis, Cormorant, Egret, etc; which nest on trees in the islands of the lake. Recent survey has indicated 87 species and 12 of them migratory. Herons, Asian open bill storks, Egrets, Red wattle lapwing, Sandpipers, Rose Ringed Parakeet, Brown Shriek, Red-whiskered Bulbul, Booted Warbler, Sunbird and Greenish Warbler are some of the species of birds sighted here.

**Butterfly Park:** The butterfly park has been raised on a small island within the Karanji Lake. About 45 species of butterflies have been identified here. With the collaboration of a botanist, appropriate species of host plants and nectar plants essential for the breeding of butterflies have been identified, selected and planted within the island and a facilitatory environment created.

**Boating:** Visitors to the lake can hire boats. It is a great opportunity to photograph the birds.

**Regional Museum of Natural History:** The Regional Museum of Natural History was inaugurated on May 20, 1995. Objectives of the Museum are to display the floral, faunal and geological wealth of South India; display the ecological interrelationships among plants and animals and provide facility for school children to study biology and geology perspectively.

**Community Park:** The natural aesthetic beauty of Karanji Lake has become upgraded with the creation of a community park on the banks of the lake. The park, a paved walkway dividing the Zoo and the Karanji Lake, is designed as a pedestrian walk-way, over the surface on one side and a soft landscape on the other side. The Karanji lake view park is designed in a way where one could have a view of the zoo and the lake while strolling in the garden with access to the viewing decks of the Karanji lake, the calmness of the water sheet, expanse of Karanji lake sets into the mind and would provide a sense of calm and relaxation to the visitors.

Some of the salient operational features of Community Park are:

- No tree will be cut down for creating the park. An environment-friendly plan has been put in place to form the park with existing trees. There will be the least harm to aquatic animals or the animals in the Zoo and the ecosystem of lake in general as a result of this project. The plan has been formulated with expert advice;





- The bund road has been widened and vehicle movement prohibited, thus making access to the Zoo and Karanji Lake easier; tourism perspective is kept in view;
- All tourists who come to the Zoo do not visit the Karanji Lake. Through this project, the visitors to the Zoo may also visit the lake. It will be easier for them to visit the Regional Museum of Natural History;
- The development of the Community Park will be taken up in the second phase of the project at a cost of Rs. 32.5 million. The glorious era of the Kings' of Mysore will be rejuvenated with added significance here in a heritage style. For the purpose, a wall will be built on the Zoo side at a cost of Rs. 14 million and the road will be widened from 5 meter to 20 meter for the development of the park;
- Attractive pavement and pedestrian walk have been designed at a cost of Rs. 0.5 million. Four towers will be built at a cost of Rs. 1 million. The bund on Karanji Lake is 800 meter long and four fountains will be built at a cost of Rs. 1 million. For bird watchers, an observatory deck will be built at a cost of Rs. 1.8 million on the lake bund road; and
- Toilet blocks and play areas for children are also proposed.

**Aquarium complex:** The Karanji lake part will act as a community park and provide an additional open space. The green corridor is designed in a way that entails less maintenance efforts and provides walk-ways, jogging tract, seating area for senior citizens and provides freshness to the users all with a linkage to the heritage of the city. It is conceived as a pedestrian walk-way and a place for relaxation, with a beautiful view of the lake.

Out of Chief Minister's special grant of Rs. 1000 million, funds released for Karanji lake development will be utilized to build aquariums and to convert the lake's tank bund into a Community Park (each Rs. 32.5 million). Using a part of this financial grant, the famous Mysore Zoo and Karanji Lake will be connected through a subway. A project in this connection is all set to start soon.

Apart from the subway, for the first time in South Asia, huge glass aquariums will be constructed all along the subway. The aquariums will be designed as per the traditional style of Mysore.

The subway will be constructed under the bund connecting to Nazarbad, a little ahead of Ranapratap Singh Circle between the Mysore Zoo and Karanji Lake. The subway thus connects the Zoo and the lake. The aquariums would be built on the roof and the two sides of the subway, which has a width of 10.5 meters, length of 40 meters and height of 4 meters. Each aquarium places inside the wall, will be of 900 sq maters. Around 10,500 visitors may enjoy the sight of aquariums at a time.



The Aquariums have been designed in such a way that they can be illuminated using natural sunlight. Special glasses will be used for the aquariums. Green trees will be grown above the subway to facilitate natural temperature. In case of any mishap, all those who are inside can come out very quickly.

## 5.2 Kukkarahalli Lake

Kukkarahalli Lake also called Kukkarahalli Kere (Lake is 'Kere' in local Kannada language), located almost at the heart of Mysore City, adjoins the Manasagangotri within the University of Mysore, the Kalamandira and the Central Food Technological Research Institute campus. It was constructed in 1884 during the reign of Mummadi Krishnaraja Wodeyar to provide water for irrigation to about 4000 hectares of land outside the city ([http://en.wikipedia.org/wiki/Kukkarahalli\\_lake](http://en.wikipedia.org/wiki/Kukkarahalli_lake)). The Lake also used to be a source of water supply to the city of Mysore but over the years, sewage and excessive land encroachments (mostly illegal) and blockage of water flow sources almost led to the eutrophication of the lake. The University of Mysore and the citizen forums of Mysore continue to make efforts to preserve the lake by implementing several remedial measures.

Surroundings of tank, gardens, lawns and avenues of campus accommodate 432 species of plants spread over 85 families (Rao and Razi, 1974) (Fig. 7). In addition, campuses of Central Food Technological Research Institute, Regional Institute of Education, All India Institute of Speech and Hearing, Chandravana, and Mysore University make vast stretches of green patch supporting varied life

**Fig. 7: A portion of Kukkarahalli Lake with Lush Greens within the Mysore University Campus.**



forms. The lake drains in a catchment area of more than 414 sq km and the water body spreads over 62 hectares. Dewan Purnaiah feeder canal, 27 km long, which passes through Hinkal, Bogadi, Kudremala and Manasagangotri outfalls into the Lake. The maximum depth of lake is reported to be 5 m (16 feet). The east-west bund holds water on one side. Sandy loam to clay loam forms the dominant geological content of the Lake base. On the northern side another temporary bund holds back the direct flow of waste water into the lake.

**Bird watching :** The Lake was once a big attraction to bird watchers. According to Naturalists, about 176 species of birds (a large number of them migratory birds, including birds from Siberia) with 10,000 to 15,000 of them visited the lake during winter to roost. Organized bird watching expeditions around the lake used to be actively pursued by the Mysore Amateur Naturalists (MAN) Association. In recent years, with the lake getting into a eutrophic state (though since restored), the number of birds visiting the lake has substantially declined. Now, the number of birds visiting the lake has reduced to about 2,000. They are found to breed in the isolated bird island (Fig. 8). The birds now found in the lake are Spot-billed Pelican, Little Cormorant, Painted Storks, Openbill Storks, Eurasian Spoonbills, Black Crowned Night Herons, and Oriental Darters. Birdlife International has included Kukkarahalli Lake in the list of 38 important Bird Areas in the State of Karnataka.

During the year 2003-2004, with grants of about US \$ 0.2 million (Rs 0.91 million) provided by the Asian Development Bank, Karnataka Urban Infrastructure Development Corporation (KUIDFC) in association with the University of Mysore under whose jurisdiction the Lake falls and citizens groups, carried out the restoration works of the lake. In order to effectively reduce the external loading of pollutants and the entry of wastes into the lake ecosystem the measures implemented have covered the following with funds provided by the Asian Development Bank:

**Fig. 8: Kukkarahalli Lake - Island with Birds in the Centre of the Lake**





- Widening of the bund on the southern side;
- Forming a new walkway on the western side for the benefit of large number of morning walkers who visit the lake;
- Shaded (Bougainvillea creepers) stone benches for visitors to sit, relax and enjoy the scenic serenity of the lake;
- Improving the eastern and the northern pathway;
- Fencing of the lake perimeter;
- The iron watch tower (within the lake) about 30 meter from the shores has been restored,
- Lighting arrangement along the southern bund;
- Adopting rainwater harvesting methods to improve the quality and quantity of water inflows;
- Adopting aeration of water techniques: boating is one of the methods widely adopted - a boating center has been established;
- Removal of algae by manual methods;
- Engineering methods to clean the boundaries of the lake such as desilting and opening of the inflow channels;
- Ban on immersion of idols during Ganesh festivals;
- Increased security system to restrict human influence (vandalism);
- Increased aquaculture; and
- Stakeholders participation for collective ownership and responsibility to restoration activities.

The new all season walkway has increased tremendous human density in the morning and evening hours disturbing the birds in shore, marsh, water and land otherwise in the vicinity. The restoration of the lake without restoring the feeder canal is resulting into fast eutrophication, but often, seasonal rain is saving the lake.

In order to give the Lake a new lease of life and to bring more freshwater, desilting has been proposed. It has also been proposed to improve its bund and protect its boundaries with chain link fencing and compound wall. In addition to that construction of parking area, toilet, security cabin and boating jetty in the lake; construction of entrance arch gate, orchidarium, aquarium and cafeteria; improvement of Kuvempu Vana; construction of children's park, yoga platform and electrical work; construction of a wetland park also has been proposed

### 5.3 Lingambudhi Lake

Historical records document that Lingambudhi lake was constructed in 1828 A.D. by Lingajammani, a queen of Krishnaraja Wodeyar III, ruler of the erstwhile

kingdom of Mysore as part of building the Mahalingeshwara temple and as an act of thanks giving to the local female deity Chamundeshwari. It has a catchment area of 45 sq km. The lake was well outside the city limits when a survey (1988) was conducted, but now (2011) it is surrounded by the city on all the sides. The lake is located to the southwest of Mysore city at an altitude of 730 m above mean sea level. From the city center, the lake is situated at a distance of 7 km. During the years of its existence it was noted that, brick manufacturing units numbering about 20 were functioning. They have all been stopped for good. The Lake Fringe that was without tree cover in the beginning has grown into a thicket by 1997-98 courtesy State Forest Departments' Social Forestry Scheme and began thinning by 2002-03 due to firewood collection and natural destruction

**Fig. 9: Lingambudhi Lake - year by year it Reduce the Water Storage due to Urbanization**



**Fig. 10: No Water in the Lake due to Drought Condition in the year 2012.**



of fast growing and decaying trees that had been planted. Forest Department officially declared the lake as spread over 217 acres, as Lingambudhi Bird Sanctuary in 2001 (Fig. 9 and 10).

Tropical dry deciduous, secondary scrub and semi arid grass land is the habitat covering the area followed by irrigated fields during good rainy season. Pongamiapinnata, Acacia-spp, Mangiferaindica, Syzygiumcumini, Ziziphusspp are some that are in abundance here. Lake fringes that was without a tree cover (1988) when earlier studies began by individual bird watchers and NGOs. Loss of tree density was observed during 2002-03 due to ageing process and firewood collection. But, forestation thereafter in open grassland and shore line resulted in restoring the tree cover to some extent.

**Birds :** Lake was once considered as the flying highway of winter migratory birds. A variety of migratory birds used to arrive and congregate (22,000 in year 1995) in September third week and then gets spread out. Again, just before summer, March-April, spread out birds started arriving from different directions, to assemble and fly back towards northern direction to their breeding ground. A total of



around 210 bird varieties have been spotted here including the local ones and the migrants.

**Butterflies** - Study over a period of a decade has resulted in observation of 107 species representing all the five families. Occasionally rare butterfly like - Chestnut Streaked Sailer, Gaudy Baron and Peacock Royal have been recorded. Abundance, seasonal variation and encounter frequency have been observed. On a single day 54 species of Butterflies were recorded in 2001. Vegetation, mainly supporting butterfly population like *Cadabaspp*, *Criticalariaspp*, *Cassisspp*, and variety of grasses was abundant at that time. Distortion and distraction caused while laying huge sewage lines and clearing undergrowth to facilitate public utility has led to diminishing of species. Being part of Mysore area, Lingambudhi also experiences, pre and post monsoon danoids butterfly migration (located in the plains between eastern and western Ghat, hilly region, where migration is documented). Thicket that provides incessant shade throughout the day provides shelter to these migratory butterflies roosting.

## 6. THE MYSORE AGENDA TASK FORCE (MATF)

"The main (self tasked) responsibility of the MATF has been to contribute to the welfare of Mysore and encourage private sector participation with the empowerment of citizens. Besides raising the levels of efficiency and transparency, stakeholder participation to upgrade and maintain civic services with an increased involvement of citizens in the identification of problems and formulation of action programs "...through participation of expert professionals and citizens concerned" - this seems to describe who is responsible and obligated to undertake the conservation of lakes in Mysore. Public interest in particular has been a key factor in preventing further deterioration of some of the city's healthier lakes. Between 1999 and 2002 for instance, pro-environment groups and activists staged protests and prevented the widening of the Ring Road onto the area of the Lingambudhi Lake. Due credit is to be given to the Mysore city Administration for the incident involving 'Planet - X's Club Hookah', a popular discotheque at the foot of Chamundi Hills. Several parts of the theme park had encroached upon the feeder channels to Karanji Lake and the then District Collector had made mention of this encroachment. Mr. Ravi Kumar remains a key figure in the MATF today and handles the planning and implementation of programs for the development, maintenance, and conservation of the lakes of Mysore. (<http://thealternative.in/environment/saving-mysores-lakes>).

## 7. LAKE DEVELOPMENT AUTHORITY

According to Section 67 of the Karnataka Revenue Act, lakes are the property of the state. In other words, it is not legal for the State to transfer sovereignty over lakes to the Lake Development Authority (LDA). The LDA set up as a non-profit



organization to work for the regeneration of lakes, cannot therefore use public money in order to make a profit from lakes by trading them for maintenance through commercial leases with private enterprises.

Further, according to the Public Trust Doctrine that the Supreme Court has advanced in many cases, the public commons should be maintained based on the principle of inter-generational as well as intra-generational equity.

Posterity must have free access to the public commons. And the present generation and possibly the State have to conserve these resources effectively. Public commons should not be perceived as usable for only those with access to resources and it is the Government's obligation to ensure access to commons for all with well formulated normative restrictions on use.

Traditional wisdom of harvesting rain water through thousands of tanks and sourcing its waters through millions of open wells, has almost gone out of vogue. This common sense social practice is being ignored by the lure of expensive and labor saving technological interventions. The profit motive has become the prime mover. The bore well is a significant cause for the deliberate neglect of tank systems in rural and urban areas, and today despite drilling hundreds of feet water could not be sourced. The bore well cannot be a source of water without the healthy and adequate presence of nearby larger water bodies such as tanks. Therefore, up-gradation of the capacities and health of tanks is very necessary for the maintenance of the bore-well system.

The public at large are as guilty as politicians, bureaucrats and builders, as they encourage such dangerous practices with their silence and indifference. The need of the hour is public involvement in decision making and not public indifference.

The Lake Development Authority is an autonomous regulatory, planning and policy body for Protection, Conservation, Reclamation, Restoration, Regeneration and Integrated Development of Lakes, whether natural or man-made in the state of Karnataka (<http://www.karunadu.gov.in/lda/activities.html>). The Authority has been formed to take remedial measures and to restore and revitalize the dying lakes and to co-ordinate efforts of various organization towards the above objectives. The Authority would also seek financial support from various funding agencies. The Authority would prepare database about lakes with the help of satellite imageries and Survey of India topo-sheets and ground verification. The Authority would also concentrate on monitoring of lakes. Policy formulation regarding public participation in lake development is also being worked out. Apart from these the Authority would take up actual implementation of various State and Centrally sponsored schemes for lake development.



### Restoration process :

- De-siltation of Lake Bed and topographical restoration of rain water inflow paths;
- Creating islands for birds;
- Monitoring water quality;
- Afforestation and Landscape Gardens;
- Improving and creating habitat for aquatic life;
- Providing jogging path;
- Providing recreational facilities like boat jetty and surfing;
- Community participation and public awareness programs for conservation of lakes; and
- Budgetary allocation.

### 8. CONCLUSIONS

Mysore city is known for its beauty and cleanliness and is a popular tourists' destination. All Natural areas are necessary to be managed by the respective authorities. One of the adverse effects of the relatively unplanned growth of the city is the encroachment of gardens, parks, playgrounds and cutting the avenue plantations and other organized open spaces and lakes. There are several beautiful lakes or water bodies in Mysore city in all directions, managed by various organizations, to protect them following measures are required to be taken up:

- With natural drainage pattern and permeable soil, water can be collected through rain water harvesting and stored. Water flow paths facilitated by carefully preserving topography all around, be explored;
- Efforts should be made to ensure that existing lakes are not polluted by discharge of sewage, effluents and industrial wastes should be channeled through underground drainage away from the city. These lakes should be de-weeded and desilted and aquatic life must be revitalized and restored;
- Lake beds and the surrounding areas can offer an ideal location for regional parks. These spaces have to be utilized for rain water conservation and re-aquafying bore wells in the surrounding regions;
- Planting of trees and development and maintenance of tree parks will help prevent the encroachment of lake beds. The nature and type of these plantations have to keep in view the prospect of keeping the water clean and providing for medicinal plants; they should in addition form a habitat for birds and fishes;





- The existing water bodies act to recharge and upgrade ground water in the surrounding. Bunds have to be rebuilt and overflow downstream has to be facilitated as a priority;
- There is much scope for water front developments in all the lakes of Mysore;
- The area in between the lake and Chamundi hills has been managed by various organizations including hotels and clubs, therefore they need to resort to rain water harvesting vigorously;
- There has to be regular siltation and so dredging is required to keep the capacity of the tank intact. The silt gathered periodically may be used to refurbish Sylvan Islands inside the lake;
- Butterfly Park and boating are an additional attraction in the Karanji Lake. Several species of water birds, both local and migratory, are seen during the nesting season. A good beginning has been made recently by planting more than 1000 bird-friendly saplings in Kukkarahalli Lake which needs to be further strengthened;
- It is also the responsibility of all the citizens of Mysore city to join hands with the University of Mysore to conserve this beautiful lake. Plastics should be banned. Fish fingerlings may be introduced periodically to enhance fish population and to attract more water birds. Grants can also be made available from Jawaharlal Nehru Urban Renewal Mission funds; and
- It is necessary to take up new initiatives by dedicated NGOs, immediately to form, an active Committee for conservation of dying lakes. Many people are coming for morning / evening walk and they should be made to take some interest in the conservation, with monetary contributions. Public-People participation is the only solution for conservation of natural areas, specifically lakes.

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## Redefining Wellbeing through Slum Inhabitants' Perspective

**Charumitra Bouddha and Krishna Kumar Dhote**



### Abstract

*Well being is a subjective term which, differs from the nation to nation, person to person and even within varying economic and social strata of society. It depends on how satisfied a person is. Satisfaction in life includes health, economic attainments, social status, immediate surroundings, and above all aspirations and achievements. In a developing country like India, where 27% of urban population is slum inhabitants, the perception of well being needs to be redefined from their perspective. This paper attempts to review the prevalent definitions to assess human development; sometimes to quantify happiness; sometimes to measure success of policy; and sometimes to decide upon interventions to improve quality of life. Emphasis is on to make an effort to identify the characteristics of slums that have direct or indirect impact on, overall slum environment that defines the status of well-being of a particular slum and their inhabitants.*

## 1. INTRODUCTION

### 1.1 Urban Environment

Urban environment consists of interaction and overlay of three dimensions natural components, urban development and urban services, and socio-economic environment (Shrinivas, n.d.a). Lack of basic services, poor maintenance regimes, overcrowding, uncontrolled and conflicting land-uses, and unabated pollution pose serious challenges to the quality of life of the urban inhabitants in general and these conditions led to jeopardize the health and economic productivity (United States Agency for International Development [USAID, n.d.]). The problem becomes severe for the slum inhabitants, where the shortages are acute. It is not that the attempt to improve the lives of slum inhabitants have never done before. But, the failure of the previous efforts either partly or wholly lies in the isolation of slum inhabitants from such processes and / or misconceptions about slum inhabitants' perceptions of their well being.

## 2. WELL BEING

Well being is a relative term and it depends on the state of mind of a person, which changes with time. Historically, economists have said that well being is a simple function of income. However, it has been found that once wealth reaches

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a subsistence level, its effectiveness as a generator of well being is greatly diminished. This is because after, the basics for survival are taken care of, money cannot bring people any more happiness than they would experience without it. Abraham Maslow (1943) theorized that human happiness is the outcome of meeting a set of needs, listing these in order of priority, leads to Maslow's hierarchy of needs pyramid. World Health Organization (WHO, [1997]) defines, quality of life as individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment.

### **2.1 Well being Considerations in Slum Redevelopment Strategies**

As an agrarian economy Government of India had never offset poor, but initially the slums were seen as garbage of the cities and cleared off very often or thrown out at fringe areas of the cities. However, focus was to provide subsidized housing for poor through schemes like Subsidized Industrial Housing Scheme (SIHS), 1952; EWS Housing Scheme; and LIG Housing Scheme (LIGHS), 1954. Gradually the slums were accepted as the outcome of poverty, hence, the inhabitants of the slums are rehabilitated but at far off places to the original locations, generally at outskirts of the city. Slum Areas Improvement and Clearance Programme (SAIC), 1956, was one of such programmes. Environmental Improvement of Urban Slums (1972-73), through Integrated Urban Development Programme (IUDP), was the first one through which the slums are considered as a habitat of urban poor that needs improvement. Under this programme physical improvement of notified urban slums in cities was carried out with main focus on infrastructure services. In line with this programme many initiatives were taken till early 21st century with an aim to improve the lives of urban poor through providing physical amenities, community infrastructure and shelter.

It was only in 2005, when Basic Services for Urban Poor (BSUP) programme under Jawaharlal Nehru National Urban Renewal Mission (JnNURM) was launched by the Government of India (GOI), the focus was enlarged to security of tenure, affordable housing, and social security along with provision of water, sanitation, health, and education facility. It is the first time when beneficiaries are involved as an active stakeholder of the programme.

Recently launched, Rajiv Awas Yojna (RAY) 2011, is a milestone shift towards bringing slums settlements within the formal system and enabling them to avail of the same level of basic amenities as the rest of the town. The beneficiaries' perception, their aspirations, willingness and satisfaction levels are being equally



weighted to formulate redevelopment strategies. Ultimate realization is that the efforts will be sustainable only if the “well being as a whole” of the slum inhabitants could be improved rather than to intervene in individual sector of improvement.

## 2.2 Factors affecting Slum Environment

The characteristics of slum, define the status of well being of a particular slum and its inhabitants. The features that characterize a slum settlement have the major impact on overall slum environment. Various terms are employed by researchers to describe overall environment of a human society in general, Gross National Happiness (GNH) by Bhutan’s then, King Jigme Singye Wangchuck (1972) (GNH, n.d.); Quality of life (QOL) by Canter (1996), to indicate the overall characteristics of the socio-economic environment in a given area; Urban Well Being by Mark R. (2009); Human Development Index (HDI) by Human Development Reports; Happiness Index by Ming Yu and Shengzhi Weng (2006).

Associated to the terms employed to describe human society and its environment, a number of attributes of “Well Being” of a person have been identified by agencies and researchers in the field. Canter, et.al (1985), proposed a generic structured checklist for QOL, which was based on the application of the recommendations that the approach (list of QOL factors) should be comprehensive in the use of “life-domains”. QOL consists many dimensions like - the approach should incorporate both perceptual and objective QOL factors (indicators); these two basic types of indicators essentially account for different phenomena; and specific factors should be chosen based on local conditions localized set of indicators should be applied across all conditions. The category, domain and indicators identified by Canter are listed in Table 1.

WHO (1997), defines Quality of Life as individuals’ perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. WHO, has developed two instruments for measuring quality of life (the WHOQOL-100 and the WHOQOLBREF), that can be used in a variety of cultural settings.

The six broad domains of quality of life, and the twenty-four facets covered within each domain are shown in Table 2.

