# PERI-URBAN INTERFACE: EXPLORING THE DETERMINANTS TOWARDS A POLICY LEVEL APPROACH

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# CERTIFICATE FROM THE SUPERVISOR

This is to certify that the thesis entitled **"Peri-Urban Interface: Exploring the Determinants towards a Policy Level Approach"** submitted by **Smt. Sourovee Dutta,** who got her name registered on January 10, 2014 for the award of Ph. D. (Engineering) degree of Jadavpur University is absolutely based upon her own work under the supervision of **Prof. Madhumita Roy** and that neither her thesis nor any part of the thesis has been submitted for any degree / diploma or any other academic award anywhere before.

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# *Declaration*

This is to declare that this Thesis Report titled “Peri-Urban Interface: Exploring the Determinants towards a Policy Level Approach” has been undertaken by the author in partial fulfillment of the requirement for the award of the PhD degree in Architecture. The research work undertaken is original and authentic. The content of the thesis is the result of the approved thesis synopsis. I hereby also declare that I am the sole author of this thesis. I authorize Department of Architecture, Jadavpur University to lend this thesis to other institutions or individuals for the purpose of scholarly research.

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## *Abstract*

Conventionally, world-wide settlements are classified into ‘Urban’ and ‘Rural’, majorly on the basis of population, population density, occupational structure and administrative status. Peri-urban area is generally defined as areas lying in the periphery or outskirt of the urban area, which are physically, economically, ecologically and socio-culturally interrelated with their parent city. These areas act as a transition between the city and its rural hinterlands, characterized by continuous exchange of natural resources, goods, people and other infrastructural supports to and from the city. The parent city and its edges are always interdependent and together they create a sustainable habitat. However, in absence of clear definition, familiarity as a part of settlement classification, clear delineation in City Master Plans / Regional Plans, these peripheral areas are still not recognized effectively by city administration and urban development authorities. This results in unplanned, unregulated spatial expansion of towns and cities, which appears as an edge or interface between urban and rural realms of a region with features like fast growth and mixed characteristics of urban and rural areas. It evolves as spatial conglomeration of physical form, people, ecology and socio-economic activities and face changes over a period of time along with the parent city.

In the present era of globalization, Peri-Urban Interface is an urban transformative process which is now a significant spatial feature in the discipline of Urban and Regional Planning. The process of peri-urbanization are majorly triggered by the development of organic, illegal settlements, new towns, mini-cities in the form of gated communities, industrial belts and other large-scale urban infrastructures in absence of a statutory Master Plan. The city periphery is facing irregular and haphazard development, resulting into a townscape / city form and spatial pattern which have no specific identity of it. The natural integrity of ecology with built environment at the peri-urban areas has been destroyed many a times in absence of statutory rules and regulations which results in deterioration of quality of life in these areas. On the basis of these observations, the research aims to identify the determinants or governing factors behind the phenomenon of peri-urbanization, kind of transformation which takes place in city peripheries due to these factors, their

impacts and consequences and to define, categorize, delineate and predict City Peripheries / Peri-Urban Interfaces. This research aims to evolve a futuristic planning model towards planned peri-urban development under the Regional Planning framework to measure / quantify, categorize and delineate it.

This research undertakes the issue of peri-urbanization of Chandigarh, India; a unique context to understand and analyze peri-urban developments, where its peripheral towns are falling within 16 km radial boundary and the settlements are not limited within the administrative boundary of the city of Chandigarh but spreads in the adjoining states of Punjab, Haryana and Himachal Pradesh. Overlapping of boundaries of three states creates more complex issues in urban planning. This can be explained as the process of Urban-edge / fringe development showing the change in spatial pattern over time, like even / uneven increase in built-up area or total building footprint area to population, change in land-use etc.; finally leading towards fast horizontal expansion mostly in the form of 'Ribbon Development'. The dynamics involves land-use of the edges, transit corridors, development pattern and urban form. These dispersed developments have impacts like gradual decrease of agricultural lands or its conversion to non-agricultural lands, loss of open spaces and ecologically sensitive areas in and around the city cores. The city peripheries even lack urban infrastructure, basic facilities and amenities due to unmanaged and unrecognized growth and lack of prior planning and forecasting of such outgrowth of the cities during the policy interventions and master plan / regional plan preparation.

From the analysis of the collected data, the patterns, transformation process and the causes of peri-urbanization is understood. The consequences of such process are analyzed which will eventually aid in the design of future planning model for peri-urban areas. This entire study helps to understand the nature of peri-urbanization in this particular context and to frame the determinants / parameters / indicators, on the basis of which peri-urban realm can be measured / quantified, defined and delineated further. From the basic study of such development, it is understood that a regional planning approach is required to have basic infrastructure and balanced development in peri-urban areas and to solve the issues associated with the city peripheries. However, in majority of the cases, it is observed that there are

insufficiencies to ascertain the nature of unmanaged growths. Due to lack of an overall vision for the edge, prior planning, coordinated decision-making and prediction / forecasting of the outgrowths, the regions always lack the basic services like water, electricity, sanitation, etc. This results into major changes in land-use over time, affecting the environment and quality of life, hampering the overall sustainability of the habitat and the region.

Peri-urban areas appear as an interwoven fabric with nature, a mosaic of grey and green. It is never a 2-dimensional phenomenon, but the 3-dimensional aspect, which creates a dynamic edge. Till date in Indian context, there is no such definite attempt to define and delineate this edge of the cities, where landscape acts as a rural-urban continuum and creates an ecologically driven city edge or boundary. Boundaries are yet enacted only with respect to administrative decision making process, where the ground scenario is observed as a gradual expansion in organic fashion beyond the administrative boundaries. Hence, a policy level approach can come up, which will create a definite framework for planning at expanding city edges.

With this overview, the thesis addresses the issues of peri-urbanization with an interdisciplinary approach. In this research; the introductory chapter, Chapter 1 attempts to understand the concept of 'Peri-Urban Interface' in the process of urban planning, where the evolution of peri-urban can be discussed with respect to present urbanization trends in India. It also gives an understanding on how migration and peri-urbanization are related to each other. Accordingly, chapter 1 frames overall research agenda – the need of study, hypothesis, aim & objectives, scope of study and overall research methodology. Chapter 2 explains the study and outcome / learning from the related literature and previous works, which provides a possible research direction further. A comparative analysis among major cities in India & their urban agglomerations helps to generate a clear picture of growth trends in Indian context. The selected area of study – Chandigarh & its growth nodes around is introduced in Chapter 3. How the periphery has been evolved / expanded gradually in the last decade in this specific context is the main discussion of this chapter. The data collected to understand the peripheral transformations and associated acts, regulations or guidelines pertaining to peripheral development around Chandigarh

are presented in the Chapter 4. Further, the critical settlements have been identified in terms of their quality and degree of urbanization, which are studied to propose a settlement hierarchy and a predictive model for future. Accordingly, in Chapter 5, the key issues emerging at peri-urban realm of the selected study area are identified. The issues are elaborated at city as well as periphery level. In Chapter 6, the most fundamental issue for peri-urban interfaces is explained. It critically examines the relevance / validity of existing criteria of Rural-Urban Classification (RUC) system in contemporary development, discussing a global perspective. Further in Chapter 7, the larger impact of existing RUC system on funding pattern and level of urbanization at different types of urban areas is assessed, describing the present Indian scenario. Alike the learning from chapter 6, it is further emphasized here that there is an urgent need to review the criteria / parameters, defining 'Urban', which appears as the basis of urbanization, funding pattern and local governance. The above study, understanding, analysis and inferences finally culminate into the research proposal, enumerated in Chapter 8, which explains three planning proposals – (1) identifying relevant planning parameters, on the basis of which homogeneity among the peri-urban settlements around the city of Chandigarh is analyzed; (2) accordingly clustering of settlements is formed and hence a model of peri-urban settlement typologies is defined and delineated in the form of physical planning and finally (3) formulating a futuristic model for delineation of peri-urban interface in the Rural-Urban-Classification (RUC) framework for Chandigarh on the basis of a specific planning parameter. Such new planning parameter can be also adopted as additional criteria along with the existing parameters of the Rural-Urban definition. To formulate the final research proposal, a total of 16 peripheral towns which fall within the 16 km radial peripheral boundary around Chandigarh have been taken into consideration to frame the proposed clustering as well as model. This includes 2 settlements at immediate periphery of Chandigarh Municipal Corporation, 7 settlements in the state of Punjab and 4 settlements in the state of Haryana. 3 other settlements in the state of Himachal Pradesh also lies just adjacent to the 16 km peripheral boundary of UT and contributes significantly in the peripheral transformations as per the previous study and analysis of the research. The entire dataset, required to conduct the research, has been collected from both primary and

secondary sources, includes household survey at peripheral towns as well as data from various govt. departments and urban development authorities of these 3 states along with Chandigarh UT. The analysis of collected data is done through graphs, maps and statistics. Statistical analysis is done using statistical analytical software MINITAB and accordingly the proposed model is developed. The proposal elaborates a holistic research framework to measure / quantify peri-urban growths with the help of relevant planning parameters prior to Master Plan preparation, creating their hierarchy to assure equitable distribution of funds for development and inclusion of peri-urban realm in Rural Urban Classification (RUC) system. The framework is prepared on the basis of conducting research on the case of Chandigarh. However, the process can be experimented for other similar contexts too. The chapter further explores few implications of peri-urban modeling in planning policy and governance. The research concludes outlining the limitations faced in the entire process and multiple research directions / challenges, which could be explored further in managing peri-urban growth in Chapter 9; while in Chapter 10, it summarizes the whole process and the new scientific achievements of this research, which can ensure sustainable urbanization at peri-urban interfaces in India.

A “paradigm shift” seems ready to emerge, following a movement, research about interactions and linkages between rural and urban areas in the form of spatial pattern and urban modeling. Hence the interface between two appears extremely significant for future planning and design. A new planning system should be emerged where urban and rural development will not be dealt as separate issue, but integrated with each other under the regional planning framework.

**Keywords:** Peri-Urban Interface, Determinants, Spatial Expansion, Transition Zone, Planning Model, Regional Planning Framework, Planning Parameter, Rural-Urban Classification, Peri-Urban Settlement Typologies, Planning Policy.

# CHAPTER 1. THE CONCEPT OF PERI-URBAN INTERFACE

## 1.1. Introduction

India has only 2% of global land and 4% of water, but it has 16% of the population of the world. Urbanization is a significant parameter to measure the development scenario of any region. The phenomenon of urbanization depends solely on the resource base of any region. Today, there are 53 Urban Agglomerations in 2011 from 35 Urban Agglomerations in 2001. Statistics show that urban population has been increased from 27.8% in 2001 to 31.16% in 2011. The number of Census Towns has increased from 1362 in 2001 to 3894 in 2011. As stated by Ramachandran, *"An unprecedented population growth and migration, increased urban population and urbanization are inadvertent. More and more settlements are blooming with a change in land-use along the highways and in the immediate vicinity of the city, forming a ribbon development".* Urbanization as such is not seen as a threat to the environment and development, but it is the unplanned and haphazard peripheral growth, that transforms the area with loss of prime agricultural lands. Then the scenario of today's peri-urban interfaces evolves over a short period of time. Therefore, the peripheral development has formed a kind of 'mixed spaces', which is midway between urban and rural areas. This acts as a transition space gone through several transformative processes like physical, socio-cultural, economic etc. This spatial category can only be explained as a mixed group of rural and urban spaces, forming a third-tier of development – partially urbanised on the edges of urban areas, however maintaining the characteristics of rural realms.

## 1.2. Concept of Urban, Rural and Peri-Urban: An Overview

Conventionally, worldwide settlements are classified into 'Urban' and 'Rural' majorly on the basis of certain nos. of population, density and occupational structure. Though different countries apply diverse criteria with diverse value range and hence inconsistency in comparative international data on urbanization exists till date. There is no specific benchmark established to define the degree of urbanization or rural character of a settlement. Moreover, the transition areas in-between urban and rural is totally ignored in this classification system. In most the cases, Peri-Urban comes under 'Rural' category, though they have an urban tendency. A critical debate arises that how

we can measure these peripheral developments? Shall we need a third tier of settlement category? If yes, then what are the criteria to measure it?

Focusing to Indian context, the Census of India – an organ of the Central Government – classifies settlements into 'rural' and 'urban', whereas it is State Governments which grant municipal status to urban centres. Census 2011 defines 'Urban Area' as follows:

> *"1. All places with a municipality, corporation, cantonment board or notified town area committee, etc.*
>
> *2. All other places which satisfied the following criteria:*
>
> *i. A minimum population of 5,000;*
>
> *ii. At least 75 per cent of the male main working population engaged in non-agricultural pursuits;*
>
> *iii. A density of population of at least 400 persons per sq. km.*

*The first category of urban units is known as 'Statutory Town'. The second category of Towns is known as 'Census Town'".* As per the definition, both of them are 'Urban', however only the Statutory towns get Municipal status and thus, receive grants for all kind of urban facilities, whereas Census towns for not getting Municipal status, treated as 'Rural' in ground reality. Due to Census definition of settlement classification in a dichotomous fashion, all the developments, facilities, funds are only concentrated in statutory towns. The Census towns, majorly spreaded in the city peripheral areas, are deprived from planned urbanization and gradually deteriorating in terms of quality of life, infrastructure & environment.

Various concepts pertaining to settlement hierarchy / classification like 'Urban', 'Rural' and 'Peri-Urban' by different agencies / stakeholders in the discipline of urban planning and city administration are reviewed and compared, as shown in Table 1.1 below.

Table 1.1: Comparative study of terminologies used for city peripheries by different agencies

| Comparative Study of Terminologies used for City Peripheries by Different Agencies | | | | |
|---|---|---|---|---|
| | **Census** | **Statutory Development Plan (DP), prepared by Urban Development Authorities** | **URDPFI Guidelines, MoUD** | **International Case Studies** |
| **Existing Definitions / Terminologies / Settlement Classification** | Census of India defines the "Urban Area" only. Even there is no specific definition for "Rural Area" also. Urban Area is further categorized into two - Statutory Town & Census Town.<br><br>To address large metropolitan regions in the country, the term "Urban Agglomeration" (UA) is coined, which consists of both the 'Urban Area' as well as its 'Out Growths' (OGs). However, | For all the 'Urban Area', governed by an ULB as per the definition by Census, statutory DP is prepared by Urban Development Authorities.<br><br>However, as per Census definition, for only Statutory Towns are benefited with such master plans. Census Towns, for not having any ULB as governing body are deprived from DPs. | The guideline emphasizes upon Regional Planning Framework, to integrate urban nodes, semi-urban and the rural areas under one planning system. The guideline identifies 'Peri-Urban' only as the zone, which is within the planning area limits, but outside the urbanization limit of the MC.<br><br>It also states that "Since peri-urban area is not well defined in all the states, identification and planning of peri-urban area is important in the context of urban and rural development. Also the States till now have not clearly defined what should constitute peri- | As found from literature study and comparative study among eight different countries of diverse contexts, it is found that nos. of countries, in their respective national census, three types of settlement hierarchy has made: Urban, Peri-Urban and Rural.<br><br>Here it is also significant to mention that internationally, 'Satellite Towns' are called to the towns, which refers essentially to smaller metropolitan areas which are located somewhat near to, but are mostly independent of larger metropolitan areas.<br><br>Here, 'Peri-Urban' as a concept is different in terms of its dependence (Economic, physical infra & Social Infra in all respect) over the parent city / the nearest major urban area. Thus, though a 'peri-urban' is governed by Municipal Council, because of its high dependence over the mother city, we can categorize them 'peri-urban' w.r.t that parent city (Directorate for public governance and territorial development, |

| | | | | |
|---|---|---|---|---|
| | separate definition for these Out Growths is not given by Census. | | urban areas and therefore a change in the acts in this context is considered a necessity". | OECD Regional Typology, 2011). 'Peri-Urban' areas are also termed as 'Urban Fringe', 'Out-Growth', 'Urban Sprawl' etc. and always referred w.r.t certain distance from the core urban area. |
| **Terminologies found** | Urban Area, Statutory Town, Census Town, Urban Agglomeration | Urban Area, Statutory Town, Development Plan | Regional Plan, Peri-Urban | Peri-Urban, Satellite Town, Urban Fringe, Urban Sprawl, Out Growth |
| **Remarks** | Census does not respond effectively towards 'Peri-Urban' areas, lying outside the main Urban Area. Even there is no equivalent term to define such areas / settlements. However, the kind of urban character, the Census Towns have and the way, they are spatially located; they may be treated as the 'Urban Fringe' or 'Peri-Urban' area w.r.t a major urban centre. | Follows Census data and boundaries for preparing Development Plans for cities. There is no separate terminology or Development Plan prepared or found specifically for 'Peri-Urban' areas or even for Census Towns. | It is appreciable that the guideline shows pro-active approach towards the 'Peri-Urban' areas. However, it does not define it in a quantitative method or through certain planning parameters, which may be used as a national benchmark. Even, the guideline does not clarify about the hierarchy of settlements and even among 'urban' areas, how we can differentiate them w.r.t their degree / nature of urbanization. In such context, 'Peri-Urban' needs to be explored further. | To showcase a scenario, where a no. of smaller towns is highly dependent over a large urban centre; to distinguish their degree of urbanization / nature of urbanity; we may adopt such three-tier hierarchy of settlements: Urban, Peri-Urban and Rural. The parameters, on the basis of which such categories can be defined, need to be explored further.<br><br>From the case studies of US, China and France, where 'Peri-Urban' areas are clearly defined from the census of the countries; it is significant to mention that the delineation of an area as 'Urban' or 'Peri-Urban' should not be solely dependent on certain no. of population or their administrative status. Instead of that it should be dependent upon their nature / degree of urbanization and accordingly such hierarchy can be made. |

Source: Author

**After reviewing the terminologies used in global and Indian platform, this research proposal takes Census definition as a base to explore the settlement hierarchy further, as Census being a legal data source, used for urban planning and development in India.** The research finds that due to Census definition of 'Urban Area' in a dichotomous fashion, all the benefits towards urban area is being concentrated towards the Statutory Towns only and the Census Towns, majority of which lies in the city periphery area, contiguous or non-contiguous of the major urban centre are completely ignored from getting benefits, though being one category of 'Urban'. This research limits itself only to focus such areas (Census Towns lying in city peripheries) in a specific regional context and boosts the lack with a new framework of settlement hierarchy and definitions based on planning parameters. It is also important to mention here that **from the above mentioned background study, the research questions and argues with the existing system of giving status of 'Urban' to a specific area only on the basis of population or its municipal status. It tells that a peri-urban area may reach a certain amount of population today and it is given Municipal status accordingly. As per the existing system, it is going to be considered as 'Urban'. However, its physical character does not change within that period of getting status from 'Peri-Urban' to 'Urban'. Hence, the status of 'Urban' or 'Peri-Urban' for a specific area should not be solely dependent on population or its governing body. The research attempts to find out alternative parameter to create settlement hierarchy, which can define an area on the basis of its degree / nature of urbanization.**

Here it is also significant to mention that the concept of 'Urban', 'Peri-Urban' and 'Rural'; such settlement typologies are subjected to a specific time frame / time span. **As a concept, this is always dynamic, changing in nature w.r.t a certain period of time.** As the world is going to be more urbanized day by day, we can see the transformation of settlements in such way that the rural area of today can be the peri-urban of tomorrow and it may transform into an entirely urban area within a certain time span due to existence of some trigger factors towards urbanization. Considering such dynamic nature of development, this research showcases the study, analysis and proposals for peri-urban areas in a specific context for a specific time period.

## 1.3. Present Urbanization Trends

The purpose of studying urbanization trends is to ascertain the significance of peripheral developments in the current urbanization scenario. The study of present urbanization trends reveals that since independence, the urbanization is majorly concentrated towards large cities, even during colonial as well as after that period too. As a result of such imbalanced urbanization, we can see that a high percentage of urban population is concentrated in Class-I cities, which creates good employment scenario and job & earning opportunities. This situation has been gradually increased over the past few years. As stated by Sivaramakrishnan, Kundu, and Singh; *"Partly this is due to graduation of lower order towns into Class – I category. There is nonetheless adequate empirical evidence that these cities have grown at a distinctly higher rate than the lower order towns. The pattern of growth has remained similar over the past few decades although there is a general deceleration in urban growth in all size categories during eighties and nineties".* It is observed that during nineties, the growth rates of Class-I cities had gone up over Class-II, III, IV and Class-v towns. This gap in the growth rates have increased. The developed states and the Class-I cities, which had their own economic resources, quality administrative and institutional mechanisms, were prone towards migration from other states and have increased economic activities.

During the seventies and eighties, the small and medium towns of India, which had a population below 50,000; they were experiencing an average growth with a slower rate. Rather, rapid growth was seen in case of backward states, which was similar or in some cases higher than the growth rate of the Class-I cities during sixties, seventies and eighties. *Detailed empirical analysis reveals that the demographic growth in these towns was not backed up by manufacturing / commercial activities or infrastructural facilities in these states (Sivaramakrishna, 2005).* During nineties, it is seen that the Census towns have faced significant decreased demographic growth. Even later, in the period 1991-2010, this number has been further decreased, which defines *"some sort of urban crisis in the context of development dynamics in the country" (Ramachandran, 1991).*

Table 1.2 reveals that there is a rapid increase in number of towns and cities from 1915 in 1901 to 7935 in 2011. In 1947, there were only 3 cities above 1-million populations. Currently numbers have grown rapidly to 53 U.A. in 2011 from 35 U.A. in 2001. It also substantiates the fact that the % of urban population

has increased from 10.84% in 1901 to 31.16% in 2011. Also rate of growth has increased from 2.73% in 1991-2001 to 3.22% in 2001-2011.

Table 1.2: Growth in number of towns and urban population from 1901 to 2011

| Number of Towns, % and Growth Rate of Urban Population in India since 1901 | | | |
|---|---|---|---|
| Census Year | No of Towns / UAs | % of Urban to Total Population | Annual Exponential Growth of Urban Population |
| 1901 | 1915 | 10.84 | - |
| 1911 | 1864 | 10.29 | 0.03 |
| 1921 | 2018 | 11.18 | 0.79 |
| 1931 | 2188 | 11.99 | 1.75 |
| 1941 | 2392 | 13.86 | 2.77 |
| 1951 | 3035 | 17.29 | 3.47 |
| 1961 | 2657 | 17.97 | 2.34 |
| 1971 | 3081 | 19.91 | 3.21 |
| 1981 | 3891 | 23.34 | 3.83 |
| 1991 | 4615 | 25.72 | 3.09 |
| 2001 | 5161 | 27.78 | 2.73 |
| 2011 | 7935 | 31.16 | 3.22 |

Source: Census of India, 1901-2011

of the total urban population, approx 70% urban population is being accommodated by Class-I cities as per 2011 census. The table 1.3 exhibits the growth of towns according to their class and also the % of urban population held by them. Class-I cities exhibit most dynamic growth trends unlike any other class of town in India.

Table 1.3: Growth of towns and % of population in different sized towns from 1901-2001

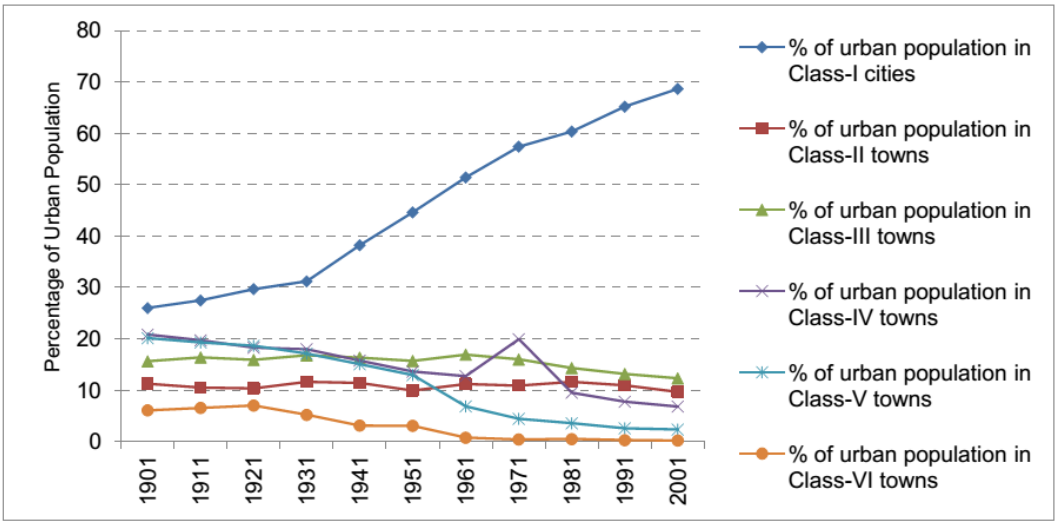
| Growth of towns and % of urban population in different sized towns from 1901-2001 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Class I | | Class II | | Class III | | Class IV | | Class V | | Class VI | |
| | No | % of urban pop. | No | % of urban pop. | No | % of urban pop. | No | % of urban pop. | No | % of urban pop. | No | % of urban pop. |
| 1901 | 24 | 21.68 | 44 | 11.47 | 143 | 16.92 | 427 | 22.76 | 771 | 20.75 | 503 | 6.42 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1911 | 25 | 23.39 | 38 | 9.63 | 157 | 18.92 | 388 | 20.97 | 744 | 20.21 | 509 | 6.88 |
| 1921 | 28 | 24.17 | 49 | 11.34 | 171 | 18.26 | 395 | 19.4 | 767 | 19.42 | 605 | 7.41 |
| 1931 | 30 | 24.12 | 59 | 12.54 | 217 | 19.83 | 477 | 19.74 | 846 | 18.12 | 556 | 5.65 |
| 1941 | 48 | 31.64 | 87 | 12.97 | 273 | 18.41 | 551 | 17.54 | 976 | 15.99 | 454 | 3.45 |
| 1951 | 75 | 37.89 | 110 | 12.18 | 374 | 17.93 | 672 | 15.05 | 1188 | 13.65 | 616 | 3.3 |
| 1961 | 105 | 44.34 | 139 | 12.16 | 517 | 20.08 | 816 | 14.35 | 842 | 8.04 | 238 | 1.03 |
| 1971 | 149 | 48.78 | 219 | 13.59 | 649 | 18.65 | 985 | 12.87 | 803 | 5.62 | 276 | 0.79 |
| 1981 | 224 | 52.57 | 325 | 14.09 | 878 | 17.08 | 1240 | 11.24 | 900 | 4.34 | 324 | 0.68 |
| 1991 | 322 | 56.67 | 421 | 13.33 | 1161 | 16.35 | 1451 | 9.77 | 971 | 3.43 | 289 | 0.45 |
| 2001 | 441 | 62.29 | 496 | 12.04 | 1387 | 14.72 | 1564 | 7.9 | 1042 | 2.76 | 231 | 0.29 |

Source: Census of India, 1901-2011

The above table indicates that Class-I cities are growing at a faster rate than lower order cities. The reasons for this phenomenon are presence of strong economic base, better resource mobilisation and resource raising through institutional borrowing and innovative credit instruments which are more attractive than medium and small sized towns. Hence these towns are witnessing rapid urbanization.

