

## Integration of PRA with GIS for Planning of PERI Urban Areas

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### 1 INTRODUCTION

Urbanization is a worldwide phenomenon, since mid 20th century both developed and developing countries across the world are experiencing rapid urban growth with or without adequate/ necessary infrastructure. Urban settlements are continuously growing in size all well as in numbers. Urban development at the dawn of the new millennium is characterized by fading structural boundaries and the outward shifting of urban gravitational centres incorporating a growing area of rural landscape; agriculture once the predominant space consuming and economic factor within rural-urban fringe is largely losing this position and today it mainly functions as reserve potential for urban expansion (Zsilincsar, 2003).

Cities are the hubs of opportunities of livelihood and prosperity. Urbanization across the world is the outcome of rapidly growing and expending cities to host influx of population. The increasing number of urban residents are a result of three developments; expansion of cities, where the growth of the cities is absorbing villages surrounding the cities, migration from rural to urban areas and high population growth in the cities themselves (Bakary, 2005). Increase in size of a city does not only mean expansion of city boundary, but also aggregation of urban infrastructure such as roads, airports, etc. This expansion often referred to as urban sprawl which has significant impacts on the environment. Nowadays urbanization is no longer typical for the growth of cities or towns only, but it influences the process in the rural countryside as well (Antrop, 2004). The real modification of landscapes is induced by elements of urbanization such as residential or industrial land development.

The areas outside the city boundary are characterized by intermittent and scattered demonstration of the city in some non-farm residences and estates with commuting patterns to the city. The rural – urban fringe is an area of mixed rural and urban population and land use which begins at a point where agricultural land uses appear near the city and extends up to a point where villages have distinct urban land uses or where some persons, at least, from the village community commute to the city daily for work or other purposes. The area beyond the city limits but contiguous to it, having other municipal towns, Census towns or fully urbanized villages, constitute so-called urban fringe, which is the part of the rural urban fringe zone (Ramachandran, 1989). These peripheral areas of the cities are known by various names viz. urban fringe, rural-urban fringe, dynamic edge outskirt, city edge, peri –urban, rural urban interface, etc.

Keywords: PRA, peri-urban, integration, GIS, planning

### 2 PERI URBAN AREAS AND ITS ASSOCIATED ASPECTS

Peri urban areas undergo constant change in landuse, the predominant landuse is agriculture with encroachments of residential and industrial estates (it is an area into which the city expands). The agricultural landholdings are small, intensive in nature, devoted to produce perishable commodities for the nearest urban markets. Peri-urban area has typical characteristics, contains both urban and rural features, more specifically speaking, it can be distinguished as an interface urban and rural ecosystems. Basically the areas undergo transition from rural ecosystem towards urban ecosystem. Conflicts between landuses are predominant characteristics of peri-urban regions. The agricultural lands are prime attraction to the builders who develop residential colonies in the rural-urban fringe. These areas experience inadequate social amenities and public utilities, environmental degradation due to haphazard/ uncontrolled settlement and infrastructure development, lack of interest to maintain environmental quality and to retain functional green areas - arable land, forests, recreational areas, etc. At the initial stage, development takes place without any forward development plan. These areas devoid of urban amenities like solid waste disposal as well as sewage disposal, here partially treated water and sewage waste are utilized for irrigation of agricultural land. Peri urban areas lack in clarity of planning and development jurisdiction and the rural-urban fringe is a problem area from the point of view of administration because nobody is responsible for the management of complex problems. Gradually it becomes zone of chaotic urbanization leading to sprawl. Peri-urban areas are outside formal urban boundaries and urban jurisdictions which are in a process of urbanization and which therefore

progressively assume many of the characteristics of urban areas (Oloto, and Adebayo, 2010). Planning for Peri urban areas is tough challenge to the urban planners.

Planning and management of peri-urban areas is governed by the dynamics of rural hinterland, regional perspectives and city planning approaches. The local tradition practice influences the evaluation of each factor. Population size, population density in built-up areas, infrastructural characteristics, administrative boundaries and predominant economic activities are the main variables conventionally used to distinguish rural from urban (Tacoli and Cecilia 1998). The characteristics of peri –urban area is summarized as below:

(a) Dynamic mosaic of rural and urban ecosystems:

Peri urban areas are characterized by dynamic mosaic of ‘natural ecosystem’ primarily engaged in agricultural activity and ‘urban” ecosystem’ recently developed to fulfill the demand of expanding urban area. This area undergoes constant change with respect to its use. For instance, the agricultural lands, open spaces, areas under vegetation covers get converted to residential, commercial, industrial infrastructural landuses, etc. The development of this area is need based and governed by the demand of urban expansion. Mostly the conversion of landuse happens haphazardly and unplanned manner become the habitat of lower income groups,. Generally, development takes placed without considering the factors like environmental sensitivity, traditional practices, physiographic characteristics etc.