Amartya Sen’s approach to Well Being’ assessment is based on two concepts, first capabilities and second functioning. Capabilities are the freedoms people have to achieve the kinds of lives they have reason to value. Functioning’s are the states of doing or being which people value. Well Being can be measured by assessing people’s freedom and choices, rather than their level of income and consumption (Frediani, 2007). Sen does not propose an operational guideline


**Table 1: Generic Structures Checklist for Quality of Life (Canter, et. al. 1985)**

Category	Domain	Indicators (Factors)
Basic Life Needs	Income	<ul style="list-style-type: none"> <li>Household income distribution</li> <li>Real income</li> <li>Income per capita</li> <li>Cost of living index</li> </ul>
	Housing	<ul style="list-style-type: none"> <li>Percent age of owner occupied housing units</li> <li>Median value, owner occupied, SFDU's</li> <li>Net housing starts</li> <li>Vacancy rate</li> <li>Satisfaction with housing</li> </ul>
Well-Being Needs	Employment	<ul style="list-style-type: none"> <li>Unemployment rate</li> <li>Percent of labour force employed</li> <li>Satisfaction with employment and job opportunities</li> </ul>
	Health	<ul style="list-style-type: none"> <li>Infant mortality rate</li> <li>Communicable disease index</li> <li>Number of physicians per 1000 people</li> <li>Hospital beds per 1000 people</li> <li>Death rates per 1000 people</li> <li>Satisfaction with health care</li> </ul>
	Safety	<ul style="list-style-type: none"> <li>Crime seriousness index (per 1000 people)</li> <li>Number of police per 1000 population</li> <li>Percentage of crimes cleared by arrest</li> <li>Percentage of recovered stolen property</li> <li>Perceived safety</li> </ul>
Opportunity Needs	Education	<ul style="list-style-type: none"> <li>Public school expenditures per capita</li> <li>Public school tax base</li> <li>School enrollment</li> <li>Continuing education opportunity</li> <li>Satisfaction with education opportunities</li> </ul>
	Transportation mobility	<ul style="list-style-type: none"> <li>Ratio of miles of surfaced streets to miles of unsurfaced streets</li> <li>Number of traffic accidents per 1000 people</li> <li>Motor vehicle registrations per 1000 population</li> <li>Percent age of workers who use public transportation to work</li> <li>Satisfaction with transportation</li> </ul>
	Information	<ul style="list-style-type: none"> <li>Number of books in public library per 1000 people</li> <li>Local Sunday newspaper circulation per 1000 population</li> <li>Local radio stations per 1000 people</li> </ul>
	Equality	<ul style="list-style-type: none"> <li>Ratio of white to non-white employment rates</li> <li>Ratio of male to female employment rates</li> <li>Percent of families with income below poverty level</li> <li>Perceived inequality among residents</li> </ul>
	Participation	<ul style="list-style-type: none"> <li>Percent of eligible voters</li> <li>Vote turnout in local elections</li> <li>Satisfaction with opportunity to participate</li> </ul>
Amenity Needs	Recreation	<ul style="list-style-type: none"> <li>Acres of parks and recreational areas per 1000 population</li> <li>Miles of trails per 1000 population</li> <li>Satisfaction with recreational opportunities</li> </ul>
	Environmental Quality	<ul style="list-style-type: none"> <li>Air pollution index</li> <li>Mean annual inversion frequency</li> <li>Water pollution index</li> <li>Noise pollution index</li> <li>Satisfaction with environmental quality</li> </ul>
	Cultural Opportunities	<ul style="list-style-type: none"> <li>Cultural events per 1000 people (dance, drama, music events)</li> <li>Fairs and festivals, annual rate</li> <li>Sports events</li> <li>Satisfaction with cultural opportunities</li> </ul>



**Table 2: WHOQOL - Measuring Quality of Life (WHO, 1997)**

Domain	Facets incorporated within domains
<b>(Overall Quality of Life and General Health)</b>	
1	Physical health <ul style="list-style-type: none"> <li>• Energy and fatigue</li> <li>• Pain and discomfort</li> <li>• Sleep and rest</li> </ul>
2	Psychological <ul style="list-style-type: none"> <li>• Bodily image and appearance</li> <li>• Negative feelings</li> <li>• Positive feelings</li> <li>• Self-esteem</li> <li>• Thinking, learning, memory and concentration</li> </ul>
3	Level of Independence <ul style="list-style-type: none"> <li>• Mobility</li> <li>• Activities of daily living</li> <li>• Dependence on medicinal substances and medical aids</li> <li>• Work Capacity</li> </ul>
4	Social relationships <ul style="list-style-type: none"> <li>• Personal relationships</li> <li>• Social support</li> <li>• Sexual activity</li> </ul>
5	Environment <ul style="list-style-type: none"> <li>• Financial resources</li> <li>• Freedom, physical safety and security</li> <li>• Health and social care: accessibility and quality</li> <li>• Home environment</li> <li>• Opportunities for acquiring new information and skills</li> <li>• Participation in and opportunities for recreation/leisure</li> <li>• Physical environment (pollution/noise/traffic/climate)</li> <li>• Transport</li> </ul>
6	Spirituality/ Religion/ Personal beliefs <ul style="list-style-type: none"> <li>• Religion / Spirituality / Personal beliefs</li> </ul>

to select and measure capabilities (Robeyns, 2003). Rather he emphasized the need for democratic processes to identify the list of valued capabilities that are context sensitive and culture sensitive.

Mark R. (2009), outlined “The Multiple Dimensions of Urban Well Being” with the fact that a household is non-poor in terms of consumption provides no guarantee of adequacy in other important aspects of well being. The dimensions of urban well being are given in Table 3.

The HDI is a measure of average achievements in basic human development. National Human Development Reports (NHDR) states that, if well-being and deprivation of people have to be evaluated in their broadest sense under the human development approach, it becomes necessary to have a cross tabulation of household that have access to sanitation, as well as safe water or for that


**Table 3: The Multiple Dimensions of Urban Well Being**

Dimension		Indicators
1	Health	<ul style="list-style-type: none"> <li>• Crowding, contagion, and social epidemiology</li> <li>• Costs and quality of private and public health services</li> <li>• Municipal interventions in traffic control, emergency transport, pollution control and other environmental risks</li> </ul>
2	Private Goods and Services	<ul style="list-style-type: none"> <li>• Food and non food consumption</li> <li>• Variability (over areas and over time) in prices, wages, and demand</li> <li>• Provision of electricity</li> <li>• Holdings of consumer and producer durables</li> <li>• Access to savings and credit</li> <li>• Access to land</li> </ul>
3	Leisure Time	<ul style="list-style-type: none"> <li>• Time costs of commuting</li> </ul>
4	Shelter	<ul style="list-style-type: none"> <li>• Security of tenure</li> <li>• Use of housing for informal enterprises, rental income</li> <li>• Exposure to environmental risks</li> <li>• Non dirt flooring</li> <li>• Ventilation of cooking space</li> </ul>
5	Health- related Public Services	<ul style="list-style-type: none"> <li>• Adequate supply of safe drinking water</li> <li>• Sanitary disposal of human waste</li> <li>• Drainage</li> <li>• Solid waste disposal</li> </ul>
6	Freedom from Violence and crime Personal	<ul style="list-style-type: none"> <li>• Access to the police and judicial system</li> <li>• Lighting of walkways, streets, and bus stops</li> <li>• Safe spaces for girls and women</li> <li>• Counselling and intervention services for intimate partner violence</li> </ul>
7	Efficacy Collective	<ul style="list-style-type: none"> <li>• Personal social networks</li> <li>• Perceptions and interpretations of urban inequality</li> </ul>
8	Efficacy and Political Voice	<ul style="list-style-type: none"> <li>• Local social and political organizations (including associations of slum dwellers)</li> <li>• Political and institutional accountability</li> <li>• Participatory planning</li> <li>• Social exclusion</li> </ul>

matter access to other amenities, if the overall attainment of the society on these dimensions has to be accurately reflected (GOI, 2001). Table 4 shows the indicators and the associated aspects of well being given in NHDR, 2001.

The economic well being of population is reflected in expenditure on food. The proportion of amount spent on food is higher in poor as compared to prosperous people. The level of employment and employment opportunity directly capture the economic attainments, whereas individual's economic attainment is driven by



**Table 4: National Human Development Report 2001**

<b>Economic Attainment and Well Being</b>	
Per Capita Consumption Expenditure	Food / Non - food Items (consumption expenditure has been adjusted for inequality using Gini Ratios)
Employment Indicators	captures the economic attainments
Incidence of Poverty	
Shelter and Quality of Housing	
Sanitation: Access to Toilet Facilities	
Access to Safe Drinking Water	
Access to Electricity	
Road Connectivity	

his access to social and public provisions of goods and services. The later includes access to shelter, sanitation, drinking water, electricity and road connectivity.

The goals of sustainable urbanization as enumerated in Global Report on Human Settlements (2009), focus on reliability in infrastructure and services, including water supply, waste management, transport, communications and energy supply; access to land or premises in appropriate locations with secure tenure; a healthy educated workforce with appropriate skills; and special attention needs to support the urban informal sector, which is vital for a sustainable urban economy for economic sustainability of towns and cities.

Habitat Agenda incorporates principle social aspects of sustainable urbanization including the promotion of equal access and fair and equitable provision of services; social integration by prohibiting discrimination and offering opportunities and physical space to encourage positive interaction; and the prevention, reduction and elimination of violence and crime (UN -HABITAT , 2009).

### 3. CONCLUSIONS

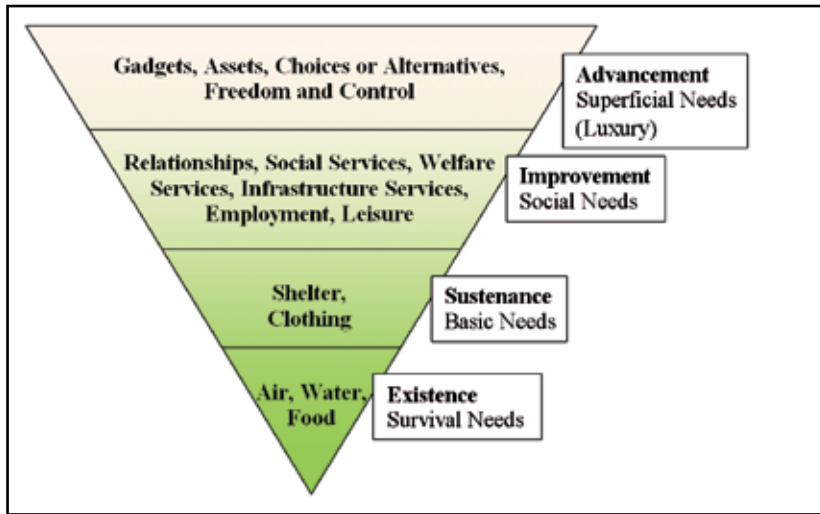
Survival needs of any living being are air, water, and food. For sustenance human being necessitated shelter and clothing. To fulfil social needs man required relationships, social services, welfare services, infrastructure services, employment, and leisure; but to dominate in the name of advancement a person acquires variety of gadgets (Fig. 1) and assets; he owns choices or alternatives; he avails freedom to do whatever he wants and puts control over others.

Defined by any of the terms whether Quality of life, satisfaction with life, happiness of life, or any other; well being is thus, represents a balance between shifting needs of man from "survival needs for existence" to "superficial needs for advancement" with corresponding level of achievement in every aspect.





Fig. 1: Hierarchy of Human Needs



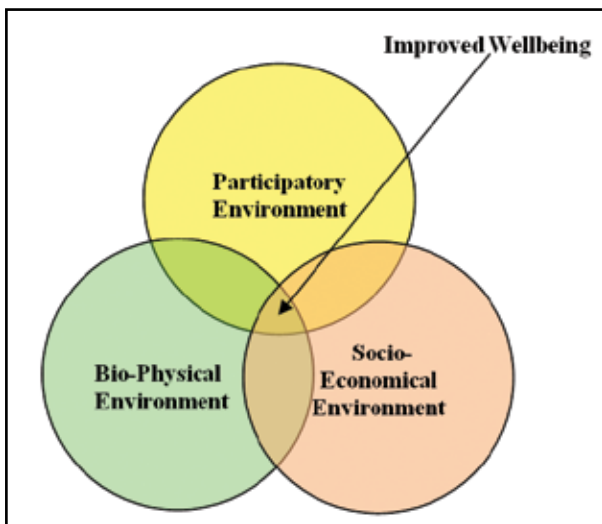
Slums are conglomeration of those urbanites who are struggling either for their survival needs, basic needs, and / or social needs. Improvement in the lives of slum inhabitants beyond their existence and sustenance is the ultimate desire of a slum inhabitant. Their perceived wellbeing revolves around air, water, food, shelter, clothing, relationships, social / welfare / infrastructure services, employment, and leisure.

The dimensions of human society and its environment particularly in the context of urban poor or slum inhabitant thus, includes a number of factors other than bio-physical factors that have direct or indirect impact on the well being of slum inhabitants. Factors responsible in contributing well being of slum environment can be grouped under three major dimensions, namely bio-physical environment, socio-economical environment, and participatory environment (Fig. 2). The probable indicators of well being are compiled in Table 5.

### 3.1 Bio - Physical Environment

Stress on land in terms of slum population and resource availability and quality of built environment are the two main factors that impact upon the bio-physical environment of slums namely air, water, land and flora-fauna.

Fig. 2: Dimensions of Well Being



Congestion is a dominating feature of slums. Instead of the increase in slum population, the number of slums is lower, which makes them more dense (NSSO's 58th Round). There is higher concentration of slum population in the large urban centres (Census, 2011). Net density is quite high in the slum areas compared to the net density of the cities.

Substandard living conditions are again a major characteristic of slums. Living condition



**Table 5: Probable Indicators of Well-Being**

Dimension →	Bio-Physical Environment		Socio-Economical Environment					Participatory Environment
Factors →	Stress on Land	Quality of Built Environment	Social Status	Status of Living	Incidence of Poverty	Welfare	Leisure	Inclusion
Indicators →	Proportion of urban population in slum  Slum Density  Pressure on natural Resources	Housing Water Supply Sanitation  Garbage Disposal  Electricity Fuel Used Streets	Education Occupation Equality Social Class Social Network Cultural Ethos Neighbourhood Violence Crime	Security of Tenure  Vulnerability to diseases  Vulnerability to risks and hazards	Household Income  Per Capita Consumption Expenditure  Accessibility to Savings/ Holdings of land, consumer or producer durables	Public Health Centre  Primary School Balwadis  Police Station  Community Welfare Centre	Time spent on non-worthy works  Recreational/ Public Spaces	Awareness Communication Community mobility Job opportunities Transport Roads network Political voice

often determined by tenure status, vulnerability of site, and capacity to pay for up gradation, in most of the cases slum inhabitants lack in these aspects. Housing condition and basic minimum services like primary health, potable water supply and sanitation, as defined by Government of India (GOI, 1999), are the essentials to improve the quality of life of the poor. Among slum-dwelling households with consumption levels that are twice the official poverty line in India, more than one in six households live in housing so precarious that it requires major repairs to be safely habitable (Chandrasekhar and Mark , 2009).

Housing shortage is more in economical weaker section and low income groups. The condition of the dwelling units in the slum areas is also not satisfactory. The households of slum and squatter settlement are living in semi-pucca (semi-permanent) and katcha (temporary) structures. (Dhote and Bouddha, 2011).

### 3.2 Socio - Economic Environment

Socio - economic environment is governed by social status, status of living, incidence of poverty, welfare status of slum inhabitants and the availability of leisure time.

Deprived class of the society, illiteracy and unemployment dominate in the slums. The slum settlements have a higher proportion of backward class as compared to non-slum settlements. Also, expectadly, the literacy level of slum population is lower, which often results in violence and crime.

Social networks provide social security to the slum inhabitants. Jha et. al (2002) show that, social networks in Delhi slums perform three main functions - survival,



mobility and providing access to public services. The dwellers find friends and neighbors in the slums to provide shelter to their families. Similarly, social networks provide avenues for slum inhabitants to access credit in times of need, as well as routine informal services, such as, providing day-care to children and organizing “neighborhood watches” to keep an eye on property.

As mentioned by Global Development Research Center (GDRC, n.d.), without effective property rights and legal or de-facto recognition of informal settlements, the urban poor have neither the incentives nor the proper legal channels to reinvest in improving their communities and to strengthen the social networks necessary for community environmental planning and upgrading.

Squatter settlements often appropriate marginal lands for the sake of security from forced eviction. These patches of land are often located at hazardous or environmentally vulnerable sites like, along railway lines, hill slopes and low-lying areas.

### **3.3 Participatory Environment**

Inclusion is a major parameter in the management of slum environment, although it gained attention of the administrators and policy makers too late. Being able to participate, makes people feel good, it enhances a sense of ownership. The urban poor have demonstrated enormous resilience and ingenuity in mobilizing and organizing themselves, when formal institutions have failed to serve them (Cities Alliances, 2005).

Participation involves consultation, information sharing, debate and empowerment. Urban poor have enormous potential as development agents and their livelihood can be upgraded a lot with support of their participation in decision-making processes. But, slum inhabitants are not able to access most of the formal institutions of society and lacking a legal address, they are often unable to access social services (UN-HABITAT, 2003).

Job opportunities are enhanced when there is awareness, mobility and participation. Road connectivity is a useful indicator of ‘inclusionary’ aspect of development process and perhaps, reaches of the market as well (GOI, 2001).

Conclusions can be drawn that although well being is a relative as well as subjective term and could not be perceived in the same way by two individuals, it purely depends upon the rating of the factors that impact upon the bio-physical, socio-economical, and participatory environment. For the slum inhabitants the factors are stress on land, quality of built environment, social status, status of living, incidence of poverty, welfare, leisure, and inclusion.



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## Effectiveness of Environmental Clearance Process in India : Case of Building, Construction and Township Projects



**Subhrangsu Goswami and Vidula Kulkarni**

### Abstract

*Taking into consideration that the increasing number of real-estate and construction projects are being granted Environmental Clearance (EC) by respective state governments, an effort have been made in this paper to examine the rationale of having threshold value of Built up Area (BUA) for applicability of EC, and also to examine the efficiency of the EC process, in terms of project appraisal, impact assessment, and monitoring. In this study, EC for real estate and construction projects from two States namely Gujarat and Maharashtra has been examined by analyzing secondary as well as primary data and detailed case study. Major findings of the paper suggested that, the concept of threshold need to be re-examined at the policy level, and re-commands to strengthen the EC process, impact assessment, impact monitoring and management plan, to achieve the very objective of EC.*

### 1. INTRODUCTION

Due to increasing urbanization and favorable demographics, the real estate sector in urban India is turning into one of the most appealing investment areas for domestic as well as foreign investors. As per census 2011, India is 31.16 percent urbanized and hosting 7935 urban centers. It is, therefore, obvious that Residential, Commercial and Corporate Real Estate Sectors are experiencing a considerable growth in urban India. It is to be noted that, these projects have potential negative environmental externalities of different scales which is quite visible during construction as well as operation phase. It is evident that, not so big real estate projects are changing the urban landscape of the country, with significant immediate environmental and social impacts (Kulkarni, 2011). Therefore, an attempt has been made in this paper to examine the efficiency of EC process followed in the country for real estate projects.

### 2. ENVIRONMENTAL CLEARANCE AND CONSTRUCTION PROJECTS

#### 2.1 Relevance and Historical Perspective

Economic development in developing countries has been focused on immediate economic gains. Environmental protection has not been a priority because the economic losses from environmental degradation often occur long after the

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economic benefits of development have been realized (Lohani et al, 1997). The past failure of development planning processes to take adequate account of the detrimental impacts of economic development activities led to the advent of EC processes. Environmental Impact Assessment (EIA) was first employed by industrialized countries in the early 1970s. Since that time, most countries have adopted EIA processes to examine the social and environmental consequences of projects prior to their execution. The purpose of these processes is to provide information to decision makers and the public about the environmental implications of proposed actions before decisions are made.

In India, the environmental action formally started after UN Conference on Human Environment in Stockholm in 1972. A National Committee on Environmental Planning and Coordination (NCEPC) was established as an apex body in the Department of Science and Technology. The term Environment figured for the first time in the Fourth Five Year Plan (1969-74) which recorded that harmonious development is possible only on the basis of a comprehensive appraisal of environmental issues. The Tiwari Committee (Committee on Review of Legislative Measures and Administrative Measures), in its report in 1980, recommended creation of a Department of Environment as a nodal agency to ensure environmental protection, to carry out environmental impact studies of proposed development projects, and to have administrative responsibility for pollution monitoring and control. The Department came into being in 1980 within the Ministry of Science and Technology. In 1989 the subjects of wildlife and forestry were added to the list and a new Ministry of Environment and Forests (MoEF) was created. Since its inception the Department (under the Ministry) has issued guidelines on EIA for various projects (Dutta and Bandyopadhyay, 2010).

On 27th March 1994, the Centre Ministry of Environment and Forests (MOEF), Government of India, under the Environmental (Protection) Act 1986, promulgated an EIA notification, making EC mandatory for expansion or modernisation of any activity or for setting up new projects (MoEF, 1994). Since then, there have been several amendments made in the EIA notification of 1994. One of the major amendment was made in 1997 with the introduction of the public hearing procedure. It outlined the process of conducting public hearing, from submission of report to State Pollution Control Board (SPCB) to the specification for public hearing notice, composition of the hearing panel and time period for the completion of public hearing process. Thereafter, on 2006 new EIA legislation was notified which was again amended in 2009.

### **3. EIA NOTIFICATION 2006 AND CONSTRUCTION PROJECTS**

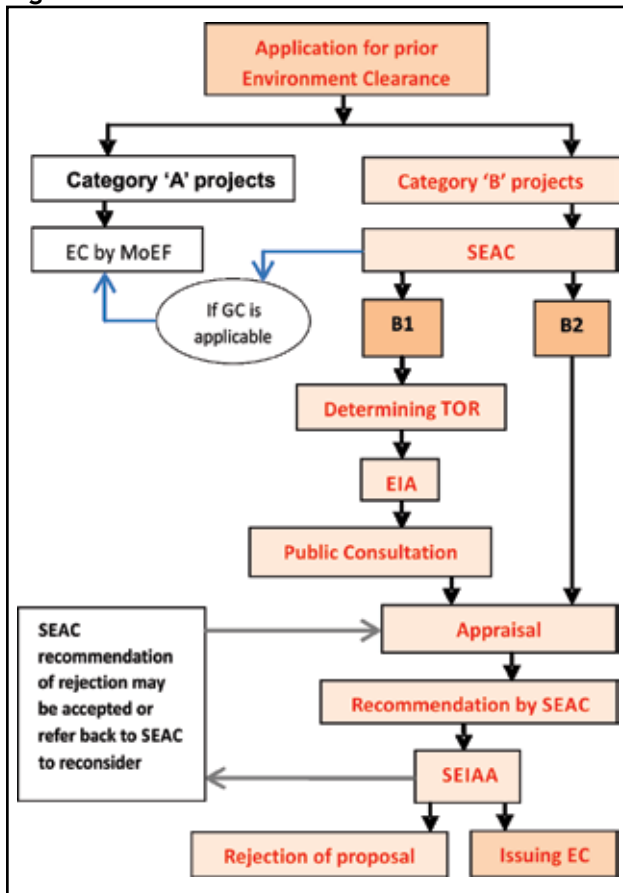
In the re-engineered EIA Notification of September 2006, projects are categorized into category 'A' and category 'B' depending on their threshold capacity and likely pollution potential and are appraised for prior environmental clearance at



the Central and the State level respectively. Further, the notification provides guidelines for screening, scooping, public consultation and appraisal for category 'B' projects and activities. In case of Category 'B' projects or activities, project proponent will have to submit application seeking prior environmental clearance in Form 1, based on which the concerned State Level Expert Appraisal Committee (SEAC) determines whether or not the project or activity requires further environmental studies for preparation of an EIA for its appraisal prior to the grant of EC, depending on the nature and location specificity of the project. The projects requiring an EIA report is termed Category 'B1' and remaining projects is termed Category 'B2', which do not require an EIA report (MoEF, 2006). Based on the recommendations of SEAC, State Level Environmental Impact Assessment Authority (SEIAA) issue EC or reject the proposal. Procedural work flow for environmental clearance is given in Fig. 1.

As per EIA notification 2006, EC is not required for building and construction projects with built up area (BUA) less than 20,000 sq m. As can be seen from Table 1, the item 8a (Building and construction projects) having BUA more than or equal to 20,000 sq m come under purview of EC and need to fill up Form 1 and 1A. Form 1A is a detailed questionnaire, almost a mini - EIA, based on secondary environmental data along with a detailed Environmental Management Plan (EMP) and Environmental Monitoring Plan and also a Disaster Management Plan. Item 8b (Townships and area development projects) covering area more than or equal to 50 ha or BUA more than 1,50,000 sq m comes under EIA purview. As per the notification, though EIA is made mandatory for item 8b (category B1 - requiring EIA report), item 8a, may require EIA only if the construction area is more than 150000 sq m.

Fig. 1: Procedural Workflow for EC



As per the notification, though EIA is made mandatory for item 8b (category B1 - requiring EIA report), item 8a, may require EIA only if the construction area is more than 150000 sq m.

It is important to note here that, public hearing is not required for any construction project (MoEF, 2006). The application is reviewed by SEIAA and is sent to the SEAC for appraisal. SEIAA grants, in principle EC after getting green signal from SEAC. After receiving the EC, as per guidelines, the project proponent is supposed to submit half yearly monitoring reports to concerned authorities.



**Table 1: Threshold Limits as per Notification for Building, Construction and Townships Projects**

Project/ Activity		Category with threshold limit		Conditions if any
		A	B	
8(a)	Building and Construction projects		≥20000 sq m and <1,50,000 sq m of built-up area #	#(built up area for covered construction; in the case of facilities open to the sky, it will be the activity area )
8(b)	Townships and Area Development projects.		Covering an area ≥ 50 ha and or built up area ≥1,50,000 sq m ++	++All projects under Item 8(b) shall be appraised as Category B1

Source: MoEF, 2006 (EIA Notification 2006)

#### 4. RATIONALE, APPROACH AND METHODOLOGY

While the main goal of EIA is to influence the development of decision making by providing sound information on environmental impacts and the means for preventing or reducing those impacts, it is fundamental that, the impact assessment is done with maximum precision. It is evident that Government is continuously trying to make the process better and efficient. However, some issues and challenges are yet to be addressed specially in case of projects in building, construction and township projects. Increasing number of such projects and its exposure to larger population in the vicinity makes it more crucial.