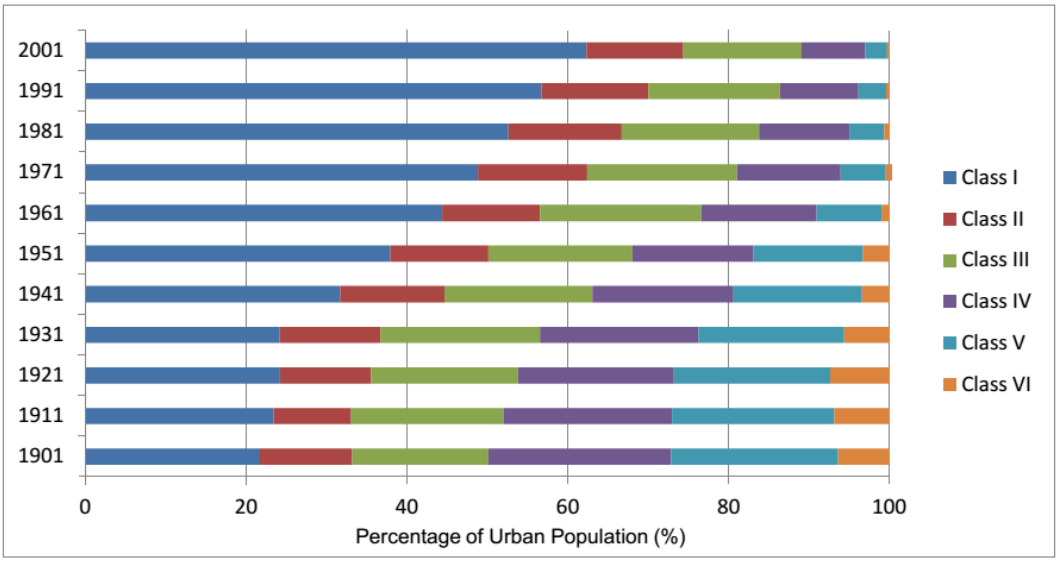
Figure 1.1: Comparison of growth of different classes of towns




Source: Census of India, 1901-2011

Figure 1.2: Comparison of growth of urban population

in different classes of towns




Source: Census of India, 1901-2011

Fig. 2.2 validates the phenomenon of lopsided growth in favour of Class-I cities. Growth trend of mega cities is being explored further. The cases of Kolkata, Mumbai and Delhi have been discussed to ascertain the growth dynamics in these cities and their urban agglomeration.

**Kolkata -** The table below indicates that Kolkata U.A. exhibits a growing population trend while the population of Municipal Corporation exhibits a negative growth rate signifying decreasing population. The figures reveal that the growth rates within the municipal limits are quite low as compared to the urban agglomeration indicating that the areas outside municipal limits are growing faster than the area inside / within the urban limits.

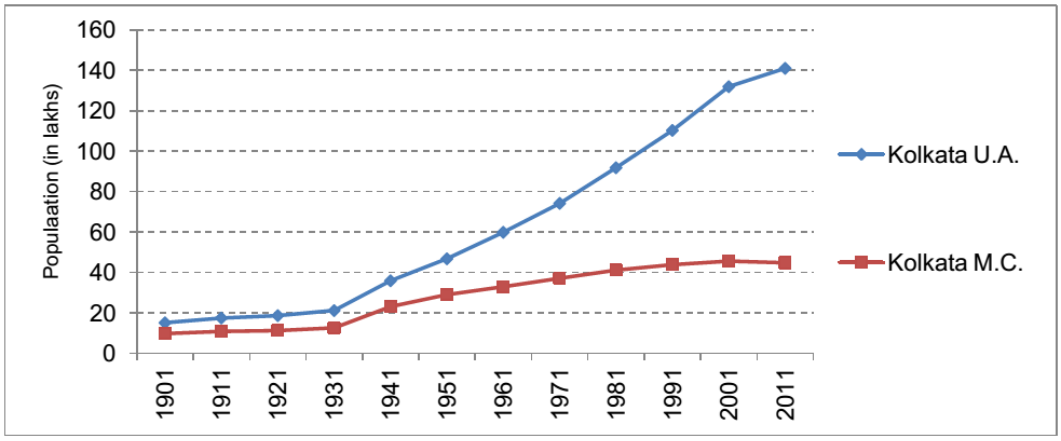
Table 1.4: Growth of population in Kolkata City & U.A.

| Year | Population of U.A. (Lakhs) | Growth Rate (%) | Population of MC (Lakhs) | Growth Rate (%) |
|---|---|---|---|---|
| 1901 | 15.2 | - | 9.88 | - |
| 1911 | 17.56 | 15.5 | 10.93 | 10.6 |
| 1921 | 18.72 | 6.6 | 11.32 | 3.6 |
| 1931 | 21.23 | 13.4 | 12.6 | 11.3 |
| 1941 | 35.97 | 69.4 | 23.16 | 83.8 |
| 1951 | 46.85 | 30.2 | 29.11 | 25.7 |
| 1961 | 59.99 | 28.0 | 33.06 | 13.6 |
| 1971 | 74.29 | 23.8 | 37.16 | 12.4 |

| | | | | |
|---|---|---|---|---|
| 1981 | 91.92 | 23.7 | 41.26 | 11.0 |
| 1991 | 110.41 | 20.1 | 43.99 | 6.6 |
| 2001 | 132.05 | 19.6 | 45.72 | 3.9 |
| 2011 | 141.12 | 6.9 | 44.86 | -1.9 |

Source: Census of India, 1901-2011

Figure 1.3: Growth of urban population in Kolkata city & U.A.




Source: Census of India, 1901-2011

**Greater Mumbai -** It has been observed that in case of Greater Mumbai, peripheral areas witness higher growth rates than the areas within Municipal limits. Period post 1991 exhibits stark difference in growth rates of Urban Agglomeration and Municipal Corporation. As per 2011 census, population of UA is as high as 184 lakhs while that of Municipal Corporation of Greater Mumbai is 124 lakhs.

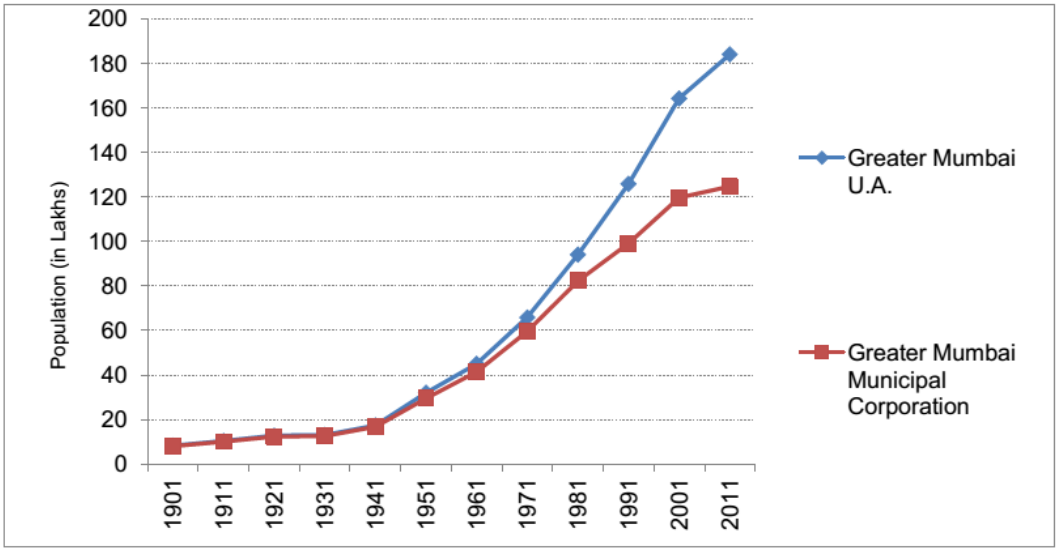
Table 1.5: Growth of population in Greater Mumbai city & U.A.

| Year | Population of U.A. (Lakhs) | Growth Rate (%) | Population of MC (Lakhs) | Growth Rate (%) |
|---|---|---|---|---|
| 1901 | 8.4 | - | 8.1 | - |
| 1911 | 10.5 | 24.7 | 10.2 | 25.4 |
| 1921 | 12.9 | 22.8 | 12.4 | 22.2 |
| 1931 | 13.2 | 2.4 | 12.7 | 1.9 |
| 1941 | 17.5 | 32.8 | 16.9 | 33.0 |
| 1951 | 32.2 | 84.1 | 29.7 | 75.9 |
| 1961 | 45.2 | 40.4 | 41.5 | 40.0 |
| 1971 | 66.0 | 46.1 | 59.7 | 43.8 |
| 1981 | 94.2 | 42.8 | 82.4 | 38.1 |
| 1991 | 126.0 | 33.7 | 99.3 | 20.4 |

| | | | | |
|---|---|---|---|---|
| 2001 | 164.3 | 30.5 | 119.8 | 20.7 |
| 2011 | 184.1 | 12.0 | 124.8 | 4.2 |

Source: Census of India, 1901-2011

Figure 1.4: Growth of urban population in Greater Mumbai city & U.A.




Source: Census of India, 1901-2011

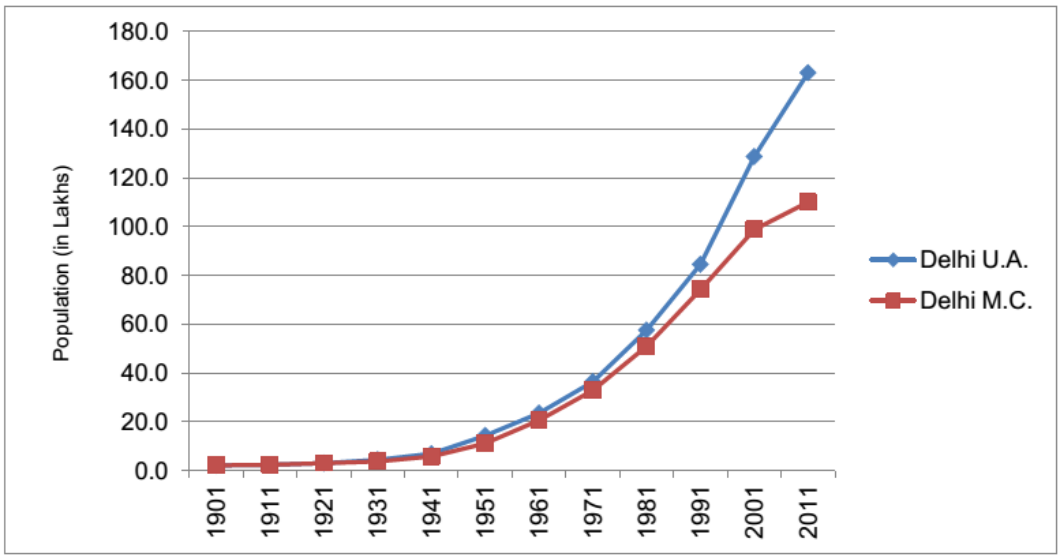
**Delhi -**

Table 1.6: Growth of population in Delhi city & U.A.

| Year | Population of U.A. (Lakhs) | Growth Rate (%) | Population of MC (Lakhs) | Growth Rate (%) |
|---|---|---|---|---|
| 1901 | 2.1 | - | 2.1 | - |
| 1911 | 2.4 | 10.7 | 2.4 | 10.7 |
| 1921 | 3.0 | 28.3 | 3.0 | 28.3 |
| 1931 | 4.5 | 47.0 | 3.7 | 22.7 |
| 1941 | 7.0 | 55.5 | 5.8 | 55.0 |
| 1951 | 14.4 | 106.8 | 11.2 | 93.6 |
| 1961 | 23.6 | 64.2 | 20.6 | 84.2 |
| 1971 | 36.5 | 54.6 | 32.9 | 59.5 |
| 1981 | 57.6 | 57.9 | 51.0 | 55.1 |
| 1991 | 84.6 | 46.8 | 74.2 | 45.6 |
| 2001 | 128.8 | 52.2 | 98.8 | 33.1 |
| 2011 | 163.1 | 26.7 | 110.1 | 11.4 |

Source: Census of India, 1901-2011

Figure 1.5: Growth of urban population in Delhi city & U.A.




Source: Census of India, 1901-2011

The figures shown above indicate that peripheral development is playing a very significant role in the growth of urban agglomeration of Mumbai, Kolkata and Delhi with higher growth rates outside Municipal areas.

## 1.4. Peri-Urbanization as a Result of Migration in Indian Context

### 1.4.1. Introduction to Migration Scenario in India

Migration and emergence of peripheral developments around Census towns are direct impacts / implications of recent economic development, especially in this present era of globalization. The shift of population from rural areas to urban centres is a major issue today and a big challenge to mitigate its consequences. There is a need to explore this inevitable phenomenon – Migration and the complexity it brings in. The main focus is to highlight the emerging spatial pattern and associated issues of peri-urbanization as an impact of migration. Migration is the result of disparities in regional planning and development. This happens due to lack of job opportunities in the rural areas and better economic scenario and other facilities and amenities (infrastructure-wise) in the urban areas. This internal migration not only involves people, but along with their accommodation, facilities, amenities as well. There begins the larger impact of this occurrence. The main concern is that the cities begin to collapse under the strain of migrants. Either it creates illegal slum development within city or leads towards peripheral development. The migrated population prefers to stay adjacent to city (working place) at a lower cost and commute daily for work. In the

absence of any specific planning policy for peri-urban area, this transition space between urban and rural undergoes huge transformation – physically and spatially. Hence, the question is how far we may allow the volatility of rich agricultural land and agrarian economy as an impact of migration. It comes out with this view that it is necessary at this stage to decentralize the growth, thus decreasing the rate of migration and simultaneously formulate a specific policy for peri-urban areas to restrict the haphazard and non-sustainable growth at these areas due to migrated population.

*The Constitution of India (Article 19) gives the right to all citizens to "to move freely throughout the territory of India; to reside and settle in any part of the territory of India".* As per Census 2011, the total population of the country comes as 1.21 billion, within which a large population is internal migrants, i.e. 309 million, 30% of the total population (Census of India, 2001). More latest estimates tells that this internal migrants is 326 million or 28.5% of the population (NSSO, 2007-08). As stated by Sharma, *"With an urbanization level of 31.16% in 2011, India is the least urbanized country among the top 10 economies of the world. In addition, unlike other countries, the transition of workforce out of agriculture is incomplete. This coupled with jobless growth in recent years has contributed to an increase in certain migration streams".* As per NSSO, 2007-08 survey, *"Migration for employment-related reasons is given as the prominent reason for male migration in both rural and urban areas – 29 per cent rural male migrants and 56 per cent of urban male migrants".* The scenario of total migrants within India has become 301.1 millions in 2001; refer Table 1 (Kundu, 2012).

Table 1.7: Internal migrants in India (1961-2001)

| | **Percentage of Total Population** | | | | | **Total Migrants in Millions** |
|---|---|---|---|---|---|---|
| | 1961 | 1971 | 1981 | 1991 | 2001 | 2001 |
| Total Migrants | | | | | | |
| Intercensal | 15.0 | 12.4 | 12.2 | 9.7 | 9.5 | 98.3 |
| Intercensal Interstate | 2.0 | 1.6 | 1.6 | 1.3 | 1.6 | 16.8 |
| Lifetime | 30.6 | 28.7 | 29.4 | 26.5 | 29.2 | 301.1 |
| Lifetime | 3.3 | 3.4 | 3.6 | 3.3 | 4.2 | 42.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Interstate | | | | | | |
| **Note:** Life time migrants are by their place of birth while inter-censal migrants are by their place of last residence for reasons of temporal comparability. | | | | | | |

Source: Census of India, 1961-2001

As the rural-urban migration has gradually increased in terms of its volume, besides we can see that there is continuous increase of both-way commuting population in-between rural and urban areas. To avoid this transportation, migrated population prefers to stay at city peripheries. As stated by UNICEF, 2012;

> *"These large volume of migrants settle down at city peripheries especially due to affordability and face denial of basic entitlements including access to housing, drinking water, sanitation and public health facilities, education and banking services and often work in poor conditions, devoid of social security and legal protection".*

Net 21.0% distribution is found as rural-urban migration and settled down at city expansion zones along with 13.0% increase in migrated population, due to expansion in urban area and merging of towns, refer Table 2 (Kundu, 2012).

Table 1.8: Disaggregation of total incremental urban population into components

| | **Percentage Distribution** | | | |
|---|---|---|---|---|
| | **1961-71** | **1971-81** | **1981-91** | **1991-01** |
| Total Increase | 30.18 | 49.9 | 57.7 | 67.7 |
| (a) Natural Increase on base year population and on inter-censal migrants | 64.6 | 51.3 | 61.3 | 59.4 |
| (b) Population of new towns less declassified towns | 13.8 | 14.8 | 9.4 | 6.2 |
| (c) Net RU migration | 18.7 | 19.6 | 21.7 | 21.0 |
| (d) Increase due to expansion in Urban Area and merging of towns | 2.9 | 14.2 | 7.6 | 13.0 |

Positive impacts of migration remain unrecognized till date in India. Migration as an obvious result of development should be accepted along with a balance is required to restrict growth and associated impacts from the thrust of migrated population. With this background, the obvious factors behind this phenomenon is highlighted and the need to recognize peri-urban development dedicatedly to provide them a healthy and planned habitat.

### 1.4.2. Migration and the Factors behind the Occurrence

Migration is defined as movement of people from one geographic location to another geographic location, across a specified boundary. The aim is to establish a new permanent or semi-permanent residence in this new location. Besides other factors like fertility and mortality, migration is a key component behind vast change in population. Within a country, internal migration is termed for "in-migration" and "out-migration", indicating movement between areas within a country. The part of the chapter focuses to analyze the factors behind the occurrence of internal migration only to understand its impact in development of city peripheries. As stated by Das, 2013; *"In developing countries like India, migration mostly takes place not due to the so called pull forces of the destination place, but because of poverty, unemployment, natural calamities and underdevelopment at the origin place. Migration in developing countries is still viewed as a survival strategy".* With this overview, we can see that a growing research area is focused to migration and its consequences. Lot of debates are going on the negative effects of migration on development of settlements. It is always debated that underdevelopment in an area is the main reason behind migration and besides, concentration of development at one place also leads to migration. Therefore, migration happens to move towards development and to avail the associated facilities. Migration majorly happens because of disparity in a region in terms of its developmental scenario. People move to improve their living conditions, economy, social status, infrastructural facilities and other amenities. As discussed by U.N. ESCAPE Report, 1991 (pp. 1-12); *"Population pressure on finite resources encourages migration. While urbanization and rural-urban migration are natural outcome of the transition from agriculture-based economy to an industrial economy, the extent of such migration is frequently perceived to be excessive and urban population have been concentrated in the largest urban agglomerations in most of the Third World nations in general and in the Asian and Pacific regions in particular. The migration is seen, not so much as a natural outcome of development, but more as a result of distortion in the development*

*process, deriving from inappropriate or ineffective planning".* There is a strong interrelationship found in-between migration and regional disparities. In a study (Mukheji, DPFW-93) on "Inter-state migration and regional disparities in India" found that *"In India, even in recent times, inter-state migration of the males for employment, (as well as of females) is still very much linked with the underdevelopment, poverty, spatial disorganization, regional disparities, social inequalities, rural stagnation, rural neglect and unbalanced regional development over national space. In India, people are still primarily migrating just for the survival".* A study done by economic and social commission for Asia and the Pacific (ESCAP, 1991) observed that *"Migration from rural to urban areas continues at a rapid pace in many countries of the region, and it was often beyond the capacity of towns, cities and metropolitan areas to cope with the increasing numbers".* As a direct impact of this, city peripheries are rapidly developing in an organic, haphazard manner in the absence of a strategic planning policy and guidelines for those transition areas and finally cities begin to collapse under this strain of migration.

### 1.4.3. Migration Tendencies in Peri-Urban Areas – Causes

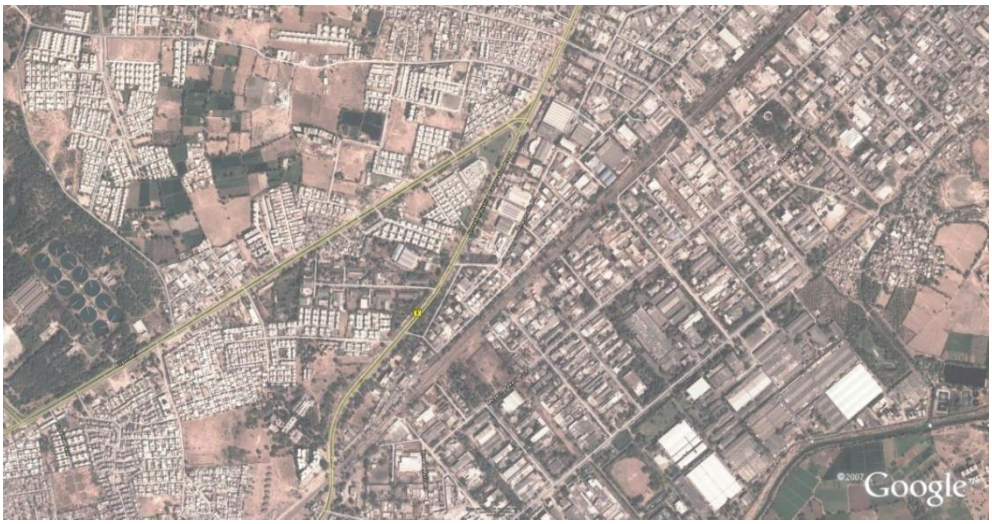
The growth we observe of today's mega-cities is majorly because of the factor of internal migration within the country. Such growth rate evolves the level of urbanization on a global platform. However, it involves different type of socio-spatial dynamics. Specifically, once the horizontal expansion of mega-cities happens, this result into peri-urbanization; a "mixed-space" is being formed, which is midway between urban and rural areas in terms of their characteristics and transformative processes. These spaces have no established definition and delineation till date, which would help into formation of a planned growth there. An analysis by Sivaramakrishnan, Kundu and Singh, 2005 states that *"Study based on the urbanization pattern and projections for the next twenty years is indicative of the fact that bulk of the urban population will be living in metropolitan regions".* In India, the major feature of urbanization is emergence of no. of agglomerations, which cover multiple municipal jurisdictions. Spatially, it is observed through continuous or discontinuous sprawl, which has multiple nodes / centres, horizontally spreaded along the transport corridors. As stated by Ramachandran, *"The peripheral areas of large cities along the corridors have been growing and absorbing migrant population in areas lacking basic services. Such developments are exerting considerable pressure on land and other natural resources".*

A huge stagnation and volatility is observed in case of agricultural lands in recent days and there is also less diverse options available within agriculture based economy. Such agricultural scenario is indirectly linked with migration and peri-urbanization. In rural areas, the growth rate of agricultural production and associated economy has been gradually decreased and unstable throughout the country. This has a direct impact on lack of job opportunities in rural areas. Lack of investments in infrastructure sector has also affected the agrarian economy at a large. This leads to out-migration from rural areas, where migrants are being involved into the informal or tertiary sectors of urban economy.