(b) Changing social structures

The Peri urban areas experience constant but irregular process of urbanization. As an outcome of this the social composition of peri-urban systems is highly heterogeneous and subjected to alteration over time. Small farmers, informal settlers, industrial entrepreneurs and urban middle-class commuters use to co-exist in the same territory with different and often competing interests, practices and perceptions. This areas used to attract rural to urban migrants. Planning and management for this heterogeneous, social composition need people participation in decision making process.

(c) Institutional landscape

The peri-urban area experiences congregating of sectoral and overlapping institutions with varied spatial and physical responsibilities. It is subjected to the change of geographical location and physical structure of Peri urban area. Private sector institutions, nongovernmental and community-based organizations intervene in the management of peri-urban areas in isolated manner sometimes without clear articulation or leadership from government structures. In some cases, Peri-urban areas contain territory of multiple administrative unit. Weak inter sectoral linkage with limited power in sectors like water supply, energy, waste management, transportation, etc create chaotic urban development susceptible to natural and man-made disasters . There is a need for integration of people participation/ tradition practice with the modern technology based planning for Peri urban areas.

### 3 PERI URBAN AREA – INDIAN PERSPECTIVE

In our country both number of cities and its geographical area are continuously progressing. During year 1951, the country had only five cities with population of more than one million, according to 2011 census of India the number has increased to 53 and it is estimated that, it will be 70 cities by 2031. Similarly, in the year 2011 there are three cities in the country having population more than 10 million populations and it is estimated that this number will become six by 2031. Indian cities are experiencing both horizontal and vertical expansion. The growth of cities beyond its administrative limits became more familiar and challenging task for planners and urban administration. The development of fringe areas becomes a practice than being only a theory. Its genesis is influenced by various factors related to physical and socio-economic aspects which ultimately encroaches into the natural resources existing around major cities. The driving forces for genesis of peri urban areas are socio-economic, political, technological, institutional, natural and cultural. The factors like increasing land value, congestion, desire to own land, inadequate infrastructure facility, population growth in cities, deterioration of living conditions, desire to own a house, availability of communication facilities and higher transport accessibility outside the city and community or friends influence encourage the development of peri-urban areas.

### 3.1 Urban growth and development of Peri urban areas

During year 1991 the urban population of India was 217 million (27.5 per cent) and it became 377 million (31.16 per cent) in 2011. About 43 per cent of population live in cities or urban agglomerations with a population more than 1 million, the number of these cities has also increased from 35 in 2001 to 53 in 2011. Out of 53 urban agglomerations, the three largest urban agglomerations or megacities (with a population of more than 10 million) are Greater Mumbai urban agglomeration (18.4 million), Delhi urban agglomeration (16.3 million) and Kolkata urban agglomeration (14.1 million). These urban agglomerations are followed by Chennai urban agglomeration (8.7 million) and Bangalore urban agglomeration (8.5 million). During the first decade of the economic reforms there was substantial growth in the population of megacities but this has slowed considerably in the period 2001–11 (Government of India, 2011a). The remainder of the 57 per cent of the urban population in India resides in the growing peripheries of the cities in ‘statutory towns’ and ‘census towns’. Statutory towns are towns with municipalities or corporations, whereas census towns are agglomerations that grow in peripheries of big cities and rural areas and do not have effective urban governance structures or requisite urban infrastructure such as safe drinking water supply, waste disposal facility, sanitation, roads etc. The number of statutory and census towns in India increased from 5,161 in 2001 to as many as 7,935 in 2011 with a population of 215 million.

The transformation of agriculture land is inevitable with urbanization. The process of land use transformation includes and acquisition for industrial, commercial, real-estate and infrastructure development; land acquisition for the creation of special economic zones (SEZs); and selling of agriculture land by farmers for the construction of houses by individual owners. The distress in agriculture – manifest in low incomes and unemployment caused by the economic reforms – has resulted in some increase in rural to urban migration (Kundu, 1997; Mitra and Murayama, 2008). Alongside diminishing prospects in agriculture there are also other factors such as droughts, difficult working conditions and growing debt, which contribute to rural-urban migration (Krishna et al., 2014).