An effort have been made in this paper, therefore, to answer the research questions like -

- How appropriate is the Built Up Area criterion mentioned in the EIA Notification as a screening parameter for construction projects?;
- How effective is the environmental clearance process as an environmental management tool?; and
- How effective are the EMP proposed by the proponents in EC documents?

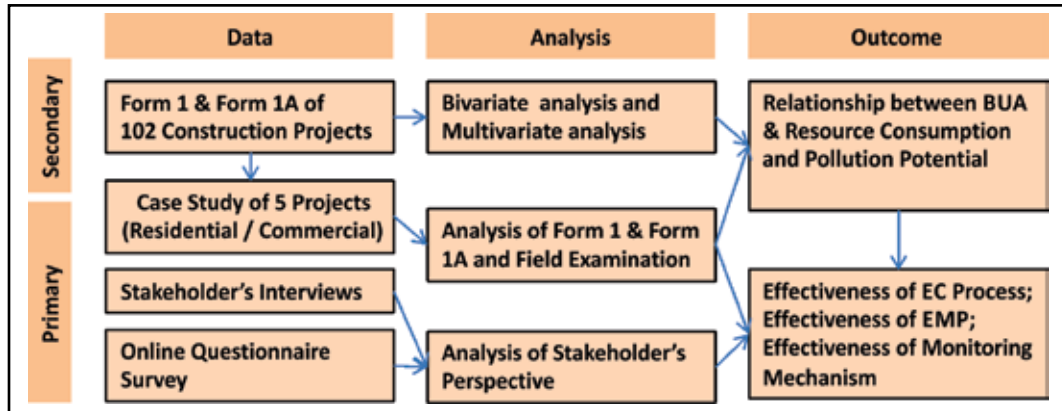
Bivariate and multivariate analysis was done to examine the relationships. Out of 102 projects, five projects were selected as case study to explore the ground scenario. These case studies represent both the category of projects i.e., B1 and B2. It also represent the type of project e.g., residential projects and commercial projects. Stakeholders were identified and interviewed for all the five case studies. Ground scenario was also examined against the EMP proposed in Form 1A in respective projects. Online survey with designed questionnaires

<sup>1</sup> In 2011, Gol made it mandatory that, all the Consultants/public Sector Undertakings (PSUs) / Universities and Research Institutes working in the area of Environment Impact Assessment are required to get themselves registered under the scheme of Accreditation and Registration of the National Accreditation Board of Education and Training (NABET) and the Quality Council of India (QCI). No EIA/EMP Reports prepared by such Consultants who are not registered with NABET/QCI shall be considered by the Ministry after 30th June, 2011.





Figure 2: Approach and Methodology



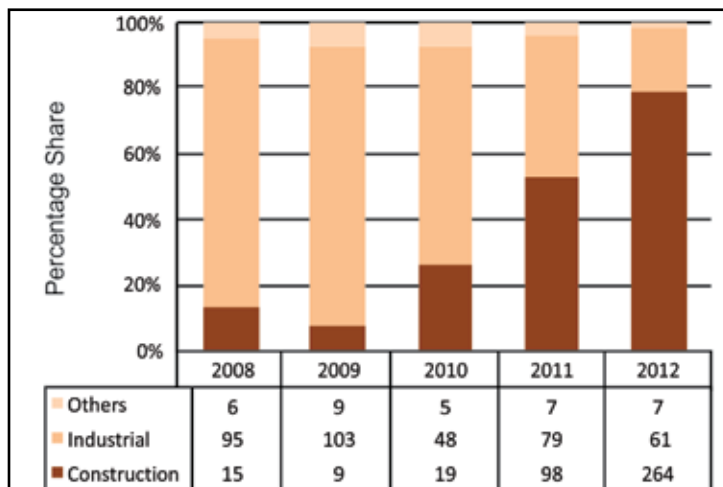
was conducted to capture the diverse perspective of Project Proponents, Environmental Consultants, SEAC Members, Government officials. Neighborhood residents of each project were also interviewed. Major findings of the analysis have been discussed in the following Section.

## 5. ANALYSIS AND DISCUSSION

### 5.1 Increasing Number of Environmental Clearances

EC related data available on the official website of Gujarat and Maharashtra was analyzed to examine the status. The Fig. 3 show the share of environmental clearance (EC) granted to real estate and construction projects in the state of Gujarat and Maharashtra. It is evident from Fig. 3, that, there is an unprecedented increase in number of EC granted to real estate projects in Gujarat after 2010. Figure 4 and 5 show, the cumulative numbers of sector wise granted ECs. Updated

Fig. 3: Increasing Number of EC Granted to Construction Projects in Gujarat



Source: <http://seiaa.gujarat.gov.in>

data for Gujarat is available in SEIAA website, which shows that till July 2013, maximum number of ECs was granted to projects from construction sector in the state. Updated data for Maharashtra state is not available till 2013, however, the numbers available till 2011 shows similar trend as Gujarat.

## 5.2 Relationship between Built up Area and Environmental Impact

The EIA notification, 2006 suggested that, the project proponent will have to conduct EIA, only if the BUA is more than 1,50,000 sq m or covering an area more than or equal to 50 ha. While many of the environmental experts in the country are unaware of the rationale behind these area criteria, it appears that, the criteria is based on the understanding that construction projects with larger BUA create more environmental impact. An effort has been made, therefore, to examine, whether this assumption is correct. Therefore, available data in EC document was analyzed to examine the probable impacts from two perspectives, namely resource consumption and pollution potential.

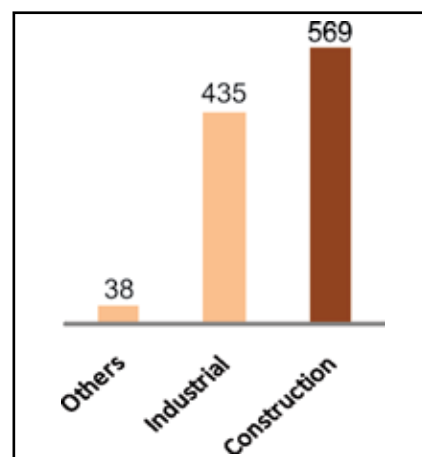
Since absolute values are not comparable, indicators (per unit area per day) were developed to capture the resource consumption and pollution potential. Two indicators were used to capture resource consumption namely, Water requirement (cu m / 1000 sq m / day) and Energy requirement (kw / 1000 sq m / day). Similarly, two indicators were used to capture pollution potential namely, waste water generation (cu m / 1000 sq m / day), and solid waste generation (kg / 1000 sq m / day).

Average value for each indicator was calculated for all the four parameters based on data available in 102 EC documents, as mentioned in Section 3. Number of projects showing above average values in four different indicators during operation phase (Fig. 6), reflect the fact that, there are considerable number of smaller projects (with smaller BUA), with larger resource consumption and pollution potential (per unit area per day). The observations from case studies justify these facts. For example, commercial buildings like shopping malls and multiplexes with much lesser area, compared to a residential apartment, consume much more energy due to huge volume of air conditioning, ambient lighting (even during the day time), escalators, etc. As far as waste generation is concerned, many of these commercial buildings house considerable number of shops and restaurants generating huge amount of food waste and paper / packaging waste (Kulkarni, 2011).

## 5.3 Partial Availability of Significant Data

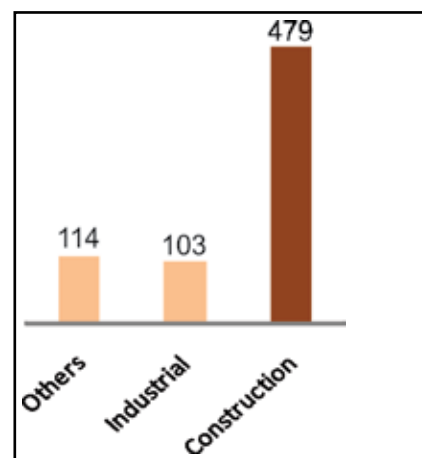
As per the guidelines, the project proponents need to submit Form 1 and Form 1A, to SEIAA for environmental clearance.

Fig. 4: Sector wise Number of ECs Granted in Gujarat, till July 2013



Source: <http://ec.maharashtra.gov.in>

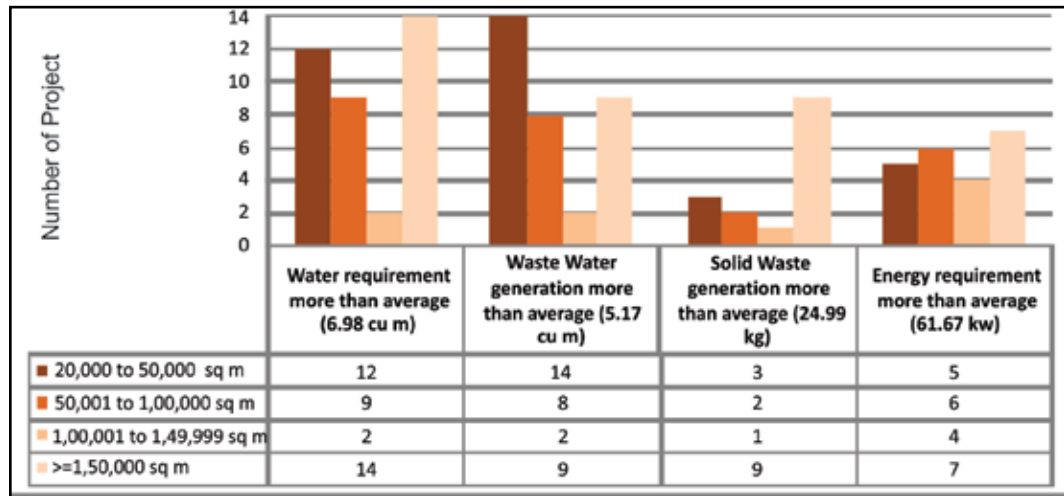
Fig. 5: Sector wise Number of ECs Granted in Maharashtra, till December 2011



Source: <http://ec.maharashtra.gov.in>



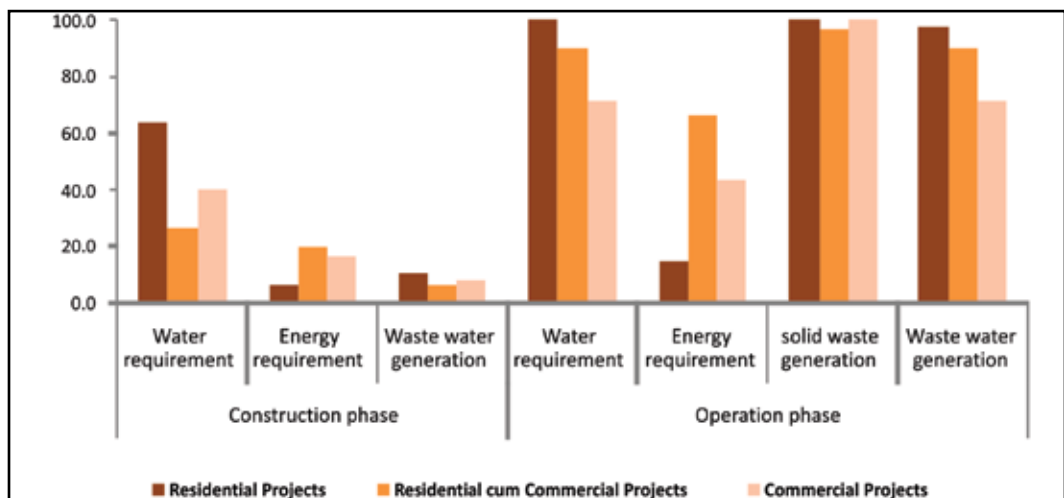
**Fig. 6: Number of Projects with Pollution Potential and Energy Consumption More than Average Values (per 1000 sq m per day)**



These Forms are supposed to contain important information to know and predict environmental impact of the project. However, most of the submitted applications by proponents are silent about essential and crucial information. It is evident from the analysis (Fig. 7), that very few proponents provided information on energy requirement and waste water generation during construction phase. As far as operation phase is concerned lowest number of proponents provided information about energy requirement. Unavailability of data is more prominent in case of commercial projects.

While many proponents do not disclose the total amount of water required during the construction and operational phase and more over very conveniently

**Fig. 7: Percentage of EC Letters with Complete Information on Crucial Environmental Parameters**





indicate that, water will be supplied by local authority. Same is the case with waste water generation. However, in practice many of these projects end up using ground water by drilling bore well in the project site, simply because many of these projects are located at the out skirts of the city where water supply and sewerage network is not present. It is observed that, all the four case study projects from Ahmedabad are located in a region termed as 'over exploited' in terms of ground water potential (CGWB, 2011). Three out of four projects from Ahmedabad reported to depend only on the bore well in a site for its complete water requirement. The case project from Maharashtra is located in Haveli Taluka, which is experiencing fall in water level up to 20 cm/year in major parts of the district (CGWB, 2009). However, EC has failed to capture this crucial information and the implications.

#### **5.4 Inefficient Environment Management Plan**

As part of the EC process, project proponent is supposed to prepare an Environmental Management Plan (EMP), which is supposed to assure minimum environmental damage due to the project during construction as well as operational phase. However, it was observed while examining the EMPs submitted by different proponents, that all proposed EMPs look same, irrespective of the nature and scale of the project activities. Moreover, many good environmental management practices are proposed in the EMP without proper understanding of feasibility and applicability of the same. Most common environmental management practise proposed to be implemented during the construction phase, are measures like sprinkling of water to avoid dust, methods for noise reduction, etc.; however, most of the time these are completely missing at the project site. Fig. 8 describes, a similar situation at Apple Wood Township of Ahmedabad, which is under construction.

As far as operational phase of the project is concerned, it is evident, that many of the proposed management interventions are either missing or non-functioning on the site. For example, most of the projects propose green belt development by planting suitable tree species in adequate number. However, in practise on site, one will find very few trees, especially in case of commercial buildings. Fig. 9 portrays, a similar situation in case of the Acropolis Mall at Ahmedabad.

Another very interesting observation is that, following the rules, suitable rainwater harvesting techniques are proposed in many such projects, however from the case studies, it is evident that, most of the time they are non functional on the site, due to inappropriate design, wrong location and poor maintenance.

In case of commercial buildings most of the time ownership is retained with the project proponent, however, in case of most of the residential projects, developer hand over all responsibilities to the residents or the society. Majority of residents have no information about the environmental clearance process that,

**Fig. 8: Dust Cloud due to Construction Activities at Apple Wood Township**



**Fig. 9: Lack of Greens and Lack of Designated Parking at The Acropolis Mall**



the proponent had to follow and about the proposed EMP. Therefore, residents are also unaware about the need for operation and maintenance of such facilities and the cost to be incurred for the same (Kulkarni, 2011).

### 5.5 Surrounding Land Use and Assessment of Cumulative Impact

EC process addresses the issues related to individual projects to certain extent. However, the cumulative environmental impact of many such projects coming up in vicinity is never assessed. One of the most important cumulative impacts is visible on the roads in terms of increasing traffic and on-road parking. This impact has multiple induced environmental impacts like air and noise pollution, increasing accidents and conflicts and most importantly it allows very little space for safe movement of pedestrian and cyclist. However, carrying capacity of a particular road or junction is never taken into account while granting EC. Fig. 10, 11, 12 and 13. illustrate, the co-existence of three different and distinct land uses in Vastrapur area of Ahmedabad City. While the lake and the amphitheater was created to provide ward level green infrastructure and entertainment, Alfa one mall covering 35,000 sq m area, launched to cater shopping, entertainment and hospitality. The area is surrounded by low rise and high rise residential apartments. It was evident from the case study, that during the weekends the mall attracts a huge amount of traffic which results into similar issues as discussed above. Infact, in recent time the residents of the area have filed a PIL against the Mall owner due to the direct and indirect nuisance caused by the mall.

### 5.6 Issues in the Clearance Process

**Absence of Public Consultation:** While the very purpose of Environmental clearance is to minimize environmental damage caused by the proposed project and to safeguard the quality of life, it is contradictory that, the building, construction and township projects do not require public consultation at any stage of EC.

As a result anticipated impacts envisaged by the people staying in the vicinity are never accounted for.

**Lack of Human Resources:** Rapidly growing cities like Ahmedabad and Pune are experiencing increasing number of building, construction and township projects which falls under the purview of EC, however, the SEAC is loaded with appraisal of many other projects at the state level. While on one hand, because of this, time duration of the EC process for any particular project becomes much longer than the prescribed time limit in the notification, on the other hand, one cannot deny the probability, that, the load on the SEAC may weaken the rigour of impact assessment. It should be noted that, understanding this issue, State Government of Maharashtra has recently formed two separate committee (SEAC); one committee will handle projects from Mumbai Metropolitan Region only and the other one will handle projects from rest of the state.

**Insignificant Involvement of Urban Local Body:** It is observed that most of these projects are located within the jurisdiction of Urban Local Body (ULB) or Urban Development Authorities (UDA). Since, ULBs and UADs are the most informed authorities on any new development in the city; representation of these authorities in the EC process becomes imperative. However, representation of these authorities in the EC process is observed to be insignificant.

**Weak Post Project Monitoring:** Post project monitoring, which is the responsibility of regional offices of MoEF, comes into play once the project is commissioned. It ensures that, the impacts of the project do not exceed the legal standards. It also ensures that, an action had been implemented in accordance with the measures specified while providing the EC. However, it is observed that this monitoring mechanism is very weak with its inherent procedural and capacity issues. According

**Fig. 10: Pre-project Site Conditions**



Source: Google Earth 20/04/2006

**Fig. 11: Post-project Site Conditions**



Source: Google Earth 12/02/2013

**Fig. 12: Pre-project Site Conditions**



**Fig. 13: Post-project Site Conditions**





to the officials of Bhopal Regional Office, regional offices do not have enough staff to monitor such large number of projects.

## 6. CONCLUSIONS

Real Estate Sector is booming in the country with diverse scale of construction projects. These projects have potential negative environmental impacts of different scale, which is prominently visible during construction as well as operation phase. While the main goal of EC process is to influence development decision making by providing sound information on environmental impacts and the means for preventing or reducing those impacts, this paper observes some loopholes in the EC process which starts with the rationale behind the area criteria and threshold limits.

One of the major observations of this paper is that, comparatively smaller projects may have significant resource consumption and pollution potential. It is also observed, that, although the Form 1 - 1A, in case of construction projects asks for comprehensive dataset, the cumulative impact on surrounding land use is never captured effectively. Case studies and personal interviews reflect the fact that, due to increasing number of construction projects duration of EC process is longer than prescribed limit. Representation of ULBs in EC process needs to be strengthened to capture local issues. It is observed that proposed EMPs should be more specific and should be effectively implemented and monitored. While post project monitoring is observed to be weak in the country, lack of awareness among the residents adds to the inefficiency of the entire process.

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## Integrated Planning for Metropolitan and District Regions



**K. K. Pandey**

### Abstract

*After two decades of introduction of the 74th constitution Amendment, the progress on the follow up for integrated planning is far from satisfactory. The basic reason is reluctance of states to devolve powers and authority for decentralized governance. A bottom up multiple perspective plan is not in place for the region as a whole, besides regional planning is confined to a top down project based planning depending upon soft loans and inter-governmental plan funds which have their own constraints in size and volume and are not linked with a gradual and systematic reduction of backlog. However, It is encouraging to note that India is all set to undergo a rapid pace of urbanization as per recent trends of Census 2011. Yet, there are regional disparities in the development. Integrated planning to trigger a balanced growth which is inclusive, sustainable and environment friendly, therefore, becomes crucial. It is in the context that this paper suggests specific actions to implement the constitutional provision of MPC/DPC to carry out regional planning in a bottom up, inclusive, realistic and sustainable manner.*

### 1. INTRODUCTION

The 73rd and 74th Constitution Amendment Acts (CAA) of, 1991 and 1992 in India have promoted a process of decentralization and empowerment of local bodies. It is in line with the global recognition that urbanization is inevitable and irreversible and has positive relationship with the levels and pace of economic and regional development. Accordingly, as a part of development process, India after a transition from pre-dominantly rural (up to 1981) to a semi-urban society, is also moving towards an urban majority society i. e. a level of 50 per cent of total population. The global population, however, has already achieved 50% mark of urbanization in the year 2007.

Recent census data indicate that, India is all set to have a rapid pace of urbanization. It is noted that last decade has witnessed reversal of decline in the net percentage increase in the urban population occurring since 1981 and highest ever number of census towns meaning the change in the economic character of 2800 rural settlements. At the same time data also show a direct relationship between urbanization and economic development. Accordingly, states with low level of urbanization have to take steps to trigger urban growth. This requires a balanced regional growth so that economic development is put in place all across the country. This covers a balanced development at district and metropolitan level.

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## 2. INTEGRATED PLANNING APPROACH

The rationale behind setting up of Metropolitan Planning Committees (MPCs) and District Planning Committees (DPCs) is that they would establish the necessary linkages in the integrated planning. This approach intends to meet aspirations and requirements of grass root level planning to form the basis of state level planning and subsequently national level planning. Non-constitution of DPCs and MPCs in most of the states has held back the purpose of bottom-up planning approach. There is a focus on the need for bottom-up planning and necessary constitutional amendment was enacted long back, lack of political will led to neglect of these critical institutions.

## 3. MAIN FEATURES OF MPC AND DPC

The 74th CAA provided constitution of MPC and DPC to expedite regional planning in the overall context of balanced regional development. The two bodies were expected to give due cognizance to local plans and draw a regional plan to address jurisdictional and distributional issues of mutual concern. As noted in a study by Indian Institute of Public Administrator (IIPA), the main areas of concern in this regards are:

- While the State by legislation has to decide the composition of these bodies and the manner in which seats are to be filled in, there are provisions requiring not less than 4/5th of the members in case of DPC and not less than 2/3rd of the members in case of MPC shall be from among the elected representatives. However, only in the case of MPC there is a requirement of representation of the Government of India and the State Government and of such organizations and institutions as may be deemed necessary for carrying out the functions assigned to such Committees;
- While both DPC and MPC are supposed to have regard to matters of common interest between the *panchayats* and the municipalities, MPC is supposed to keep in mind the overall objectives and priorities set by the Government of India and the State Government; and
- The MPC is advised for coordinated spatial planning of the area, sharing of water and other physical and natural resources, the integrated development of infrastructure and environmental conservation whereas, the DPC is advised only for spatial planning, sharing of water and other physical and natural resources, and environmental conservation. It indicates that there would be greater need of the coordination in view of large number of agencies.

## 4. BROAD STATUS OF MPCs

In contrary to DPCs, it is observed that MPCs have been constituted in a couple of mega and larger metros only such as Kolkata and Mumbai, whereas, Hyderabad



and Bangalore are at preliminary stages of constitution. On the other hand, non-mega city regions are far away from initial steps to set up MPC.

Therefore, basic purpose to initiate integrated planning in a metro region has not been achieved so far and there is a need to expedite the implementation of 243 ZD and ZE of 74th CAA. In this regard, as the local Bodies (LBs) are within the purview of State Governments, necessary actions are to be taken at State level. However, Centre (National Government) as in the past has to motivate and engage states to follow the suit. At the same time Local Governments which have a grass root connectivity should also play pro-active role and identify their own concerns and requirements in the form of Development Plan.

## 5. BROAD STATUS OF DPCs

Almost all the states have constituted District Planning Committee as per the 74th CAA. Formation of DPC in several states has become a channel to transfer Central Government funds / grants like Backward Region Grant Fund (BRGF is designed to redress regional imbalances in development of 250 identified districts). According to a study by the IIPA most states have constituted DPC though they are not in letter and spirit of the 74th CAA. The Key issues in this regard are:

- DPC have been constituted more under compulsion rather than convention as constitution of DPC was a pre-condition to avail funds under Backward Regions Grant Fund (BRGF);
- DPC is lacking people's representation as its members are not elected from amongst the elected members of rural and urban local bodies. Instead the elected members are nominated to DPC by District Commissioner;
- Members of DPC among many states do not include representatives of parastatals working in the urban and rural areas of the state for example in Haryana, the PHED, Housing Board, etc.;
- Chairman of the DPC in most of the States is either Minister or District in-charge instead of the elected representative. In some states like Haryana, District Magistrate is heading DPC. This set-up creates hindrances in the planning process which needs to be participative in nature;
- Some DPCs have Chairman as special invitees;
- In most cases of DPCs proportion of urban and rural population is not clear from the manner of composition of DPC;
- DPC if functional is neither preparing District Plans covering the mandate nor list of functions nor is it consolidating the plans of rural and urban areas.



Thus, DPC has been unsuccessful in establishing the effective and efficient rural-urban linkages;

- They don't have assistance of technical agency / staff in discharging their planning functions;
- Planning process of various Central Government Schemes are often independent of annual plans of *panchayats* and municipalities;
- There is no separate office space / cell for functioning of DPC which need to function as a permanent institution; and
- DPC has become an additional task of the Commissioner and Deputy Commissioner instead of giving full and sole responsibility to someone.