### 1.4.4. Peri-Urbanization as a result of Migration

Peri-Urbanization is one kind of urban transformation, a continuous process, which creates changes in the spatial pattern of cities / towns at their peripheries / boundaries. Due to such transformation, the rate of urbanization of these areas spatially separates them from the core town and this scenario is rising rapidly in present context of India. Migration happens as people move from rural areas to get better job opportunities, better quality of life, healthy environment, better infrastructural facilities and amenities at a lower cost. This directly creates rise of residential areas for migrated population and as a result the overall urbanization scenario changes. Therefore, this residential peri-urbanization caused by majorly migrants; also the new economic opportunities and commercial activities move from the city centre to the city peripheries, boosts the density of development further. The rise of new activities and their permanencies – commercial suburbanization, what can in its advanced phase lead into existence of rival marginal towns, competing with the original agglomeration (Sedlakova, 2004). Eventually, this peri-urbanization process may end in the change from a mono-centric urban structure into a polycentric one. From different contexts in India, we can observe that where migrants settle up and how the transformations are happening.

Figure 1.6: New developments around agricultural lands, Case: Ahmedabad




Source: Google earth pro

Figure 1.7: Development of haphazard settlement of migrants around wetlands or other natural resource areas, Case: East Kolkata Wetlands


Source: Google earth pro

Figure 1.8: Migrants prefer to settle around existing villages,

Case: Chandigarh Periphery

Source: Google earth pro

Figure 1.9: Unauthorized construction activity by migrants around industrial areas


Source: Google earth pro

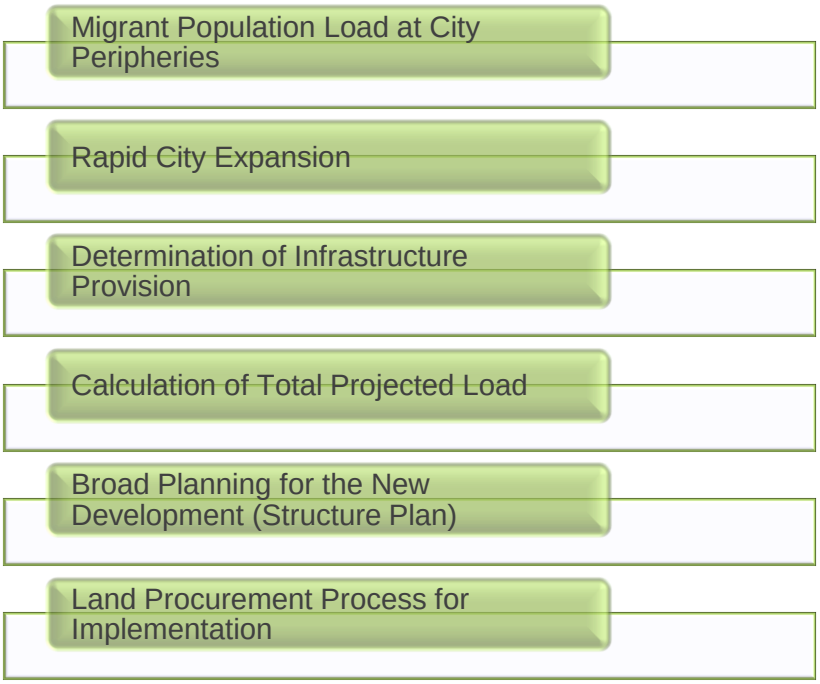
This scenario gives inferences that migration from the city centres / inner cities to city outskirt areas / from rural areas to peripheries can be considered as quantitatively huge and significant internal migration scenario in the present context of the country. Here, the “motive forces” can be explained as: “pull factors are towards urban peripheries and push factors are out of the central city” (Kundu, 2012). The concept and the ground scenario of such areas in developed and developing countries are very different. Specifically in the context of developing countries like India, peripheries are marked by rapid demographic growth due to internal migration, leading spatial expansion in a haphazard manner. From that perspective, peripheries without any single established institutional framework evolves certain question: At what extent is a peri-urban area functional and fulfilling the requirement of migrated population? Is this transition space only for agriculture or it may accommodate migrants also in a planned manner? How the city peripheries can be defined and a boundary / spatial limit can be determined and delineated?

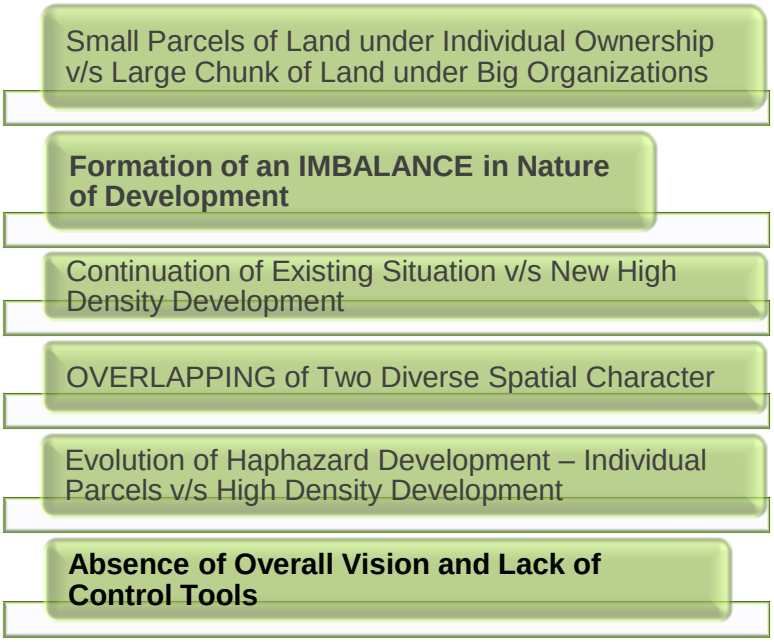
Figure 1.10: Low-density peri-urbanization, evolved mainly due to residential settlements of migrants

Source: Regional Plan Report, Greater Mohali Area Development Authority

The common process of setting of an 'edge' due to increased number of migrants is described below:

Figure 1.11: Process of peri-urbanization, keeping migration as a major driver



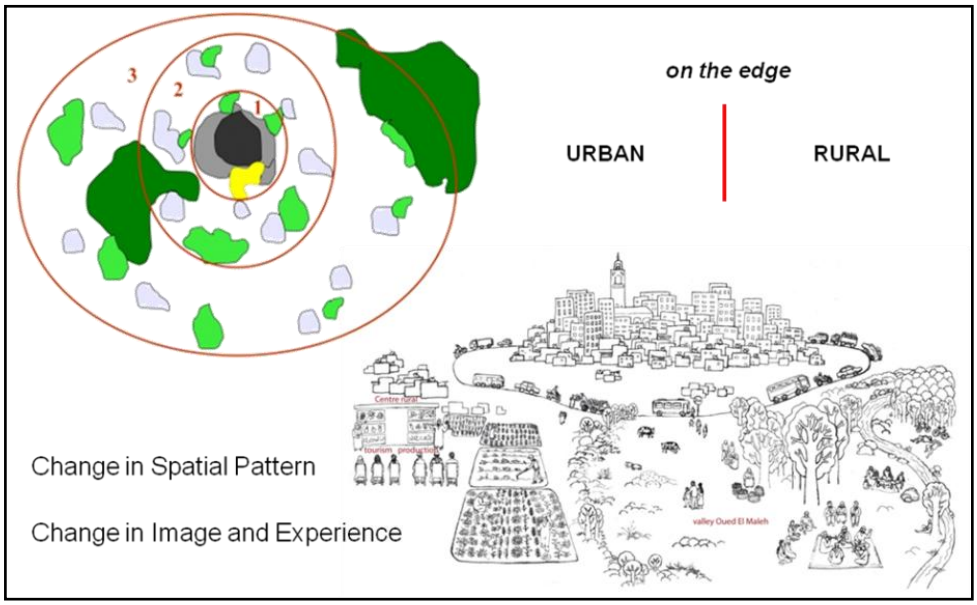



Source: author

### 1.4.5. Emerging Scenario at Interface

Peri-Urbanization is basically refers to the direct impact of migration of a population from rural areas to the vicinity of urban areas, which creates a low density residential development over agricultural land and associated transformation in the area as a whole. The multiple transformations here lead towards a haphazard spatial expansion in the absence of a specific policy or institutional mechanism for 'peri-urban'. The end result is the spreading of a city over more and more rural lands without provision of basic infrastructural facilities and amenities. As stated by Goel, 2011; *"In India today, 'peri-urban' have the same amount of built-up land as urban areas, but are only half as densely populated".* People migrate due to affordability, lack of space within city and for better livability. Whether they are facilitated and well accommodated, that's the emerging question. Migration and development of peri-urban areas are not something, which is happening in recent days only. However, it is observed that due to this scenario, the city peripheries are affected at a large in terms of environmental deterioration, imbalance in spatial pattern / growth pattern, distribution of infrastructures and overall quality of life.

Figure 1.12: Effect of peri-urbanization




Source: author

To manage this degradation of the transition spaces, these areas need recognition for effective planning and to accommodate the migrated population well-in-advance without hampering overall sustainability of the place. As it is analyzed that issues of internal migration is mainly residence related and that's how it affects the development of peri-urbanization through several ways:

- Increase in Public Expenditure: Settlement of migrants in peri-urban areas increase public costs because of changes in infrastructures.
- Increased Traffic: Due to inappropriate planning and inadequate public transport, migrated populations settled in peripheries begin to use private vehicles more often, which means that there is more traffic on the roads, and there is also more air pollution and more probability towards accidents.
- Environmental Impact / Issues: The organic, haphazard and unauthorized (at most of the peripheries) settlements of migrants in peripheries affect the environmental quality of the place as a whole. As observed from the cases, the ribbon development along natural water courses / canals and clogging them by throwing solid wastes or settlement above natural drainage systems appear common in these days.
- Impact on Social Lives: The distance from working to living area for these migrants, settling at peripheries; becomes long for daily commuting. Also in absence of social facilities and amenities needed for everyday life in the vicinity of living place, it is becoming difficult for people to sustain. This has an impact in overall quality of life.

### 1.4.6. Key Issues as an Impact of Migration

As stated by Mahapatro, 2011; *"Migration of persons within national borders is far greater in magnitude than migration across international borders and has enormous potential to contribute to economic prosperity, social cohesion and urban diversity. Internal migration is an essential and inevitable component of the economic and social life of the country, given regional imbalances and labor shortages and safe migration should be promoted to maximize its benefits".* However, issues are emerging in terms of their concentration at city peripheries due to lack of living space in the core city along with affordability. Further transformations are happening in terms of land-division, land-use change, urban form, image / character of the place etc. as follows:

Figure 1.13: Undefined land-use – agricultural land has slowly perishing due to laying of infrastructure

Source: Chandigarh periphery, Chandigarh Master Plan Report, 2013

Figure 1.14: Development of fragmented mini-cities / gated communities – lack of homogeneity and cohesiveness with overall planning system / spatial pattern

Source: Regional Plan Report, Greater Noida Development Authority

Figure 1.15: Imbalance between old & new – lack of compatibility with existing settlement pattern and creation of residual space, which is eventually filled by illegal constructions

Source: Regional Plan Report, Greater Noida Development Authority

Figure 1.16: Encroachments and environmental deterioration at the edge

Source: East Kolkata Wetlands, EKWMA Report, 2010

In the absence of a coherent policy framework and planning strategy for peri-urban areas, migration imposes heavy costs on human habitat development through poor spatial arrangements, environmental deterioration, poor quality of life for migrants and overall crisis in their access to basic services like shelter, education, healthcare and food. This concern can be well addressed with recognition of the need to plan peripheral areas dedicatedly, by formulating effective planning policy for peri-urban interfaces of Indian Metropolises and through design interventions at neighbourhood scale to enhance quality of life.

Migration and the development of peri-urban areas as its direct impact are something, which is not going to change. Over time, the transition areas are going to become more populated because of this natural transformation and become part of the urban agglomeration. This phenomenon can be considered good at time and bad from certain perspectives as well. However, while this is inevitable, why not we plan our city peripheries well in advance with respect to the emerging growth direction and take appropriate measures in planning to accommodate the migrants in these areas with a better quality of life without affecting overall sustainability of the place.

### 1.4.7. Effective Approaches towards a Balanced Development Pattern

Migration is an inevitable phenomenon, which is rapidly developing city peripheries and extends the city boundary towards an organic, haphazard development at its peripheral areas. It is high time to develop a coherent legal framework and policy mechanism to deal with issues related with migration along with the focus on their overall habitat system at peri-urban areas. Effective planning of city peripheries can settle and accommodate well the migrated people along with provision of affordable living space, healthy environment, better infrastructure and amenities. The peri-urban phenomenon should be accepted by policy makers due to present heterogeneous pattern of settlements of migrant population, happening all around the major cities and needs to be accommodated through established definition and planning policies as a third-tier of development. The major focus of migration related policies should be towards addressing the issues related to ecological footprints of cities, which encourages out-migration and creating stagnation in agricultural economy by making new income opportunities. A large portion of the society – the poor too have their

"right to the city", however they should be an easy target towards forced shifting "forced migration and transferring encompass more poignant vulnerabilities". Enabling people from rural areas to avail urban infrastructure, facilities and income and strengthening rural urban linkages, planned development of peri-urban areas and betterment of regional commutation should be significant manoeuvre to address the issues related to fast-growing urbanization in different parts of the country.

Besides, the existing methodology of defining development areas should be relooked as it only considers demographic and economic profile as parameters to denote degree of urbanization / ruralization. However, peri-urban can't be defined by these two parameters (urban and rural) only. Therefore, the determinants of the evolution of such 'transition' spaces needs to responded through its definition. Besides, decentralization of the overall growth process can be an effective strategy to decrease the rate of internal migration in India. Instead of creating low-density sprawl, it is better to upgrade infrastructure of small and medium towns in the country. Parallel, there should be developed planning strategy to restrict growth in peri-urban areas and to conserve rich agricultural land to maintain food security. The possibilities for a 'Model of Sustenance' can be achieved through:

- Planned development on the basis of environmental impact assessment of a particular place.
- New development along with conservation of natural resources.
- New settlement after retaining agricultural land enough to ensure food security.
- City expansion with balance of migration population load and determination of total amount of habitable land.

Thus, a balanced growth pattern can be achieved through restricting growth at certain areas and optimum utilization of peri-urban land as a scarce resource. A region-based planning and design intervention may fulfill the purpose of sustainable development at rapidly expanding city peripheries while settling migrated population with better quality of life.

### 1.4.8. Learning from Migration & Peri-Urban Development

As stated by Ali & Shamshad, 2014; *"India's future seem to be paradoxical, on one hand it has to sustain under the pressure of migrated population and on the other hand, it should have optimum use of the scarce natural resource – land, in order to compete globally with stable economic*

*growth. Housing, which constitutes a large percentage of the built environment, is a critical element in any sustainable urban growth strategy".* Overall, the challenges of the peri-urban and migration as a driving force, need to be resolved at a broader perspective of the entire 'rural-urban region', which requires stronger local administrative bodies, active social and cooperative bodies to create an integrated development in the entire 'rural-urban region'. This study so far, calls for an integrated approach that links migration and its impact on development of peri-urbanization around major cities of India, which will aim to explore and understand the complexity of migration and dynamicity of its impact in the peripheral interfaces and further evolves an appropriate sustainable growth model.

## 1.5. Research Agenda

### 1.5.1. Need and Significance of the Study

The present scenario of globalization has extended the metropolitan regions and now moved towards dispersal and location of growth on the peripheries or fringes of cities. Lack of planning control in these areas marks its impact as improper standards of social and physical infrastructure. Thus leads to poor utilization of resources and environmental deterioration. So it is important to plan for the appropriate utilization of these future city areas. Peripheral growth / city sprawl is generally seen as one of the potential threats for development. However, this transformation in city peripheries triggered by ground scenario / demand cannot be acknowledged by problems only. Hence, it is very essential to understand this phenomenon of peripheral growth, the factors trigger the transformation and at what scenario it can be a problem or a potential to accommodate future urbanization in a balanced / sustainable manner. The investigation of the thesis is also very crucial from regional planning point of view as for several cases it is found that peripheral growth happens beyond the carrying capacity of the region, leading to deterioration of natural resources and environmental degradation of the entire region. In this direction, this research is an attempt to identify the determinants or triggering factors of peripheral growth, which transform the development scenario at fringe areas, to formulate a framework to classify the peripheral settlements and delineate them using those determinants / planning parameters and also to create model and effective planning policy further to govern peripheral growth in near future.

This research may appear as significant / need of the hour as it can create a new sustainable planning framework for 'Urban', 'Rural' and 'Peri-Urban'. A new research agenda can be emerged for not experiencing urban and rural development as separate issue, but integrated with each other.

### 1.5.2. Research Question

1. How to characterize Peri-Urban Interface?
2. What are the determinants / governing factors behind peripheral growth around major cities?
3. What kind of transformation takes place in city periphery areas due to these factors and what are the impacts / consequences of them?
4. How to categorize, delineate and predict City Periphery / Peri-Urban Interface?
5. What are the policy options for managing peri-urbanization?

### 1.5.3. Hypothesis

Peripheral growth around any major city is a natural phenomenon, triggered by several factors, leading to physical and spatial transformation of the place. However, in absence of physical planning based parameter in its definition and delineation method in Statutory Master Plan and respective planning policy, peri-urban areas face unplanned, haphazard and organic development and also deprived from government development grants, though these areas largely have urban tendency.

### 1.5.4. Aim & Objectives

**Aim:** To include Peri-Urban Interface under the Regional Planning framework to measure / quantify, categorize and delineate it and to predict it for future scenario through specific planning parameter.

**Objectives:**

1. To understand and analyze the process of transformation takes place in peri-urban interfaces and their impact on nature of urbanization.
2. To study and analyze various determinants / governing factors, behind the peripheral developments around major cities.
3. To formulate peri-urban settlement typology / hierarchy on the basis of identified determinants.

4. To evolve futuristic, probabilistic mathematical model to predict peri-urbanization for future Master Plans and to recommend suitable planning policy for managing peri-urban growth.

### 1.5.5. Scope of the Study

**Scope:** The present thesis aims to address the problem of peri-urbanization in the perspective of a developing country with the City of Chandigarh, as the case under investigation. From the last decade, Chandigarh has been observed unprecedented growth spatially; leading to peripheral expansion all around the city. Also Chandigarh being a unique case to study peri-urban growth as it expands into the adjoining states and thus presents a peri-urban scenario with overlap of multiple boundaries. It is in this setting, the present research is conducted to address the above aim and objectives.

### 1.5.6. Research Methodology

The methodology is divided into 4 major stages. The framework of the thesis is given in the figure below.

**Stage 1:** Background Study relates to the topic, which will help to understand the viability, need and significance of the study. It includes study of the rising trends of urbanization in India and establishing the ground scenario of peripheral growth around cities in India. This part shall also deal with study of various literature and case studies relevant to the similar phenomenon and conclude the factors responsible for expansion of cities. The case studies and other literature study shall be helpful in detail understanding of the process of evolution of peri-urban interfaces in India.

**Stage 2:** This stage broadly covers data collection from primary as well as secondary sources, shows the results of questionnaire survey & their analysis. It includes understanding of the process of transformation faced by peri-urban settlements, its causes and consequences.

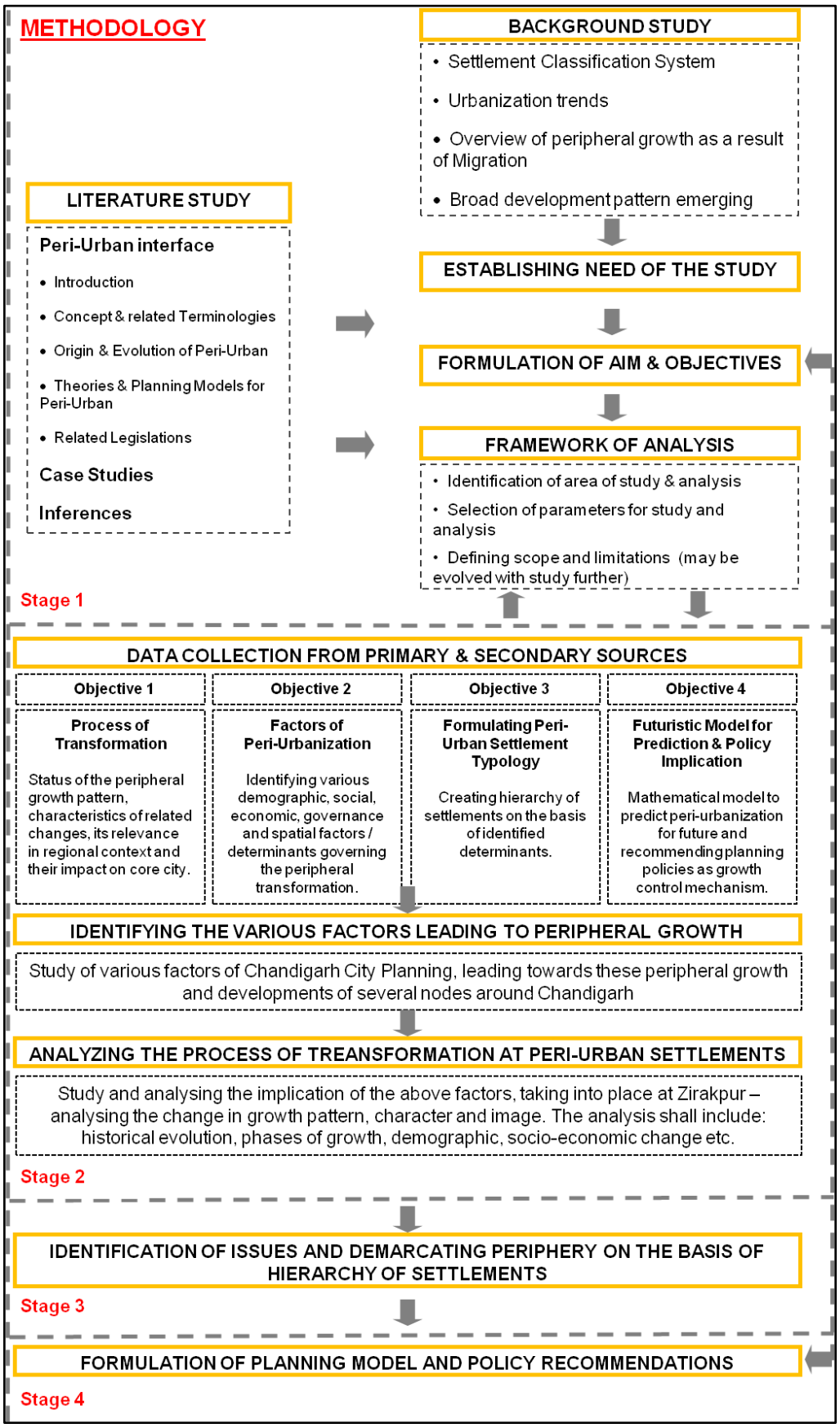
**Stage 3:** The third stage aims towards identification of the issues as an outcome of the above mentioned analysis. It also critically judge the fundamental issue of the entire process. To establish the same, a world-wide perspective on R-U Classification is studied and also it is seen that how the RUC and funding pattern in the context of India is interlinked.

**Stage 4:** Accordingly, in the fourth phase, the determinants are identified, on the basis of which settlement typologies are formed, peri-urban settlement hierarchy is delineated in the proposed regional plan. It also evolves a

mathematical model using a specific planning parameter, which can predict emergence of peri-urban areas in future, can be included as an additional criteria in the existing definition and recommends effective policies for implementation purpose.

**Further,** the below mentioned Process of Methodology and then table has been formulated to combine objective wise requirement of data, their source of collection, purpose of analysis and supportive literature reviews.