Urbanization of former villages and the reclassification of rural areas, following the extension of cities’ boundaries, have been significant components of urban growth in 2001–11 (Bhagat, 2011). The intrusion of cities in to the rural hinterland generates complex condition where urban and rural activities and or institutions are juxtaposed. The migrants from rural to urban areas primarily settles in the slums, unauthorised colonies and villages of Peri urban areas devoid of basic amenities like water, sanitation or health, resulting in severe public health problems. Studies documenting the process of urbanisation and its impact on the lives of the people and the water bodies in the peri-urban areas of Gurgaon and Hyderabad in India also show how water security, which was earlier ensured by numerous water bodies in and around cities, has been under threat by land use changes, land grabbing, and environmentally negligent development focused on growth through unsustainable means (Prakash et al., 2011). For those peri-urban communities still involved in smallholder farming this often involves reliance on recycled wastewater which is becoming increasingly contaminated, as traditional village ponds which were recharged by rainwater disappear in the development process, and other water sources become less accessible (Amerasinghe et al., 2013; Marshall et al., 2010).

During 12th Five Year plan Government of India has given special attention to Peri Urban areas. During this plan under Rajeev Awas Yojana (or RAY, a social welfare programme to provide housing for the urban poor) initiatives are taken to provide affordable housing for the urban poor in the peri urban areas. Further, the Town and Country Planning Office (TCPO) of the Ministry of Urban Development also suggests to conserve agricultural land, to protect of forest and water resources judiciously for the development of this transitional zone. However, despite some formal recognition at this level, peri-urban areas have largely been neglected in policy and practice.

### 3.2 Urban planning Initiatives in India

The Government of India (GoI) has taken various initiatives such as National Commission on Urbanization, 74th Constitutional Amendment Act, Urban Development Plan Formulation and Implementation Guidelines, Jawaharlal Nehru National Urban Renewal Mission, National Urban Information System, Rajiv Awas Yojana, National GIS, Smart City, Swachh Bharat, Atal Mission for Rejuvenation and Urban Transformation, etc.

During early 1980s National Commission on Urbanization under the Chairmanship of Charles Correa was appointed by GOI to analyze the state of urbanization with reference to the demographic, economic, infrastructural, environmental, physical, shelter, energy, communication, land, poverty, aesthetic and cultural aspects and to identify priority action areas and it had also made projections of future needs and estimated the available resources. The commission prepared basic guidelines for the specific action plan in priority areas along with policy frames and suggestion of basic approaches for the encouragement of manageable urbanization and also the methods of creating networks of interactions as an ongoing process among government, academic and research institutions and citizen groups. The recommendations of the Commission had not been finalized and yet to be implemented as policy.

To keep this economic transformation in tune with needs and requirements at the grass-root level, it is essential that the people and their representatives participate actively in the planning and implementation of the programmes at local level. The Constitution (Seventy Fourth Amendment) Act, 1992 has introduced a new part namely, Part IXA in the Constitution, which deals with the issues relating to municipalities. The main provisions introduced by Act are constitution of municipalities, composition of municipalities, composition of ward committee, duration of municipalities, etc. This amendment has provided a constitutional form to the structure and mandate of local bodies. It has made urban local bodies to perform as democratic and self governing institution at grassroots level.

Since 1996, due to rapid growth of population and reasons like globalization and liberalization, the towns and cities have become more dynamic in nature. Urban areas are subjected to challenges in terms of requirements of infrastructure and other basic services and amenities. The Urban Development Plan Formulation and Implementation (UDPFI) Guidelines have been framed to incorporate the provisions of the various legal and policy/ guidelines of the respective Ministries and departments, best practices of the States as examples and the planning system in vogue. An interrelationship between them is proposed for a sustainable urban and regional development.

Jawaharlal Nehru National Urban Renewal Mission (JnNURM) was launched in 2005 to encourage cities to commence steps for bringing phased improvements in their civic service levels. The mission of JnNURM was to development in the context of urban conglomerates focusing to the Indian cities. JnNURM aims at creating 'economically productive, efficient, equitable and responsive Cities' by a strategy of upgrading the social and economic infrastructure in cities, provision of Basic Services to Urban Poor and wide-ranging urban sector reforms to strengthen municipal governance in accordance with the 74th Constitutional Amendment Act, 1992.