## 6. KEY ISSUES

As per a recent study conducted by IIPA, the key issues observed in the implementation of constitutional provision are:

- Appointment of chairperson;
- Composition of MPC / DPC;
- Organizational structure for MPC / DPC;
- Overlapping of MPC area with DPC; and
- Inter-institutional Coordination.

These issues need to be addressed through a systematic development of inclusive, realistic, bottom up, environment friendly and sustainable plan for the development of metro and district level plan.

## 7. AGENDA FOR INTEGRATED METRO / DISTRICT PLANNING

MPC and DPC should be viewed as a viable tool to promote balanced regional growth in the overall context of economic development and urbanization. It is observed that these institutions should be given due autonomy so that, they are able to engage urban and rural local governments to prepare a bottom up, realistic, inclusive, and sustainable plan for the region. For an effective regional planning system, there is the need to have a package of inter-related plans at three levels namely, long-term perspective structure plan (20-25 years), medium-term integrated infrastructure development plan (5 year) and short-term annual action plan as part of Infrastructure development plan. The integrated infrastructure plan and annual plan could be in the form of "rolling" plans to enable the LBs to continuously review and monitor the plan, and to update it every year / five years.

Specific initiatives needed to enable MPC / DPC to operate as autonomous and accountable institution to prepare inclusive, environment friendly and sustainable regional plan are identified in the subsequent analyses.



### 7.1 Autonomy and Accountability

It is important to ensure that MPC / DPC operate with reasonable autonomy with adequate powers and functions. In this regard specific steps are suggested covering IIPA study (2011) and observations during other discussions are :

- Members may also include co-opted members from Civil Society Groups, organizations such as registered NGOs / CBOs, teachers, doctors, engineers, planners, architects, labour unions, resident welfare association (RWAs), etc.;
- Chairperson may be under different models namely (a) Chief Minister for mega city regions and (b) Minister Incharge for other metros and DPCs along with a co-chairperson as may be elected out of the elected members;
- MPC areas currently falling under DPC also should be detached from respective DPC;
- Non-elected functionaries covering both professional and administrative staff should be earmarked and appointed on full-time basis and separate office space should be identified for smooth operation of MPC / DPC;
- Metropolitan Development Authority / *Zila Panchayat* should operate as technical arm of MPC / DPC;
- Backward and forward linkages should be used by MPC / DPC to prepare a realistic plan:
  - Institutions under forward linkages include Central Government, State Government, bilateral and multilateral agencies. Forward linkages also cover mutual feedback for State Planning Board, State Finance Commission, Central Finance Commission and Planning Commission of Government of India;
  - Backward linkages cover private sector / civil society organization / service agency / parastatals, local development agency and local body under backward linkages; and
- Specific funds allocated by centre / state should be channeled through MPC / DPC for onward transfer to ULB / RLB and service agencies.

### 7.2 Environment Friendly Planning

Specific focus is essential for environmental considerations covering Government of India's emphases on Climate Change and Reduction of Green House Gas Emissions. Specific actions on Environmental Friendly Planning (EFP) should cover:

- There is increasing awareness that, Local Governments are expected to play decisive role to promote local solutions on environment. Accordingly, 73rd and 74th Constitution Amendment Acts for the first time recognized urban environment as one of the local function;



- Jawaharlal Nehru National Urban Renewal Mission (JnNURM) has provided massive investments for urban infrastructure and low income housing along with a reform agenda which include several actions pertaining to reduction in emission levels and promotion of absorptions capacity of urban environment. The mission has so far sanctioned projects worth over Rs 1,00,000 crore out of which 90 per cent concentrate on utility infrastructure. This is an opportunity to strengthen these projects from the angle of energy efficiency;
- India's first ever National Urban Housing and Habitat Policy, 2007, lays specific focus on Green Settlements and development of city housing and habitat plan. This will provide a chance to incorporate Green Agenda in the settlement planning;
- Prime Minister's Council on Climate Change has finalized National Action Plan on Climate Change (NAPCC) which is based on eight missions which have direct bearing on different functions of local bodies;
- Ministry of Urban Development, Government of India, has been assigned the role to design Sustainable Habitat Mission which is a unique occasion to put together convergence from investment potential under NAPCC;
- Energy Conservation Building Code (ECBC) provides a model to gain energy efficiency for high consumption brackets. This also provides a chance to redesign regulatory frame-work and modify development control rules to have energy efficiency for medium and low consumption brackets for both residential and commercial uses of energy;
- Metropolitan Development Plan (MDP) should cover environmental concerns on each of the functions and services to be covered under MDP;
- Pioneering programme on employment creation in rural areas known as (MNAREGS) Mahatma Gandhi National Employment Guarantee Scheme has components for revival of water bodies, construction of tanks, social forestry and connecting roads with green surroundings. These will go a long way to promote safe environment and energy efficiency;
- These would cover resource conservation recycling and treatment to promote sustainable energy use;
- This has to particularly include transport and traffic, roads and related services, water supply, sanitation, solid waste management, street lighting, public safety, shelter as well as spatial organization of livelihood opportunities;
- While planning for each of the focus area, MPC / DPC have to suitably apply rules, regulations and bye laws taking into account State Municipal Act, Town Planning Act, Environmental Guidelines, Development Control Rules and Energy Conservation Building Code (ECBC), etc,. In addition, Environmental Status / Assessment Report should be prepared by each local body for final feedback to MPC / DPC,



- There is increasing awareness on Mass Rapid Transport System (MRTS) as a tool to use low carbon transport and other means of transport and traffic efficiency;
- Suitable instruments for adaptation and sequestration (Carbon Capture) should be adopted to include emission of green house gases. It will also facilitate access to carbon credit; and
- MPC / DPC may guide ULBs / RLBs and hand hold them for designing and pooling the projects as safe environment.

### 7.3 Inclusive Planning

XII Five Year Plan has given emphasis on 'More Inclusive Planning' as a tool to achieve objectives of welfare state. This is equally relevant for MPC / DPC. Regional Plan should be inclusive. This also means that MDP and DPC at local body level should be based on a consultative and bottom-up process. In this regard, MPC / DPC should engage ULBs / RLBs to initiate a bottom-up process from neighborhood level to have necessary feedback covering:

- Local interest groups should be identified and contacted to transform into pressure-groups. Subsequently, these groups should be organized to deliberate on local requirements. It will not only help identify the priorities but also enable these groups to own the plan, have sense of belongingness and better compliance for resource mobilisation, cost recovery and upkeep of assets created under the projects;
- Bottom-up plan thus, starting at grass-root level should have specific input from NGOs / CBOs to stimulate interest groups to undergo a transition into a formal community structure. This should also include media which needs to be sensitized about importance of urban concerns in a systematic manner.
- In this regard, *Area Sabha / Gram Sabha*, should be used to consolidate neighborhood level proposals for developing a ward level plan for onward consideration of ULB / RLB;
- Simultaneously, specific service agencies / parastatals should also participate right from formal community level up to MPC / DPC level to deliberate feasibility of planning and implementation at
  - neighborhood;
  - inter-ward;
  - city / village;
  - inter local body;
  - metro level; and



- Inclusive planning should include both physical and fiscal / financial plan under alternate scenario that is annual plan as well as mid - term and long term plan.

Therefore, a process of inclusive plan has to include interest groups, pressure groups, community structure at grass-root level, CBOs / NGOs, parastatals, etc., to deliberate and contribute in the planning process on a range of parameters such as spatial, services and infrastructure, livelihood opportunities, climate change and investment.

#### **7.4 Sustainable Planning**

Planning is a dynamic process and therefore it needs to be appropriately linked with implementation to have a regular feedback. A realistic, inclusive, environment friendly plan as above should also be made sustainable. This will mean linking plan with implementation and post implementation stages of the projects to be developed under the plan. In this regard, MPC / DPC has to maintain a constant touch with each of the stages and has to assume the role of overall coordination with various stakeholders.

- MPC / DPC has to coordinate with (a) ULB / RLB (b) civil society including private sector and (c) concerned parastatals in the implementation of MDP / DDP;
- Overall implementation of plan should be monitored by empowered committee constituted by MPC / DPC;
- Individual Development Plan will be the main responsibility of ULB / RLB; and
- Parastatals and civil society should perform their respective role as may be decided by MPC and ULB / RLB concerned.

#### **7.5 Capacity Building**

Capacity building process for planning and implementation of MDP / DDP needs to be evolved on following lines:

- Awareness workshops / seminars for senior functionaries from MPC / DPC, ULBs, RLBs, Parastatals, civil society, etc;
- Mid - career training for functionaries of organization as above. This should include class-room training / on the job training / study visits / handholding;
- Sensitization meeting at ward level and workshop at ULB / RLB level to discuss draft plans;
- Development of material for capacity building; and
- MPC / DPC has to be nodal agency for capacity building in the metropolitan/ district area and should carryout training need assessment for a long term training plan and mobilisation of necessary resources.



## 7.6 Inter-governmental Follow-up

Although Centre Government should continue to perform its role to engage, motivate, support, guide and hand hold states to take suitable actions, the States have to take a lead in the implementation of constitutional provisions in a realistic manner for a balanced and inclusive development of respective district / metro areas.

## 8. CONCLUSIONS

The integrated planning for urban and rural settlements as envisaged by the constitutional provision under article 243 ZD and ZE needs to be taken up in the letter and spirit of the 74th CAA. It is particularly important to have a balanced regional growth, economic development and associated levels of urbanization. The regional plan for metropolitan and district region should be inclusive, realistic, bottom up , environment friendly and sustainable.

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Editor





## National Transport Policy of India: Organization, Issues, and Bottlenecks for Implementation

Paulose N. Kuriakose

### Abstract

*This paper is an attempt to look in to the main reason of slow progress of implementation of the National Transport Policy. Decision making and financial powers are concentrated in Central and State Governments. Creation of Unified Metropolitan Transport Planning Authorities were envisaged in the National Policy to devolve power to local metropolitan governments, but out of 53 million cities only two metropolitan cities are equipped with this. Adherence to the national policy is very minimal on the implementation side. This non-adherence is created due to lack of institutional and technical man power. In the urban transport sector, financial, political and regulatory controls are very much concentrated in Central Government. Local comprehensive planning is absent and always ends in ad hoc problem solving. Smaller municipal corporations are not even considering transport issues in its real dimension. To solve these issues and to create a strong local transport governance body, it is eminent to create necessary legal footing.*

### 1. INTRODUCTION

Transport is one of the most regulated sectors in any economy (Button and Gillingwater 1986). Government takes the role of service provider, regulator, and implementing the standards for various parameters. There are many reasons why Governments intervene with policies in the transport market. Generally speaking, there are three reasons behind these interventions, which include, market failure, equity reasons and generating revenues. Market failure is an economic concept meaning that, the, market itself will not result in optimal outcomes from a welfare societal perspective. Equity reasons aims at the distribution cost and benefits in a fair way and finally governments use the transport market as a source of revenue for further improvement in the sector (Annemma 2013). Transport is one of the important sectors with various types of external costs involved. It is very much necessary to bring these external costs in to a formal system of pricing or taxing to achieve equity in accessibility and sustainability. Sustainability targets economical efficiency, environmental justice and social equity by including policies for integrating land-use and transport planning, ensuring adequate transport supply measures, managing travel demand efficiently, and incorporating environment-friendly strategies and policies (Haque, et al. 2013).

Policy implementation requires coordination among various stakeholders ranging from different Central Government Ministries to the local governance agencies,

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private agencies and NGOs. This paper examines, the level of implementation of National Urban Transport Policy of India and highlights the areas lagging in urban transport of India. Specific concentration is given for the transport governance, and progress of adoption of sustainable travel demand management methods like land-use transport integration, management information systems in urban transport, parking and coordination among various central government agencies. Specifically, transport governance and progress of adoption of sustainable travel demand management methods like land-use transport integration, management information systems in urban transport, parking and coordination among various central agencies are examined in detail. Secondary data and available literature on innovations in improving the urban transport is used to build the argument. The paper in first section gives introduction, the second section provides a brief back ground about Indian urban transport scenario; while third section details the objectives of the NUTP 2006. Fourth section gives an account of Transport organization in India's federal arrangement. Further sections are highlighting the lacuna in the implementation of the policy.

## 2. BACKGROUND

India is one of the fastest urbanizing countries in the world. As per 2011 census, it has an urban population of 31% (Census, 2011) and it is estimated that, India's urban population would reach near to 40 percentage by 2021 (Gol 2006). Similarly the number of urban centers in India has increased from 5161 to 7,935 in 2011. A total of 2,774 additional habitations were classified as urban units for the 2011 Census (Kundu 2011). If we look in at the number of million cities, the case is not different; the number of million cities in India has increased from 35 in 2001 to 53 in 2011 census (Census, 2011). After the liberalization and integration of Indian economy with world economy, India has shown an unprecedented growth in urbanization. Cities became engines of growth and attracted migrant population. Between 2001 and 2011, the number of people living in urban areas increased from 286 million to 377 million, a rise of 91 million person (Census, 2011). There has been a spurt in growth of population in urban areas in the country, which could be due to migration, natural increase and inclusion of new areas which are defined as urban.

This rapid urbanization and sprawling of urban areas has come up with induced demand for mobility, but accessibility in its physical and financial terms varies across Indian cities. This rapid urbanization and sprawl of urban areas has increased the demand for mobility, but accessibility in its physical and financial terms varies across Indian cities. Only few Indian cities are having formal public transport system.

Recently, many Indian cities have taken initiatives to improve the public transport system. Table 1 shows, the availability of various types of public transport available in Indian cities with population of five million or more. Government of



India had initiated a massive urban infrastructure building scheme in 2006 with a loan of 50 thousand crores from World Bank. Buses carry more than 90 percent of public transport in Indian cities. Indeed, except for some of the mega cities like Delhi, Kolkata, Mumbai and Chennai, most Indian cities have no rail based public transport at all and relies instead on a combination of buses, minivans, auto rickshaws, cycle rickshaws, and taxis. Even in most of the larger cities, rail transport carries less than a third of public transport passengers. The only exception is Mumbai, which has India's most extensive suburban rail network, carrying more than 5 million passengers a day—58 percent of total public transport passengers in the region (vs. 42% by bus) and 80 percent of total passenger per km (vs. 20% by bus) (Pusher, et al 2004). Only very few cities in India are having more than 40 percentage trips by public transport options. Table 2 shows the current situation of model split in Indian cities.

Generally, there is a positive connection between city's population and use of public transport share; all the mega cities in India have more than 40 percent public transport usage (MoUD 2008). Another fact, which is neglected by urban

**Table 1: Public Transport Options in Mega Cities of India**

Cities	Population (in persons)	Metro	Bus	Monorail	BRT	Tram	Suburban Rail
Mumbai	18,414,288	-	X	X	-	-	X
Delhi	16,314,838	X	X	-	-	-	
Kolkata	14,112,536	X	X	-	-	X	-
Chennai	8,696,010	-	X	-	-	-	X
Bangalore	8,499,399	X	X	-	-	-	-
Hyderabad	7,749,334	-	X	-	-	-	-
Ahmedabad	6,240,201	-	X	-	X	-	-
Pune	5,049,968	-	X	-	X	-	-

Source: Compiled from various Comprehensive Mobility Plans and Master plans

**Table 2: Model Split in Indian Cities**

City Category	Population	Walk	Cycle	2 Wheeler	Public Transport	IPT	Car
Category-1 a	< 0.5 Million with plain terrain	34	3	26	5	5	27
Category-1 b	<0.5 Million with Hilly terrain	57	1	6	8	1	28
Category-2	0.5-1.0 Million	32	20	24	9	3	12
Category-3	1.0-2.0 Million	24	19	24	13	8	12
Category-4	2.0-3.0 Million	25	18	29	10	6	12
Category-5	4.0-8.0 Million	25	11	26	21	7	10
Category-8	> 8.0 Million	22	8	9	44	7	10
National		28	11	16	27	6	13

Source: Ministry of Urban Development (MoUD)

**Table 3: Total Number of Registered Motor Vehicles in India: 1951-2009 (In numbers)**

Year	Two-Wheelers	LMV* (Passengers)	Jeep/Car	Taxis	Buses	Goods Vehicles	Miscellaneous	Total No. of vehicles
2001	38556026	1777130	6423367	634357	633900	2948300	4017946	54991026
2002	41581058	1878261	6925281	688204	635006	2973740	4242787	58924337
2003	47519489	2113781	7774223	825416	720696	3491637	4562042	67007284
2004	51921973	2167324	8549287	901889	767593	3748484	4661385	72717935
2005	58799702	2337264	9380576	939738	678521	3877622	5488296	81501719
2006	64743126	2492726	10486599	1039845	762341	4274984	5818646	89618267
2007	69128762	2697449	11606832	1042347	1098422	5118880	6014568	96707260
2008	75336026	2903821	12747967	1201862	1156568	5600938	6405672	105353854
2009	82402105	3146619	14004781	1307805	1205793	6040924	6843006	114951033
2010	91597791	3615086	15509834	3615086	176642	6431926	7552876	127745972
2011	101864582	4016888	17441726	1789417	1238245	7064495	8045441	141865607

Source: Ministry of Statistics and Programme Implementation. \*LMV Light Motor Vehicle

planners is dependency of people on NMT options in cities with a population of less than 0.3 million. With growing industrialization and induced travel demand, people are moving towards personalized mode of transport. Total number of registered vehicles has exploded in recent years (Table 3).

### 3. EXISTING URBAN TRANSPORT ORGANIZATION

In Indian federal government system, urban transport development goes in to the concurrent list and all the three tiers of governance has functional role improving it. Nonetheless, powers in the urban transport governance are more concentrated in the Central and State Government. In India's federal setup the sub-national governments require to devolve the power and responsibilities to local governments in line with the matters enumerated in the 12th schedule listed in the constitution as part of the 74th Constitution Amendment Act 1993. However, States remain reluctant to devolve powers to local governments including metro regions. Inter - government fiscal transfers from Union and State Governments have not been consistent and predictable and failed to enhance the fiscal capacity at the local level. Due to populist reasons municipal bodies in metropolitan regions are unable to mobilize resources from local taxes and user charges (Alok, 2011). Table 4 shows, the devolution of functions in urban transport sector in India. Major decision making power and financial capabilities are vested in Central Government or in State Government.

### 4. NATIONAL URBAN TRANSPORT POLICY (NUTP) 2006

Government of India introduced a National Urban Transport Policy to coordinate a balanced development of urban areas (MoUD 2006). Under the NUTP, each


**Table 4: Devolution of Functions in Urban Transport in India**

Urban Transport Functions	Central	State / Regional Level	Local
Policy	Ministry of Urban Development (MoUD)	Urban Development Department (UDD) (P)	Municipal Corporation (MC)
Transport planning		Urban Development Department (UDD)	Development Authority (DA) (P)
Land-use - planning		Urban Development Department (UDD)	Development Authority (DA) (P)
Road infrastructure (O & M)	MORTH, NHAI	Public Works Department (PWD)	Municipal Corporation (MC) (P)
Suburban rail system	Indian Railways (IR)		
Bus transport service and depot operations		State Road Transport Corporation (SRTC)	Bus Corp. (P)
Bus regulations and licensing	MORTH	State Transport Authority (STA) (P)	
Traffic management		Police (P)	Municipal Corporation (MC)
Traffic engineering		Police	Municipal Corporation (MC) (P)
Traffic enforcement		Police	
Motor vehicle registration		State Transport Authority (STA)	
Motor vehicular safety and emission regulations		State Transport Authority (STA)	

Source: Chapekar, 2010

city with a population of over four million will be encouraged by the central government to start planning for a mass transit system adopting a technology that, would 'best suit the city requirements in the next 30 years'. The policy also highlights the need for linking the transport plans with the geographical constraints of its location, increased priority to public transport, non-motorised transport, and improving parking facilities. The policy encourages to set up Unified Metro Transport Authorities (UMTA)s in cities with a million-plus population. This is sought to be achieved for following objectives:

- Incorporating urban transportation as an important parameter at the urban planning stage rather than being a consequential requirement;
- Encouraging integrated land use and transport planning in all cities so that travel distances are minimized and access to livelihoods, education, and other social needs, especially for the marginal segments of the urban population is improved;



- Improving access of business to markets and the various factors of production
- Bringing about a more equitable allocation of road space for pedestrians, rather than vehicles;
- Encourage greater use of public transport and non-motorized modes by offering Central financial assistance;
- Enabling the establishment of quality focused multi-modal public transport systems that are well integrated, providing seamless travel across modes;
- Establishing effective regulatory and enforcement mechanisms that allow a level playing field for all operators of transport services and enhanced safety for the transport system users;
- Establishing institutional mechanisms for enhanced coordination in the planning and management of transport systems;
- Introducing Intelligent Transport Systems for traffic management;
- Addressing concerns of road safety and trauma response;
- Reducing pollution levels through changes in traveling practices, better enforcement, stricter norms, technological improvements, etc.;
- Building capacity (institutional and manpower) to plan for sustainable urban transport and establishing knowledge management system that would service the needs of all urban transport professionals, such as planners, researchers, teachers, students, etc.;
- Promoting the use of cleaner technologies;
- Raising finances, through innovative mechanisms that tap land as a resource, for investments in urban transport infrastructure;
- Associating the private sector in activities where their strengths can be beneficially tapped; and
- Taking up pilot projects that demonstrate the potential of possible best practices for sustainable urban transport.

NUTP 2006 envisages for bringing a sustainable development in the field of transport by adopting various tangible and intangible strategies. But contradictions between the approaches of Central / State ministry policies and missing links in the lower echelons come as hurdles for the implementation of the policy. Along with NUTP 2006 Central Government has initiated Jawaharlal Nehru National Urban Renewal Mission (JNnNURM) in 2006. In the gamut of complex transport issues, JnNURM could provide some minimal infrastructure facilities for its mission cities. If we look into the total number of reported accidents in India, from the year 2002 to 2012. It steadily increasing and it reached 0.5 million in


**Table 5: Number of Road Accidents and Number of Persons Involved: 2002-2012**

Year	Number of Accidents		Number of Persons		Accident Severity*
	Total	Fatal	Killed	Injured	
2002	4,07,497	73,650 (18.1)	84,674	408,711	20.8
2003	4,06,726	73,589 (18.1)	85,998	435,122	21.1
2004	4,29,910	79,357 (18.5)	92,618	464,521	21.5
2005	4,39,255	83,491 (19.0)	94,968	465,282	21.6
2006	4,60,920	93,917 (20.4)	105,749	496,481	22.9
2007	4,79,216	1,01,161 (21.1)	114,444	513,340	23.9
2008	4,84,704	1,06,591 (22.0)	119,860	523,193	24.7
2009	4,86,384	1,10,993 (22.8)	125,660	515,458	25.8
2010	4,99,628	1,19,558 (23.9)	134,513	527,512	26.9
2011	4,97,686	1,21,618 (24.4)	1,42,485	5,11,394	28.6
2012	4,90,383	1,23,093 (25.1)	1,38,258	5,09,667	28.2

Source: Ministry of Road Transport and Highways.

2012 total number of people died in road accidents is 0.14 million Table 5. Even though, NUTP highlighted increase in private vehicles are the major cause for road accidents and less dependency on public transport, the trend in domestic sales of cars and two wheelers are in forward trend. From 0.3 million cars and 0.72 million two wheelers domestic sale has reached to 0.53 million and 13.80 million respectively. Table 6 depicts, the trend of automobile sale in domestic market from 2007 to 2012.

## 6. LACK OF UNIFIED METROPOLITAN TRANSIT AUTHORITY (UMTA)

To establish an Urban Metropolitan Transport Authority (UMTA) was realized over thirty years ago, when Justice B. N. Pande Committee Report, strongly recommended setting up of UMTA for all million - plus population cities to provide an integrated and coordinating institutional mechanism (CAI-Asia 2011).

**Table 6: Automobile Domestic Sales Trends in India**

(Number of Vehicles)						
Category	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Passenger Vehicles	1,549,882	1,552,703	1,951,333	2,501,542	2,618,072	2,686,429
Commercial Vehicles	490,494	384,194	532,721	684,905	809,532	793,150
Three Wheelers	364,781	349,727	440,392	526,024	513,251	538,291
Two Wheelers	7,249,278	7,437,619	9,370,951	11,768,910	13,435,769	13,797,748
<b>Grand Total</b>	<b>9,654,435</b>	<b>9,724,243</b>	<b>12,295,397</b>	<b>15,481,381</b>	<b>17,376,624</b>	<b>17,815,618</b>

Source: SIAM



Establishment of UMTA in Mumbai was one among the hundred recommendations given by V. M. Lal Committee (Lal 2000). This committee was constituted by Maharashtra High Court, to study and recommend measures for reducing vehicular pollution in Greater Mumbai (Tol 2008). Proper implementation of a policy should be guided by an efficient and balanced institutional mechanism and devolution of decision making power along with financial powers to the local level. Even though, NUTP 2006 is envisioned to create UMTAs, till date, only two cities could formulate something similar to that. Urban transport in India is married with multiple agencies having stakes in several aspects. The agencies involved in urban transport include, transport department, police, urban development department, municipal corporation, revenue department, finance department, public works department, pollution control board, etc;. With institutions bickering and overtaking ownership of pedestrian facilities, the conditions are deteriorating. There is little coordination among existing institutions. Also, there is a lack of communication mechanisms for users to provide input / feedback to urban transport decision-making and learn about issues and progress (CAI - Asia 2011).