Figure 1.17: Research methodology for the study




Source: Author, 2014

Table 1.9: Data inventory and framework for analysis

| Sl. No. | OBJECTIVES | ASPECT | DATA REQUIRED | SOURCE OF COLLECTION | PURPOSE OF STUDY / ANALYSIS | LITERATURE SEARCH |
|---|---|---|---|---|---|---|
| 1 | The Process of Urban Transformation at Peripheral Towns - Causes & Consequences Analysis | **Demography** | Change in population | Municipal Council, ULBs | Will help to show the change in density by trend analysis, also the factors for in-migration. | 1. Reports from various Departments of Punjab Govt. |
| | | | Population Density | Census of India | | |
| | | | Migration (in and out) | | | |
| | | | Literacy Rate | | | |
| | | **Social** | Social / Community Groups | Municipal Council, ULBs | To analyze the mix. of different social groups. | |
| | | | HH Size | | Trend of nuclear families instead of joint families. | |
| | | | Open Space | | Open to Built Ration - Lack of Open Space. | |
| | | | Crime Rate | Local Police Station, Zirakpur | Security Issues. | |
| | | | Provision of Social Infrastructure - Demand and Coverage | Primary Survey, Municipal Council, ULBs | To analyze Sufficiency of Infrastructural provision. | |
| | | **Environmental** | Change in Course of natural water channel (river / canal) | Google Earth Observations, Punjab Urban Development Authority (PUDA) | To analyze the environmental quality and impact on nature due to recent development. | |
| | | | Pollution Level (water and sound) | Punjab Pollution Control Board | | |
| | | **Economic** | Occupational Pattern and shift | Census of India, Primary Survey | To analyze people's engagement in economic sectors. | |
| | | | Income Levels | | To analyze paying capacity of people and affordability. | |
| | | | Non-Working Population | | Presence of employment opportunities or not in the place itself. | |
| | | | Movement for Occupation | Primary Survey | To check the location of economic opportunities and the status of Living-Working Relationship for the local population. | |
| | | | Land Values, Property Values, Rental Value | Property Dealers | To check whether affordability issue is responsible for moving people from Chandigarh or not. | |
| | | | Tax Collection | Municipal Council, ULBs | Tax paying area and quantity, further to analyze the amount of unauthorized developments in the place. | |

Table 1.9 Continued

| Sl. No. | OBJECTIVES | ASPECT | | DATA REQUIRED | SOURCE OF COLLECTION | PURPOSE OF STUDY / ANALYSIS | LITERATURE SEARCH |
|---|---|---|---|---|---|---|---|
| 1 | The Process of Urban Transformation at Peripheral Towns - Causes & Consequences Analysis | **Spatial** | | | | To analyze the growth pattern, change in land-use with time, dense / sparse built-fabric - the degree of sprawl, the sufficiency of open spaces, conversion of agricultural lands for property developments, the amount of un-used lands and finally the overall character / imagibility of the place. | 1. Reports from various Departments of Punjab Govt. |
| | | | Land | Land Development Pattern | Field Observation, Google Earth Observations | | |
| | | | | Built-Up Land & Agricultural Land | Greater Mohali Regional Plan - 2008-2058 | | |
| | | | | Land Conversion | | | |
| | | | | Dead Pockets of Land | Municipal Council, ULBs | | |
| | | | Fabric, Land-Use, Density, Built-Form, Character, Built-Open etc. | Land-Use | Municipal Council, ULBs | | |
| | | | | Built-Open Ratio, Density | Google Earth Analysis | | |
| | | | | Distribution of Built-Form, Character | Field Observation | | |
| | | **Housing** | | Housing Need, Demand & Supply, Shortage | Greater Mohali Regional Plan - 2008-2058 | Will help to analyze the demand for housing for which majorly people may have shifted to this place and whether that is fulfilled or not. Further, to analyze the user satisfaction from their habitat. | |
| | | | | Location of Unauthorized Developments and Density | Field Observation, Municipal Council, ULBs | | |
| | | | | Liveability - User Satisfaction of Present Housing Condition | Primary Survey | | |
| | | | | Affordability | | | |
| | | | | Govt. & Private Sector Investments | Punjab Urban Development Authority (PUDA) | | |
| | | **Transport** | | Road Hierarchy | Greater Mohali Regional Plan - 2008-2058, Primary Survey and Punjab State Transport Corporation (PSTC) | To analyze the development pattern related with transport aspect, the increasing congestion and status of public transport. | |
| | | | | Public Transport (Route, Number / Day, Capacity and Users) | | | |
| | | | | Vehicular Count | | | |
| | | | | Daily Avg. Travel Time | | | |
| | | **Physical Infrastructure** | | Water Supply - Source, Demand & Coverage | Municipal Council, ULBs | To analyze the sufficiency of Physical Infrastructure and increasing demand with time. | |
| | | | | Sewerage - Demand and Coverage | | | |
| | | | | Solid Waste - Demand and Coverage | | | |
| | | **Governance** | | Administrative Bodies | Dept. of Housing & Urban Development, Govt. of Punjab, Punjab Model Building Bye-Laws, 2010 | To check FAR restricting / favouring growth, future plans related with, land management to reserve necessary amount of agricultural lands. | |
| | | | | Building Bye-Laws | | | |
| | | | | Jurisdiction Conflicts | | | |
| | | | | Development Controls | | | |
| | | | | Land Management Policies | | | |

Table 1.9 Continued

| Sl. No. | OBJECTIVES | ASPECT | DATA REQUIRED | SOURCE OF COLLECTION | PURPOSE OF STUDY / ANALYSIS | LITERATURE SEARCH |
|---|---|---|---|---|---|---|
| 2 | Factors / Determinants of Peripheral Development around Chandigarh | **Location and Regional Setting** | Neighbouring Cities, States and Regions | Draft Chandigarh Master Plan - 2031, TCPO, Chandigarh | Will help to understand regional importance of Zirakpur as emerging growth node in expansion of the City of Chandigarh. | 1. Draft Chandigarh Master Plan - 2031,<br>2. Greater Mohali Regional Plan - 2008-2058,<br>3. Punjab New Capital (Periphery) Control Act, 1952,<br>4. Punjab Regional Town Planning and Development (Amendment) Act, 2006,<br>5. Punjab Model Building Bye-Laws, 2010. |
| | | | Area, Population and Regional Connectivity | Census of India | | |
| | | **Administrative Boundaries** | Boundary for Periphery, Area | Draft Chandigarh Master Plan - 2031 | For this specific context, to find out the areas of common interest, this study is necessary. | |
| | | | Planning Area Boundary, Area | | | |
| | | | Municipal Boundary, Area | | | |
| | | **History of Settlement and Evolution** | History of Settlement and Evolution | Draft Chandigarh Master Plan - 2031 | Will help to understand the basic city structure and pattern of expansion. Further, to analyse whether the emerging pattern is in tune with the planning philosophy of Chandigarh or not. | |
| | | | Population of City and its Periphery areas (UA) - 1981 - 2011 | Census of India | | |
| | | | Chronological Periphery Development - Spatial Growth since 1981 | Greater Mohali Regional Plan - 2008-2058 | | |
| | | **Growth Pattern - Land, Land-Use, Density** | Change of Land-Use in and around Chandigarh | Draft Chandigarh Master Plan - 2031 | The details will help to understand the reasons behind the peripheral expansion. Whether the present status of Chandigarh Planning is facilitating the need for all or not? The expansion is natural or forced? Will be answered by the details. | |
| | | | Change in Density, Urban Form, Character and Image | | | |
| | | **Housing** | Housing Need, Demand & Supply, Shortage | Dept. Of Housing & Urban Development, Govt. Of Punjab, Draft Chandigarh Master Plan - 2031 | | |
| | | | Location of Unauthorized Developments and Density | TCPO, Chandigarh, Google Earth Observations | | |
| | | | Affordability, Govt. & Private Sector Investments | TCPO, Chandigarh, Property Dealers | | |
| | | **Regulations / Acts governing City Growth and its Periphery** | Development Control for City and Periphery | Dept. of Housing & Urban Development, Govt. of Punjab, Punjab Model Building Bye-Laws, 2010 | For this specific context, Governance is one key factor to study due to presence of no. of states around the UT. Mainly to understand what has been done so far for a sustainable growth in peripheries and what are the lacks in policies due to which the present inorganic pattern of periphery development is emerging. | |
| | | | Building Bye-Laws in support of Accommodation Reservation, FAR etc. | | | |
| | | | Land Management Policies, specific to periphery control | Punjab New Capital (Periphery) Control Act, 1952, Punjab Regional Town Planning and Development (Amendment) Act, 2006 | | |
| | | | Governance of City and Periphery | TCPO, Chandigarh | | |

Table 1.9 Continued

| Sl. No. | OBJECTIVES | ASPECT | DATA REQUIRED | SOURCE OF COLLECTION | PURPOSE OF STUDY / ANALYSIS | LITERATURE SEARCH |
|---|---|---|---|---|---|---|
| 3 | Formulating Peri-Urban Settlement Typology | **Issues as evolved from Analysis of above** | - | - | To take necessary approach and strategies for future developments. | 1. International cases, where appropriate approach and strategies have taken and under experiment. |
| | | **Demarcating Periphery** | Approach to demarcate periphery | Literature Study and Case Studies | | |
| | | | | | | |
| 4 | Futuristic Model for Prediction & Policy Implication | **Governance** | Policy for Periphery | Analytical Outputs | Policy level intervention is extremely required for this case specific due to its location (overlapping jurisdictions, areas of common interest). | 1. International cases, where appropriate approach and strategies have taken and under experiment. |
| | | | Growth Management Solutions through Broad Guidelines | | | |
| | | **Spatial** | Model to predict for future using inputs of variables | | To demonstrate planning strategy envisioned for the place. | |
| | | | Extended Area Master Plan / Regional Plan (Conceptual) as per proposed hierarchy | | | |
| | | | | | | |

Source: Author, 2014

## 1.6. Concluding Remarks

This chapter presented the concept of Peri-Urban Interface, where the aspects of urban growth and emergence of a new realm – peri-urban, is described. Considering the present urbanization trends in India, the existing Rural Urban Classification (RUC) system is questioned. The major reason behind peri-urbanization – Migration scenario is elaborated here. With reference of this preliminary study, the need to understand the sprawl dynamics – the process of urban transformation at peri-urban areas, its causes and consequences, the need to formulate peri-urban settlement typology and finally the need to evolve a futuristic mathematical model for prediction of peri-urbanization; is established and research methods and stages are derived accordingly.

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# CHAPTER 2. LITERATURE REVIEW

## 2.1. Introduction

This chapter on Literature Review will study, understand and analyze the earlier research / works done till date on the present nature of urbanization at which the concept of "Peripheral Development" has evolved, its definition as established till date, historical existence of such phenomenon, related planning theory, legislations / acts / regulations evolved to govern peri-urban area planning, peri-urbanization around Indian cities at present scenario and inferences out of these. The outcome will help to critically review the case of Chandigarh & its periphery and formulate appropriate planning strategies accordingly.

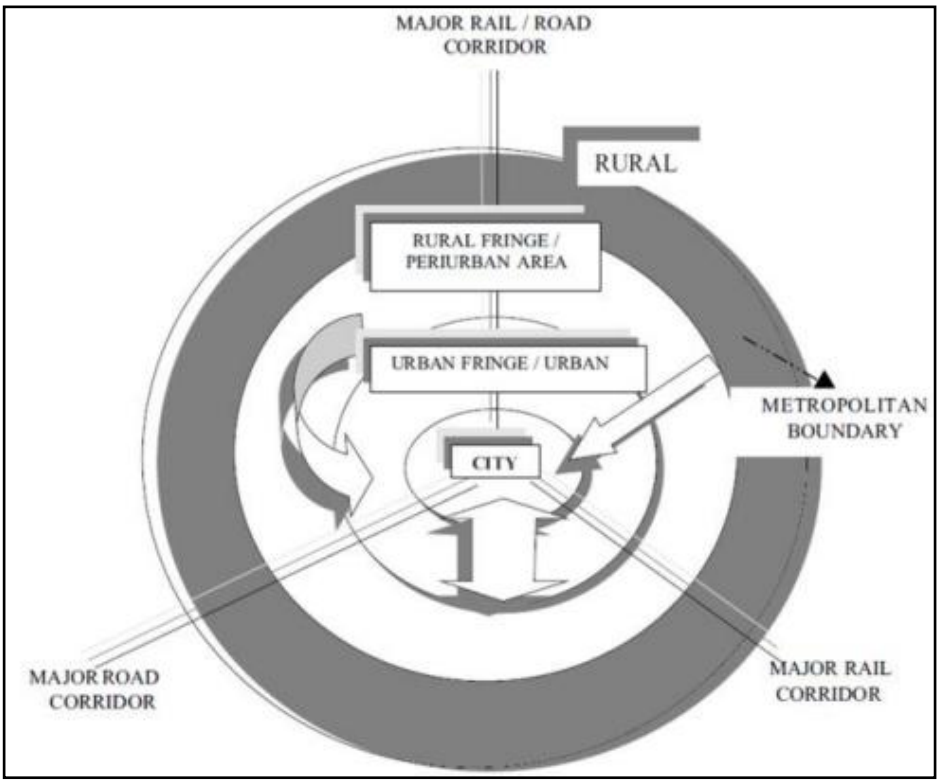
## 2.2. Literature Review

### 2.2.1. Concept & Definition: City Periphery / Peri-Urban Area / Fringe / Sprawl

The term **'Periphery'** has been used frequently in literature and policy discussions but definitions employed are situational and case specific. The concept of periphery has been imprecisely defined and also the term is used interchangeably with numerous other terms like fringe, peri-urban area, transitional zone, sprawl, outlying areas, outgrowths, rurban, suburbs etc.

The term **'Periphery'** is mostly referred to an area, which lies outside formal urban boundaries and urban jurisdictions and accommodates the spillover developments of the core cities. It can also be classified into inner periphery (urban edge) and outer periphery (rural edge). The simplest definition of 'Peri-Urban' areas refers to the settlements beyond, about or around cities. These areas accommodate the spillover developments of the core cities. Peri-urban areas are in some form of transition from strictly rural or urban. These areas often form immediate urban rural interface and may eventually evolve into being fully urban.

Figure 2.1: Concept of formation of a peri-urban area




Source: Working paper on "Sustainable settlements in peri-urban areas," Division of urban systems development,
Anna University (ANNA), Chennai, India.

The term **Peri-Urban** has been described in dictionary of Urban and Rural Planning as a defined area bordering a city characterised by a mix of urban and rural forms and functions. As per New Zealand Parliamentary Commission for Environment, peri-urban areas are in some form of transition from strictly rural to urban. These are the transitional zones between Countryside and city. They can also be defined as a place, concept or process. These are mainly the area outside Municipal boundary of the mother city, which is under transition from rural to urban and from where people commute to the mother city for employment, business, education and use of other facilities and services. The majority of them are on the fringe of established areas. They have significant ecological, bio-diversity, land and cultural heritage values. These areas may be within the planning areas, but outside the administrative boundaries of the cities.

The peri-urban areas record staggering growth rate of population during inter-decennial periods. The land value is relatively cheaper. Therefore, middle and lower middle class families, conscious about cost, settle in these areas. This

also helps them to get away from the cramped, congested and polluted city environment.

The Peri-Urban settlements and the core cities have very strong interactions, interdependence and interrelationships. The Peri-Urban settlements are always at the receiving ends. They are the source of resources needed for the city. In turn, the cities let out highly polluted effluents and sewage into them. The Peri-Urban areas supply all the essential daily requirements such as milk, vegetables etc. to the cities. However, cities use them as dumping grounds for solid wastes.

**Fringe area** may be defined as that area outside the central city which has a strong functional, economic, social linkage with the central city and is characterized by higher degree of interaction between the city and its surrounding areas. It is a transitional belt around the main urban developed area where both urban and non-urban functions exist side by side. 'Smith' recognized the built up area outside the municipal limits as urban fringe. 'Andrew' defines it as the adjacent peripheral zone of characteristically agriculture and characteristically urban land use structure obtained in an area. 'Cater' considers it as an area with distinctive characteristics which is only partly accumulated into growing urban complex, which is still partly rural and where many of the residents living in the country are not socially and economically part of it.

On ground where the city municipal limits end, the fringe begins. There is no separate administrative unit for the fringe neither do urban, rural or regional land uses have a category as a fringe. If fringe is a transitional zone, then the fringe today would be core of the city tomorrow. Hence, there is no static fringe and therefore there can be no static delineation. It would be a part of the overall city dynamism. Hence, we need to plan not only the urban area, but the periphery as well.

The term **'Urban Fringe'** as per Smith (1937) refers to the built up area outside the Municipal limits. As per Krishirsagar J.B., it is the area which is adjacent and touching the municipal boundary having direct impact of urbanization and experiencing rapid pace of transformations. Also beyond the 'Urban Fringe', rural fringe is encountered and as the city expands, urban fringe is included in the Municipal limits.

The term **Urban Sprawl** refers to the growth of a metropolitan area through the process of scattered development of miscellaneous types of land use in isolated locations on the fringe, followed by gradual filling in of the intervening spaces of similar use. It may also be related to increase in built up area and

paved areas with impact like loss of agricultural land and its conversion to non-agricultural land, loss of other types of open spaces, loss of unprotected ecologically sensitive areas or may be equated to horizontal expansion of city/town. It is the unplanned growth of urban centres along periphery of city, in the urban fringe of peri-urban area, at the edge of an urban area or along highways.

Another term which could be related to the concept of core and periphery is **"Urban Agglomeration"** coined by Census of India. The concept of Urban Agglomeration introduced in 1971 defines U.A. as a *"continuous urban spread constituting of a town and its adjoining urban outgrowths (OGs). Also two or more physically contiguous towns together with any adjoining urban outgrowths of such towns is termed as an urban agglomeration"* (Census of India, 1971).

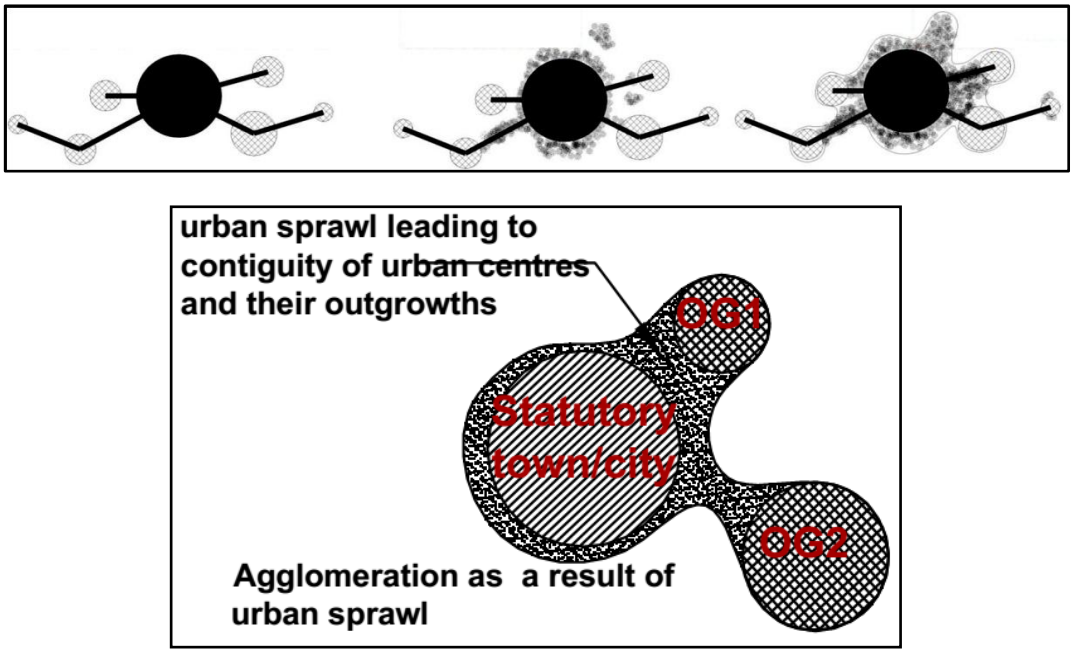
In some cases railway colonies, university campuses, port areas etc. may come up near a city or statutory town outside its statutory limits but within the revenue limits of a village or villages contiguous to the town or city. Each such individual by itself may not satisfy the minimum population limit to qualify it to be an independent urban unit but may deserve to be clubbed with the town as a continuous urban spread. For purpose of delineation of Urban Agglomerations during Census of India 2001, following criteria was adopted:

- *"Core town or at least one of the constituent towns of an urban agglomeration should necessarily be a statutory town and*
- *Total population of all the constituents (i.e., towns and outgrowths) of an Urban Agglomeration should not be less than 20,000 (as per 199 Census).*

*With these two basic criteria having been met, the following are the possible different situations in which Urban Agglomerations would be constituted:*

- *A city or town with one or more contiguous outgrowths / Two or more adjoining towns with their outgrowths*
- *City and one or more adjoining towns with their outgrowths all of which form a continuous spread"* (Census of India, 2001).

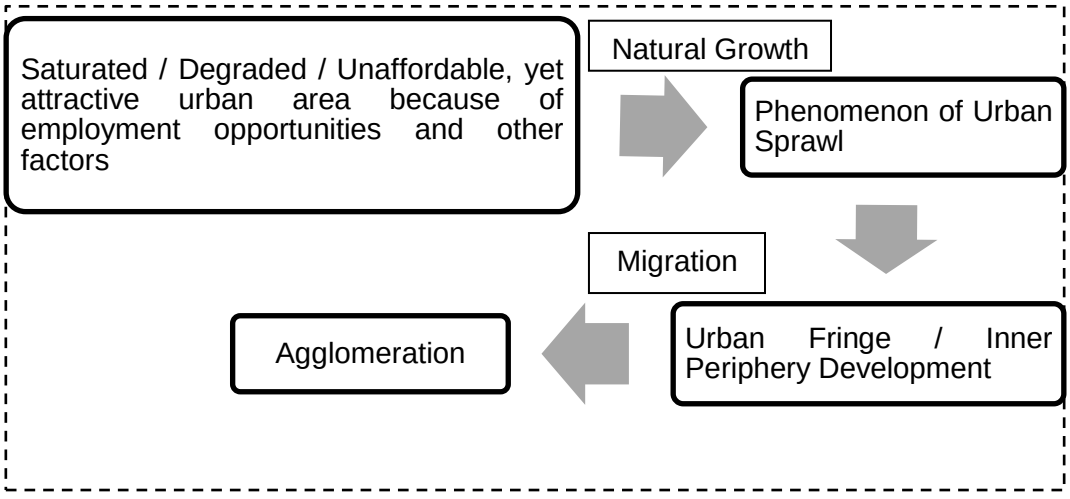
Figure 2.2: Concept of formation of an urban agglomeration




Source: Author, 2015

The following conceptual diagram establishes the relationship between the different terms which are inter-changeably used with the term 'Periphery'.

Figure 2.3: Concept of urban sprawl leading to peripheral development and urban agglomeration




Source: Author, 2015

In this context, it is also relevant to discuss the related terminologies and considerations, mentioned in **UDPFI & URDPFI Guidelines**. Taking into account the not so efficient capabilities of the urban local authorities vis-a-vis the provisions of the Constitution (74$^{th}$) Amendment Act, 1992; the deficiencies in the Master Plan approach as identified during the National Workshop on this subject held at Delhi in 1995 and the current policy of economic liberalisation, the need is felt to assist the administrators, municipal town planners and the consultants with Guidelines for Urban Development Plans Formulation and Implementation (UDPFI). During 1995, a National Workshop on Master Plan Approach: Its Efficacy and Alternatives was held, which examined the entire process of urban development planning and implementation and as a recommendation of this Workshop, the first national level planning guidelines 'Urban Development Plans Formulation and Implementation' (UDPFI) were framed in 1996 by Institute of Town Planners, India. UDPFI Guidelines, 1996 provided a framework for plan preparation and implementation process. However, **UDPFI Guidelines consider classification of Urban Centres as Small Town, Medium Town and Large City, on the basis of population only.** The scenario of a large / medium town along with its adjoining peripheral developments as a whole is never been considered to understand, analyze the dynamics of their developments and hence planning proposal can be made accordingly.

Since 1996, many developments have taken place in the field of urban planning, especially in view of emerging needs and requirements of urban settlements due to rapid population growth, globalization of economy and phenomenal advances in information and communication technologies. The towns and cities have become more dynamic in nature and are subject to unprecedented changes in terms of requirements of infrastructure and other basic services/amenities. Besides, new emerging aspects like regional development, inclusive planning, sustainable habitat, land use and transport integration at planning stage, Service Level Benchmarks, disaster management concepts, and governance reforms have given a new dimension to the planning process. To address these emerging aspects, it was felt that the revision of the UDPFI Guidelines should be taken up. The 'Urban and Regional Development Plans Formulation and Implementation Guidelines (URDPFI)', 2014 were conceptualized.

URDPFI Guidelines, 2014 gives a focus to Non-Statutory Towns, as it was noticed that the number of statutory towns has increased marginally, by 6.4 per cent only, whereas the number of non-statutory towns has gone up by 186

per cent. Obviously, new towns are developing very fast, but, being not notified as a town, these are kept out of the purview of planned spatial development and become prone to haphazard growth. This would call for a serious effort to introduce the principles of the URDPFI Guidelines to even non-statutory towns, preferably in a regional set up, wherein the spatial plans for such towns are prepared in conjunction with that of the main cities, to which these are generally the satellite towns. In this reference, in the part of 'Classification of Urban Settlements', it mentions that **Small towns can be referred as 'transitional towns'** mentioned in the 74th CAA where a Nagar Panchayat (as a municipality) is to be formed for an area in transition from a rural area to an urban area. Agglomeration of urban nodes along with its peri-urban and rural areas are currently observed in the Metropolitan cities II (like in Chennai, Bengaluru, Hyderabad, Ahmedabad) and in Megapolis. However, 'Conurbation' of settlements is on much larger scale, which may develop accounting for population more than 5 Crore and with adjoining several large cities and few metropolitan cities. **UDPFI Guidelines, 1996 gives focus only towards Statutory Towns. There was no mention about the peripheral developments around a large or medium city. In that comparison, URDPFI Guidelines, 2014 mentions the significance of consideration of 'transitional towns'. However, no specific development guideline or planning framework for these emerging transitional areas are elaborated in URDPFI Guidelines, 2014.**

**Inferences:** It has been observed that a number of terms are used inter-changeably with periphery but none of them have any legal support. Urban agglomeration defined by Census of India is the only term with legal basis, which can be used for comparative analysis of different settlements in the next section.