National Urban Information System (NUIS) initiated by Ministry of Urban Development (MoUD) in 2006 for creation of multi-scale (1:10,000, 1:2000, 1:1000) hierarchical urban geospatial database on thematic content using satellite, aerial and GPR techniques. It generated GIS based maps for preparation of Master Plan for selected cities.

Rajiv Awas Yojana (RAY) The scheme was launched in 2009 as a continuation of JnNURM. It envisages a "Slum Free India" with inclusive and equitable cities where every citizen has access to basic civic infrastructure and social amenities and decent shelter.

Ministry of Urban Development during 2015 has launched the Smart city mission transformation with the objective to support cities to enable them to offer core infrastructure and provide a decent quality of life to its citizens along with a clean and sustainable environment and application of 'Smart' Solutions. The aim is to achieve sustainable and inclusive development. The mission aims to develop a replicable model which will act like a light house to other aspiring cities.

During 2015 the Ministry of Urban Development has launched Atal Mission for Rejuvenation and Urban Transformation (AMRUT) with the aim to formulate GIS-based Master Plan for selected AMRUT cities. The geospatial technologies is used for formulate a master plan for decision-making, effective land use management and utilization, spatial growth management, enable project planning and urban management.

#### **4 PLANNING FOR PERI URBAN AREAS**

With the growth and expansion of a city, gradually the peri-urban areas become the part of cities and the development of new Peri-urban areas take place. These are dynamic zones with chaotic urbanization leading to sprawl. The expansion of urban areas is steadily advancing leading to engulfing of adjacent rural

areas and other urban centres to form corridors. These changes have far reaching implications to environment and social well-being of the population and pose a challenge to sustainable urban development. These areas witness inadequacy of infrastructure facility. To keep pace with economic development these areas undergo environmental stress. Moreover, there is lack of identity and proper planning and management across all sectors of governance, finance and infrastructure delivery for this area. As these areas have enormous potential to accommodate urban development, therefore, there is need to understand of the challenges and opportunities of Peri-urban areas. Planning for resilient Peri urban areas should consider socio economic condition, environmental quality, infrastructure facility, disaster management, etc. aspects along with the existing physical environment and indigenous cultural landscape of Peri urban areas.

#### **4.1 The issues and needs of planning of Peri – urban areas**

In India the socio-economic development of Peri-urban is governed by population growth in cities caused by migration, deterioration of living conditions in the cities, the desire to own a house, availability of communication facilities and higher transport accessibility outside the city and community or friends influence. The issues related to peri urban areas are as follows:

- (a) Lack in clarity of planning and development jurisdiction - Peri-urban areas lack in clarity of planning and development jurisdiction. Its issues are multi facets in nature.
- (b) Absence of responsible administrative body The basic issues of development of Peri –urban areas lies in the absence of responsible administrative body for planning and development. Peri urban areas are characterized by multiple transformations like physical, morphological, socio-demographic, cultural, economic and functional, hence it experiences conflicting land uses, juxtaposition of rural and urban activities, lack of environmental consideration in development, inadequate infrastructure, degradation of environmental quality and susceptible to natural and man-made disaster.
- (c) Dynamic chaotic development pattern - The landuse is originally agricultural and arable land is devoted to produce perishable commodities (e.g. vegetables, fruits, flowers and dairy products). With the expansion of urban territory, haphazard and unplanned encroachment of residential and industrial estates takes place in agricultural and open spaces.
- (d) Inadequate infrastructure facility - The social amenities and public utilities are inadequate and irregularly spaced in this areas. Peri urban areas are cheap destination for the urban poor, rural to urban migrants, unskilled labors and distress agricultural workers. Low affordability of the dwellers along with regular addition of population without planning intervention leads to inadequate infrastructure facility.
- (e) Degradation of environmental quality: This area experiences constant change in landuse. The environmental impacts of development are not taken into consideration. All these leads to uncontrolled settlement and infrastructure development, lack of interest or attention to retain green areas, arable land, forests, recreational areas, etc. As a consequent of this, there is no forward development planning and control on landuse change. Degradation of environmental quality is the outcome of limited urban management, inappropriate phasing of development, nonexistence of integrated conversion of agricultural and forest lands to urban land use and informal holdings. All these leads to deforestation, depletion of natural resources. Moreover, Peri urban areas, not only receive solid waste from the core city but its own generated waste also is not managed.
- (f) Crisis of natural resources: The development of Peri urban areas is need based. It has potential to accommodate the future development of the city. It is generally observed that the initial development takes place adjacent to the city boundary and gradually it spreads outwards and captures surrounding areas without conserving the surface water resources, natural vegetation etc. Previously in many urban fringe areas, development used to take place on the wet land (after filling them), nowadays most of these towns are facing water scarcity. Unplanned extraction of groundwater is also depleting the ground water table.
- (g) Susceptible to disaster: With the growth of cities it occupy surrounding hinterland in different forms, such as in radial sprawl, ribbon sprawl, leap frog sprawl. The physiographical feature like watershed boundary, low lying areas, flood plain areas etc are not taken into consideration. Sometimes these leads to urban flood.