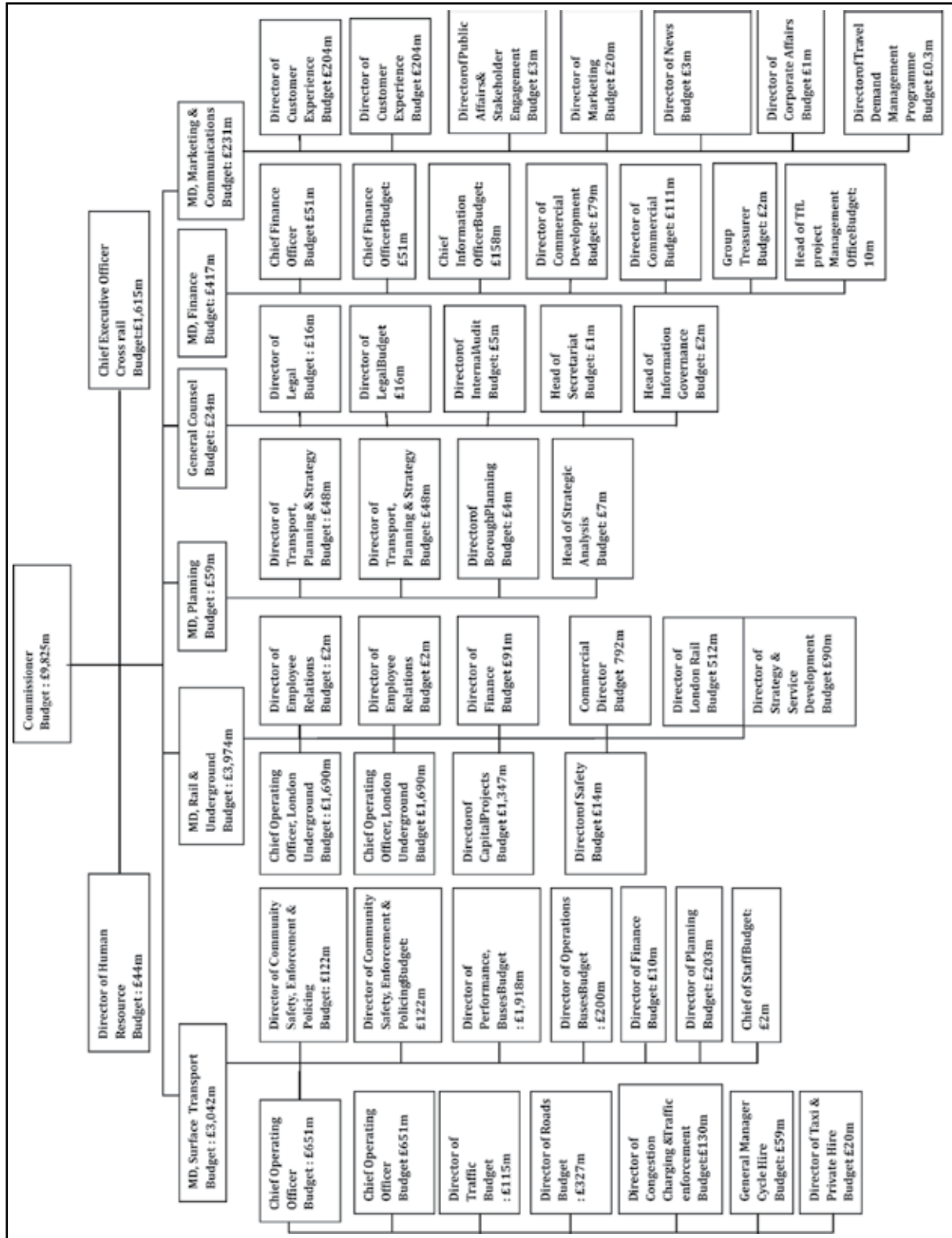
Case studies from other countries prove that Local Governments have more roles in resolving transport issues as an important stake holder. Regional entities, particularly Metropolitan Planning Organizations (MPOs), are becoming increasingly important in following a coordinated effort to implement inclusive policy. American Transportation Policy and Planning, albeit inconsistently across different regions, hence, MPOs are regional planning bodies based on metropolitan areas. In most American cities, transportation systems span many jurisdictional boundaries outside the city and often across more than one State. Thus, MPOs have been established to coordinate and plan transportation policies for metropolitan areas. Greater London, which has an administrative area of about 2 km and a resident population of 7 million, comprises 32 Boroughs and the city of London. There are many successful Metropolitan Local Governments, contribute in a comprehensive way for solving the transport issues in urban areas (Fig. 1). Transport for London is a statutory body created by the Greater London Authority Act 1999. This act empower the Mayor of London to develop and implement policies to promote and encourage safe, integrated, efficient and economic transport facilities and services for London Metropolitan area (ToL 2013).

The Greater Vancouver Transportation Authority, known as Trans Link, was created by the British Columbia Greater Vancouver Transportation Authority Act in 1998. It is an independent organization governed by a board consisting of representatives from regional municipalities. It was established to provide coordination between different jurisdictions and modes, allowing one organization to plan and provide services for all forms of transportation in the region (VTPI 2012). Trans Link's





Fig. 1: The Organizational Setup of Transport for London





mandate is to plan and finance a regional transportation system that moves people and goods efficiently and supports the regional growth strategy, air quality objectives and economic development of the Greater Vancouver Regional District (GVRD). Trans Link supports the GVRD's Livable Region Strategic Plan. The goals of the plan include preserving green space, reducing urban sprawl and protecting air quality (VTPI 2012). Trans Link's subsidiary companies and contractors provide, Public Transit Services (buses, Sky Train, West Coast Express and Handy DART); Transportation Demand Management - trip reduction programs and promoting transportation alternatives such as cycling and carpooling; and Major Road Network - in partnership with municipalities and other agencies. Trans Link helps to fund the maintenance, rehabilitation and improvement of the major road network. Trans Link receive funds through property taxes, a portion of fuel taxes collected in the region, and special taxes on parking. All revenues collected by Trans Link are allocated to its transportation programs and services (Translink 2013).

But in India, even after the constitutional amendment to decentralise the powers, things has not changed much. Lack of institutional mechanism and trained manpower slow down the development. Existing Municipal Corporations and Development Authorities are struggling to cope up with planning issues with available technical expertise. Lack of trained man power delays the process of preparation of Comprehensive Mobility Plans (CMP). Most of the million urban agglomerations do not have a CMP.

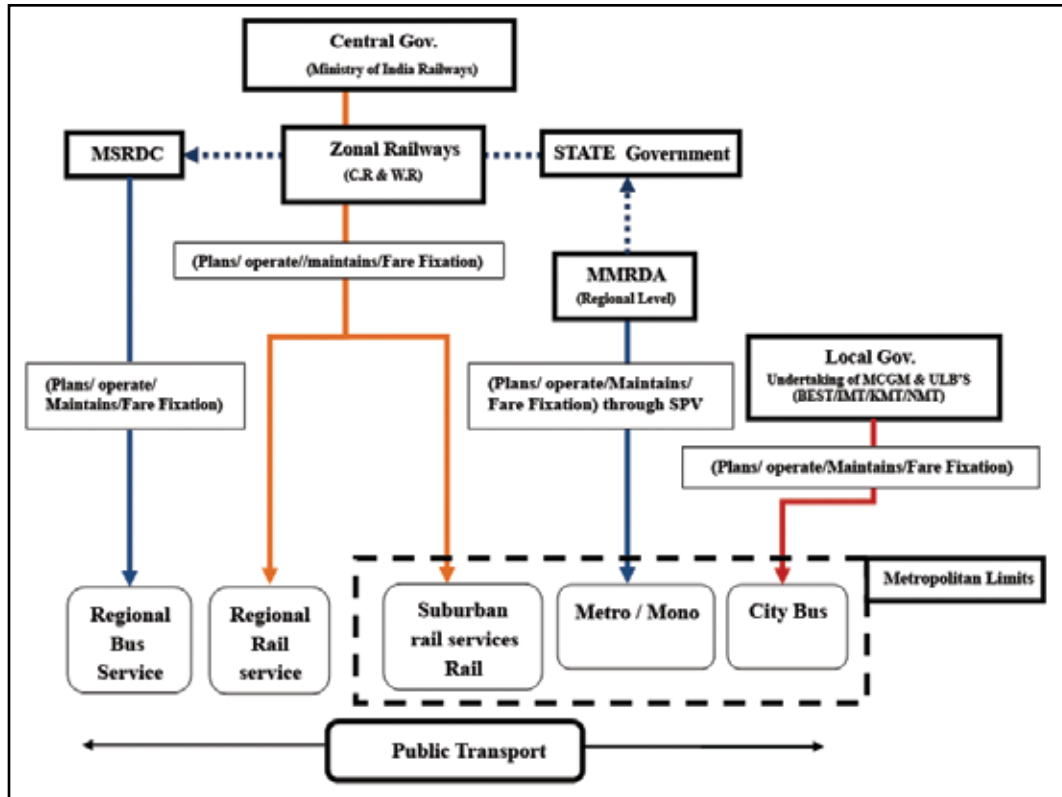
A city like Mumbai has various stakeholders for provision of transport service. Central Government is the custodian of suburban and regional rail linkages, and National Highways. On the other hand State Highways, Road Transport Corporation, etc; are managed by State Government. Along with these two big players Municipal Corporations are also involved for service provision. State Government has brought private agencies for the construction and management of Monorail and Metro Rail in Mumbai. Multiplication of service provider demand the need for a unified agency to look after for planning, implementation and monitoring. Mumbai, the financial capital of India, has various types of public transport systems available, and these systems are managed at various levels. Fig. 2 gives a complete account of stake holders, involved in transport infrastructure provision in and it hierarchy in Mumbai.

## **6. LACK OF LAND-USE TRANSPORT INTEGRATION**

The lack of effective planning and land-use controls has resulted in rampant sprawled development extending rapidly in all directions, far beyond old city boundaries into the distant countryside. It also has greatly increased number and length of trips for most Indians, including those by public transport. (Pucher 2004). Many Indian cities do not have a proper land-use plan, for example,



Fig. 2: Transportation Service Provider Stakeholders in Mumbai



Thiruvananthapuram Municipal Corporation has recently kept its Master Plan for public disclosure. But, the gap between the previous notified plan and latest plan is 40 years. The first development plan for the city was prepared in 1966 and got sanctioned by Government in 1971 (TMC 2013). Even if there is a Master Plan available, the percentage level of implementation is very meager and always kept in shelf.

Almost all million urban agglomerations in India, we can find, a core historical area with narrow roads. But some of the old cities were planned and it was not meant for automobiles. Even though, these core areas are the commercial hubs in many cities, with increasing automobile usage these core areas become congested. It encourages sprawling in Indian cities, and instead of trying to give planned directions for historical commercial core, many Master Plans encouraged sprawling. An extensive area, like Delhi, forces people choose personalized mode of transport because of the difficulties faced in travelling from home to work. In an explicit attempt to decongest City Centers, government regulations limit the of floor areas ratio for buildings, and thus, restrict the heights of buildings and density of development for the core area, for example, the “floor space index” in city core area was only 1.6 (Pucher 2004).



The whole of Curitiba urban area (in Brazil) is zoned according to the kind of use to which the land can be put to and the density of development permitted, - although mixed land uses are allowed. On the land sites located along the structural axes, this legislation permits buildings to have a total floor area up to six times the plot area. Developments close to other kinds of road well served by public transport are also permitted relatively high coefficients - with floor space up to four times the plot size. This has encouraged new commercial developments outside the central city, along with each structural axis and also high density residential developments. So there is a match between high density residential and commercial areas and the availability of public transport (World Bank, 2013).

## 7. MANAGEMENT INFORMATION SYSTEM

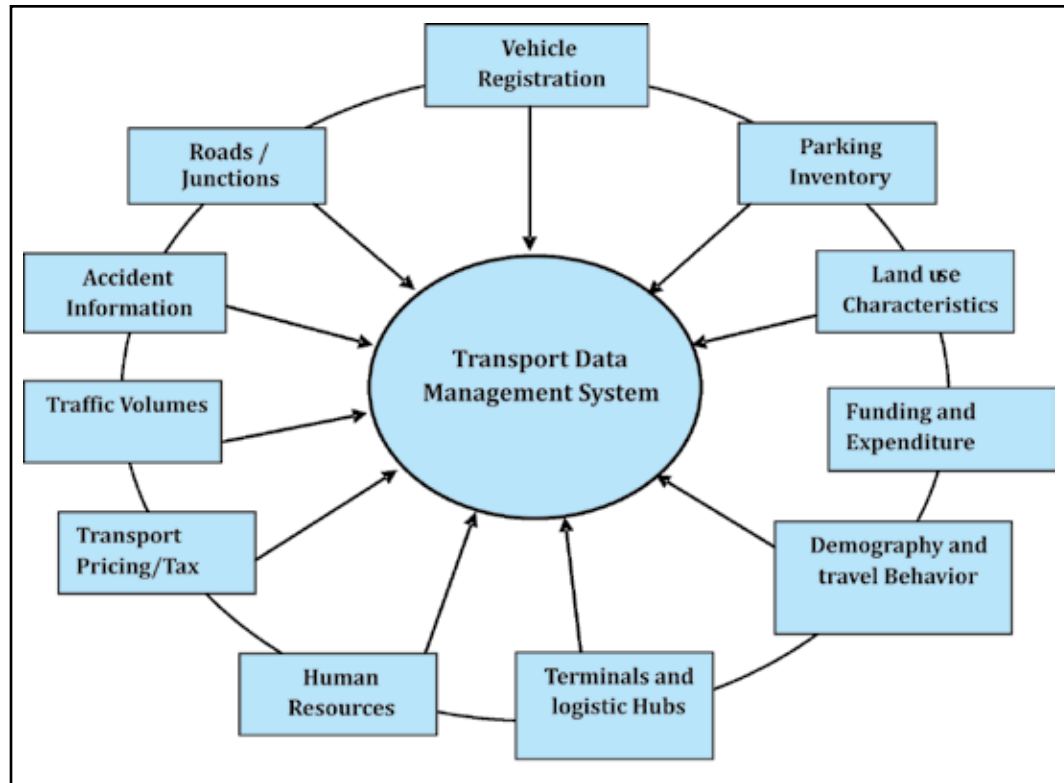
Management of transportation data is in various hands and that includes Central, State, and Municipal Agencies. Road Transport Offices under the State Government is one of the nodal agencies that deal with vehicle registration, issuing of drivers license, issuing of permit, motor vehicle tax collection, enforcement, etc;. A Road Transport Office divisional boundary does not coincide with Urban Area Boundary. This results in issues regarding, accurate quantification of vehicle available in an urban area.

It is very much imperative to conduct National Travel Surveys and create a temporal data base on travel behavior of citizens, to guide the policy formulation, implementation and monitoring. Till date, Ministry of Urban Development has not conducted a holistic survey specifically, to study the travel behavior of people. A variety of information gathered from several sources are used as the rationale behind transport policies. Census of India is one of the main source of data for demographic, economic aspects and house hold amenities. But there is no source for information about who, what, when, where, why and how, Indian citizen across the nation travels to work, school, shop, medical services, recreation purposes and more. Some of these data are available for the cities with a Comprehensive Mobility Plan (CMP), but the major share of urban centers of India do not have a CMP. Efforts for the preparation of CMP are concentrated in some of the million cities only. It seems transport issues will get the authority recognition only when the city crosses the million mark. A cross examination of some of the policy preparation initiative will reveal that, they have a comprehensive temporal data collection mechanism. Fig. 3 shows, the possible attributes that can be included in a transport MIS. But to have an effective MIS, government has to create a Unified Metropolitan Transport Authority and provide enough legal cover for its functioning.

The National Travel Survey (NTS) is the primary source of data on personal travel patterns in Great Britain. The NTS is an established household survey which has



**Fig. 3: Major Sectors of Transport Data**



been running continuously since 1988. It is designed to monitor long-term trends in personal travel and to inform the development of policies. The survey collects information on how, why, when and where people travel as well as factors which affect personal travel such as car availability, holding of driver's license and access to key services. Since 2002, the Department of Transport (DoT) has commissioned the National Centre for Social Research to conduct the survey fieldwork. Data collection consists of a face-to-face interview and a one week self-completed written travel diary. Approximately 20,000 individuals, in 8,000 households, participate in the NTS each year (GoUK 2013).

Since 1969, the FHWA National Household Travel Survey (NHTS) of US has been collecting information about who, what, when, where, why and how US household members across the nation travels to work, school, shop, medical services, recreation purposes and more. Data collected from these surveys provide the transportation community, the information needed for planning, forecasting travel patterns, policy decisions and a host of other programs and initiatives. Since 1990, the NHTS program has been accepting states and local add-one to provide value-added products to both the national program and local data needs. Currently, plans are underway to conduct the 2015 NHTS (FHA 2013).



## 8. SUBSIDIZED PARKING

There is a distortion created by the free parking space or low parking charges. Large inefficiency in transport pricing is due to the fact that many car drivers do not pay for the resource cost of parking (Calthrop et al., 2000; and Calthrop, 2007). It acts as an inducement for using personalized mode of transport. Parking charges should act as a deterrent to use personalized mode of transport. Use of urban land for subsidized parking is happening at a time when more than 20 percentage of city's population living in slums in almost all Indian million cities (Census 2011). Parking in urban areas is managed by Municipal Corporations and Traffic Police in India. If we take the capital cities in each state, there will be more percentage of government employees using two wheelers or cars for daily commuting. All these government offices are providing parking space free of cost. On street parking deteriorates the quality of urban street design and acts as a hurdle for smooth pedestrian movement. Even though Municipal Corporations are callously considering the creation of bicycle lane network. They are providing on street parking in almost all roads in urban areas at cheaper rates. This thwarts the idea of democratic utilisation of urban space. Innovative parking pricing mechanisms and use of Intelligent Transport Systems should be adopted for efficient and equitable use of parking space. Instead of following a blanket pricing all over the urban area, real estate value variations of the urban land also needs to be considered before fixing the parking charges, so that, the revenue from parking can induce the Municipal income. NUTP 2006 suggests the involvement of private agencies for infrastructure provision and parking can be one of the areas where public private partnership can be worked out. But, this calls for the Municipal Corporations across the country, to prepare an inventory of existing parking spaces and assess the demand for parking. Along with this, the existing parking charges in on street and off street spaces needs to be revised to remove the distortions.

Urban centers in developed countries have started to move towards adopting policy measures to reduce car usage. Transport planning that provides parking spaces for car owners at their homes, workplaces, shopping centers and recreational places, has supported increased private car use and car-oriented city streets and discourage walking (Knoflacher 2008). Many urban agencies are adopting innovative ideas in parking pricing to reduce the use of personalized modes. Some cities are even charging for parking based on vehicle emissions. For example, several Boroughs in London have introduced CO<sub>2</sub> emission based residential parking permit schemes. The vehicles that emit the more CO<sub>2</sub> pay the highest fees, while electric cars can park for free. More European cities are using parking management to encourage replacement of clunkers with low emission or emission-free vehicles in an effort to improve air quality and tackle climate change. In France, for example, parking is viewed as a tool that can influence a 14% reduction of the greenhouse gas emissions emitted every year



nationwide. Nottingham, in UK, recently decided to impose a tax of £250 per year, on companies for each parking space they provide for employees. The levy, which came into effect in 2012, only applies to companies with over 10 parking spaces. Other cities like Hamburg are allowing companies to provide fewer parking spaces than required by zoning regulations, if they provide a monthly transit pass to employees (ITDP, 2011). Some cities limit the maximum number of parking spaces build in certain areas, in order to limit total downtown traffic and encourage more efficient parking management. For example, Portland, Oregon, set a limit of 40,000 total parking spaces in their downtown, which has increased public transport mode share from 20-25% in the 1970's to 48% in mid 1990's. Similarly, for more than thirty years both Zurich, Switzerland and Hamburg, Germany, have prohibited any net increase in city center parking supply. When a new off-street space is built (for example, in a new building), an on street space is removed and converted to other uses such as wider sidewalks or bikeways. (ITDP 2011)

## 9. LACK OF INTANGIBLE TDM MEASURES

Many cities has implemented mass transit infrastructure to meet the increasing transport demand. New Delhi, the capital city of India has implemented Metro in 2002 even after the implementation of various other lines. Table 7 depicts, the details of vehicles registered in National Capital Region. In Delhi, the percentage composition of two and three wheelers comes up to 94% (GoNCT Delhi 2013). NUTP envisaged for implementing travel demand management methods to control it, but till date, Delhi Administration did not do anything.

The reluctance to adopt innovative travel demand management measures act as a hindrance in inclusive and equitable transport development. Little progress has

**Table 7: Percentage wise Distribution of Vehicle Registration in NCR**

Year	Personal Vehicles		Commercial Vehicles				Total
	Cars & Jeeps	M. Cycles/ Scooters	Auto rickshaw	Taxis	Buses*	Good Vehicles	
1980-81	22.48	64.13	3.83	1.20	1.52	6.85	100.00
1990-91	21.74	67.51	3.51	0.57	1.06	5.61	100.00
2000-01	26.64	64.53	2.52	0.53	1.20	4.59	100.00
2006-07	30.66	63.64	1.43	0.48	0.90	2.89	100.00
2007-08	30.73	63.58	1.33	0.54	0.93	2.85	100.00
2008-09	30.92	63.17	1.40	0.66	0.91	2.91	100.00
2009-10	31.21	62.85	1.34	0.70	0.89	2.99	100.00
2010-11	31.34	62.64	1.27	0.84	0.89	3.02	100.00
2011-12	31.50	62.43	1.19	0.94	0.86	3.08	100.00

Source: Government of NCT of Delhi



been made despite the realization that, optimal road pricing based on marginal social cost principle is the better way to proceed. (Sen, et al 2010). In 1999 Maharashtra High Court constituted a committee under the Chairmanship of V. M. Lal, then Transport Commissioner, to study and recommend measures to reduce vehicular pollution in Greater Mumbai (Tol 2008). This committee submitted its detailed probe into Mumbai's transport related pollution and gave various recommendations for improving the ambient air quality. One of the major recommendations was to introduce a Traffic Restraint Scheme (TRS). According to this all private vehicles including 2 and 3 wheelers ( non-commercial) having registration numbers ending with digits 1 or 2 shall not be allowed to ply in the limits of island city of Mumbai on Mondays. Similarly, vehicles with registration numbers ending with digits 3 or 4 shall not be allowed to ply on Tuesdays, 5 or 6 on Wednesdays, 7 or 8 on Thursdays and 9 or 0 on Fridays. On Saturdays, Sundays and public holidays all vehicles would be permitted to ply (Lal 2000). But till date this recommendation has not been implemented and while hearing a Public Interest Litigation, filed by Bombay Environmental Action Group (BEAG) and the Smoke Affected Residents' Forum, seeking the implementation of the Traffic Restrain System (TRS) in Mumbai, High Court Division Bench of Justice Bilal Nazki and Justice A R Joshi observed that, "By developing infrastructure you are not going to solve this mess" (IE 2009).

Barrett (1996) claims that, residential densities are the most important land-use-related and influence on personal travel behavior. International comparisons of gasoline usage per head in different cities suggested that, consumption rises at an increasing rate as densities fall. According to Newman and Kenworthy (1989a, 1989b) and Newman (1992), US cities with the lowest densities exhibit the highest mobile energy consumption rates, while European cities are relatively fuel efficient and those cities with very high densities are the most efficient cities.

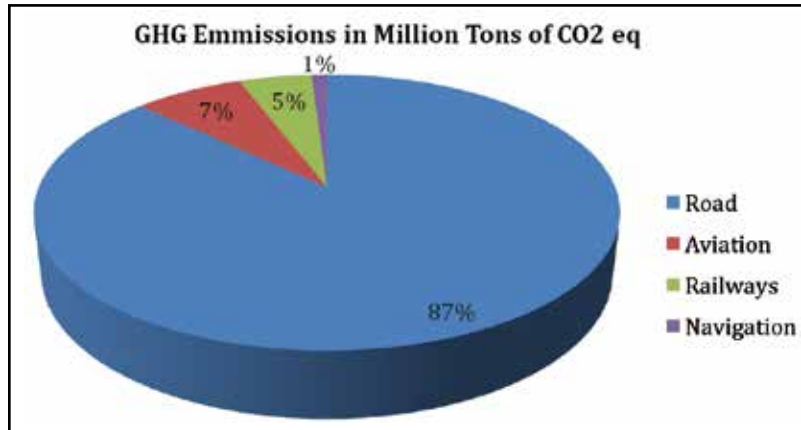
## 10. BICYCLE PHOBIA

The best instance that exposed the lack of linkage between the policy made at the center and the lower level of government came out in Kolkota, when the Municipal Administration decided to ban bicycling in selected 174 roads (Hindu 2013). At a time when global cities are thinking beyond the car and popularizing shared bicycle systems, the law enforcement machinery in West Bengal's capital has chosen to go the opposite way, in order to create more space for powered vehicles. The police order on bicycles and non-motorised vehicles has inflicted misery and financial pain on tens of thousands of workers who use this humble mode of transport to travel for their job. The move to effectively banish the bicycle from large parts of 'Calcutta' is particularly ironic, since Asansol was the home of Sen-Raleigh, among the iconic brands of bicycles made in post-independence India (BBC, 2013). Bicycles as a mainstream transport option are under threat





Fig. 4: GHG Emissions in Million Tons of CO2 eq



today, as it is difficult and risky to ride them in crowded cities. The National Urban Transport Policy has made little headway in addressing the concerns of cyclists and pedestrians. The urban planning record stands in contrast to what is happening in the developed countries, and even emerging nations in Latin America. Curitiba in Brazil, for instance, is creating a micro-grid of roads for bicycle connectivity,

to benefit workers. New York, with a history of 'class conflicts' in allocation of road space, has provided space for cyclists with the launch of a bike-sharing programme. Regrettably, none of these progressive models seems to appeal to Indian policy makers, who promote car use to the exclusion of other modes. Even the settled legal principle of 'polluter pays' has been ignored in Kolkata.