The various terminologies, similar with the phenomenon of Peri-Urbanization are summarized here, in the table below (Table 2.1).

Table 2.1: Comparative Study of Terminologies related to Peri-Urbanization

| Sr. No. | Terminology Used in Diverse Countries Pertaining to Peripheral Developments around Cities | Definition | Source |
|---|---|---|---|
| 1 | **Rural-Urban Fringe** | The rural–urban fringe, also known as the outskirts or the urban hinterland, can be described as the "landscape interface between town and country" or also as the transition zone where urban and rural uses mix and often clash. Alternatively, it can be viewed as a landscape type in its own right, one forged from an interaction of urban and rural land uses. Its definition shifts depending on the global location, but typically in Europe, where urban areas are intensively managed to prevent urban sprawl and protect agricultural land, the urban fringe will be characterized by certain land uses which have either purposely moved away from the urban area, or require much larger tracts of land. | 1 |
| 2 | **Outskirts** | Same as Rural-Urban Fringe | 1 |
| 3 | **Urban Hinterland** | Same as Rural-Urban Fringe | 1 |
| 4 | **Urban Sprawl** | Urban sprawl or suburban sprawl describes the expansion of human populations away from central urban areas into low-density, mono-functional and usually car-dependent communities, in a process called 'Suburbanization'. In addition to describing a particular form of urbanization, the term also relates to the social and environmental consequences associated with this development. **In Continental Europe the term "Peri-Urbanization" is often used to denote similar dynamics and phenomena, although the term urban sprawl is currently being used by the European Environment Agency.** | 2 & 3 |
| 5 | **Urban Edge** | An Urban Edge is the border between a city or suburb and its surrounding environment, often defined by the boundary of urban infrastructure, such as sewers, or by a sharp contrast in density or the built environment. | 4 |

| | | | |
|---|---|---|---|
| 6 | **Urban Agglomeration** | Urban Agglomeration is defined as "Cluster of cities", "an aggregate of cities", "New form of integrated urban-rural (Desakota) combination" (as defined by different planners). In India, Census defines Urban Agglomeration as a continuous urban spread constituting a town and its adjoining outgrowths (OGs), or two or more physically contiguous towns together with or without outgrowths of such towns. An Urban Agglomeration must consist of at least a statutory town (all places with a municipality, corporation, cantonment board or notified town area committee, etc.) and its total population (i.e. all the constituents put together) should not be less than 20,000. | 5 & 6 |
| 7 | **Peri-Urban** | Peri-Urban (similar to the terms 'Rurban space', 'Outskirts', 'Hinterland'), is defined as the interface between town and country, refer to the rural-urban transition zone where urban and rural uses mix and often clash. Its definition shifts depending on the global location, but typically in Europe, this is similar to Urban Sprawl. The word originates from the French word "Peri-urbanization", which is coined by INSEE (The French Statistics Agency), to describe spaces between the city and the countryside, are shaped by urbanization of former rural areas in the urban fringe. | 7 |
| 8 | **Semi-Urban** | A semi-urban area is between urban and rural, or partly urban. More similar with Peri-Urban. | 7 |
| 9 | **Outgrowth** | Outgrowth (OG) is defined in the definition of Urban Agglomeration (UA) by Census of India. Outgrowth is the smaller towns / the urban spreads within an UA. | 6 |
| 10 | **Satellite Town** | A satellite town or satellite city is a concept in urban planning that refers essentially to smaller metropolitan areas which are located somewhat near to, but are mostly independent of larger metropolitan areas. Satellite cities are small or medium-sized cities near a large metropolis, those are at least independent from that metropolis economically and socially, are physically separated from the metropolis by rural territory or by a major geographic barrier such as a large river; satellite cities should have their own independent urbanized area, or equivalent. Satellite Towns differ from Suburbs / Peri-Urban / Urban Sprawl etc. especially due to their independence of the parent city. | 8 |

Sources: 1. https://en.wikipedia.org/wiki/Rural%E2%80%93urban_fringe; 2. Batty, Michael; Besussi, Elena; Chin, Nancy (November 2003). "Traffic, Urban Growth and Suburban Sprawl" (PDF). UCL Centre for Advanced Spatial Analysis Working Papers Series. 70. ISSN 1467-1298; 3. https://en.wikipedia.org/wiki/Urban_sprawl; 4. http://www.fractalcities.org/book/fractal%20cities%20chapter%205.pdf (Author: M. Batty, 1994); 5. https://www.sciencedirect.com/science/article/pii/S0169204617300439; 6. http://censusindia.gov.in/; 7. http://www.insee.fr/fr/methodes/default.asp?page=definitions/couronne-periurbaine.htm; 8. https://en.wikipedia.org/wiki/Satellite_town.

Source: Author

### 2.2.2. Planning History: Origin & Evolution of Urban, Rural & Peri-Urban Developments, An Overview

#### a) Origin & Evolution of Settlements

The origin of settlements can be traced about 4 million years back. The human life was lived in forests and had a hard existence until the early civilizations began approximately 8500 years ago. Sjoberg (1965) notes that *"the different levels of human organisation characterised by technological, economic, social and political patterns, are the factors that aided the origin and evolution of cities before the modern epoch of urbanisation".*

During the very initial time, the human society was not urban and educated, the only occupation was huntering and they lived with little or no surplus food and other resources. The society was simple and had no class structure. Gradually, the human society had become little complex by creating village settlements, constituting certain nos. of population. Humans become involved into cultivation, evolved agriculture-based economy and gradually the communities started supporting the population with more food, surplus resources for living. As stated by Sjoberg (1965), *"With the knowledge of cultivating plants, lighting fire, inventing wheel, making tools, humans advanced by leaps and bounds. This second level of human organisation is attributed to the knowledge of humans to cultivate thereby creating a surplus of food. This pre-industrial civilised society is also characterised by the art of writing to make inscriptions, maintain and record law, literature, and religious beliefs and the ability to harness energy from wind and water sources for sailing in seas to grinding grains to make use of water power".* Approximately around 2500 years BCE, the first urban scenario came into history through towns like Harappa and Mohenjo-daro. Till 500 years BCE, all such urbanization evolved mostly along the rivers. The cities we see in history in India, Mesopotamia, Egypt, China, all emerged in the river valleys. Later, due to development of various religious beliefs, the settlements had taken shape in a different way. The cities had expanded gradually, different reins of kingdoms appeared, humans started harnessing the natural resources in an abandoned manner. With technological innovation, the post-industrial cities evolved, which can be featured by their increasing literacy rate, existence of class in society, tremendous dependence on technology, mass production from industries etc. As noted by Sjoberg (1965), *"The post-industrial revolution cities was characterised by mass literacy, a fluid class system and the tremendous technological breakthrough to new sources of inanimate energy that sustained*

*the industrial revolution from the third level of complexity in the human organisation".*

Due to such industrial growth, technological innovations; the next level of growth of towns and cities happened in the 18th and 19th century. *"The developments during the industrial revolution between 1750 and 1830 CE transformed most of north-western Europe from a largely rural and agrarian population to a town-centric society engaged increasingly in factory manufacture, trade and commerce. The post industrial revolution era also saw the enormous upsurge in people moving from rural to urban settlements"* (Harris, 2005). Urbanization became faster as the major portion of Europe became industrialized. Urbanization was perceived in the fast developed countries, as the direct impact and consequence of industrial revolution, technological innovations. However, the impact of industrial revolution over development was noticed in case of advanced countries only. The urbanization scenario in the developing and under-developed countries was poor till the mid 19th century. In the late 19th and 20th century, in the developing countries, there was a steep rise in the rate of urbanization. Over the last few decades, the overall number of cities and urban agglomerations has increased at a large. Such massive change in urbanization scenario has come up not only due to industrialization or globalization, but also because of gradual decrease of agricultural production, less scope or option of livelihood in rural areas resulting into migration of large volume of population to urban areas.

As stated by Grubler, (1994); *"In industrialised countries the growth of urban population is comparatively modest as population growth rates are low and over 80 percent of their population already live in urban areas. Conversely, developing countries with higher growth rates are in the middle of a transition. The exceptional growth of many urban agglomerations in many developing countries is the result of a threefold structural change process: the transition away from agricultural employment, high overall population growth, and increasing urbanisation rates".* The problem of urbanization is different in developing countries in terms of its nature or form from the developed countries. Like for developed countries, the problem of peri-urbanization needs to be addressed by strategy for reducing gap between demand and supply of urban transport, land-use management, environmental protection, energy optimization etc., whereas the developing countries need to deal with few additional aspects like rise of urban poverty, continuously increasing urban population, increasing numbers of slums or squatter (informal) settlements at the city peripheries. In

such context, this study and research is formulated on peri-urban interfaces, which needs attention and importance to resolve its issues.

### b) Terminologies – "Urban Areas" & "Urban Growth"

The parameters to define an urban area are conventionally measured from the number of houses, population density, involvement of population in non-agricultural activities, provision of urban services etc. *"The term 'urban' has its origin from the Roman word Urbanus, which adopted the meaning 'city dweller' in Latin"* (Shashidhar, H., 2001). This definition of an urban area varies from one country to another country, with respect to the criteria chosen to define it. As stated by Shashidhar, (2001); *"Some countries define an urban area as any place with a population of 2,500 or more while some other countries set a minimum population of 20,000 as a criterion. In general, there are no universal standards and therefore each country develops its own set of criteria for recognising urban areas. In India, an area is designated as urban if the population is more than 5000 with a population density of more than 400 persons per sq. km and at least 75 percent of the population is involved in non-agricultural occupations".*

As per UN Population Division data of 2007; the growth rate of urban population in India is 2.35% per annum from 2000 to 2005. As found from the report of UN, 2004; the projected scenario for urban population in India can be 28.3% in 2003, which may increase upto 41.4% by 2030. As data found from report by Census of India, 2001; *"By 2001, there were 35 urban agglomerations (cities having a population of more than one million), as compared to 25 urban agglomerations of 1991. This increased urban population and growth in urban areas is inadvertent due to an unpremeditated population growth and migration. Urban growth, as such is a continuously evolving natural process due to growth of population (birth and death). The number of urban agglomerations and towns has increased from 3697 in 1991 to 4369 in 2001".* The data shows that among the 4000 plus UAs, around 38% of their population live in only 35 urban areas, which directly indicates the kind of density in urban areas, the thrust of centralised growth and the overall urbanization scenario.

### c) Urbanization & Peri-Urban Growth

*"Urbanisation is a form of metropolitan growth that is a response to often less understood implications of technological, economic, social, and political forces and to the physical geography of an area"* (Shashidhar, H., 2001).

Presently, a tremendous transformation is seen in Indian economy. Indian economy which was majorly agriculture-based (around 70% population lived in rural areas, generating 28% of GDP), has transformed to service-based economy in this globalized era (around 30% population lived in urban areas). Due to better job opportunities and facilities & amenities related to urban lifestyle, urbanization is increased at a large, facing expansion of cities to accommodate the migrant population. Urbanization was never observed as a threat to the environment and developmental scenario. But today's urbanization, which is happening in unplanned manner, the peripheral expansion of cities, which creates impact over land-use of the region, as a whole the urbanization which leads towards a great loss of fertile agricultural lands; that raises the main concern. Thus, it is the need of the hour to study and resolve the implications of such unplanned, haphazard urban expansions leading to peri-urbanization.

As explained by Totzer, 2008; *"Towns and cities are expanding in certain pockets with a change in the land-use along the highways and in the immediate vicinity of the cities due to ad hoc approaches in regional planning, governance and decision-making. This outgrowth along highways and roads connecting a city and in the periphery of the cities is caused by the uncontrolled and uncoordinated urban growth. This dispersed development outside compact urban and rural centres that is along highways and in rural countryside is referred to as peri-urban. This generally refers to some type of development with impacts such as losses of agricultural lands, open spaces, and ecologically sensitive habitats in and around the urban areas. These regions lack basic amenities due to the unplanned growth and lack of prior information and forecasts of such growth during policy, planning and decision-making".*

Peri-Urbanization engulfs villages into its expansion areas, transforms village areas into small towns and then towns into cities. It appears as a phase of development. In such scenario, to provide basic infrastructure, understanding of Regional Planning is required. In majority of the cases, there are lot of insufficiencies to understand the nature of unplanned growth. As there is a lack of effective planning and management, coordination among stakeholders, integrated decision-making and forecasting inability to visualize the peri-urban growth; the entire region lacks tremendously the basic services like water supply, electricity, sanitation etc. and as a result, this leads to affect the environment and deteriorates the quality of life, built environment and becomes a threat towards sustainable habitat.

**d) Urban Governance & Planning**

The main organisational body, which represents the citizens of any urban area, is the elected Urban Local Body. Apparently, in India, there is an Urban Local Body for all the Census declared towns and cities. For the Metropolitan cities, as a governing body there is a Municipal Corporation along with its nearby Municipal Councils, together which form a large area of an Urban Agglomeration. The 73rd and 74th Constitutional Amendment Acts were introduced to make it mandatory that Urban and Rural Local Bodies will be formed to govern, manage urban and rural areas as well as they will be responsible to prepare the Master / Development Plans for those areas. As mentioned by Narain, Anand and Banerjee, 2013; *"..... Planning in the form of land-use zoning is undertaken for the metropolitan region while their regulation is vested with a parastatal agency. Significant administration and decision-making in these areas with regard to delivery of various services rests with other parastatal organisations. Apart from the urban local bodies represented by the local elected representatives, all other organisations responsible for essential services are parastatal bodies controlled by the State governments. Thus, there exist striking contrasts with respect to devolving powers to the respective urban local bodies by the State governments much against the policies of Central government".*

A planned regulated development in any urban area is only possible, if the Master Plan / Development Plan for that area is effectively placed for implementation. Since independence, approximately 1200 Master Plans / Development Plans have been prepared for small towns to large cities in India, however the implementation of those plans are not so satisfactory because of several reasons. Ineffective implementation of Master Plans results into emergence of slums, illegal and unplanned development, deterioration of environmental quality and issues related with transportation within and around the urban centres. Another critical aspect is that these plans are having limitation in terms of forecasting capabilities and are not able to simulate the future scenario, so that prior planning and policy change can be done accordingly. Further, these plans mainly stand for land-use demarcation with minimal regulation for its proper implementation. Additionally, there is very less effort from the planning agencies / authorities and other stakeholders in city administration and development in terms of coordination among them to integrate different departmental works like transport, water supply, sanitation etc. in the mainstream planning process. As stated by Narain, Anand and Banerjee, 2013; *"..... This*

*result in, organisations involved or catering to different services (transport, health, water, energy, etc.), work in disintegration to address basic amenities. Lack of coordination among many agencies has led to unsustainable use of land and other resources and also uncoordinated urban growth".*

*"From the observation and analysis of the practices in urban governance, the operation plans drawn are ineffective in addressing smooth coordination with other agencies concerned with delivery of services. Essentially much of the chaos is contributed due to the disengagement with the planning organisation and the organisation involved with daily operations. A stark contrasting fact with the planning organisation is its lack of acknowledgement of any city functions: mobility, jobs, economy, energy, etc. The planning organisation on the one hand is focussed on land-use plans and its regulation alone, accepting supplements of integrating land-use with transportation for enhancing mobility. On the other hand, the local administration has to resolve overnight about daily operations management with little realisation on the implications of the planning organisation ignoring the city functions"* (Narain, 2009).

As there are several organizations responsible to address various civic functions, hence there should be interdependencies among them to execute the plans properly. The possible solution towards effective city management is to facilitate systems for proper coordination among several stakeholders. *".... Essentially the interplay of these organisations involved with different city functions has to be acknowledged and bridged from short-to-medium (5 to 10 years) time frame planning undertaken by development authorities to near-to-short term operations undertaken by City Corporations".* Therefore, it is very important to relate the short-term planning with long-term planning done by planning and development authorities, so that the nearby future issues can be resolved. In this context, it is also significant that planning and governance should address local as well as regional issues, with provision of adequate physical and social infrastructure at both the levels.

As identified by Narain, 2009; *".... Much of the urban growth is normally attributed to migration of people from other places. Migration takes place mainly due to uncertain employment in rural areas where the majority relies on agriculture, which is dependent on unpredictable monsoons. In the absence of effective rural-employment guarantee schemes and prevalent macro-economic initiatives, catering to urban areas further fuel rural-urban migration with some formal or informal employment in the offing. Thus, for certain critical issues planning and governance cannot confine itself even to limited boundaries of the*

*urban area, but acknowledge conditions and factors to address and plan effectively at a regional level".*

**e) Policies and Programs for Urban Areas**

As per the Report from Ministry of Urban Development, 2005; it states that, *"... Traditionally, the policies of urban development have been focussed on addressing the lack of housing and delivery of basic services due to the rise in urban population. A premise while pursuing urban policies was also that the country was predominantly agrarian and largely supported by the rural economy. These are further evident from the plan outlays under housing and urban development sector in the Five Year Plans of the Planning Commission of India. Until recently, the positive aspects of cities as engines of economic growth in the context of national economic policies were not much appreciated and, therefore, the problems of urban areas were treated more as welfare problems and sectors of residual investment rather than as issues of national economic importance".*

As quoted by Ravindra, 1989; *"... Addressing the urban areas in the initial years, focus was on land policies, later on towards delivery of basic services to urban poor, and currently on urban infrastructure and governance". "He has attempted to delineate the urban land policy in the country. Accordingly he has examined the instruments of land policy employed by the State for interventions broadly as: legal measures, fiscal measures and direct interventions. There have been intense debates and some large-scale initiatives to systematically tackle urbanisation. The first major attempt to address the urban land problems was by the Committee on Urban Land Policy. The other initiatives were through: the Task Force on Housing and Urban Development in 1985, the National Housing Policy in 1985, the National Commission on Urbanisation in 1988, the Mega City Scheme during 1993-1998, the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) from 2005 to 2012 and the National Urban Transport Policy (Ministry of Urban Development, 2006)"* (Ravindra, 1989).

As per the JNNURM Status Report, 2012; *".... The Ministry of Urban Development, Government of India, launched the JNNURM in 2005. This countrywide programme addresses renewal of urban areas for 63 cities encompassing nearly 70% of total urban population, its primary aim being to link the revitalisation of urban infrastructure with a specific agenda of institutional reforms. The total investments envisaged under JNNURM over the mission period (2005-2012) is pegged at Rs. 12,05,360 million. The key mission of this*

*programme is to support reforms-driven, fast track, planned development with focus on improving efficiency in urban infrastructure and service delivery mechanisms, through community participation and ensuring accountability of urban local bodies and parastatals towards citizens. JNNURM is made operational with two sub-missions:*

- *Urban Infrastructure and Governance (UIG)*
- *Basic Services to Urban Poor (BSUP)*

*The sub-mission on UIG focuses on major infrastructure projects for water supply, sanitation, sewerage, solid waste management, road network, urban transport and redevelopment of inner (old) city areas with a view to upgrading infrastructure therein, shifting industrial and commercial establishments to conforming areas, etc. The sub-mission on BSUP focuses on integrated redevelopment of slums combining housing, water supply, drainage, storm water drains, solid waste management, street lighting, and community halls. Realising the growing concerns of mobility and more specifically the acknowledgement of linkages of land-use planning and transportation planning, the Ministry of Urban Development, Government of India, approved the National Urban Transport Policy (NUTP) in June 2006".*

This is evident from the study of earlier attempts and works in the context of our country pertaining to planning and development of cities; that the acknowledgement or effort towards urbanization in a planned manner has evolved in India in recent days and that concern is only concentrated for major urban areas till date, the issues related to peripheral expansion of cities are completely ignored yet. Hence, this research gives importance to study peri-urbanization and attempts to resolve the issues not only through physical interventions in Master Plans, but also through policy change. ".... Understanding the sprawl processes, its dynamics and modelling provide an insight of future growth trends, which is useful for effective resource utilisation and infrastructure planning. The efficiency of urban settlements largely depends on how well they are planned; how well they are developed economically and how efficiently they are managed. Management of urban sprawl entails quantifying the pattern of sprawl and capturing the processes requires analysis of causal driving factors. This requires understanding and visualisation of the consequences of policies, local planning and administration on sprawl, like lack of effective public transport system with varying work-home distances, giving rise to independent motor vehicles and the resultant congestion and spatial expansion. This necessitates an integrated regional planning system for managing sprawl. It is thus essential to

undertake a study to understand the dynamics of sprawl and evolve a Regional Planning System" (Dutta, 2012).

### 2.2.3. Studies on Planning Theory and Model for Peri-Urban Development

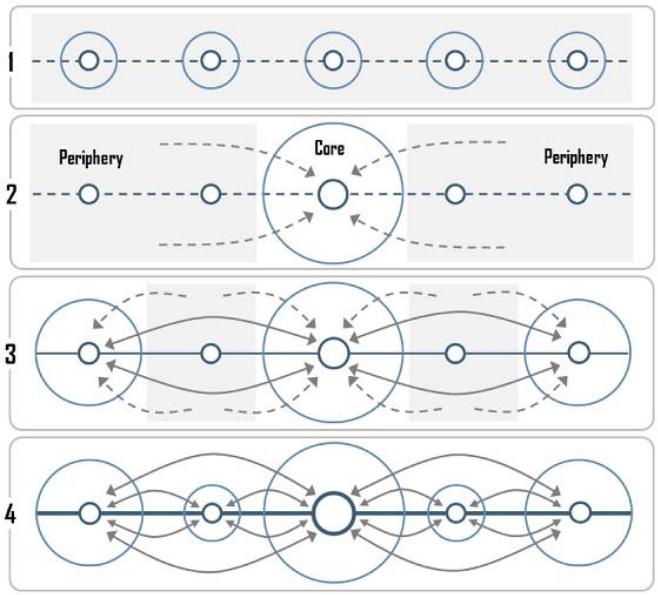
#### a) Conventional Core-Periphery Model of Development, Friedmann – 1842

The conventional core-periphery model of development tries to represent the emergence of an regional urban system in four major stages which goes on par with the development of regional transport systems. From an initial process that favours the setting of spatial inequalities, these are eventually reduced and a functionally integrated urban system emerges. The following stages have been identified in the Core-Periphery Model of Development:

- **Stage 1 (Pre-industrial):** The pre-industrial (agricultural) society, with localized economies and a small scale settlement structure. Each settlement is fairly isolated, activities are dispersed and mobility is low. There are limited differences.
- **Stage 2 (Transitional):** The concentration of the economy in the core city begins as a result of capital accumulation and industrial growth. The specific reasons behind this concentration is often not too clear, location (better access) being a significant factor, but the fact remains that a dominant centre emerges within an urban system to become its growth pole. Trade and mobility increase, but within a pattern dominated by the core even if the overall mobility remained low. Among the numerous examples of such a phase are the early industrialization of Great Britain in the late 18$^{th}$ century or the beginning of the colonial incorporation of regions in Latin America, Africa or Asia.
- **Stage 3 (Industrial):** Through a process of economic growth and diffusion, other growth centres emerge. The main reasons for de-concentration are increasing input costs (mainly labour and land) in the core area. This diffusion is linked with increased between elements of the urban system and the construction of transport infrastructures.
- **Stage 4 (Post-industrial):** The urban system becomes fully integrated and spatial inequalities are reduced significantly. The distribution of economic activities creates a specialization and a division of labor linked with intense flows along high capacity transport corridors. The factors that have favoured spatial inequalities in the previous phases of development

have structured the dominant poles of the urban system and favoured the setting of a large commercial gateway, usually a world city.

Figure 2.4: The various stages of 'Core-Periphery Development Model' propagated by Freidmann




Source: https://people.hofstra.edu/geotrans/eng/ch2en/ conc2en/ coreperipheryurban.html

**b) Theory of Garden City and Agricultural Belt, Ebenezer Howard – 1898**

In 1898, Ebenezer Howard in his book 'City of Tomorrow: a path to peaceful reform' focused attention to create new cities and outlined the principle involved as 'Garden City'. Garden city was a town designed for healthy living and industry. Town of a size that makes possible a full measure of social life but not very large. Land was to remain in a single ownership of community or held in trust of the community. It was to be a complete working city of population 30,000 approx. The town area would be about 1000 acres. A large central park containing public buildings is surrounded by a shopping street. The park and the street would indeed be surrounded by dwellings in all directions at a density of 12 families / acre. The railroad would bypass the town, meeting the town at a tangent. In 1903 Letchworth – a town on the concept of garden city was started 35 miles from London.