## 4.2 Planning for Peri urban areas

Government of India has taken various schemes and programmes for urban planning, management, development and improvement for cities. But except Rajeev Aawas Yojana hardly any initiatives are taken for peri urban areas. Urban development efforts are limited within the city boundary. Even for AMRUT and NUIS programmes GIS based data are being generated for the cities only. For sustainable development of the Peri urban areas, GIS based data for the Peri urban areas are urgently needed.

### 4.2.1 GIS as a tool for Peri Urban Planning

Remote sensing offers updated time series data for urban land use/land cover mapping and environmental monitoring. The modern technology of remote sensing helps to collect physical data rather easily with speedy and on repetitive manner, GIS is a tool to analyze the spatial data and capable to generate numerous options for future planning, identification of potential areas etc. Therefore, remote sensing and GIS technologies together are now providing tools for advanced ecosystem management and projection of urban growth and its potential impacts.

GIS has the capacity to analyze the information quantitatively and capable to provide best possible option. It can not incorporate aspects related people participation. As the Peri urban areas are indigenously belong to the rural people, therefore, Participatory Rapid Appraisal (PRA) along with GIS will offer the best possible option for planning for Peri-urban areas.

### 4.2.2 PRA as a tool for Peri Urban Planning

The objective of PRA is to include the knowledge and opinions of rural people in the planning and management of development projects and programmes. PRA is not only used for collection of information by also it involves the community in plan preparation process. It include qualitative aspects of information. It gives the answer of how and why. For instance, in India there are various indigenous technologies which are being used for water harvesting. With urbanization these techniques are now extinct and the cities are facing scarcity of water. If potential water harvesting areas along with techniques are marked on the GIS based maps, then the integration of qualitative and quantitative information will be able to solve the basic infrastructure problem of Peri urban areas.

## 5 CONCLUSION

Peri-urban areas lack in clarity of planning and development jurisdiction. Its issues are multi facets in nature. The land use is originally agricultural and arable land is devoted to produce perishable commodities (e.g. vegetables, fruits, flowers and dairy products). With the expansion of urban territory, haphazard and unplanned encroachment of residential and industrial estates takes place in agricultural and open spaces. The social amenities and public utilities are inadequate and irregularly spaced. This area experiences constant change in land use. The environmental impact of development is not taken into consideration. All these leads to uncontrolled settlement and infrastructure development, lack of interest or attention to retain green areas, arable land, forests, recreational areas, etc. As a consequent of this, there is no forward development planning and control on land use change. The basic issues of development of Peri –urban areas lies in the absence of responsible administrative body for planning and development.

Development of peri-urban areas without considering environment aspects, local natural resources and tradition practice leads to chaotic urbanization. The sustainable development of peri urban area needs resource mapping in combination with local traditional practice. The modern technologies like remote sensing and geographical information system (GIS) allow us to collect physical data rather easily with speed and on repetitive basis, GIS helps to analyze the data spatially with various options of modeling and other planning processes. Participatory Rural Appraisal (PRA) aims to incorporate the knowledge and opinions of rural people in the planning and management of development projects and programmes, The integration of PRA with GIS will help the planners to prepare the plan where both traditional knowledge and modern technology are used to prepare development plan. In this paper attempts are made to understand the characteristics and issues associated with peri-urban areas and how both traditional and modern techniques can be used to prepare sustainable development plan for Peri-urban areas..

Schemes like PURA ( Providing Urban Amenities in Rural Areas) aims to provide urban amenities and livelihood opportunities in rural areas to bridge the rural-urban divide, thereby reducing migration from rural to urban areas. This scheme has the scope to integrate PRA with GIS for planning of the peri urban areas.

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