The large cities have a bicycle modal share varying from 9% (Hyderabad) to 18% (Ahmedabad). The medium and large cities have a typical bicycle modal share of 13%-21%. Nagpur being a very unique case with a large number of cyclists (34%), more than walk trips (24%). While Bhopal is another extreme case city with only 4.3% cycle trips and 49% walk trips (Tiwari, and Jain 2008). In most developing cities, average bicycle trip distances are extremely short. Often over 60% of trips are under 3 kilometers long (ITDP 2011). Fig. 4 illustrates, the amount of emissions from transport sector.

Emissions from the transportation sector are the fastest growing in India, with road transportation being the major contributor. This is particularly due to increasing urbanization. In 2004, about 8 percent of total emissions were attributed to transportation and only road transport accounted for 90 percent of this, compared to a global average of 72 percent. It is important to note that roads carry approximately 65 percent of the total freight and 90 percent of passenger traffic across the country. As the urban population increases and cities get more connected, the current growing trend of vehicle ownership rate of about 5 to 15 percent is expected to increase (ESMAP 2012).

#### 11. CONTRADICTION NATURE OF CENTRAL POLICIES

A critical analysis of the policies of the various central ministries will tell us that, there are many contradictions. National Urban Transport Policy was created for coordinating the travel demand management in a sustainable way. The suggestions made in the Automotive Mission Plan (AMP) of India 2006-2016,



prepared by Ministry of Heavy Industries and Public Enterprises would act against the strategies of NUTP 2006. The Finance Bill 2006 has announced a reduction in the duty for raw material which is now between 5 to 7.5 % as compared to the previous level of 10% (MoHIPE 2006). The AMP envisages "to emerge as the destination of choice in the world for design and manufacture of automobiles and components with output reaching a level of US\$ 145 billion, accounting for more than 10% of the GDP and providing additional employment to 25 million people by 2016" (MoHIPE 2006). This plan does not recognize the external social cost of urban transport and its load on oil imports in the era of 'Peak oil'. On one side AMP argues that, industry aims to create 25 million employment and demands changes in Labour Laws. AMP recommended that the permission required in case of a unit employing more than 100 employees, for closure of the establishment, may be raised to 300.

## 12. CONCLUSIONS

Adherence to the National Policy is very minimal in the implementation side. This non-adherence is created due to lack of institutional and technical man power. In the Urban Transport sector financial, political and regulatory control is very much concentrated by Center Government. Although there was devolution of powers recently, it still controls the money matters. Local comprehensive planning is absent and always ends in ad hoc problem solving. Smaller Municipal Corporations are not even considering transport issues in its actual dimension. To solve these issues and to create a strong local transport governance body, it is imminent to create necessary legal footing.

Whatever the improvements happened in public transport in Indian cities, is mainly a selected million bus city phenomena. From a functional perspective, the fragmentation of coordination governance of urban transport is seriously crippling the progress of implementation process. Generally speaking, the role of public transport in meeting the demand for travel is not improved much. Some of the policies at the Central Government itself act against the purpose of the NUTP 2006 and encourage private vehicle ownership.

Lack of enforcement is a key bottleneck. The effectiveness of tough land-use regulations on restricting urban sprawl, which act as the hurdle in the success of public transport system needs to be enforced stringently. Currently little consideration is given to the parking pricing mechanisms. In every city government establishments are inviting car users by providing free parking space. Need to show more political will to implement intangible travel demand management functions, like congestion pricing. Mileage based and CO<sub>2</sub> emission load based taxing regimes needs to be adopted to propagate the sense of 'polluter pays' and environmental justice. Policy preparation implementation and monitoring can be made more effective when there is plenty of data available from the field.



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## Environmental Protection, Conservation and its Management : A Challenge for Policy Planners

**S. K. Banerjee**

### Abstract

*This paper mainly deals with conservation and protection of environment and its management which is becoming a challenge to policy planners both at national and state level. A better environment or say eco-friendly environment and its management is not only an issue with a particular country, it is a world wide issue across the globe. In developed countries industrial and economic developmental projects are top priority issue ignoring the negative impact on the eco-friendly environment. It has been observed that industrial and Economic developmental projects are prime polluters of the ecological system of the planet. Study of specific development projects (ten-projects as case study) ranging from urban development mining, irrigation, construction of dams across the rivers in the hilly terrain, construction of hydropower projects on rivers at short intervals and like, have created an intense human-nature conflict giving rises to the issue of conservation and protections of environment.*

### 1. INTRODUCTION

In a developing country like India development programmes are must, but, invariably they create very many challenging issues related with conservation and protection of environment. These issues are gradually cropping up due to developmental programmes related with urban development, industrial development, mining activity, infrastructural development and irrigation projects related with construction of dams, which gives rise to submergence of large agricultural tracts, which in turn, give rise to colossal task of rehabilitation of displaced persons. These issues are mainly humanitarian in nature and they mostly affect the livelihood pattern of people where such projects are being planned or implemented. The most affected people are tribal population. Their livelihood depends on forest land and especially on minor forest products. Urban areas least affected by these projects and urban population is the only beneficiaries. The rural population is the most sufferer. Since, India is an agricultural country, the interest of tillers of the soil cannot be ignored and denied while initiating any project. It is at this point that, the issue of environmental management comes in.

In the early 1980's Dehradun based Social activist Avdesh Kaushal of the Rural Litigation and Enlightenment *Kendra* filed a case in the High Court of India for protecting the fragile Doon Valley from ravages of limestone mining. The judgment pronounced by the then Chief Justice of India Shri P. N. Baghawati on the issue

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became a land mark historic judgment which led to a new fundamental right for all Indians. "The Right to a Clean Environment". In his judgment Supreme Court Chief Justice Shri P. N. Bhagwati interpreted Indian constitution to mean the Indian citizens right to clean and healthy environment, because without this the right to life is meaningless.

## 2. CONSERVATION AND PROTECTION OF ENVIRONMENT

Conservation and protection of environment is not only an issue with a particular country. It is a worldwide issue covering all nations of the world whether developed or developing. To protect and conserve the Planet's environment on 5th June every year, is commemorated as World Environment Day (WED). United Nation General Assembly started this idea as early as 1972 by organizing the Stockholm Conference on Human Environment. Since then from 1974 till date every year a new theme on environment is chosen for the WED. Some of the important themes are:

- 1974 - Only One Earth.
- 1976 - Water -Vital Resource for Life.
- 1981 - Ground Water.
- 1984 - Desertification.
- 1986 - A Tree for Peace.
- 1989 - Global Warming.
- 1992 - Only one Earth, Care and Share.
- 1995 - We the Peoples: United for Global Environment.
- 1999 - Our Earth- Our Future: Just Save it.
- 2000 - The Environment Millennium: To Act.
- 2003 - Water- Two Billion People are Dying.
- 2005 - Green Cities: Plan for the Planet.
- 2006 - Deserts and Desertification.
- 2007- Melting Ice- A Hot Topic.

The themes adopted by WED for debating and discussing the issues at various forums across the globe clearly depicts the wide range of elements related with environment and ecological system. These elements needs to be protected and conserved for a better and healthier future for our young generations to come. It becomes the moral duty and obligation on the part of the present day human society to hand over these various elements of environment in a better form than what we received from our predecessors and nature as a precious gift.



One very pertinent question arises as to, whether it is possible to conserve and preserve the environment in the prevailing political system of different countries especially, the developed countries where industrial and economic development is on top priority in spite of the fact that, they are the maximum polluters of the ecological system?

Climatologists and environmentalist have been trying hard to find out a workable and agreeable solution to this question, since 1970, in their scientific language. So far efforts have not shown any agreeable solution to this politically complicated issue.

Projects as mentioned below have created intense human v/s nature conflict giving rise to issues of conservation and preservation of environment as identified in some of the case studies like - Lavasa Hill Town in Maharashtra; POSCO in Odisha; Vedanta Mining in Odisha; Polavaram Dam issue in Andhra; Forest Rights Practically in all Project Areas; Skyscraper rise on Lake Bed in West Bengal; Nirma White wash in Gujarat; Paradise Plunder-Koyna Wild Life Sanctuary; Vedanta University near Puri Temple in Odisha; ONGC ignores Green Rules; Dhamara Bort in Mangroves land; and Mining v/s Tiger Reserves.

The issue of conservation and protection of environment within the existing political scenario of the country is mainly dictated by the intense human nature conflict. As such, it become necessary to have a deep inside study of all the aspects of human nature interaction from every angle whether political, economical or environmental. The projects identified above are responsible for conflicts arising for protecting and conserving the environment. In such a conflict, the ecological system of the area under study gets damaged. In the present days scenario of human activity, economic and industrial development becomes a priority issue and tries to override the environmental issues giving rise to ecological imbalance. But, it is nature which ultimately overpowers the human interest by giving rise to very serious natural implications, which ultimately proves very harmful and detrimental to the natural health and environment of the country. It is at this point of conflict between human - nature interaction that, the need for protecting and conserving the environment comes in.

To save the environment and vis-anis the planet from getting damaged and polluted due to greedy approach of man to exploit natures bounties, efforts are being made to restrict the indiscriminate exploitation of the natural assets, which not only comprises land, forest, water, atmosphere but, each and every component which are dependent directly or indirectly on nature's bounties. Land means resource hidden within the land mass; forest means not only forest cover but its vegetation which sustains the tribal population. Water both surface



and underground necessary for forests also include flora and fauna protection of every category of animals, whether they are wild life by nature or other type of mammals, reptiles and birds from getting extinct, due to encroaching of forest areas by human activity.

Whether at global level or regional level question arises, as how to protect and conserve the environment in the present political system which is dominated by personnel economic and material interest rather than national issues? The answer to this question, involves very many issues which are all in conflict with the issue of conserving and protecting the natural environment and the legitimate interests of native populations of the area or regions, where developmental activities are to be launched especially by private sector. These developmental activities are mainly related with urban development projects; irrigation projects; generation of hydro-electric power projects, by putting dams across the rivers, thus, obstructing their natural flow. Mining activities comes into conflict with the clearance of forest covers and making soil unusable for agricultural purposes. Mining not only affects the forest cover, it renders the hills and mountain devoid of vegetation cover; excessive extraction of underground water sources; clearance of forest covers creates conflict with natives residing within the forest area and depending on forest resources for their livelihood. Clearance of forest covers are not only detrimental for natives but, creates a acute problem of saving the wild life which comes into conflict with human habitat areas. These are some of the very important environmental issues both at national and regional level which has to be dealt very intelligently for maintaining a proper ecological balance.

An ineffectiveness on the part of our political system towards preserving and protecting the ecological system and the deteriorate environmental scenario, as a result of industrial and economic development, has given rise to many important questions to be answered by policy planners, like:

- Why not environmental protection and conservation be given a national importance while giving clearance to developmental projects, whether related with urban development projects; irrigation projects; mining projects and hydro - power generation projects?;
- What efforts have been made by project planners towards maintaining a proper ecological balance, while giving clearance to developmental projects?
- Why the policy planners used to be so indifferent towards the issue of conserving the environment at the cost of development?;
- Is this indifference or ineffectiveness towards environment due to personal interest or national interest?;





- Why the guardians i.e. policy planners of the prevailing political system of the country, are so indifferent towards the voice of the local people who are affected by the development projects? This questions has got many dimensions and at present appear to be the main conflicting issue before project managers and even before the government both at national and state level; and
- Was there no other solution to honour and regard the worries and apprehensions of the legitimate interest of the people or population being affected? Like this many more questions will come up in course of time with the advancement of industrialization, which the policy planners will have to take into consideration and answer.

The main factors which are responsible for raising issues, regarding the protection and preservation of environmental system at national and regional level are:

- Increasing industrialization both in developed and developing countries, is the main factor for rapid urbanization. Rapid urban growth gives rise to a number of urban development programmes both at national and regional level. These programmes results into diversion of agricultural land for urban development;
- Urbanization means land to be required for housing projects, indiscriminate and excessive exploitation of water resources both for urban and industrial development;
- Industrialization requires raw material which in turn gives rise to mining activity which is responsible for deforestation and encroaching upon the interest of local population residing in the forest area i.e. *adivasis*;
- The removal of forest cover is detrimental to the very existence of wild life. It has been noticed that in many areas due to depletion of forest cover conflict arises between wild life and the human habitation;
- Heavy industrialization gives rise to pollution both air and water; and
- Hydro-electric power generation by damming the natural flow of rivers means drying up of rivers in the lower regions which ultimately creates water problem both for urban areas and also for agricultural purposes. This in turn results to indiscriminate exploitation of underground water resources.

To ensure protection and conservation of environment there is a need to achieve a natural balance between various environmental components and greedy attitude of mankind. Environment comprises of a number of natural components which nature has been kind enough to give to mankind as an asset with the hope



and desire that these environmental components will be handed over to the next generations to come without being indiscriminately exploited and without disfiguring the planet's outer landscape. These natural components and assets are:

- Mineral which gives rise to mining activity;
- Underground water resources which are at present being indiscriminately exploited both in urban and rural areas;
- Surface water of which rivers are the main source. River water is used both for domestic and irrigation purposes;
- Forest cover and products of which are mostly and legitimately used by the native population (*advisis*) for their sustenance living;
- Fauna - All type of animal life whether carnivorous or herbivorous and their interaction with human habitats;
- Wet lands which are environmental heritage of the mankind in the sense that, they are the house of migratory birds from across the borders of the country and from various climatic regions; and
- Ice and ice covers.

Dr. Man Mohan Singh, the Prime Minister of India, has expressed his opinion on the concluding day of the international seminar on "Global Environment and Disaster Management" at Delhi (2011), in which he mentioned that "we can not wait for the general agreement on environmental conservation and climate change." He further opined that, in the matter of environmental conservation it is not possible to get support from the entire world community because every country developed or developing has to protect and conserve the ecological system of the country keeping in view the economic development and program of the nation, which is perhaps paramount.

### **3. ROLE OF POLICY PLANNERS AND ADMINISTRATORS**

#### **3.1 To Ensure Protecting and Preserving the Fragility of the Swiftly Deteriorating Ecological System.**

Administrators and environmental experts, in their policy making efforts for preservation and conservation of the fast deteriorating environmental system, especially the ecological character of the region, should chart out such laws and rules binding on each developing agencies so as to ensure a pollution free fragile character of the planet (Earth). By character, ecological setting of any area especially hill areas and forest areas are highly fragile. Developmental activities on the part of man and communities are likely to disfigure the environmental system of the fragile picture and setting of the areas and region. If the ecological character of any region gets disfigured or disturbed due to greedy intension of



man, unimaginable catastrophic changes may happen, which will be harmful for human habitation. As such, any developmental project especially urban, industrial and irrigation along with power generation, should be examined in depth with the assistance of environmental experts.

Therefore, while considering any urban or industrial development projects in ecologically fragile areas the policy planners and administrators needs to ensure:

- Excessive mining of hilly terrain should be restricted to the minimum;
- Water bodies should be least disturbed so as not to create any water scarcity for domestic and other purposes;
- Pollution of surface water due to housing and other construction activities should be checked;
- Construction work should not be allowed to come up very near to the surface water;
- Loss of flora and fauna due to deforestation should be completely checked;
- It is also necessary to ensure that, development programmes should not be considered for issuing NOC against the provisions of regional development plan approved by the State Government; and
- Since urban development programmes mostly do not take care of the ecological system of the area, and liable to create high degree of air pollution and pollution of surface water due to construction work coming very near to the level of surface water, clearance from Ministry of Environment and Forest is essential.

### **3.2 Ground Realities to be Considered**

The reflections and the revelations as per the case studies have clearly pictured the conflict between the policy planners and the environmentalists both at national and regional levels. The extent of conflict clearly shows that, the feelings of the community residing in and around the project areas have been utterly neglected. The project managers have failed to visualize that, the projects will damage the occupational structure and livelihood pattern of the local population. Had their feelings been properly considered then perhaps the projects could have materialized in time. Therefore, a positive role on the part of policy planners is highly desirable in making the projects successful and meaningful and time bound.

### **3.3 Areas which Need Attention**

The question arises which are the most critical areas of development, which needs careful attention by administrators and planners while framing guidelines. These areas are:



- Mining v/s forest and forest land (interests of *adivasi* population);
- Mining v/s river - needs for water for domestic and agricultural purpose;
- Mining v/s agricultural land - issue of sustainable occupation; and
- Mining v/s growth - industrial development.

The challenge before the administrators and planners for preservation and conservation of environment is, "How to Handle the Mining Activity"?, because mining activity appears to be the core of all categories of development. Therefore, effort on the part of planners should be to make the mining activity acceptable to society and local community.

### 3.4 How to Achieve a Balance Between Rich Land and Poor People?

The case studies related with different development projects reveal that mining is the core activity especially in the forest land which has a negative influence or say damaging impact on environment and ecological character of the area i.e. forest and forest land, rivers, inhabitants and their occupational character, as such, planners have to concentrate on issues which are deeply related with mining and people whose living and occupational activities are affected. These people are mostly *adivasis*, as it is clear from the case studies. Therefore, policy makers with the assistance of environmentalists and NGO's, should try to make the inhabitants of project areas to accept the developmental activities. But, this is only possible when their interests are also taken care of.

Mining should be made acceptable to society and local community. This is only possible with the assistance of experts in the field of mining i.e. Indian Bureau of Mines (IBM) and State Pollution Control Board (SPCB's). These institutions are responsible for controlling and monitoring the environmental aspects of mining. IBM is supposed to clear the Mine Plans i.e.; opening up of mines and closure of mines. The State Pollution Control Board in collaboration with Ministry of Environment and Forest is supposed to clear Environmental Impact Assessment Plan. At this stage, the opinion and feelings of the local people likely to be affected by the project activities, should be taken care off and they should be made a part of assessment team. Beside while giving clearance to mining projects forest and environmental clearance from Central Government should be made obligatory.

Today mining is done in every ecologically sensitive areas in an around reserve forests, wild life sanctuaries and protected areas. But, mining is becoming a detrimental activity so far as environment and fragile ecological character of project areas are concerned.



The project areas are mostly covered by forest lands. This fact gets more clear from the following lines. "India is a mineral rich country. It has more than 20,000 known mineral deposits. But unfortunately, for India, almost all its minerals are in the same regions that hold its greenest forests and most abundant rivers systems." The ground reality is that, these lands are largely inhabited by *adivasi* population which are country's most poor and marginalized people. As such, it becomes an open issue for the policy planners so as to how to, "protect the interests of the poor and marginalized population?". The policy planners therefore, at national level needs to ensure:

- That mining be more acceptable to society keeping in mind that modern urban industrial economy cannot do without mining, accordingly, to work out a plan for achieving a balance, between, modern urban industrial economy and the fragile ecology;
- That mining does not destroy ecological system of land areas, which are critical for protecting and conserving environment;
- To accord top priority for an environmental impact assessment of each project, whether it is related with mining or non-mining, like construction of dams across rivers, cutting of hills for procuring land space for urban development projects, indiscriminate extraction of water resources both surface and underground and the preservation of flora and fauna i.e. conflict between wild life and human habitation. The impact of these developmental activities need to be viewed in relation to legal coverage so as to ensure that the fragile character of the environment is maintained. This is only possible by working out a proper environmental management assisted by constitutional safeguards;
- To create a strong monitoring and enforcement system for conserving and protecting the ecological system and the fast deteriorating environment;
- While framing laws for protecting and conserving the environment the policy planners have to analyze the social impact of development in depth i.e. to what extent the inhabitants of the land are gainer or loser. Unless, the negative impact is not taken into consideration in relation to the welfare of the community, any law will remain incomplete and ineffective; and
- The effort on the part of policy planners both physical and fiscal, climatologists and experts in different fields of development for achieving a balance between growth and green environment or say environmental friendly growth will remain an unfinished task unless they keep in mind the following issues at the decision making level:



- There is a struggle between the economic development and control of natural resources;
- The growth oriented economy has brought wealth to the doors of many but at the same time, it has given rise to street fights over control of natural resources as evident in case of mining as happening in Odhisa and Chattisgarh;
- There is a need to find an amicable agreement between economic growth and equitable sharing of natural resources;
- There should be a proper sharing of biological resources (plants and animals) v/s production of medicinal and chemical products. At this point the question arises, how to achieve a balance between environmental issues and global economy? It is the very question, which necessitates the policy planners to think over this issue in depth so as to protect and conserve the fragile character of the plants and its environment;
- The policy planners have to address themselves to issues both brown (urban environment) and green (rural and forests) for creating an environmental friendly developmental scenario both at national and regional level; and
- For creating an environmental friendly developmental scenario for the country it becomes necessary for the policy planners to address the same at 3-levels:
  - Issues related to rural economy and forestry;
  - Issues related to urban development and industrialization; and
  - Issues related to global environment.

Policy planners have to consider the above three - issues while framing environmental protection and conservation laws at national and regional levels, to create a better and meaningful living for the people of the country, who are endowed by nature with enormous and varied natural resources but are economically poor i.e. rich land and poor people.

Here, it will be worthwhile to mention two different thoughts on the development strategy for the nation as a whole. These two different thoughts have been expressed by high ranking personalities not less than the head of the Indian Republic. They are former president Honorable K.R. Narayanan and Honorable Dr. Abdul Kalam”.

“Under the caption two president two India”, former presidents Honorable K.R. Narayanan and Honorable Dr. Abdul Kalam held completely opposite and divergent views on the economic development of India, which is based on mineral



industry. What are the two different opinions of former president of about India's economic development?, are as given below.

"Let it be not said by future generations that Indian Republic has been built on the destruction of green earth and innocent tribal's which have been living there for centuries. Let it not be said that this great Republic in a hurry to develop itself is devastating the green mother earth and uprooting our tribal population:---" 2001. (Honorable K. R. Narayanan)

Honorable president Dr. Abdul Kalam on November 1, 2003, in his inaugural speech for the 19th World Mining Congress and Expo in New Delhi emphasized "the facilitation for the project through provision of land, infrastructural developments, community development, etc.; can be done by the government agencies whereas, the investment in the mine and the associated technological inputs can come from private sector..... In addition the private sector must have the freedom to run the mine in a cost effective manner", 2003.

The above two different thoughts, regarding the development strategy for the country clearly emphasizes on maintaining the scenario of the green earth, to protect the survival interest of the *adivasis*, who are the sons of forests and the inheritor of natural resources, below and above the land, to the extent for safeguarding their sustainable livelihood. The other thought emphasizes, the need for countries economic development based on mining activities. It identified the role of government for infrastructural and community development, whereas, the private sector to take care off the investment and technological sector. This second thought is completely silent on the destruction of green mother earth. It is here that, conflicts are arising wherever development projects have been initiated or going to be initiated. It needs to be clearly stated that development programmes for a developing country like India is a must but then the protection and conservation of the green mother earth is also required development programmes and it is this very contentious issue, which is a challenge for policy planners in the present development scenario of the country.

Therefore, the challenge before the policy planners is - how best to create an environment which will mean a better and meaningful living for those section of the people who are living and residing in rich mineralized areas of the country but are poor economically, educationally and socially.

Therefore, the policy planners will have to think over as to how to, protect the fragile character of environment and create a natural balance between rich land and poor people ? Unless the policy planners carry out a comprehensive appraisal of environmental issues, harmonious development between nature and man will



remain unanswered and the poor people will remain poor in spite of the fact that, they are the son's of rich mineralized and forested land.

The role of policy planners towards protecting the environmental and fragile ecological system so far as the economic development is concerned should not only be confined to making of rules, laws and regulations. They need to identify the main causes for people's feelings and at times their vehement opposition towards development projects especially related with mining clearance of forest covers, indiscriminate exploitation of water resources and the problem of rehabilitation of displaced persons from their place of livelihood.

The feelings and vehement opposition of people affected by projects have been clearly exposed in the case studies. These feelings of people against the project need to be taken into consideration by the policy planners before they start thinking upon framing new rules and regulations.