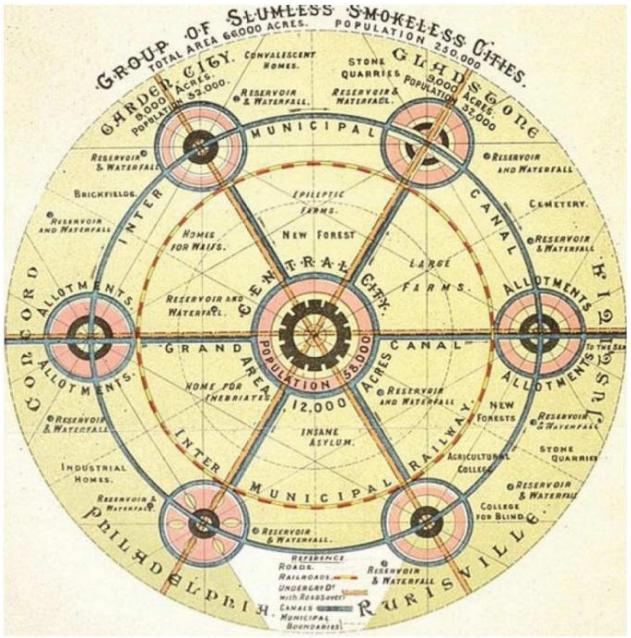
**Concept of Green Belt:** Green belt was a planning concept that intended to control the physical expansion of large cities. It was thought that green belt is an integral and absolutely necessary component of any city master plan and

would encircle the city. A green belt is where the existing rural land use are frozen permanently which acts as a barrier, preventing further physical expansion of the city. It also preserves and enhances the environment around the city. This concept was given primarily due to the following reasons –

- To check further growth of a large built up areas.
- To prevent neighbouring towns from merging into one another.
- To preserve special character of a town/
- To fulfil the needs of the city in terms of open green space.

Howard's vision of green belt must be seen in context of his cellular 'social city'. He envisaged a series of small towns separated by narrow belts of open country forming a green background. The green background would be functionally part of social city containing facilities such as hospitals, children's home and sports ground and also acting as a source of agricultural produce.

Figure 2.5: Garden City concept by Ebenezer Howard



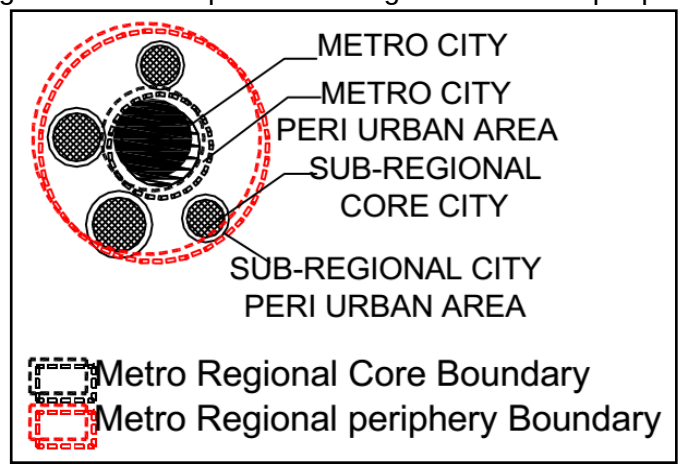

Source: http://urbanplanning.library.cornell.edu/DOCS/howard.htm

**c) Concept of Periphery on Metropolitan Scale, Kulshreshtha S. – 1991**

The concept of Periphery has been explored on a regional level by Kulshreshtha S. in 1991. In this model, he has applied the concept of core and periphery at the scale of a metro region. As per the model, Metro-Regional Core consists of the Metro-city and the Metro-City Peri-Urban Area (Fringe) while the Metro Regional Periphery has sub- regional settlements consisting of Sub-

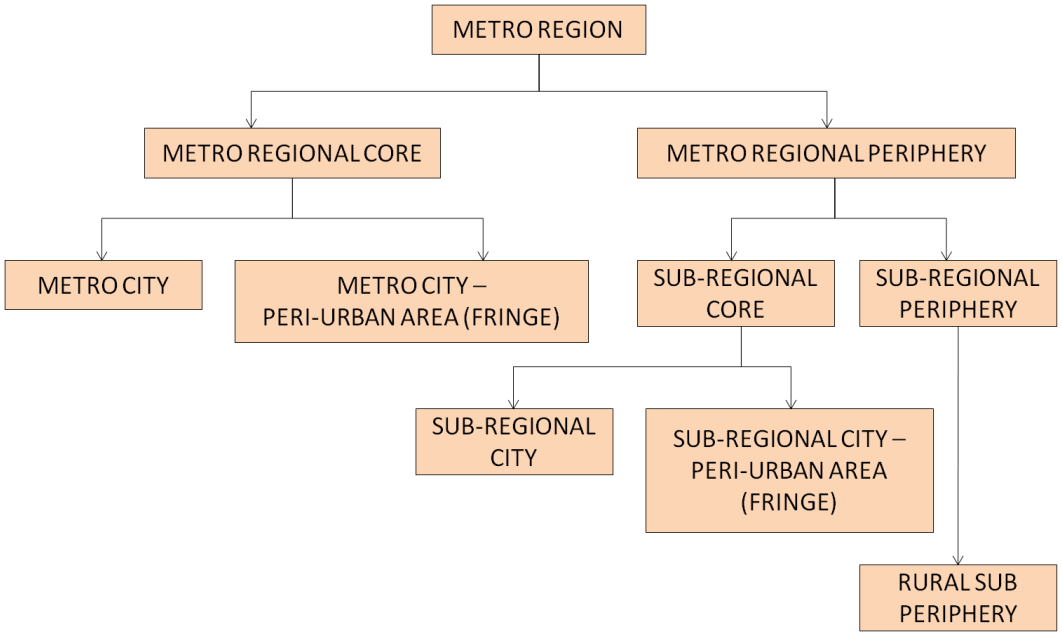
Regional Core and Sub-Regional Periphery and so on and so forth.

Figure 2.6: Concept of metro-regional core and periphery




Source: Author, 2014

Figure 2.7: Concept of core and periphery on a regional scale



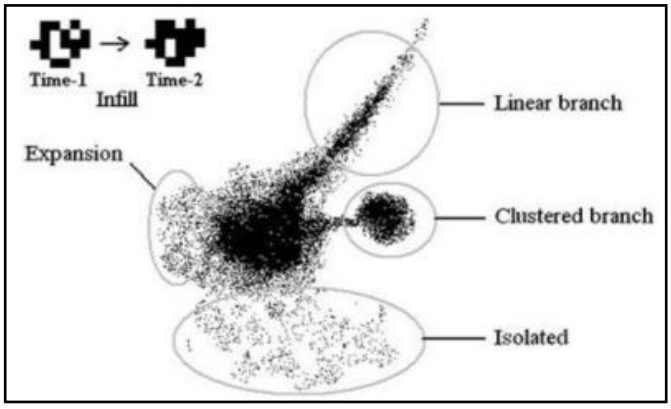

Source: Kulshreshtha, S. 2007. 'Peri-urban areas: The concepts, concerns and planning & development policies'

**d) Development in the Periphery as a result of Urban Sprawl, Harvey – 1965**

Broadly urban sprawl is of three types or in other words a city grows is a set and understood spatial pattern which can be described through three terminologies described by Harvey (1965), which are:

- Low density continuous development
- Ribbon development and
- Leap frog development

Figure 2.8: Types of sprawl




Source: Siddiqui, A. 2013. Thesis, 'Urban sprawl - Lucknow'

**e) Low density continuous development**

Use of land for urban purpose along margins of existing metropolitan areas is called low density continuous development (Clustered). Low-density sprawl is the consumptive use of land for urban purposes along the margins of existing metropolitan areas. This type of sprawl is supported by piecemeal extensions of basic infrastructures such as water, sewer, power and roads.

**f) Ribbon Development**

This kind of development follows major transportation corridors outward from urban cores. Over time land is converted to urban uses as land values increase and infrastructure extends (Linear). Ribbon sprawl is development that follows major transportation corridors outward from urban cores. Lands adjacent to corridors are developed, but those without direct access remain in rural uses / covers. Over time these nearby "raw" lands maybe converted to urban uses as land values increase and infrastructure is extended perpendicularly from the major roads and lines.

**g) Leap frog development –**

Discontinuous patterns, patches of developed lands, widely separated from each other and from boundaries define leap frog development. It is fragmented in nature generally. Leapfrog development is a discontinuous pattern of urbanization, with patches of developed lands that are widely

separated from each other and from the boundaries, albeit blurred in cases, of recognised urbanised areas. This form of development is the most costly with respect to providing urban services such as water and sewerage.

### 2.2.4. International Legislations pertaining to Development Restrictions / Green Belts

#### a) Ribbon Development Restrictions Act, 1935 (Britain)

This act came into being to ensure organized development of urban areas. The lack of neighbourhood concept in planning, ribbon development were resulting in link between two adjacent towns and thus losing their independent identities. The competent authority of this act is the Town Planning Department of Britain. It was planned that development that lies on one or both sides of the roads should be stopped because it sends figures of urbanization to the countryside which are expensive to service and which disturbs the rural development. The controls of this act were green belts which kept the country side relatively clear of undesirable growth.

#### b) National Parks & Access to Countryside Act, 1949

This act came further to check the further growth of large built up area. Other objectives were:

- To prevent neighbouring towns from merging into one another
- To preserve special character of towns
- To protect the agricultural land

The competent authority of the act is Ministry of Housing, England. The planning provision of the act is to demarcate the green belt so that the planned development is permitted. Acquisition of land on the periphery of city, publicly and controlling the development. Development in the green belt should be for agricultural purposes, sport and institutions standing in extensive ground, cemeteries or other purposes suitable to rural area.

#### c) Green Belt (London & Home Countries) Act, 1938

This act came to preserve the natural beauty of country side and enabling to derive enjoyment and recreation. The competent authority is Countryside Commission. Local planning authorities were given powers to arrange by agreement with land owners and occupiers or by making orders that the public should have access to stretches of open country.

## 2.3. Case Studies – Indian Context

Comparative analysis of growth dynamics of city & its urban agglomeration: The following section presents a comparative analysis of a number of cities and their growth dynamics. The cities chosen for comparative analysis create range from mega cities to metropolitan cities to Class-I cities in order to have a clear picture of growth trends in all higher order towns. The cities have been compared with respect to parameters like population within municipal limits, population of urban agglomeration, growth rates over the last two decades (pph), number of constituents of Urban Agglomeration, their civic status and their growth pattern.

**a) Mumbai –**

Greater Mumbai urban agglomeration is the most populated U.A. in India. In case of Greater Mumbai, it has been witnesses that the Urban Agglomeration is witnessing a higher growth rate than Municipal Corporation. The major reason for this shift is relocation of industries from the inner city to peripheral areas like Navi-Mumbai. Promoted by the "Special Economic Zone" policy of the Govt. of India, certain zones at the periphery of Mumbai have been growing recently in terms of the preferred job locations for many multinational companies including Indian MNCs. Policies also aim to decongest the city centre by relocating jobs to the periphery, within Navi Mumbai, Thane and Kalyan. As a result, periphery is growing at a faster rate than the city.

**b) Kolkata –**

The city of Kolkata and its U.A. is witnessing declining population in the Municipal Corporation, while the growth rate of Urban Agglomeration is higher. Growth in the peripheral areas or outskirts of the city is because majority of people can't afford to stay in the core due to high cost of living. Furthermore, in peripheral or outskirts, medium and large level industrial units are concentrated which provide large number of employment opportunities. As such majority of the workers working in these industrial units live in these areas. As the price of land is huge in core areas, the middle income people have moved towards the outskirts. Moreover, the people in these peripheral areas also avail most of the facilities that are enjoyed by the people staying in the core areas of the city.

Furthermore, problems of lack of infrastructure, basic amenities, cost of living and stringent land laws are being faced in the core areas which have

degenerated the capacity of the core area to absorb the net increase in population. Hence growth is happening beyond the municipal limits.

The growth pattern of Kolkata Metropolitan Area (KMA) is being undertaken to have a better understanding of the growth trends of core and periphery of KMA. KMA consists of Kalyani-Budge Budge on east bank and Bansberia-Uluberia on the west bank of River Hooghly containing the whole of Kolkata Urban Agglomeration along with rural pockets. This is almost similar to the Kolkata Standard Urban Area as defined by the Census authority. The metro core consists of twin cities of Kolkata and Howrah with intensively built up surrounding areas spreading from Bally-Dakhineshwar-Kamarhati to Andul-Garden Reach-Garia, occupying about 34% of the KMA area. The same have been indicated in Map 2.1 in the next page. It is important to note that the KMA comprised of a massive conglomeration of 74 units in 1971. The total number of constituents increased to 116 in 2001 indicating urban sprawl leading to contiguity of different urban centres. Table 2.6 shows the growth of constituents in Kolkata Urban Agglomeration.

Table 2.2: Growth in constituents of Kolkata urban agglomeration from 1971 – 2011

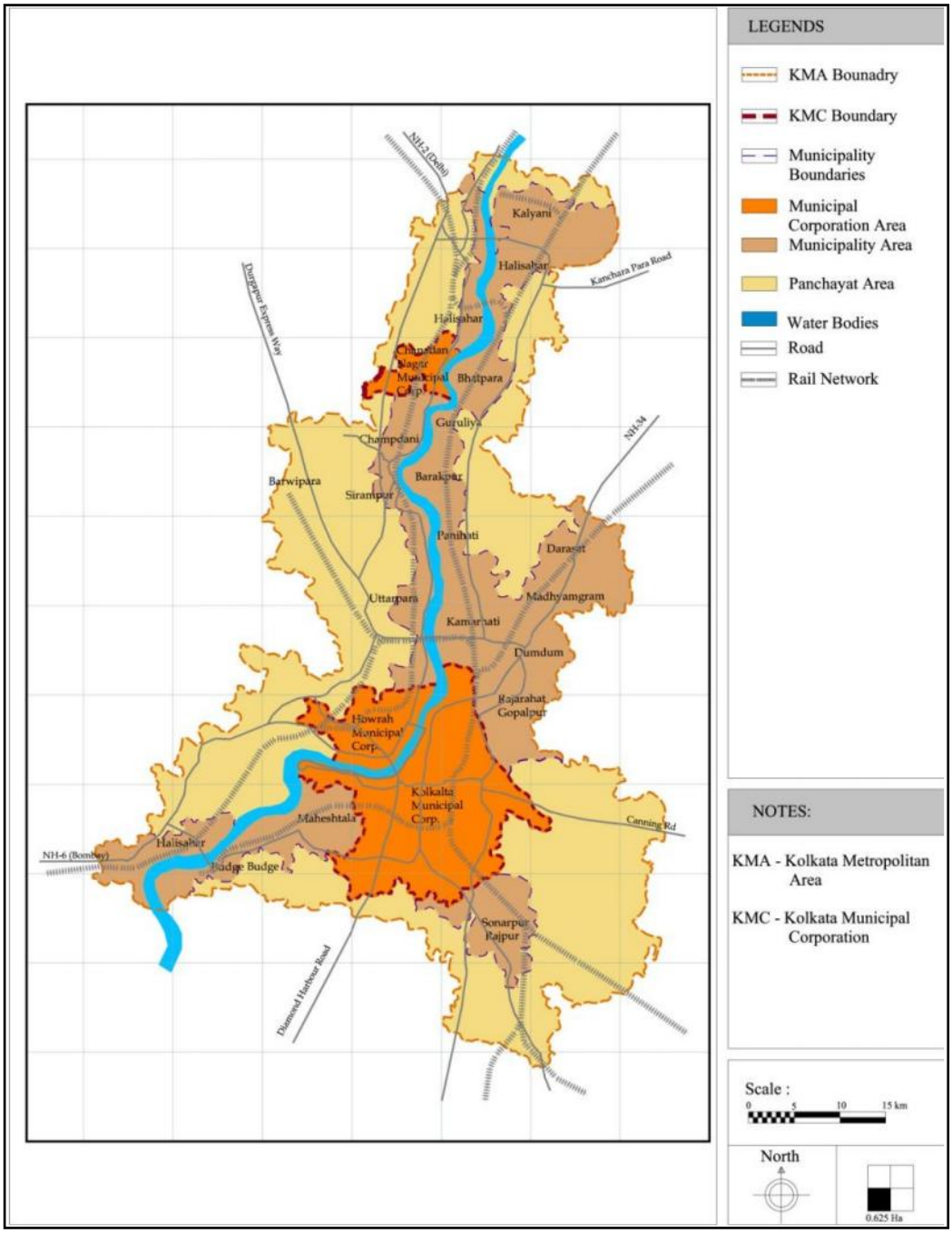
| Census Year | Administrative Units | Total (Nos.) |
|---|---|---|
| 1971 | 3M.C., 28M, 1NA, 1C, 41NM | 74 |
| 1981 | 3M.C., 32M, 2NA, 1C, 69NM, 360G | 143 |
| 1991 | 3M.C., 29M, 3NA, 1C, 93NM, 250G | 154 |
| 2001 | 3M.C., 38M, 1C, 58CT, 160G | 116 |
| 2011 | 3M.C., 38M, 1CB, 74CT, 60G | 122 |

Source: Census of India, 1971-2011

The development pattern within KMA suggests a strong linear basis along river Hooghly. The development in KMA can be classified into three broad categories – core area or compact development, inner periphery and outer periphery (rural land). Inner Periphery witnesses urban sprawl. With time, intervening spaces

have filled up and got added to UA. The development is less intense / poor quality & ultimately vanishes into countryside. The causative factors leading to peripheral developments can be summarised as high prices and exorbitant rents in the core, degrading environment & lack of green open spaces in the core and congestion in the core.

Map 2.1: Kolkata Metropolitan Area (KMA)

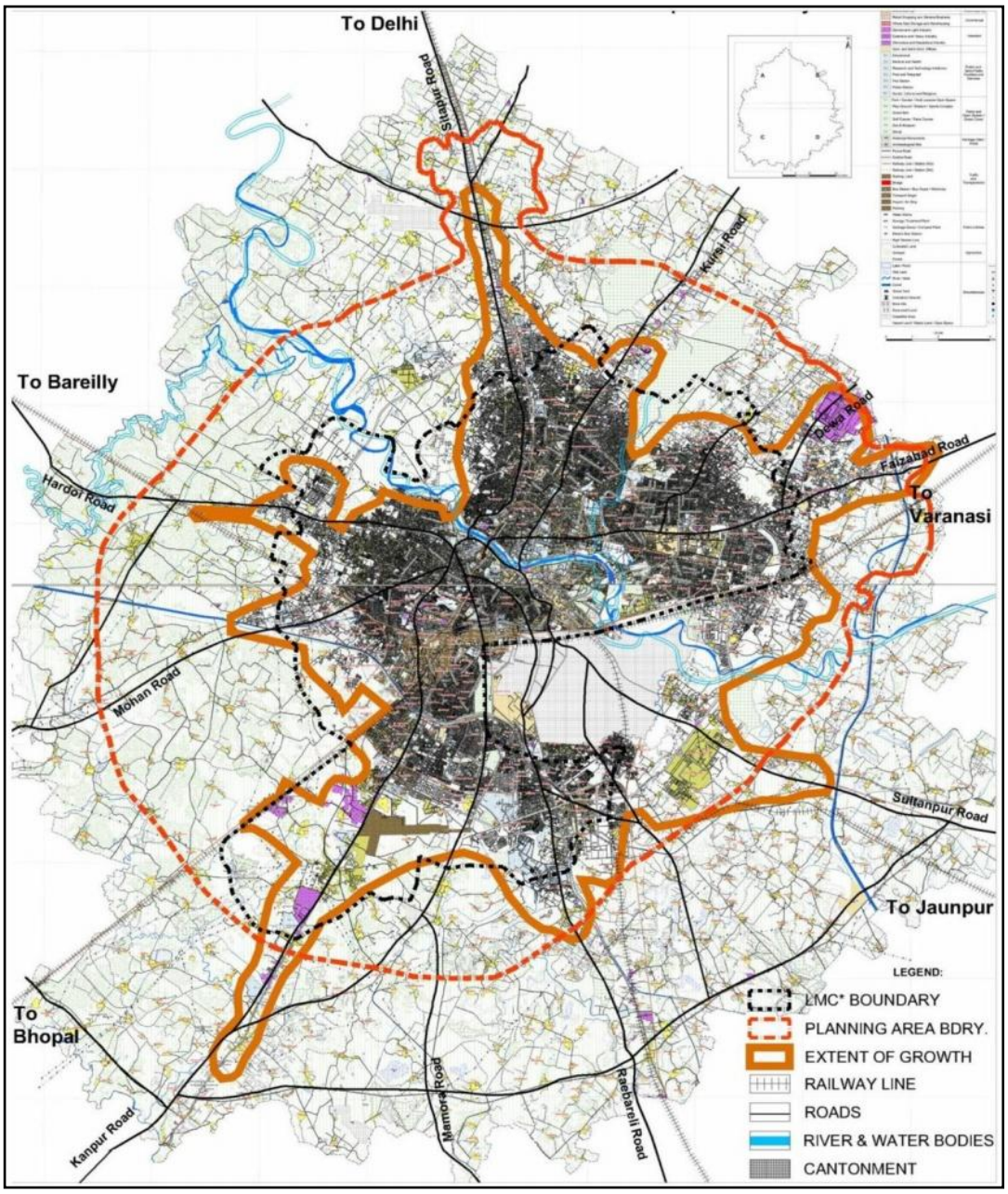



Source: KMDA, 2012

**c) Lucknow –**

Urban Agglomeration of Lucknow is the 12th most populated U.A. in India. In case of Lucknow, it has been observed that both the city and the Urban Agglomeration are exhibiting high growth rates. The prominent reason for development of periphery is that the density is high in core area, which is degrading now, hence people are moving fast towards outskirts. High land value at all places within the city is also one of the grave reasons for settling to the outskirts and fringes.

Map 2.2: Growth in Lucknow city depicting urban sprawl




Source: Siddiqui, A. (2013) 'Urban sprawl – Lucknow',

**d) Kanpur –**

Kanpur city with a population of approximately 27 lakhs is exhibiting growing core and growing periphery trend. The phenomenon of growing periphery is due to high land values, higher tax base and user charges as a result of which people are opting to settle outside city limits where land and housing are available at cheaper rates.

**e) Nagpur –**

Nagpur too witnesses the phenomenon of growing core and growing periphery, while the core is experiencing similar problems as witnessed in other cities, the periphery with vast tracts of land available at lower prices than the municipal area has become attractive for migrants and also for the residents who are moving out.

**f) Indore –**

Indore too witnesses similar trend as its other metropolitan counterparts. It has been observed that both core and periphery are growing at high rates as observed in other metropolitan cities.

**g) Ranchi –**

Ranchi city too witnesses comparable growth rates within the city as well as periphery. The main reason for growth in periphery is availability of land at lower rates than the city.

**h) Raipur –**

City of Raipur like other metropolitan cities is also witnessing growth in core as well as periphery, while the population of Municipal Corporation has increased from 6 lakhs to 10 lakhs that of UA has increased from 7 lakhs to 11 lakhs.

**i) Jamshedpur –**

Class-I city of Jamshedpur witnesses growth in core as well as periphery. Jamshedpur being a planned city has higher tax base and levy of user charges which is lower or totally absent in peripheral areas making them attractive for residential purpose.

**j) Bhubneshwar –**

Bhubneshwar city too validates the phenomenon witnesses in other class-I cities of growth in core as well as periphery. Similar to Jamshedpur, Bhubneshwar too is a planned city with higher tax base and levy of user charges in the city than the periphery making the latter more affordable.

From the study, it has been observed that majority of the cities show higher growth rate in the U.A. rather than the city limits exhibiting dynamism outside city limits. Trend is more evident in mega cities like Kolkata and Mumbai, where municipal limit is already saturated in terms of growth and is unable to cope up with the rapid rate of urbanization. Mega city of Kolkata witnesses decrease in population within the city limits while the U.A. shows a higher growth.

In other cases too, the city has become contiguous with a number of other settlements which have become a part of the urban agglomeration now. Planned city of Jamshedpur exhibits considerably higher growth rate in U.A. as compared to Municipal limits. The absorptive capacity of the city has saturated leading to urban sprawl; thereby leading to increase in the population of U.A. Dynamism outside the municipal limits can also be seen from the addition of constituents to the Urban Agglomeration. The growth in number of constituents and their civic status also exhibits the dynamism outside the municipal limits. Among compared cities, Chandigarh periphery has been exhibiting one of the highest growth rates within the municipality as well as the periphery.

Table 2.3 on the following page presents the comparative analysis of all cities based on selective parameters. The parameters selected are population and growth rate of Municipal Corporation and Urban Agglomeration in 2001 and 2011, constituents of Urban Agglomeration in 2001 and 2011, growth in urban area from 2001 to 2011 and density pattern for Urban Agglomeration and Municipal Limits.

Table 2.3: Comparative analysis of various classes of towns

| ASPECT | MEGA CITIES | | METROPOLIS (with comparable U.A. Population) | | | | METROPOLIS (with comparable M.C population) | | CLASS-I CITIES | | STUDY AREA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mumbai | Kolkata | Lucknow | Kanpur | Nagpur | Indore | Ranchi | Raipur | Jamshedpur | Bhubaneshwar | Chandigarh & Periphery | |
| Pop. MC (2011) (In lakhs) | 124.78 | 44.86 | 28.15 | 27.67 | 24.05 | 19.6 | 10.73 | 10.1 | 6.29 | 8.37 | Pop. MC (2011) | 9.7 |
| | | | | | | | | | | | UT Urban | 10.26 |
| Pop. UA (2011) (In lakhs) | 184.14 | 141.12 | 29.01 | 29.2 | 24.97 | 21.67 | 11.26 | 11.22 | 13.37 | 8.81 | Chd. & Periphery (Urban) | 18.36 |
| | | | | | | | | | | | Chd. & Periphery | 24.38 |
| Pop. MC (2001) (In lakhs) | 119.78 | 45.72 | 21.85 | 25.51 | 20.52 | 14.74 | 8.47 | 6.05 | 5.73 | 6.48 | Population MC (2001) | 8.08 |
| | | | | | | | | | | | UT Urban | 8.08 |
| Pop. UA (2001) (In lakhs) | 164.34 | 132.05 | 22.45 | 27.15 | 21.29 | 15.16 | 8.63 | 7 | 11.04 | 6.58 | Chd. & Periphery (Urban) | 12.72 |
| | | | | | | | | | | | Chd. & Periphery | 17.83 |
| Growth Rate (%) - MC (2001-2011) | 4.17 | -0.02 | 28.83 | 8.47 | 17.2 | 32.97 | 26.68 | 66.94 | 9.77 | 29.17 | Growth Rate - UT Urban (2001-2011) | 26.98 |
| Growth Rate (%) - UA (2001-2011) | 12.05 | 6.87 | 29.22 | 7.55 | 17.29 | 42.94 | 30.48 | 60.29 | 21.11 | 33.89 | Growth Rate - Periphery Urban (2001-2011) | 44.34 |
| Constituents (2011) | 6M. Corp, 2M.Cl. | 3M.Corp, 38M, 1CB, 74CT, 60G | 1M.Corp, 1CB | 1M.Corp, 1CB, 3CT, 2OG | 1M.Corp, 2CT | 1M.Corp, 10CT, 70G | 1M.Corp, 5CT | 1M.Corp, 1M, 20G | 2NAC, 1NP, 1M, 10G, 8CT | 1MC, 14OG | 1M.Corp, 5 M.Cl, 2M.Cl+OG, 17CT, 1NP | |
| Constituents (2001) | 5M.Corp, 3M.Cl. | 3M.Corp, 38M, 1CB, 58CT, 160G | 1M.Corp, 1CB | 1M.Corp. 1CB | 1M.Corp, 2CT | 1M.Corp, 1CT, 60G | 1M.Corp, 1CT | 1M.Corp, 12OG, 2CT | 2NAC, 1NP, 1M, 6CT, 10T | 1MC, 1OG | 1M.Corp, 2 M.Cl, 1UA, 2MC, 4CT, 1NP | |
| Area (MC) 2001 in sq kms. | 603 | 185 | 310.1 | 266.74 | 217.56 | 130.17 | 177.19 | 55.99 | 59.8 | 134.64 | 79.34 | |
| UA Area 2001 in sq kms. | 1135 | 1033 | 337.5 | 301.02 | 229.2 | 165.17 | 182.09 | 116.03 | 159.55 | 148.1 | 230.69 | |
| Density - MC-2001 (PPH) | 199 | 247 | 70 | 96 | 94 | 113 | 48 | 108 | 96 | 48 | 102 | |
| Density - UA-2001 (PPH) | 145 | 128 | 67 | 90 | 93 | 92 | 47 | 60 | 69 | 44 | 55 | |
| Growth Pattern | Linear | Ribbon | Ribbon | Ribbon | Sectoral | Dispersed | Linear | Ribbon | Sectoral | Ribbon | Ribbon Development | |
| Factors for Peripheral Development | 1. City limits saturated hence growth happening outside.<br>2. U.A more dunamic than the City with additional constituents getting added to U.A every decade.<br>3. Conglomeration of urban areas prominent phenomenon. | | 1. Both city and periphery witnesses to be growing at alarming rates.<br>2. Municipal limits not exhausted, hence growth witnessed within city limits too.<br>3. Most important factors responsible for preference to peripheral areas is low land prices and affordable housing in the periphery in contrast to mega cities where congeation and environmental degradation are the important factors for peripheral development. | | | | | | 1. Planned cities witnessing higher growth rates outside the city i.e. In the U.A.<br>2. Since the cities are planned so higher user charges, tax bases and land value within city, hence preference to peripheral settlements. | | 1. Chnadigarh Periphery growth rate witnessed to be the highest in comparison to the other case studies compared exhibiting its dynamic character. | |

Source: Author, 2015

## 2.4. Concluding Remarks

The inferences from the case studies are derived in the form of factors for peripheral development and characteristics of peripheral development.

### a) Factors for Peripheral Development

The factors derived are classified as physical, economic and governance aspects, presented in the following table.

Table 2.4: Factors leading to peripheral development

| |
|---|
| **Physical** |
| 1. Limited land availability within city limits / saturated core. |
| 2. Large quantity of land availability outside urban limits therefore high growth potential for housing, SEZ, FEZ, industrial, institutional development. |
| 3. Good connectivity to mother city's specialised social infrastructure, work centres and centres of employment through major road/rail networks. |
| **Economic** |
| 1. Prevailing high land prices and rents within the core city. |
| 2. Availability of cheaper housing options and cheap land in periphery. |
| 3. Comparatively low cost of living in periphery. |
| 4. Absence or low taxes, levies and fees. |
| **Environmental** |
| 1. Environmental degradation of the core city / congestion. |
| 2. Lack of open spaces within core city. |
| **Governance** |
| 1. Existence of legal framework and irrational development control regulations within the mother city. |
| 2. Simpler and liberal process of approvals for development, conversion of land use and grant of building permissions in periphery. |

Source: Author, 2015

### b) Characteristics of peripheral development

The following table shows the characteristics of peripheral development that have been derived from the case studies discussed.

Table 2.5: Characteristics of peripheral development

| **Physical** |
|---|
| 1. Inadequate provision of basic services / infrastructure. |
| 2. Unauthorized and haphazard sub-division of agricultural land. |
| 3. Dispersed and low density pattern of development. |
| 4. Irrational / non-conforming land use pattern. |
| 5. Existence of slums / low quality housing, informal settlements. |
| 6. Absence of a rationalised traffic and transportation network. |
| 7. Poor accessibility in the inner pockets. |
| **Economic** |
| 1. High degree of land speculation due to comparatively lower land values and simple procedures of land conversion. |
| **Environmental** |
| 1. Degradation due to presence of large industries, FEZ etc. |
| 2. Degradation due to unavailability of Sewerage system, solid waste management etc. |
| 3. Degradation due to existence of landfill sites, STPs etc. |
| **Governance** |
| 1. General absence of a well defined legal framework for planning, development and management. |
| 2. Absence / multiplicity of planning and developmental agencies to regulate development within the area. |
| 3. Large scale conversion of agricultural land into non-agricultural uses due to easy procedures / absence of any legal framework. |
| 4. Absence of building bye-laws or zoning regulations to rationalise use of land and control of built environment. |

Source: Author, 2015

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# CHAPTER 3. UNDERSTANDING THE DYNAMICS OF PERI-URBANIZATION: STUDY OF SELECTED CASE

## 3.1. Introduction: Study Area – Chandigarh & the Growth Nodes around

This chapter attempts to study and understand the general profile (study area, evolution, growth, location, development trends & brief statistics) of Chandigarh and its Periphery and its other regional linkages. It also gives a broad idea on the context of Chandigarh as a major growth centre of the region.

**Historical Overview:** At the very initial stage of development, 70 sq.k.m. of land was acquired for the planned city of Chandigarh, incorporating mechanisms for control and regulating development. It was envisioned to plan an administrative town, especially for the resettlement of people at the time of independence and keep the entire periphery area of the city reserved as green belt / agricultural zone to ensure source of food from the periphery to the city people. The outward expansion was prevented following different stages:

1) A new capial for Punjab was approved in 1949. This incorporated:
    i. *"The Chandigarh Master Plan area of 70 sqkm in two phases (1951).*
    ii. *A Periphery Control Area for a 8km radius around Chandigarh Plan Area (1952).*
    iii. *An expanded Periphery Control Area for a 16km radius around the Chandigarh Plan Area (1962)".*
2) The state reorganization in 1966 involved restructuring a) above into:
    i. *"Chandigarh UT 70 sq.k.m. + 44 sq.k.m. = 114 sq.k.m.*
    ii. *Punjab component of the Periphery Control Area = 1021 sq.k.m.*
    iii. *Haryana component of the Periphery Control Area = 295 sq.k.m".*
3) The Chandigarh Urban Complex (CUC) was created by the Ministry of Urban Development, Government of India in 1975 this incorporated:
    i. *"The Chandigarh UT and*
    ii. *A reorganised CUC boundary in lieu of the 8 km radius mentioned in para a)".*
4) The Chandigarh Interstate Capital Region (CISCR) as created by the Central Town & Country Planning Organization in 1984, which incorporated:
    i. *"The Chandigarh UT*
    ii. *The Chandigarh Urban Complex (CUC) – outside the UT*

iii. *The 16 km radius Periphery Control Area (outside CUC) and some portions beyond that 16 km radius in Punjab and Haryana. The total area measured 2431 sqkm".*

5) The Chandigarh Interstate Metropolitan Region (CISMeR) Plan comprising of *"50 km radius falling outside Phase I of Chandigarh and consisting of 10 tehsils (Punjab 4, Haryana 3, Himachal Pradesh 3)".*

Parallel, Punjab has created a Greater Mohali Regional Development Authority (GMADA) to prepare an integrated plan, covering a land area of 1190 sqkm region around Chandigarh and for a population of 4.5 million, part of which extends beyond earlier defines 16km radius. This plan caters a jurisdiction over 6 Local Planning Areas (Mohali / SAS Nagar, Kharar, Banur, Zirakpur, Dera Bassi and Mullanpur, among which Zirakpur itself accounts for approximately 9% of the urban population in the GMR. The Regional Plan 2008-2058 has been conceptualised each of these local planning areas as a hub for a district economy / sector. At other side, Haryana adopted the Punjab New Capital (Periphery) Control Act, 1952, in 1968 with modification. Under the operation of the Haryana Portion of the said Act, chronologically some developments were taken up as under:

i. *"Preparation of the 1st Development Plan for taking up Panchkula Project as an Urban Zone,*
ii. *Other projects shown as Special Projects Zone were Chandimandir Cantonment and HMT Township.*
iii. *Besides these, the Terminal Ballistic Research Lab (TBRL) also got established.*
iv. *New Urban Zone of Shri Mata Mansa Devi Complex was designated.*
v. *Panchkula Extension was incorporated as a new Urban Zone.*
vi. *Further additions of Urban Zone were made of the Pinjore Kalka Urban Complex, Panchkula Extension and Kot Behlana Urban Complex".*

Therefore, we can see that due to forces of urbanization and several limitations of the provisions of Chandigarh Master Plan like – affordability, housing for common people, transport etc.; a number of development nodes have been emerged in the city periphery – contiguous or non-contiguous with the city of Chandigarh in last few decades, whether by planned interventions or in an organic manner. With this overview, the thesis is carried over the rapid physical development process operating in those development nodes and rural-urban

fringe areas, as places observing fast growth in an organic manner for the spill-over effect from the city of Chandigarh; especially in absence of the statutory Development Plan and also any statutory regional board to control peripheries (like NCR Board). Hence, the study involves in finding out the factors for such urban transformation taken place already and analyzes them to formulate appropriate planning strategies for the future.

### 3.2. Significance of the Selected Context

"The Punjab New Capital Periphery Control Act 1952" was enacted while developing Chandigarh. *"It was foreseen that the city will require more land for its future growth and therefore, this act was brought into force to prevent unregulated and haphazard growth around the city. The Punjab Government have declared a belt of 16 km around the Union Territory of Chandigarh as controlled area under section 3 of this Act".* The Punjab and Haryana Government were empowered to "regulate development" under this Periphery Control Act and it was aimed that there will be specific restrictions in terms of conversion of land and land-use, construction of buildings in the no-construction zone already demarcated etc. Doing contradictory works of such restrictions was not permissible. However, these three states have formulated their own planning agenda separately without consideration of the impact in the region and this act has not been successfully implemented on ground. The actual reality describes a complete different scenario, where several unplanned, haphazard developments emerged all around the city of Chandigarh since the last decade. Is this act governs something, which is not development friendly as per today's necessity of people? Why this act has been failed and what are the reasons of this peripheral extension? Hence, it is important to study this periphery development in relevance with Chandigarh City Planning.

**Further, on the basis of understanding of the regional relevance, it is important to study the process and nature of transformation happened at certain critical peripheral settlements like Zirakpur.** Zirakpur is one of emerging development nodes around Chandigarh. What was the previous demographic and social profile, land-use and economic base, the nature of land-acquisition placed in this area – whether it is government intervention or acquired by the local builders from the farmers through negotiation – should be studied to analyze the overall transformation happened for the peripheral growth. This

settlement level study will help to formulate planning strategies for the future expansions.

### 3.3. Profile of Chandigarh

Map 3.1: Location of Chandigarh


Source: www.mapsofindia.com

Chandigarh, the first planned city after independence is located in North India sharing its boundary with two other states like Punjab and Haryana. The city of Chandigarh, declared as Union Territory and a shared capital of Punjab and Haryana and also regional centre of three adjoining states of Punjab, Haryana and Himachal Pradesh. Chandigarh was first envisioned by India's first Prime Minister, Sh. Jawahar Lal Nehru and this dream city was planned by the world famous Architect Le Corbusier. The city is expanded at the foothills of Shivaliks.

The planning and design of the 'City Beautiful' is a prime example of urban experiment in the context of India in the field of urban planning and modern architecture. The city was named from the existence of temple of *"Chandi Mandir", situated in the nearby area of the selected site for the proposed city. "The deity 'Chandi', the goddess of power and a fort of 'garh' laying beyond the temple gave the city its name "Chandigarh – The City Beautiful".*

It is the administrative hub for the UT & its adjoining two states. It is well connected through rail, road and air. NH-1 connects Chandigarh to Delhi via Ambala, NH-23 connects to Ludhiana, NH-21 connects to Ropar in Punjab and Shimla in Himachal Pradesh. The city provides state of the art social and physical infrastructure, which includes provision of electricity, water supply, roads and accessibility, health facilities and a huge no. of educational institutions. It is also

one of the fastest growing cities; however growth declined in the last decade. The per capita income of Chandigarh ranks third (i.e. Rs. 1,28,634) with high quality of life. It is one of the greenest cities of India with its 1400 nos. green belts / parks / gardens.

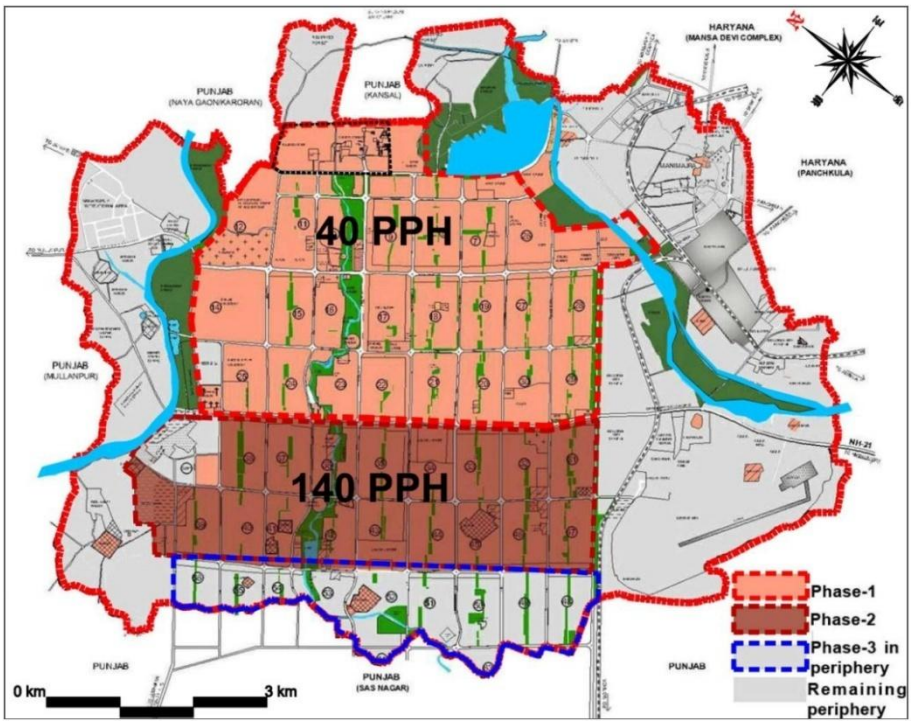
### 3.4. Evolution of Chandigarh

The need of new capital for Punjab State was felt after Partition of India in 1947, when the capital of Punjab became a part of Pakistan. The site for the new capital for the states was approved by the Govt. of India, along with the Govt. of Punjab of that time, in March 1948. In 1949, approx. 70 sq. k.m. of land between the rivulets Patiala Choe and Sukhna Choe was acquired for the city of Chandigarh. As described by Prakash, 1988; *"The first team of architects engaged for planning and designing the city was lead by American planner Albert Mayer and architect Mathew Nowicki. The team prepared the Master Plan and detailed out the super block which constituted the basic module of city planning. The Master Plan was fan shaped keeping in view the profile of the site. Curvilinear roads defined the circulation pattern punctuated by green belts. Due to the sudden demise of architect Mathew Nowicki, second team of architects lead by Le Corbusier (also called C.E. Jeanneret), Pierre Jeanneret, Jane B. Drew and Maxwell Fry took over. Le Corbusier designed an iconic city, fulfilling not just a utopian agenda, but reflecting concepts of 'modernism' movement that arose in Europe but took root here too. The city reflects the design philosophy of Le Corbusier in many tangible ways creating modular, geometric and cubist idioms using 'brute' materials yet the essence was drawn from nature (the head / lungs / heart / limbs) and incorporated the essentials of site / climate / culture / tradition. He ensured that the human resource inputs into the Capital Project would be of impeccable technical and moral standards forging philosophical underpinnings and as rightly observed by an expert, likened Chandigarh 'to an enterprise whose value will soon be proclaimed all over the world' and to whom 'the city was a sign of harmony born of good intentions, struggles, patience and perseverance and a spirit of strength and severe simplicity'".*

The proposed plan for the city was divided into 30 sectors in a Grid-Iron pattern, where the Capitol Complex and the Civic Centre was the focal point of the entire planning of the city. *"Sector 17 was designed as the CBD and a greenbelt at the centre ran through out from north-east to south-west. Wide roads*

*planned in a systematic hierarchy provide structure to the city along with well planned facilities. Landscaped green avenues give it amenity value"* (Draft Master Plan, 2031). The 1st phase was designed for 1,50,000 population, which is low-rise plots based development. Phase II was demarcated from sector 31 to 47 to fulfil the housing demand of rest of the population i.e. 3,50,000 and this phase II was planned for 4-storeyed apartments, majorly dedicated for Govt. Housing with more smaller plots, less open spaces and larger increase in density. The initial concept also kept provisions of re-densification of Phase-I to accommodate the growing population of the city, as per the requirement. However, the concept also proposed such re-densification without disturbing the character of the city and its quality of built environment.

Map 3.2: Planned density of Chandigarh




Source: Author, 2015

As described by Prakash, 1988; *".... with the emergence of Mohali, the new town on the south of Chandigarh in the post re-organisation period, the gap between Phase-II and Mohali was planned as Phase-III of Chandigarh in order to integrate and promote planned development and continue the sectoral grid and the development of the land falling between Phase-II and Mohali. Phase-III comprises of 'Group Housing Schemes' and four storied flats built by the Chandigarh Housing Board and co-operative house building societies instead of*

*plots resulting in higher densities. Over a period of time, city development has now been extended to the area earlier covered under the Periphery Control Act to meet the emerging needs of development involving setting up IT Park, tourism, transport, sports and recreation etc".*

It is important to mention that several control mechanisms like 'architectural control', 'frame control', 'advertisement control' and 'zoning regulations' were exercised to regulate development and maintain the architectural character of Chandigarh. As mentioned above, in 1952, periphery of 8 kms. was conceived under "Punjab New Capital (Periphery) Control Act, 1952" to restrict the city population to expand beyond the allowed boundary. The objectives of the periphery have been explained in one of the following sections. Further in 1962, the periphery boundary was increased to 16 kms. As per provisions of the 'Periphery Control Act', the periphery development plan was published in 1963, which identified the green belt around Chandigarh and other permitted land uses. Then in 1966, post re-organization of Punjab state, periphery got subdivided into three parts and apportioned to 3 different governments.

### 3.5. Demographic Scenario

Census was conducted in Chandigarh in 1951, when population was reported to be 24, 261 persons. Since then high growth rate has been witnesses over last 5 decades. As per census 2011, population of Chandigarh UT has reached approximately 10.54 lakhs of which approximately 9.7 lakhs are within Municipal Corporation limits. An additional 50,000 urban population lies in census towns outside the municipal limits of Chandigarh but within the UT. It has been observed that while the growth rate has been fairly high for previous decades, the growth rate for 2001-2011 has been merely 17.10%, slowest since its inception. This could be attributed to a number of factors like dearth of land for future expansion, high land prices, unaffordable housing options etc.

Table 3.1: Demography of Chandigarh UT & MC

| Year | Area (sq kms) | MC (popu.) | Urban (popu.) | UT (popu.) | Growth Rate (%) |
|---|---|---|---|---|---|
| 1951 | - | - | - | 24,261 | - |
| 1961 | 32.4 | 99,262 | 99,262 | 1,19,881 | 394.1 |

| | | | | | |
|---|---|---|---|---|---|
| 1971 | 57.6 | 2,32,940 | 2,32,940 | 2,57,251 | 114.6 |
| 1981 | 68.33 | 4,22,841 | 4,22,841 | 4,51,610 | 75.6 |
| 1991 | 78 | 5,75,829 | 5,75,829 | 6,42,015 | 42.2 |
| 2001 | 79.34 | 8,08,515 | 8,08,796 | 9,00,914 | 40.3 |
| 2011 | 90 | 9,70,602 | 10,26,459 | 10,54,450 | 17.0 |

Source: Census of India, 1951-2011

### 3.6. City and the 'Periphery'

To restrict the city population to expand beyond the city, especially not beyond the allowable limit, a new act was formulated – "Punjab New Capital (Periphery) Control Act, 1952". As per the provisions of the act, *"The 'Periphery' was a Green Belt around the Master Plan Area, identified to prevent haphazard growth. It was originally of 8 km as per 1952 act and extended to a radius of 16km in 1962. It was meant to serve the city with its agricultural produce and later to accommodate future population growth".*

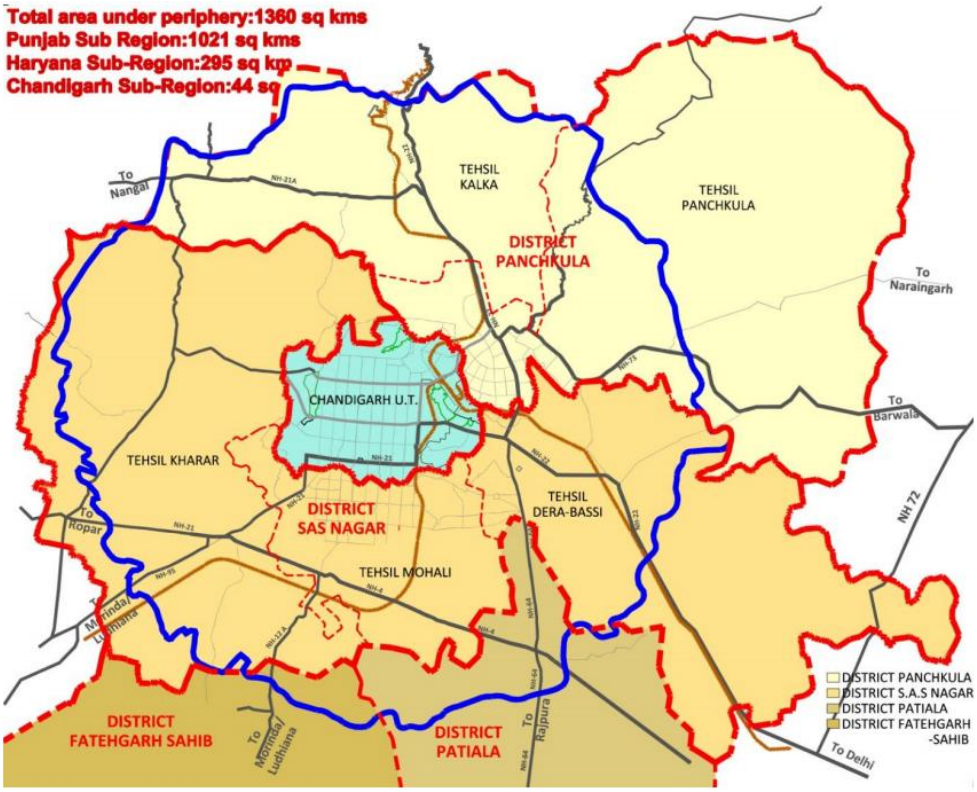
**Objectives of the act were:**

- To control & regulate the periphery of the New Capital City.
- To maintain the planned development in the new city.
- To restrict the emergence of slums and to eliminate chances of any haphazard & unplanned development in the periphery.
- To freeze land use in peripheral area (which was at that time primary agricultural) & to retain its basic character.
- To stop conversion of land use into uses other than agriculture or subsequent to agriculture.
- To provide ample area free from all encumbrances for future growth, development and expansion of the new city.
- To secure area which will cater to the basic and day to day needs of agriculture, dairy, poultry and other products of the capital city.
- To clearly segregate the functions of Chandigarh and its peripheral areas and also to create a relationship of interdependence between the two as well.
- To evolve a legal mechanism to achieve the above goals.
- To restrict the growth directions and development in the identified areas of the proposed plan only.