#### 4. CONCLUSIONS

Since, the country is vast with varied geographical and sociological conditions, the people's attitude towards any development project differs from region to region. Question arises as how best these feelings and attitude of people can be identified and accommodated by policy planners while framing new laws and regulations? Unless this question is properly examined and is made a part of the entire issues of protecting and conserving the environment and fragile ecology of regions the harmonious development between man and nature, will remain a hurdle towards economic and industrial prosperity of regions and poor people will remain poor in spite of the fact that, they are the sons of rich mineralized and forested land. This issue will ever remain a challenge for policy planners.

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## Impact of Road Transport in the Development of Gaya District

**Krishna Kumar and Anjan Sen**



### Abstract

*This paper analyzes the role of road transport in development of Gaya district in Bihar. The study determines connectivity and accessibility of surface network, and delineates the transport region, thereby, correlating road transport with the socio-economic development in the district. Graph theory, buffering methods and normalization techniques (Z-Square) has been used to determine the road transport region, while a variety of GIS and CAD software's has been used to process the spatial data. Arc GIS aids in network analysis, whereas ERDAS IMAGINE assists in map making through geo-referencing, digitization, buffering and overlay analysis. Statistical packages like SPSS and MS-Excel were also used to analyze quantitative data. Normalization is used in construction of various indices. It was found in the study area that road transport indeed has positive relation with regional development.*

### 1. INTRODUCTION

Road transport is concerned with the movement of people and material with a specific purpose from place to place. It is a service facility and is essentially required for the promotion of various economic activities, connected with agricultural, industrial and services, both production and distribution. It is an important key to the development of any region. A good road network constitutes the basic infrastructure that, propels the development process through connectivity and opening up the backward regions to trade and investment. Better the transport facilities in a region, the higher is the standard of living of its people. Deficiencies of transport facilities are invariably accompanied by poverty and under-development. The extension of transportation to rural areas helps in spreading the agricultural activities to fallow land and cultivable wasteland, marketing of agricultural products, growth in rural industries, with the expanded market network and social transformation through greater accessibility to basic amenities. Hence, development of road transport is complementary to development of region.

This paper aims to analyze the role of road transport in development of Gaya region over the period of three decades 1980-2010. It also tries to determine the connectivity and accessibility of surfaced network with demarcating the transport region and showing its correlation with the socio-economic development

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in the district. For achieving the above mentioned aims Graph Theory, Buffering method and normalization technique (Z-Square) has been used. Various GIS and computer software like Arc GIS, Erdas, SPSS and MS-Excel has been used to process and analyze the data. GIS software is used to prepare different type of maps through geo-referencing, digitization, buffering and overlay analysis. Arc GIS is used for network analysis. Normalization is used in construction of various indices.

The study is mainly based on secondary database which has been collected from Survey of India (toposheets), Census of India, Department of Road Construction, (Govt. of Bihar), Department of Transport, (Government of Bihar), Regional Transport Office, Gaya District, Department of Education, (Government of Bihar), Department of Health (Government of Bihar), Directorate of Statistics and Evaluation (Government of Bihar), Department of Water Resources; (Government of Bihar), Banking Statistics Handbook (Government of Bihar) and District Gazetteer.

The study was carried out for Gaya district which was a part of ancient Magadha region of Bihar. Located between  $84^{\circ} 4'$  to  $85^{\circ} 5'$  E longitudes and  $24^{\circ} 5'$  to  $25^{\circ} 1'$  N latitudes, it is 100 kilometers south of Patna. The surrounding physical features give the region a unique identity. The region is surrounded by a series of low rocky hills (Mangala-Gauri, Shringa-Sthan, Ram-Shila and Brahmayoni) on three sides, and River Falgu flowing on the fourth western-side, thus gets a separate identity from its surrounding area. The region has an area of 4,856 sq km and a population of 3,473,428 in 2001. It is bounded on the east, north and west respectively by Nawada, Jehanabad and Aurangabad districts of Bihar, and south by Chatra district of Jharkhand. A dominant majority of the population is engaged in agricultural activities.

## 2. GROWTH OF ROAD NETWORK IN GAYA DISTRICT

Gaya district, at present with an area of 4,856 sq km has a total road length of 3,606 km. The total road length per 100 sq km of area is merely 74 km. Table 1 and 2 indicates that village roads dominate in the study area with the share of 83 percent of the total road network whereas the National Highways, State Highways and major district roads have share of 5, 4 and 8 per cent, respectively, to total road length. From Table 3 and 4 and Fig. 1; it has been found that in Gaya district almost no new road network was laid since independence. But only some stretch of particular State Highways have been upgraded into National Highways.

In 1980 there was only one National Highway (NH-2) and four State Highways (SH-4, SH-7, SH-69 and SH-70) and collectively have length of 341 km. However, the total length of surfaced road and density of surfaced road in 1980 was only 603



Fig. 1: Gaya District - Road Network 1980

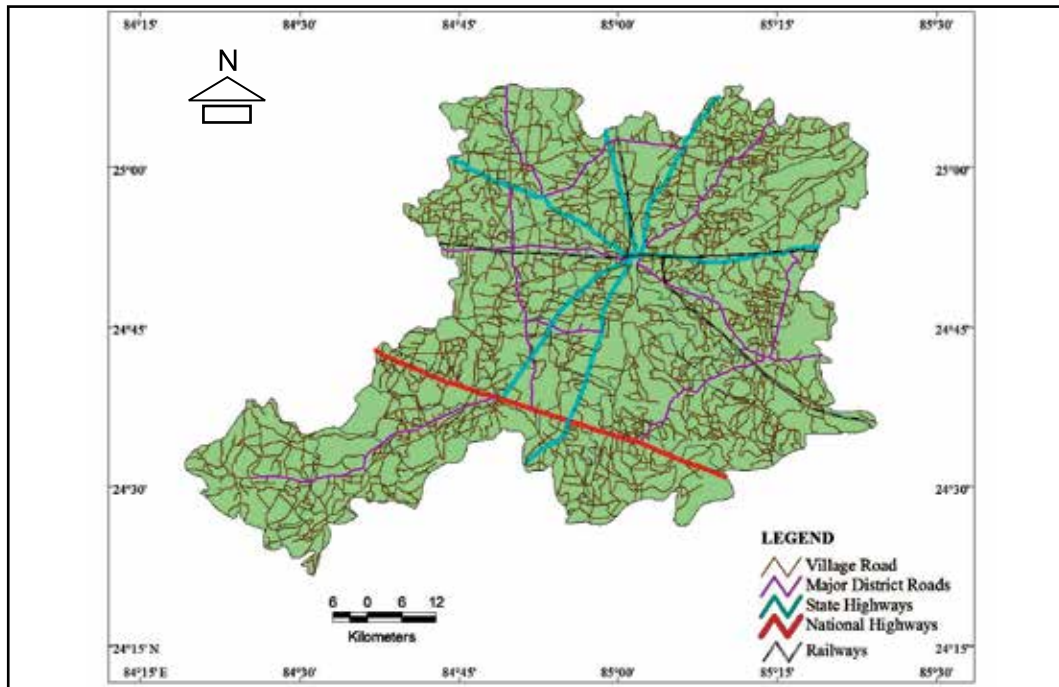
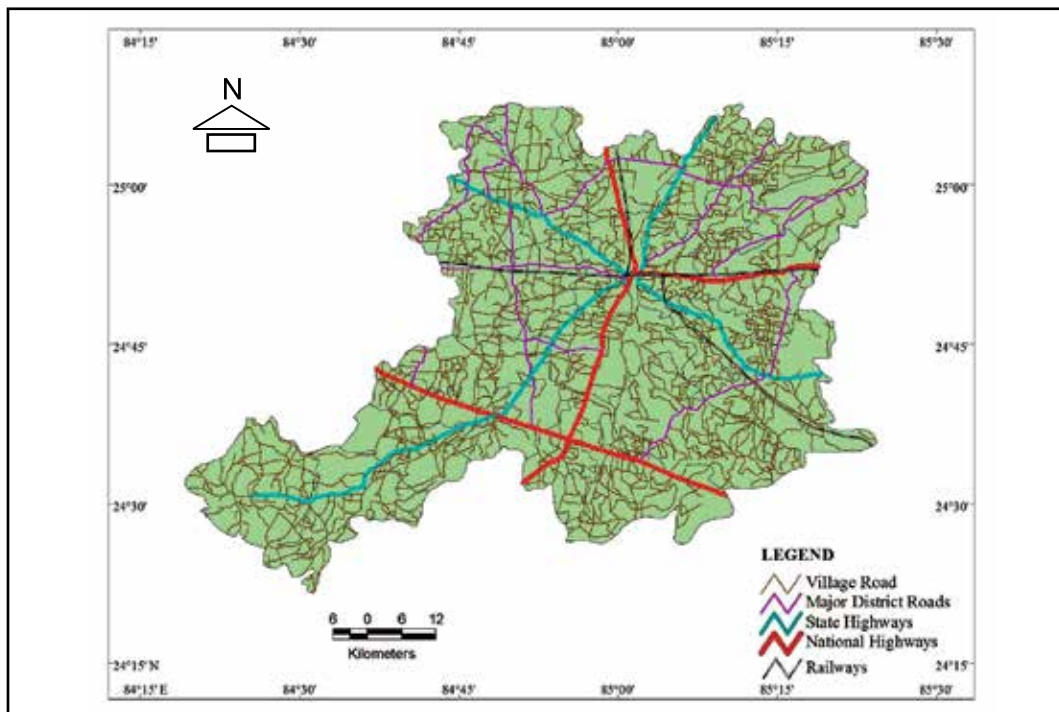


Fig. 2: Gaya District - Road Network 2010



Source: Computed by Researcher from the Topographic Sheets of Survey of India and Map of Road Construction Department (Government of Bihar)



**Table 1: Road Length in Gaya District (1980)**

S. No	Block	National Highways	State Highways	Major District Roads	Village Road/ Other Roads	Total
	Units	Km	Km	Km	Km	Km
1.	Dumaria	-	9.85	-	241.55	251.40
2.	Imamganj	-	19.44	-	157.09	176.53
3.	Banke Bazar	-	13.98	-	91.04	105.02
4.	Amas	24.2	5.23	-	94.84	124.27
5.	Gurua	-	4.02	7.15	157.85	169.02
6.	Guraru	-	12.13	11.37	102.67	126.76
7.	Konch	-	15.51	11.04	149.30	175.85
8.	Tikari	-	11.27	31.59	111.67	154.53
9.	Belaganj	-	11.40	18.20	102.23	131.83
10.	Sherghati	7.31	13.73	7.57	60.40	89.01
11.	Dhobi	29.92	-	-	116.07	145.99
12.	Barachatti	23.15	-	2.09	165.80	191.04
13.	Mohanpur	-	12.73	17.69	244.40	262.09
14.	Fatehpur	-	-	19.88	187.44	220.05
15.	Wazirganj	-	19.73	25.18	159.80	204.71
16.	Tankuppa	-	14.78	-	89.97	104.75
17.	Bodh Gaya	-	22.65	10.51	142.1	173.85
18.	Paraiya	-	12.37	2.28	81.31	95.96
19.	Gaya	-	54.36	-	96.18	150.54
20.	Neemchak Bathani	-	-	4.79	87.51	92.30
21.	Muhra	-	-	32.76	61.36	94.12
22.	Khizirsarai	-	-	26.20	150.75	176.95
23.	Atri	-	-	9.94	71.39	81.33
24.	Manpur	-	4.04	22.41	82.78	109.23
	<b>Total</b>	<b>84.58</b>	<b>256.40</b>	<b>260.65</b>	<b>3005.50</b>	<b>3607.13</b>

Source: Computed by Researcher from the Topographic Sheets of Survey of India and Map of Road Construction Department (Government of Bihar)

km and 12 km per sq km respectively. The length of unsurfaced road and density of unsurfaced road had share of 3006 km and 62 km per sq km respectively.

In 2010, Gaya had got four national highways (NH-2, NH-82, NH-83 and NH-99) and had increased its length from 84 km to 187 km in the total road length. The total length of surfaced road and density of surfaced road in 2010 is 603 km and 12 km per sq km respectively whereas the total length of unsurfaced road and density of unsurfaced road is 3006 km and 62 km per sq km respectively. In 2010,

**Table 2: Road Length in Gaya District (2010)**

S. No	Block	National Highways	State Highways	Major District Roads	Village Road/ Other Roads	Total
	Units	Km	Km	Km	Km	Km
1.	Dumaria	-	9.85	-	241.55	251.40
2.	Imamganj	-	19.44	-	157.09	176.53
3.	Banke Bazar	-	13.98	-	91.04	105.02
4.	Amas	24.2	5.23	-	94.84	124.27
5.	Gurua	1.96	4.02	7.15	157.85	169.02
6.	Guraru	-	11.31	11.37	102.67	126.76
7.	Konch	-	15.51	11.04	149.30	175.85
8.	Tikari	-	11.27	31.59	111.67	154.53
9.	Belaganj	11.40	-	18.20	102.23	131.83
10.	Sherghati	7.31	13.73	7.57	60.40	89.01
11.	Dhobi	29.92	-	-	116.07	145.99
12.	Barachatti	23.15	-	2.09	165.80	191.04
13.	Mohanpur	-	-	17.69	244.40	262.09
14.	Fatehpur	12.73	-	19.88	187.44	220.05
15.	Wazirganj	19.73	-	25.18	159.80	204.71
16.	Tankuppa	14.78	-	-	89.97	104.75
17.	Bodh Gaya	7.71	13.54	10.51	142.1	173.85
18.	Paraiya	-	12.37	2.28	81.31	95.96
19.	Gaya	29.74	24.62	-	96.18	150.54
20.	Neemchak Bathani	-	-	4.79	87.51	92.30
21.	Muhra	-	-	32.76	61.36	94.12
22.	Khizirsarai	-	-	26.20	150.75	176.95
23.	Atri	-	-	9.94	71.39	81.33
24.	Manpur	4.04	-	22.41	82.78	109.23
	Total	186.67	154.31	260.65	3005.50	3607.13

Source: Computed by Researcher from the Topographic Sheets of Survey of India and Map of Road Construction Department (Government of Bihar)

out of the total road network of 3607 km in Gaya, the share of NH has 187 km (5 percent), SH has 154 km (3 percent), MDR has 261 km (7 percent) and Village road has 3006 km (83 percent) respectively.



**Table 3: Types of Road and Road Density, Gaya (1980)**

S.No	Block	Area	Surfaced Road	Un-surfaced Road	Total Road	Surfaced Road Density	Un-surfaced Road Density	Total Road Density
	Units	Sq. Km	Km	Km	Km	Km per Sq. Km	Km per Sq. Km	Km per Sq. Km
1.	Dumaria	320.96	9.85	241.55	251.40	3.06	75.25	78.32
2.	Imamganj	264.16	19.44	157.09	176.53	7.35	59.45	66.82
3.	Banke Bazar	207.19	13.98	91.04	105.02	6.74	43.94	50.71
4.	Amas	108.42	29.43	94.85	124.27	27.13	87.48	114.61
5.	Gurua	189.37	12.13	157.85	169.02	5.89	83.35	89.25
6.	Guraru	164.99	22.68	102.67	126.76	13.74	62.22	75.97
7.	Konch	255.62	26.55	149.30	175.85	10.38	58.41	68.79
8.	Tikari	232.37	42.86	111.67	154.53	18.54	48.05	66.51
9.	Belaganj	197.87	29.60	102.23	131.83	14.95	51.66	51.66
10.	Sherghati	127.98	28.61	60.40	89.01	22.35	47.19	69.54
11.	Dhobi	183.11	29.92	116.07	145.99	16.34	63.38	79.72
12.	Barachatti	295.35	25.24	165.80	191.04	8.54	56.13	64.68
13.	Mohanpur	343.11	30.42	244.40	262.09	5.15	71.23	76.38
14.	Fatehpur	335.94	19.88	187.44	220.05	9.71	55.79	65.51
15.	Wazirganj	265.63	44.91	159.80	204.78	13.39	60.15	73.55
16.	Tankuppa	150.17	14.78	89.97	104.75	9.84	59.91	69.75
17.	Bodh Gaya	230.16	33.16	142.10	173.85	18.26	81.73	61.73
18.	Paraiya	141.93	14.65	81.31	95.96	10.32	57.28	67.71
19.	Gaya	137.02	54.36	96.18	150.54	39.67	70.19	109.86
20.	Neemchak Bathani	118.46	4.79	87.51	92.30	4.04	73.87	77.91
21.	Muhra	147.68	32.76	61.36	94.12	22.18	41.54	63.73
22.	Khizirsarai	184.61	26.20	150.75	176.95	14.91	81.65	95.85
23.	Atri	130.00	9.94	71.39	81.33	7.64	54.91	62.56
24.	Manpur	124.26	26.45	82.78	109.23	21.28	66.61	87.91
	Total	4,856.56	603.04	3,005.50	3,607.13	12.41	61.88	74.27

Source: Computed by Researcher from the Topographic Sheets of Survey of India and Map of Road Construction Department (Government of Bihar)

**Table 4: Types of Road and Road Density, Gaya District (2010)**

S.No	Block	Area	Surfaced Road	Un-surfaced Road	Total Road	Surfaced Road Density	Un-surfaced Road Density	Total Road Density
	Units	Sq. Km	Km	Km	Km	Km per Sq. Km	Km per Sq. Km	Km per Sq. Km
1.	Dumaria	320.96	9.85	241.55	251.40	3.06	75.25	78.32
2.	Imamganj	264.16	19.44	157.09	176.53	7.35	59.45	66.82
3.	Banke Bazar	207.19	13.98	91.04	105.02	6.74	43.94	50.71
4.	Amas	108.42	29.43	94.85	124.27	27.13	87.48	114.61
5.	Gurua	189.37	12.13	157.85	169.02	5.89	83.35	89.25
6.	Guraru	164.99	22.68	102.67	126.76	13.74	62.22	75.97
7.	Konch	255.62	26.55	149.30	175.85	10.38	58.41	68.79
8.	Tikari	232.37	42.86	111.67	154.53	18.54	48.05	66.51
9.	Belaganj	197.87	29.60	102.23	131.83	14.95	51.66	51.66
10.	Sherghati	127.98	28.61	60.40	89.01	22.35	47.19	69.54
11.	Dhobi	183.11	29.92	116.07	145.99	16.34	63.38	79.72
12.	Barachatti	295.35	25.24	165.80	191.04	8.54	56.13	64.68
13.	Mohanpur	343.11	30.42	244.40	262.09	5.15	71.23	76.38
14.	Fatehpur	335.94	19.88	187.44	220.05	9.71	55.79	65.51
15.	Wazirganj	265.63	44.91	159.80	204.78	13.39	60.15	73.55
16.	Tankuppa	150.17	14.78	89.97	104.75	9.84	59.91	69.75
17.	Bodh Gaya	230.16	33.16	142.10	173.85	18.26	81.73	61.73
18.	Paraiya	141.93	14.65	81.31	95.96	10.32	57.28	67.71
19.	Gaya	137.02	54.36	96.18	150.54	39.67	70.19	109.86
20.	Neemchak Bathani	118.46	4.79	87.51	92.30	4.04	73.87	77.91
21.	Muhra	147.68	32.76	61.36	94.12	22.18	41.54	63.73
22.	Khizirsarai	184.61	26.20	150.75	176.95	14.91	81.65	95.85
23.	Atri	130.00	9.94	71.39	81.33	7.64	54.91	62.56
24.	Manpur	124.26	26.45	82.78	109.23	21.28	66.61	87.91
	Total	4,856.56	603.04	3,005.50	3,607.13	12.41	61.88	74.27

Source: Computed by Researcher from the Topographic Sheets of Survey of India and Map of Road Construction Department (Government of Bihar)



### 3. GROWTH OF ROAD TRANSPORT IN GAYA DISTRICT

The total number of registered vehicles in Gaya is 1,36,884 as on 2010 (Table 5). However, it was 38,517 in the year of 1980. In 1980, it was Gaya, Bodh Gaya, Tikari and Sherghati which accounts 56.64 % of the total registered vehicle in the block. Similarly, in 2010 the same four blocks accounts for 60.68 % of total registered vehicle. The reason is that, all the four blocks are urban towns and have urban economy. So people of these blocks have more purchasing power as compared to rest of the blocks. This show that, rest of the blocks is comparatively under developed and poor. In these thirty years, almost all blocks have registered very slight change, either positive or negative, in the proportion of registered vehicles. Only Gaya and Bodh Gaya has shown some significant change. Gaya has shown the increase of 5.05 %; while Bodh Gaya has shown decrease of 2.98% in the registered vehicle. The reason for increase of registered vehicle in Gaya is that, it is district headquarter, so naturally it is more developed. However, Bodh Gaya registers decrease in registered vehicle because the block is not getting developed as it should be. Bodh Gaya still lacks in the socio-economic infrastructures and significant small scale industries. The tourism industry has not been developing as it has been expected since years. People are still poor, thus, Bodh Gaya has registered decrease in registered vehicles over the period of thirty years.

### 4. ROAD CONNECTIVITY IN GAYA DISTRICT

Vertices and edges are the two basic connectivity indices of Graph Theory, which has been used to evaluate the connectivity and the accessibility of the surfaced roads in Gaya district. Vertices, also called nodes, represent the villages whereas, edges represent the network connectivity (Fig. 3).

Villages having thousand or more than one thousands populations have been selected as nodes. While drawing edges it has been taken into consideration that no edges would cross other vertices. Thus, edges have been calculated in terms of direct connectivity.

Table 5: Number of Registered Vehicles in Gaya District (1980 and 2010)

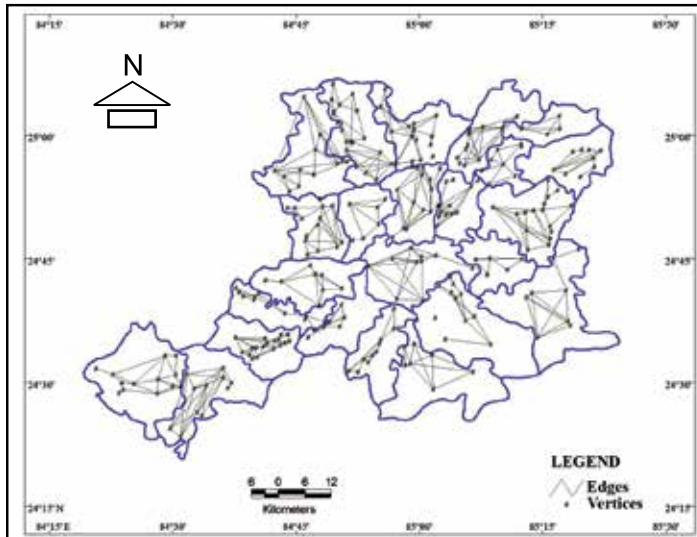
S.No.	Block	1980	2010	Growth (in %)
1.	Dumaria	832	2185	1.63
2.	Imamganj	990	2398	1.42
3.	Banke Bazar	1242	2966	1.39
4.	Amas	725	2395	2.30
5.	Gurua	410	1402	2.42
6.	Guraru	837	2625	2.14
7.	Konch	928	2345	1.53
8.	Tikari	1960	7444	2.80
9.	Belaganj	897	3131	2.49
10.	Sherghati	1941	9906	4.10
11.	Dobhi	1543	3129	1.03
12.	Barachatti	742	2330	2.14
13.	Mohanpur	860	2407	1.80
14.	Fatehpur	821	2728	2.32
15.	Wazirganj	779	3208	3.12
16.	Tankuppa	932	3051	2.27
17.	Bodh Gaya	7572	22829	2.01
18.	Paraiya	543	3777	5.96
19.	Gaya	10124	42888	3.24
20.	Neemchak Bathani	949	2713	1.86
21.	Muhra	724	1828	1.52
22.	Khizirsarai	823	2579	2.13
23.	Atri	511	1784	2.49
24.	Manpur	832	4836	4.81
	Total	38517	136884	2.55

Source: Transport Department, Government of Bihar





**Fig. 3: Gaya District - Vertices and Edges**



While evaluating vertices and edges, district of Gaya has been taken as a graph and twenty four blocks as sub - graphs. With the help of edges, vertices and sub-graphs, the attributes of the road networks (Table 6) has been obtained which shows that, there are 240 vertices, 444 edges and 24 sub-graphs.

On the basis the values of the cyclomatic number, the connectivity has been calculated. Cyclomatic numbers for all the blocks range from 1 to 14, which reflects that the district has distinct divisions in terms of level of connectivity and socio-economic development.

**Table 6: Observed Attributes of Road Network Structure**

No.	Block	Edges	Vertices	Sub graph	Cyclomatic No.	Cyclomatic Index
1.	Dumaria	22	13	1	8	0.54
2.	Imamganj	26	11	1	14	1.00
3.	Banke Bazar	33	18	1	14	1.00
4.	Amas	16	11	1	4	0.23
5.	Gurua	13	8	1	4	0.23
6.	Guraru	25	14	1	10	0.69
7.	Konch	24	13	1	10	0.69
8.	Tikari	31	18	1	12	0.85
9.	Belaganj	24	16	1	7	0.46
10.	Sherghati	9	6	1	2	0.08
11.	Dhobi	15	10	1	4	0.23
12.	Barachatti	14	7	1	6	0.38
13.	Mohanpur	14	12	1	1	0.00
14.	Fatehpur	15	9	1	5	0.31
15.	Wazirganj	24	15	1	8	0.54
16.	Tankuppa	7	5	1	1	0.00
17.	Bodh Gaya	20	10	1	9	0.62
18.	Paraiya	8	6	1	1	0.00
19.	Gaya	29	14	1	14	1.00
20.	Neemchak Bathani	6	4	1	1	0.00
21.	Muhra	12	9	1	3	0.15
22.	Khizirsarai	24	11	1	11	0.77
23.	Atri	11	8	1	2	0.08
24.	Manpur	22	12	1	9	0.62
	<b>Total</b>	<b>444</b>	<b>240</b>	<b>24</b>		

Source: Derived by Researcher on the basis of Graph Theory

To construct a choropleth map of network connectivity with the help of cyclomatic number, Cyclomatic Number Index has been developed with the help of normalization technique as given below:

$$X_{ij} = \frac{X_{ij} - \text{Min}\{X_{ij}\}}{\text{Max}_i\{X_{ij}\} - \text{Min}_i\{X_{ij}\}}$$

After calculating the Cyclomatic Number Index, choropleth map of network connectivity of Gaya district has been prepared which shows that high network connectivity is at center, towards north and north-west direction. It is because, these regions has mainly plain area suitable for agriculture and has higher population concentration in comparison to the southern part. Moderate network connectivity is concentrated towards east, south and south-west direction. However, low network connectivity is mainly concentrated towards north-east and south-west direction due to hill areas and affects of naxalism.

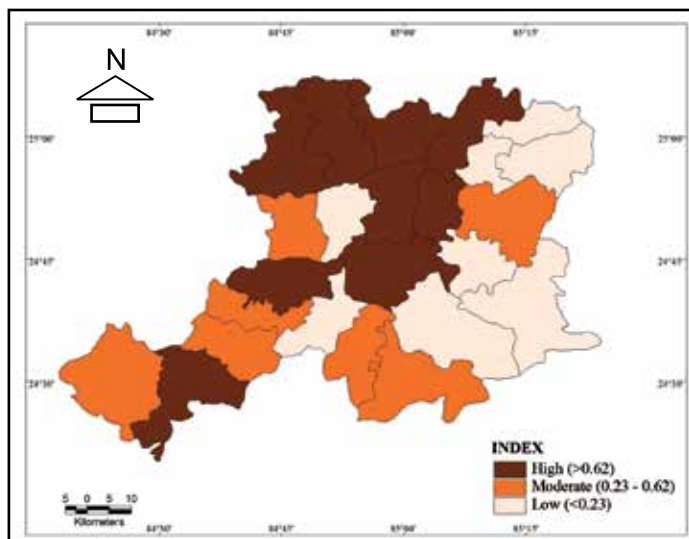
One of the major reasons of all the three level of network connectivity in the district is that, the present distribution of road networks were laid mainly during the period of Mughal and British. No new surfaced road has been laid since independence in the region and thus, settlements are also concentrating only along the existing networks.

### 5. ROAD ACCESSIBILITY IN GAYA DISTRICT

Accessibility to road especially to surfaced road is very essential as it connects to the main trading markets and helps in getting the benefits of economic activities and other social development impacts. Map of surfaced road accessibility (Fig. 4) have been prepared by using the technique of "Buffering". Accessibility to surfaced road is calculated within the distance of three kilometers to get a normal picture of the district in terms of surfaced road accessibility.

From Table 7, it is clear that, out of the area of 4856.46 sq km, only 2604.14 sq. km area is accessible within 3 km from a surfaced road. This is 52.62 percent of the total area. This indicates that population who reside in the remaining area of 42.48 percent have to travel at least three kilometers to get the access of surfaced roads which shows the backwardness of the district.

Fig. 4: Gaya District - Network Connectivity



**Table 7: Accessible Area to Surfaced Roads (within 3 km)**

S.No.	Block	Area (sq. km.)	Buffered Area (sq. km)	Accessible Area (%)
1.	Dumaria	320.96	71.01	22.13
2.	Imamganj	264.16	85.74	32.46
3.	Banke Bazar	207.19	83.98	40.53
4.	Amas	108.42	74.45	68.66
5.	Gurua	189.37	84.06	44.39
6.	Guraru	164.99	95.28	57.75
7.	Konch	255.62	197.91	77.42
8.	Tikari	232.37	155.21	66.80
9.	Belaganj	197.87	132.11	66.77
10.	Sherghati	127.98	74.40	58.13
11.	Dhobi	183.11	127.36	69.55
12.	Barachatti	295.35	107.10	36.26
13.	Mohanpur	343.11	98.40	28.68
14.	Fatehpur	335.94	130.81	38.94
15.	Wazirganj	265.63	213.61	80.42
16.	Tankuppa	150.17	92.43	61.55
17.	Bodh Gaya	230.16	116.70	50.70
18.	Paraiya	141.93	106.67	75.16
19.	Gaya	137.02	100.54	73.38
20.	Neemchak Bathani	118.46	32.73	27.63
21.	Muhra	343.11	86.33	25.16
22.	Khizirsarai	184.61	137.49	74.48
23.	Atri	130.00	80.71	62.08
24.	Manpur	124.26	119.12	95.86
	Total	4856.56	2604.14	53.62

Source: Computed by Researcher on the basis of Buffering Technique using GIS

Surfaced road accessibility is high at center, east and north-west mainly because, these regions have plain areas and have the major stretch of surfaced network which were laid during British period for transporting raw materials and marching military troops.

Accessibility to surfaced road (Fig. 5) is medium, mainly towards south-center and western side of the district, while it is low towards south-east and south-west because of the presence of hill areas and naxalism. However, negligence of state government and central government in terms of district planning is also responsible for low surfaced road in the district as no new surfaced road has been laid in district since independence.

## 6. TRANSPORT REGIONS IN GAYA DISTRICT

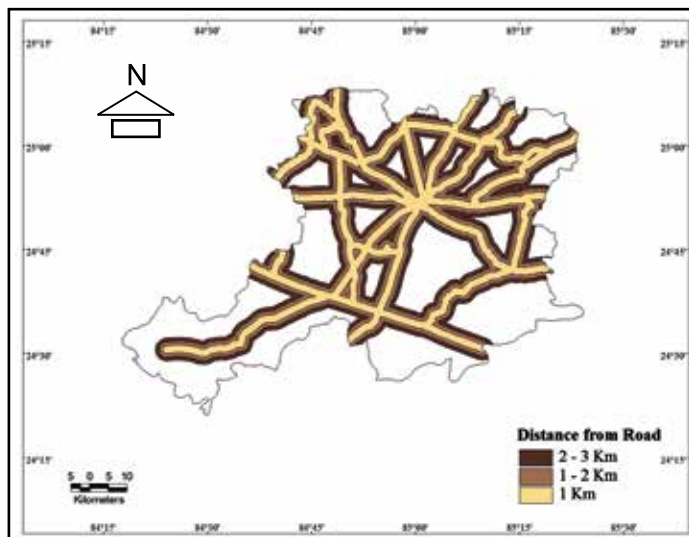
Transport regions are the functional regions in which there is some homogeneity of attributes of transportation. Delineating a transport region is an invariable step to give a composite view of homogeneity and heterogeneity in the district.

In this study, Gaya district has been divided into three different road transport regions with the help of four indicators. The four indicators are:

- Percentage of registered vehicles;
- Total road density per unit area;
- Cyclomatic number; and
- Percentage of area accessible by surfaced road.

After selecting the four indicators they have been given weightage according to their importance with respect to transport region. The given weightage (Table 8) to the indicators are:

**Fig. 5: Gaya District - Surface Road Accessibility**



After giving weightage, the values of all the four indicators (Table 9 and 10) have been converted into a unit free value, as indicators used for delineating transport region have different units. So in order to obtain figures, which are free from units and have standardized units normalization technique is used, which is based on the following formula:

$$X_{ij} = \frac{X_{ij} - \text{Min}\{X_{ij}\}}{\text{Max}_i\{X_{ij}\} - \text{Min}_i\{X_{ij}\}}$$

Indicators will come under the range from 0 to 1. Value close to 1 means high level of road transport region, while value closer to 0 means low level of road transport region.

On the basis of normalized value the district has been divided into three transport region (Fig. 6). The three regions are as follows:

- High low level of road transport region,
- Medium level of road transport region, and
- Low level of road transport region.

**Table 8: Weightage Table**

S. No.	Indicators	Weight
1.	Total road density per unit area	4
2.	Percentage of area accessible by surfaced road	3
3.	Cyclomatic Number	2
4.	Percentage of registered vehicles	1

**Table 9: Indicators of Road Transport Region**

S.No.	Block	Total Road Density	Registered Vehicle (%)	Cyclomatic Number	Area Accessible by Surfaced Road (in %)
1.	Dumaria	78.32	1.59	8	21.06
2.	Imamganj	66.82	1.75	14	32.31
3.	Banke Bazar	50.71	2.17	14	42.11
4.	Amas	114.61	1.74	4	83.94
5.	Gurua	89.25	1.09	4	45.15
6.	Guraru	75.97	1.91	10	58.38
7.	Konch	68.79	1.71	10	92.45
8.	Tikari	66.51	5.44	12	77.30
9.	Belaganj	51.66	2.29	7	74.10
10.	Sherghati	69.54	7.24	2	73.74
11.	Dhobi	79.72	2.29	4	71.31
12.	Barachatti	64.68	1.71	6	37.39
13.	Mohanpur	76.38	1.76	1	29.97
14.	Fatehpur	65.51	1.99	5	44.40
15.	Wazirganj	73.55	2.34	8	87.97
16.	Tankuppa	69.75	2.22	1	62.02
17.	Bodhgaya	61.73	16.67	9	62.08
18.	Paraiya	67.71	2.75	1	77.48
19.	Gaya	109.86	31.31	14	125.74
20.	Neemchak Bathani	77.91	1.98	1	17.51
21.	Mohra	63.73	1.33	3	57.38
22.	Khizirsarai	95.85	1.88	11	84.48
23.	Atri	62.56	1.31	2	93.07
24.	Manpur	87.91	3.53	9	106.63

Source: Computed by Researcher on the basis of data of related Government offices, Graph Theory and Buffering Technique (GIS)

**Table 10: Components of Road Transport Regional Index**

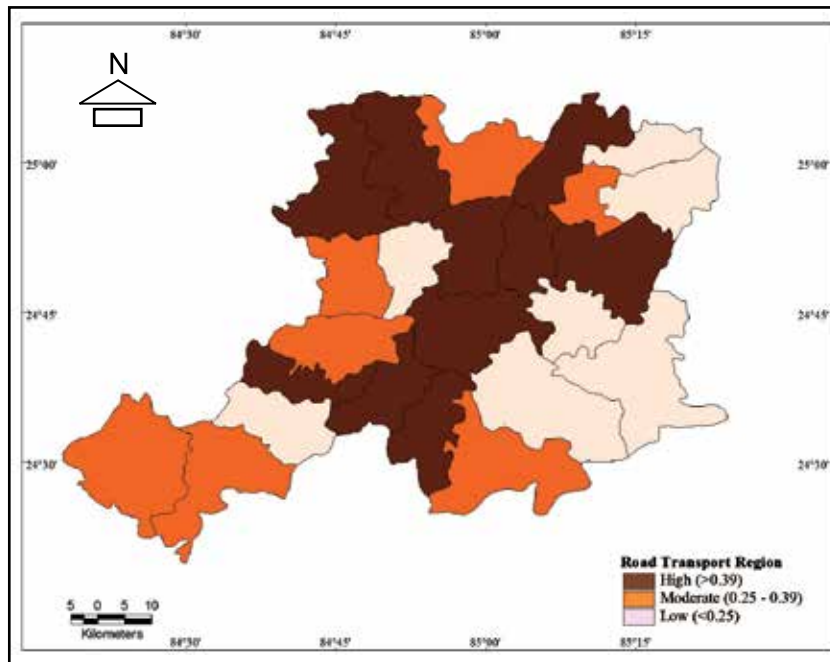
S.No.	Block	Vehicle Index	Road Density Index	Cyclomatic Number Index	Surfaced Area Index
1.	Dumaria	0.04	0.43	0.54	0.03
2.	Imamganj	0.02	0.25	1.00	0.14
3.	Banke Bazar	0.06	0.00	1.00	0.23
4.	Amas	0.06	1.00	0.23	0.61
5.	Gurua	0.00	0.60	0.23	0.26
6.	Guraru	0.04	0.40	0.69	0.38
7.	Konch	0.02	0.28	0.69	0.69
8.	Tikari	0.09	0.25	0.85	0.55
9.	Belaganj	0.03	0.01	0.46	0.52
10.	Sherghati	0.33	0.29	0.08	0.52
11.	Dobhi	0.05	0.45	0.23	0.50
12.	Barachatti	0.04	0.22	0.38	0.18
13.	Mohanpur	0.02	0.40	0.00	0.12
14.	Fatehpur	0.02	0.23	0.31	0.25
15.	Wazirganj	0.03	0.36	0.54	0.65
16.	Tankuppa	0.07	0.30	0.00	0.41
17.	Bodh Gaya	0.44	0.17	0.62	0.41
18.	Paraiya	0.11	0.27	0.00	0.55
19.	Gaya	1.00	0.93	1.00	1.00
20.	Neemchak Baithani	0.08	0.43	0.00	0.00
21.	Mohra	0.04	0.20	0.15	0.37
22.	Khizirsarai	0.03	0.71	0.77	0.62
23.	Atri	0.06	0.19	0.08	0.70
24.	Manpur	0.11	0.58	0.62	0.82

Source: Computed by Researcher by using Normalization technique (Z-Square)

High-level road transport region is mainly concentrated at the centre, north-west, east and towards south direction. It is because, these regions mainly lie on the stretch of National Highways and State Highways. It is also because all the four towns (Gaya, Bodh Gaya, Sherghati and Tikari) of Gaya district lies in these directions and thus, naturally have higher numbers of registered vehicles.

While, medium level of road transport region is mainly concentrated in the extremely south-west, east and towards north. It also lies on the stretch of

**Fig. 5: Gaya District - Road Transport Region**



National Highways, State Highways and major district roads. Mostly it also lies in the rural and underdeveloped blocks of the region.

However, low - level of road transport region is mainly concentrated towards south-east and north east direction because these regions are mainly naxalite affected and devoid of surfaced roads due to hilly area. Besides being poor these regions have low population concentration and low road density. This results in low increase in the registered vehicle.

## 7. REGIONAL DEVELOPMENT IN GAYA DISTRICT

To analyze the regional development, seven socio-economic indicators have been taken into consideration. The seven indicators are as follows:

- Total Road density per unit area;
- Irrigation facilities;
- Drinking water facilities;
- Banking facilities;
- Education facilities;
- Electrification; and
- Medical facilities.

After selecting indicators their values are normalized to remove their respective units. Normalization will convert the values in the range between 0 and 1. Values closer to 1 means, the region is more developed whereas, values closer to 0 means the region is less developed.

Before analyzing the indicators it is very important to mention that, only the data of rural area has been taken (Table 11 and 12). It is done so as to remove biasness with the urban towns present in the district. If we consider the data of urban blocks, then obviously all urban blocks will show high figure in all indicators which would be meaningless in terms of comparison with rural blocks for regional development.



**Table 11: Indicators of Regional Development**

S.No.	Block	Education (units per lakh)	Medical (units per 10000)	Drinking Water (sources per 10000)	Banking (bank per 10000)	Irrigated Area (%)	Vehicles (units per 10000)	Electrification (% of villages electrified)
1.	Dumaria	87	60	35	23	21.71	217.61	4.03
2.	Imamganj	73	79	37	24	49.39	157.57	5.13
3.	Banke Bazar	64	58	28	19	41.68	295.55	9.09
4.	Amas	65	64	35	23	62.63	293.36	5.88
5.	Gurua	92	68	38	24	74.78	98.14	11.54
6.	Guraru	81	44	21	14	64.88	233.29	3.53
7.	Konch	72	52	27	16	57.38	150.48	17.52
8.	Tikari	82	47	25	16	66.62	388.31	20.00
9.	Belaganj	82	32	20	13	32.12	176.63	28.81
10.	Sherghati	63	53	29	19	78.90	1118.22	51.16
11.	Dobhi	70	68	33	21	60.74	265.70	16.15
12.	Barachatti	52	82	37	25	36.93	208.06	0.63
13.	Mohanpur	72	96	40	26	33.32	148.75	5.63
14.	Fatehpur	64	60	27	17	44.52	147.24	4.55
15.	Wazirganj	72	52	23	16	49.42	179.86	24.49
16.	Tankuppa	73	81	32	21	50.50	327.45	1.98
17.	Bodh Gaya	62	56	29	17	72.28	1466.79	82.73
18.	Paraiya	98	50	27	18	72.02	450.72	11.76
19.	Gaya	62	43	20	13	62.23	3222.53	87.36
20.	Neemchak	70	36	15	10	65.58	343.17	4.76
21.	Mohra	92	38	20	13	68.86	236.42	5.56
22.	Khizirsarai	85	37	22	14	61.51	180.38	0.00
23.	Atri	87	54	24	17	68.32	272.95	1.64
24.	Manpur	96	44	22	14	70.15	445.65	82.05

Source: Various Government Departments of Government of Bihar





**Table 12: Regional Development Indices**

S.No.	Block	Education Index	Medical Index	Water Index	Banking Index	Irrigation Index	Power Index	Composite Index
1.	Dumaria	0.23	0.22	0.36	0.36	0.00	0.05	0.24
2.	Imamganj	0.14	0.37	0.41	0.40	0.28	0.06	0.18
3.	Banke Bazar	0.08	0.21	0.25	0.26	0.20	0.10	0.19
4.	Amas	0.09	0.25	0.37	0.38	0.41	0.07	0.33
5.	Gurua	0.27	0.28	0.43	0.40	0.53	0.13	0.38
6.	Guraru	0.19	0.09	0.11	0.12	0.43	0.04	0.20
7.	Konch	0.13	0.16	0.23	0.17	0.35	0.20	0.23
8.	Tikari	0.20	0.12	0.19	0.17	0.45	0.23	0.25
9.	Belaganj	0.20	0.00	0.10	0.09	0.10	0.33	0.14
10.	Sherghati	0.07	0.17	0.26	0.25	0.57	0.59	0.39
11.	Dobhi	0.12	0.28	0.32	0.31	0.39	0.18	0.31
12.	Barachatti	0.00	0.39	0.41	0.43	0.15	0.01	0.25
13.	Mohanpur	0.14	0.50	0.47	0.46	0.12	0.06	0.17
14.	Fatehpur	0.08	0.22	0.23	0.21	0.23	0.05	0.19
15.	Wazirganj	0.13	0.16	0.16	0.17	0.28	0.28	0.22
16.	Tankuppa	0.14	0.38	0.31	0.31	0.29	0.02	0.27
17.	Bodh Gaya	0.06	0.19	0.27	0.21	0.50	0.95	0.44
18.	Paraiya	0.31	0.14	0.23	0.24	0.50	0.13	0.29
19.	Gaya	0.07	0.09	0.09	0.09	0.40	1.00	0.51
20.	Neemchak	0.12	0.03	0.00	0.00	0.44	0.05	0.15
21.	Muhra	0.27	0.04	0.09	0.09	0.47	0.06	0.19
22.	Khizirsarai	0.22	0.04	0.13	0.13	0.40	0.00	0.20
23.	Atri	0.23	0.17	0.17	0.20	0.46	0.02	0.23
24.	Manpur	0.29	0.10	0.13	0.13	0.48	0.94	0.40

Source: Computed by Researcher by using Normalization technique (Z-Square)

The values of all the seven indicators have been converted into a unit free value, as indicators used for delineating development region have different units. So in order to obtain figures which are free from units and have standardized units normalization technique is used, which is based on the formula:

$$x_{ij} = \frac{X_{ij} - \text{Min}\{X_{ij}\}}{\text{Max}\{X_{ij}\} - \text{Min}\{X_{ij}\}}$$

## 8. ROAD TRANSPORT REGION AND REGIONAL DEVELOPMENT

Regional development of Gaya has been analyzed with the help of the seven socio-indicators which has been mentioned earlier. With the help of those seven indicators a composite index map is made and this composite index map is overlaid on the map of road transport region.

Overlaying of composite index of seven socio-economic indicators on the map of road transport region, gives a bi-variant map of road transport region and regional development of the district. On the basis of this bi-variant map; a matrix table has been also made to divide the region into nine categories. Those nine categories have been further divided the district into three categories. The three categories are as follows:

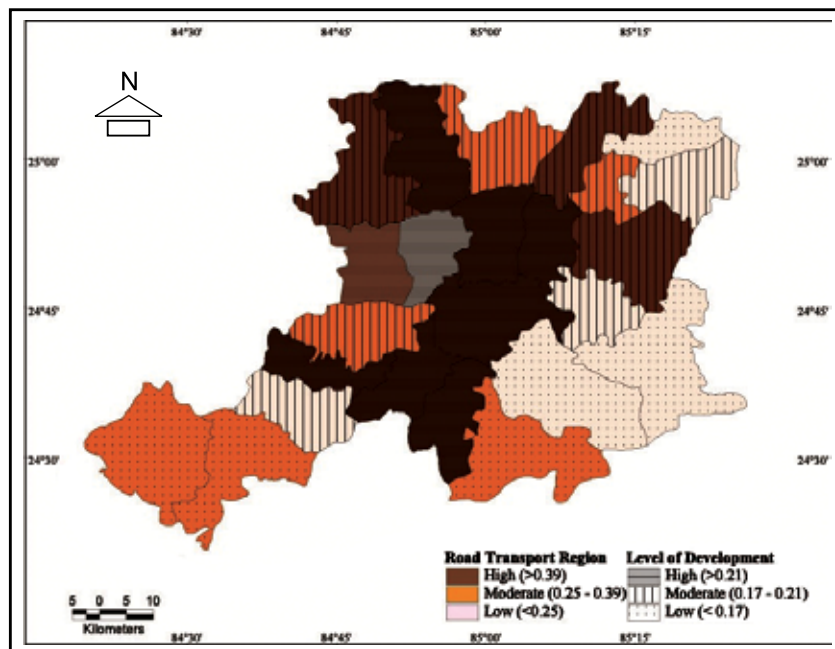
- High,
- Medium and
- Low.

From Fig. 7 it is clear that, road transport and development has positive relation. In the map of road transport and regional development it can be seen that, generally wherever level of road transport region are high; there development is also high. Similarly, wherever level of road transport region is low, there development is also low.

To make the matrix table simple, nine categories of matrix table has been categorized into three categories. The three categories are as follows:

- **High:** High RTR and High RD; High RTR and Medium RD; and Moderate RTR and High RD;
- **Moderate:** Low RTR and High RD; Moderate RTR and Moderate RD; and High RTR and Low RD; and
- **Low:** Low RTR and Moderate RD; Moderate RTR and Low RD; and Low RTR and Low RD.

Fig. 7: Gaya District - Road Transport Region and Regional Development





**Table 13: Matrix of Road Transport Region and Regional Development**

		Road Transport Region		
		High	Moderate	Low
Regional Development	High	Gaya Bodh Gaya Sherghati Tikari Manpur Amas Dobhi	Guraru	Paraiya
	Moderate	Konch Wazirganj Khizirsarai	Gurua Atri Belaganj	Tankuppa Banke-Bazar Mohra
	Low		Dumaria Imamganj Barachatti	Neemchak-Bathani Fatehpur Mohanpur
		High	Moderate	Low

From the matrix (Table 13), it has been noted that, there are eleven blocks (Gaya, Bodh Gaya, Sherghati, Tikari, Manpur, Amas, Dobhi, Konch, Wazirganj, Khizirsarai and Guraru) lies in the category of high. Similarly, four blocks (Gurua, Atri, Belaganj and Paraiya) lies in the category of moderate. While, nine blocks (Dumaria, Imamganj, Barachatti, Neemchak Bathani, Fatehpur, Mohanpur, Tankuppa, Muhra and Banke Bazar) lies in the category of low.

From the matrix table it is quite clear that road transport is a prerequisite conditions for development and growth. Thus, it

answers both the research questions and proves that the development of road transport results in improvement of socio-economic infrastructural facilities and development of road transport is complementary to regional development.

### 9. CONCLUSIONS

There is a positive relation between road transport region and regional development. Region with good road transport has high potential for development. Similarly, region with low level of transport region will have low potential for development. Road transport provides number of opportunities for development as it opens development process through connectivity and opening up the backward regions to trade and investment.

Blocks under high transport region and high development mostly lies along National Highways and State Highways. Similarly, blocks under low road transport region shows either low or moderate development or they mostly lays away from National Highways and State Highways.

The extension of transportation to rural areas helps in converting fallow land and cultivable wasteland into cultivation, marketing of agricultural products, growth in rural industries, with the expanded market network and social transformation through greater accessibility to basic amenities. Hence, development of road transport is complementary to development of region.

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