However, these objectives were not been fulfilled due to several reasons. As stated by Prakash, 1988; *"Reorganization of Punjab on linguistic basis in 1966*

*changed the very context of periphery when it got subdivided into three distinct parts with the largest part of it going to the state of Punjab – 76%, Haryana – 21% and Chandigarh only 3% of the original area of around 1400 sq.km. The states of Punjab and Haryana made the best possible economic use of the periphery area close to Chandigarh by setting up of new settlements of SAS Nagar (Mohali) and Punchkula, defeating the main objective for which the periphery was created. Not only the state government, but also the central government played a role in violation of the act by setting up of Chandimandir Cantt., HMT factory and township etc. Furthermore, incompatible land-uses may be witnessed in the periphery especially in Punjab periphery portion".*

Map 3.3: Location of Chandigarh and its periphery




Source: Author, 2015

Map 3.3 shows the various administrative units that constitute periphery of Chandigarh. It has been observed that periphery lies in 4 districts – one being in Haryana and three in Punjab State. Within District Punchkula that lies in Haryana State, periphery lies in Tehsil Punchkula and Kalka. In case of District SAS Nagar, which constitutes majority of periphery, periphery lies in three tehsils – Tenhsil Mohali, Tehsil Dera-bassi and Tehsil Kharar constituting majority are of the periphery.

## 3.7. Concluding Remarks

1. Location: It has been witnessed that strategic location of Chandigarh, excellent connectivity with neighbouring states & plethora of quality infrastructure has helped to establish its role as a regional centre and has also rendered it extremely attractive to the migrants who are attracted to Chandigarh for its employment opportunities and high quality of life.
2. Evolution of Chandigarh: Re-organization of Punjab in 1966 was a major landmark event in the history of Chandigarh.
3. Demography: Declining growth in Chandigarh due to intrinsic factors and also due to preference given to peripheral settlements. The factors for peripheral development shall be analyzed in next chapter.
4. Periphery: The milestone in the history of Periphery was when it got sub-divided and apportioned to 3 district entities with no single agency responsible for co-ordination of development. It marks the commencement of illegal and unauthorised construction in periphery.

The periphery lies in 4 districts out of which 3 are in Punjab and 1 is in Haryana and UT of Chandigarh with boundary not coterminous with any single administrative unit.

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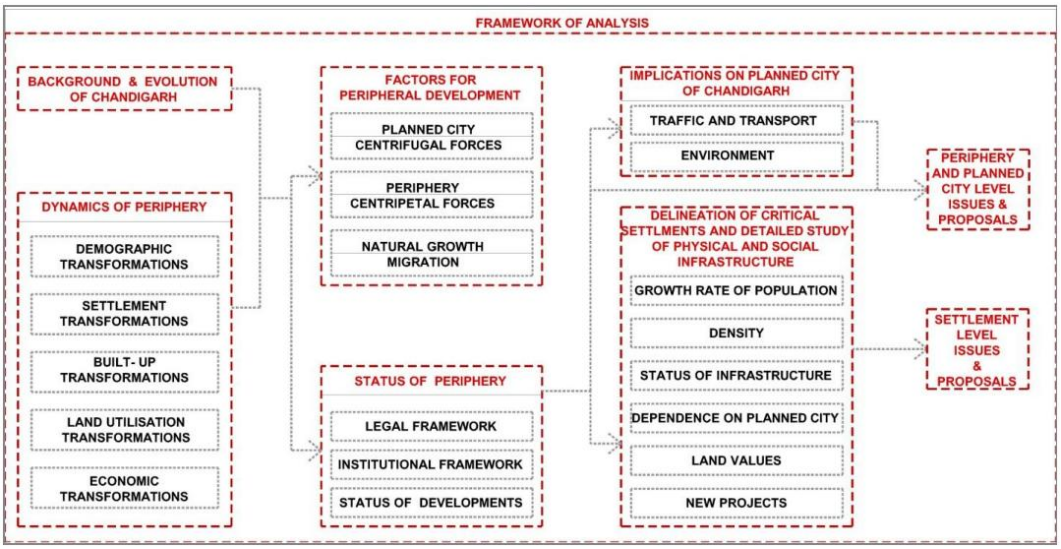
# CHAPTER 4. PERIPHERAL DEVELOPMENTS AROUND CHANDIGARH: DATA COLLECTION AND ANALYSIS

## 4.1. Introduction - Framework of Analysis

The thesis intends to identify the transformations and violations in the periphery of Chandigarh, especially with focus on Zirakpur area as the largest and rapidly developed peripheral development, which have happened against the spirit of the *"Punjab New Capital (Periphery) Control Act, 1952",* the centripetal forces exerted by periphery and centrifugal forces exerted by Chandigarh leading to these peripheral developments and the implications of these peripheral developments on the planned city and also the settlements in the periphery. Furthermore, critical settlements have been identified on the basis of identified parameters. Finally issues and proposals have been worked out at two levels i.e. overall Chandigarh & Periphery level and at identified area of Zirakpur as one of critical settlements of periphery.

Figure 4.1: Framework of analysis for study of peripheral development




Source: Author, 2015

## 4.2. Growth Dynamics of Periphery

The transformations in the periphery in terms of demography, settlements and their civic status, built-up area, land-use and economic status have been analysed. An attempt has been made to infer which part of the periphery is more dynamic in terms of the identified aspects.

### 4.2.1. Demographic Transformations

The demographic transformations in the periphery show that while the planned city is witnessing a declining growth rate, the scenario of periphery is entirely different. Total population of periphery including the parts in Haryana, Punjab and UT of Chandigarh has grown from 2.3 lakhs to 15.3 lakhs i.e. approx. 7 times from 1961-2011. The total urban population has grown from 42,500 to 9.3 lakhs i.e. 22 times in last 5 decades. Percentage of urban population has witnessed an increase from 19% in 1961 to 61% in 2011. Decadal growth rate of urban population from 2001-11 has also been very high i.e. 79% as compared to 50% growth rate for total periphery and 18% rural periphery showing that the urban component is more dynamic as compared to rural component.

Table 4.1: Demographic transformation in Haryana sub-region of periphery

| Year | Total Periphery | | | | | | | | Haryana Periphery | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | | **Urban** | | | Rural | | | Total | | **Urban** | | | Rural | | |
| | Popu. (Lakhs) | Decadal Growth (%) | Popu. (Lakhs) | % | Decadal Growth (%) | Popu. (Lakhs) | % | Decadal growth (%) | Popu. (Lakhs) | Decadal Growth (%) | Popu. (Lakhs) | % | Decadal Growth (%) | Popu. (Lakhs) | % | Decadal Growth (%) |
| 1961 | 2.28 | | 0.43 | 18.7 | | 1.86 | 81.3 | | - | | - | | | - | | |
| 1971 | 2.93 | 28.5 | 0.59 | 20.1 | 38.1 | 2.34 | 79.9 | 26.2 | 0.84 | | 0.23 | 27.0 | | 0.61 | 73.0 | |
| 1981 | 4.35 | 48.5 | 1.35 | 31.1 | 130.2 | 3.00 | 68.9 | 28.0 | 1.25 | 48.1 | 0.38 | 30.8 | 68.9 | 0.86 | 69.2 | 40.4 |
| 1991 | 6.25 | 43.6 | 2.80 | 44.8 | 106.9 | 3.45 | 55.2 | 15.0 | 2.22 | 78.4 | 1.11 | 50.0 | 189.9 | 1.11 | 50.0 | 28.9 |
| 2001 | 10.32 | 65.1 | 5.21 | 50.5 | 86.2 | 5.11 | 49.5 | 48.1 | 3.54 | 59.2 | 2.01 | 56.9 | 81.1 | 1.53 | 43.1 | 37.3 |
| 2011 | 15.33 | 48.5 | 9.30 | 60.7 | 78.3 | 6.03 | 39.3 | 18.0 | 4.30 | 21.5 | 3.06 | 71.2 | 52.1 | 1.24 | 28.8 | -18.9 |
| **Remarks** | - Total population grown approx 7 times while urban population grown 22 times in last 5 decades.<br>- % of urban population increased from 19% in 1961 to 61% in 2011 & rural population decreased from 81% to 39%. | | | | | | | | - 28% of total population in Haryana Sub-region.<br>- Sub-region of Haryana extremely urbanised with 71% urban population and 29% of rural population. | | | | | | | |

Source: Census of India, 1951-2011

Table 4.2: Demographic transformation in Punjab sub-region of periphery and periphery with UT

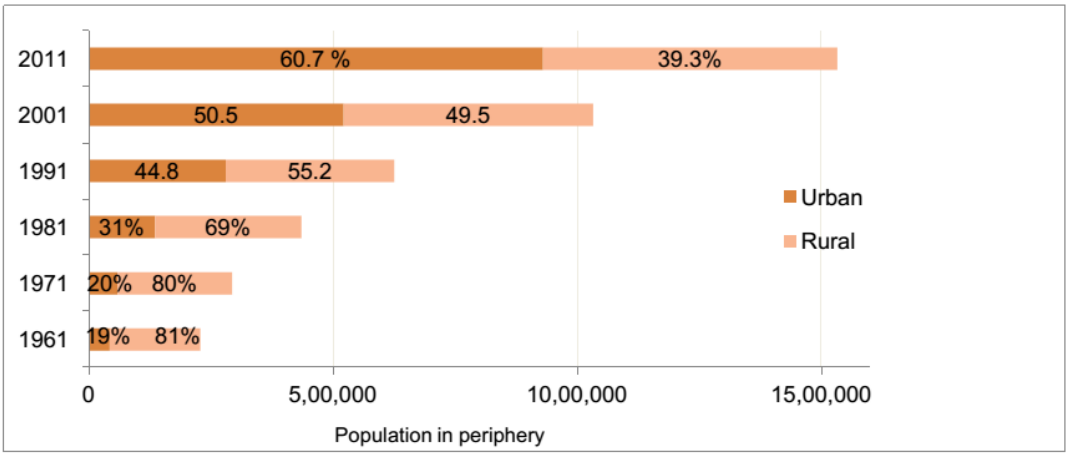
| Year | Punjab Periphery | | | | | | | | UT Periphery | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | | **Urban** | | | Rural | | | Total | | **Urban** | | | Rural | | |
| | Popu. (Lakhs) | Decadal Growth (%) | Popu. (Lakhs) | % | Decadal Growth (%) | Popu. (Lakhs) | % | Decadal Growth (%) | Popu. (Lakhs) | Decadal Growth (%) | Popu. (Lakhs) | % | Decadal Growth (%) | Popu. (Lakhs) | % | Decadal Growth (%) |
| 1961 | - | | - | | | - | | | - | | - | | | - | | |
| 1971 | 1.70 | | 0.22 | 12.9 | | 1.48 | 87.1 | | 0.39 | | 0.14 | 36.9 | | 0.24 | 63.1 | |
| 1981 | 2.54 | 49.0 | 0.69 | 27.2 | 215.2 | 1.85 | 72.8 | 24.5 | 0.57 | 47.4 | 0.28 | 49.3 | 97.2 | 0.29 | 50.7 | 18.3 |
| 1991 | 2.92 | 14.9 | 1.24 | 42.6 | 79.9 | 1.68 | 57.4 | -9.3 | 1.11 | 95.3 | 0.45 | 40.3 | 59.7 | 0.66 | 59.7 | 130.1 |
| 2001 | 5.29 | 81.3 | 2.63 | 49.7 | 111.7 | 2.66 | 50.3 | 58.8 | 1.49 | 34.5 | 0.57 | 38.2 | 27.6 | 0.92 | 61.8 | 39.2 |
| 2011 | 9.36 | 77.0 | 4.86 | 51.9 | 84.9 | 4.50 | 48.1 | 69.1 | 1.66 | 11.5 | 1.37 | 82.6 | 140.8 | 0.29 | 17.4 | -68.5 |
| **Remarks** | - 61% of total population in Punjab Sub-region.<br>- Less urbanised as compared to Haryana Periphery.<br>- More dynamic in terms of demographic growth than Haryana periphery | | | | | | | | - 11% of total population in Chandigarh sub-region<br>- Highly urbanised with 83% urban population<br>- Decadal growth rate of urban population very high ie 140% | | | | | | | |

Source: Census of India, 1951-2011

In case of Haryana periphery sub-region comprising of 295 sq kms, it has been witnesses that the population has increased from 85,000 to 4.3 lakhs i.e. approx 5 times since 1961 to 2011. Urban population in periphery has grown from 22,700 to 3.0 lakhs i.e. 13 times in last 5 decades while the percentage of urban population has increased from 27% in 1951 to 71% in 2011. The decadal growth rate of urban population 2001-2011 is also high i.e. 52% as compared to 21% growth rate for total periphery and -18% rural periphery.

Punjab periphery sub-region consisting of 1021 sq kms has witnessed total population increase from 1.7 lakhs to 9.4 lakhs i.e. approx 6 times while urban population in this part of periphery has grown from 21,900 to 4.8 lakhs i.e. 22 times in last 5 decades. The percentage of urban population has increased from 13% to 53% in 2011. Also the decadal growth rate of urban population is high i.e. 85% as compared to 69% rural periphery.

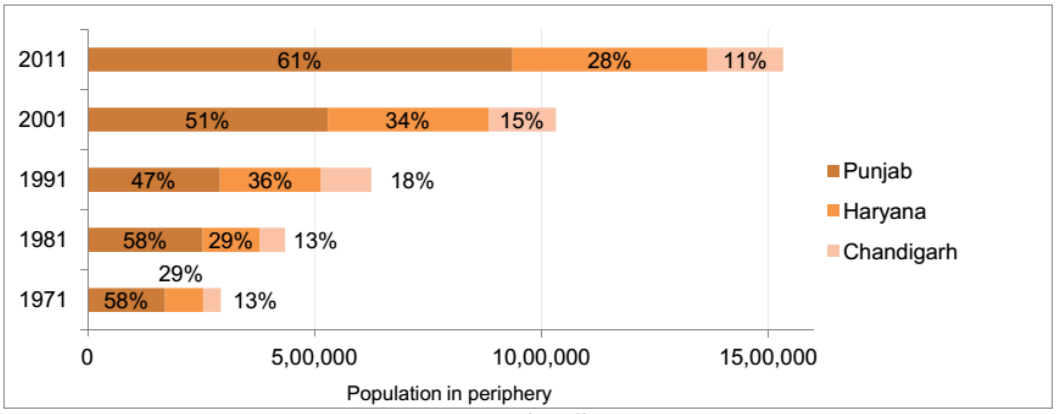
Figure 4.2: Composition of urban and rural population in periphery




Source: Census of India, 1951-2011

The above figure indicates that in 1961, major share of population was attributable to rural component which was approximately 82% while urban population was only 18%. In 1981, urban component grew to approximately 31% and also the growth rate of urban population was as high as 130%. In 2001, urban and rural component became almost 50% with high urban decadal growth of almost 86%. As per latest census, urban component is approx. 61% with a decadal growth rate of approximately 78%.

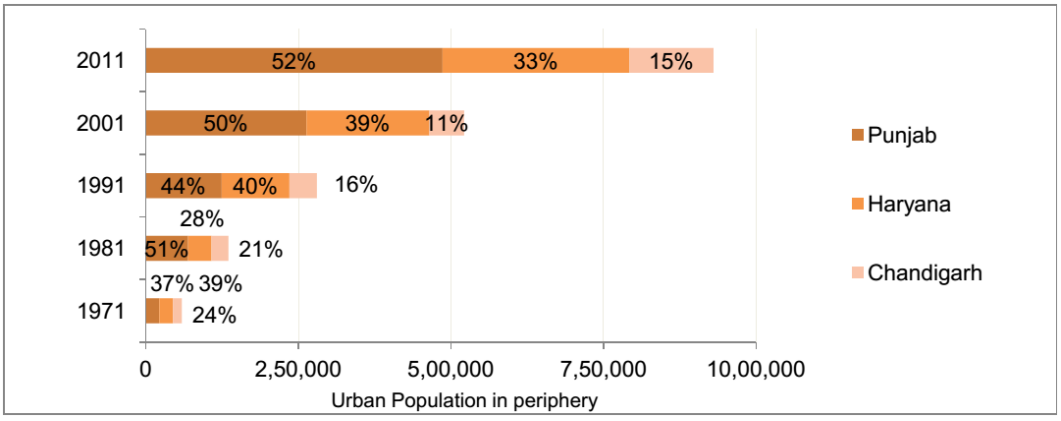
Figure 4.3: Distribution of population in all the three periphery sub-regions




Source: Census of India, 1951-2011

In 1961, Punjab region held a clear majority of total population – approx. 58%, almost double the population held by Haryana region. In 1991, the percentage dropped down to 46.7% while it grew to 61% in 2011. Punjab region exhibits high growth rate of 77% as compared to the growth rate of Haryana which is approximately 21%.

Figure 4.4: Distribution of urban population in all the three periphery sub-regions




Source: Census of India, 1951-2011

Urban population exhibits very high growth rate since 1971 due to a number of factors, the most important being coming up of planned townships of Punchkula & Mohali. Also high decadal growth rate of 78.3% is witnessed in 2001-11 for urban population. Amongst the 3 periphery sub-regions, Punjab hold maximum percentage of urban population. The component of urban population held by Punjab has increased from 37% in 1971 to 53% in 2011. Percentage of urban population held by Haryana decreased from 39% to 32% in 2011.

**Inferences**

- The total population has grown approximately 7 times while urban population has grown 22 times in the last 5 decades. While the percentage of urban population has increased from 19% in 1961 to 61% in 2011, rural population has decreased from 81% to 39%.
- Approximately 28% of total population lies in Haryana Sub-region which is extremely urbanised with 71% urban population and 29% of rural population.
- Approximately 61% of total population lies in Punjab Sub-region which is less urbanised as compared to Haryana Periphery. But it is more dynamic in terms of demographic growth than Haryana periphery.
- Approximately 11% of total population lies in Chandigarh sub-region which is highly urbanised with 83% urban population and only 17% rural population. Furthermore decadal growth rate of urban population is also very high i.e. 140% for this sub-region.

### 4.2.2. Settlement Transformations

The study of settlements in the periphery reveals that the total numbers of census towns have grown from 1 to 15 while the statutory towns have grown from 4 to 10. Census towns witness population increase from 9,941 to 1.34 lakhs (13 times) while statutory towns witness population increase from 32,643 to 7.95 lakhs (24 times).

Table 4.3: Growth of statutory and census towns in periphery

| Periphery Sub-Region | 1961 | | | 1971 | | | 1981 | | | 1991 | | | 2001 | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Census | Statutory | Area (sq km) | Census | Statutory | Area (sq km) | Census | Statutory | Area (sq km) | Census | Statutory | Area (sq km) | Census | Statutory | Area (sq km) | Census | Statutory | Area (sq km) |
| Haryana | | | | - | 1 | 2.85 | 1 | 2 | 19.08 | 2 | 2 | 23.45 | 1 | 3 | 39.44 | 4 | 3 | 70.36 |
| Punjab | | | | - | 3 | 7.38 | 1 | 3 | 24.16 | - | 4 | 28.44 | 4 | 5 | 111.91 | 6 | 6 | 142.8 |
| Chd U.T. | | | | - | 1 | 2.45 | - | 1 | 3.05 | 1 | 1 | 8.06 | - | 1 | 3.45 | 5 | 1 | 8.93 |
| Total | 1 | 4 | 6.8 | | 5 | 12.68 | 2 | 6 | 46.29 | 3 | 7 | 59.95 | 5 | 9 | 151.35 | 15 | 10 | 222.09 |
| | 5 | | 8 | 5 | | | 8 | | | 10 | | | 14 | | | 25 | | |

Source: Census of India, 1951-2011

The following table indicates population wise distribution of statutory and census towns in the three periphery sub-regions. Two class-I cities are located each in Haryana and Punjab sub-regions and are contiguous with planned city. Class-II towns are also located close to planned city indicating that their proximity to planned city has played important role in migration to these towns and cities.

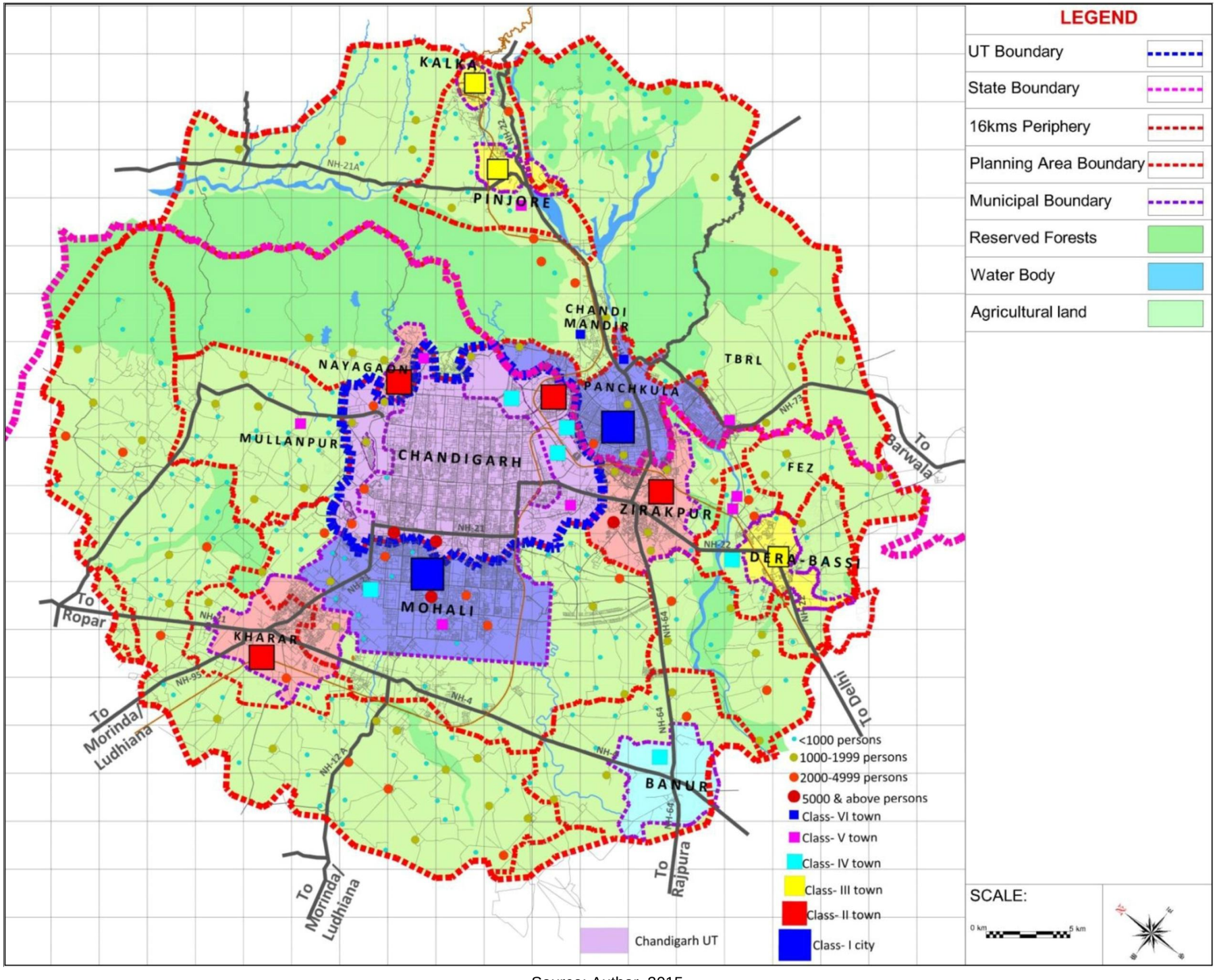
Table 4.4: Class-wise distribution of towns in periphery

| Class | Population | Punjab region | Haryana Region | Chd Region | Total |
|---|---|---|---|---|---|
| Class-I Cities | 1 lakh | 1 | 1 | - | 2 |
| Class-II Town | 50000-99999 | 3 | - | 1 | 4 |
| Class-IIITown | 20000-49999 | 1 | 2 | - | 3 |
| Class-IV Town | 10000-19999 | 3 | - | 3 | 6 |
| Class-V Town | 5000-9999 | 4 | 2 | 2 | 8 |
| Class-VI Town | <5000 | - | 2 | - | 2 |
| Total | | 12 | 7 | 6 | 25 |

Source: Census of India, 1951-2011

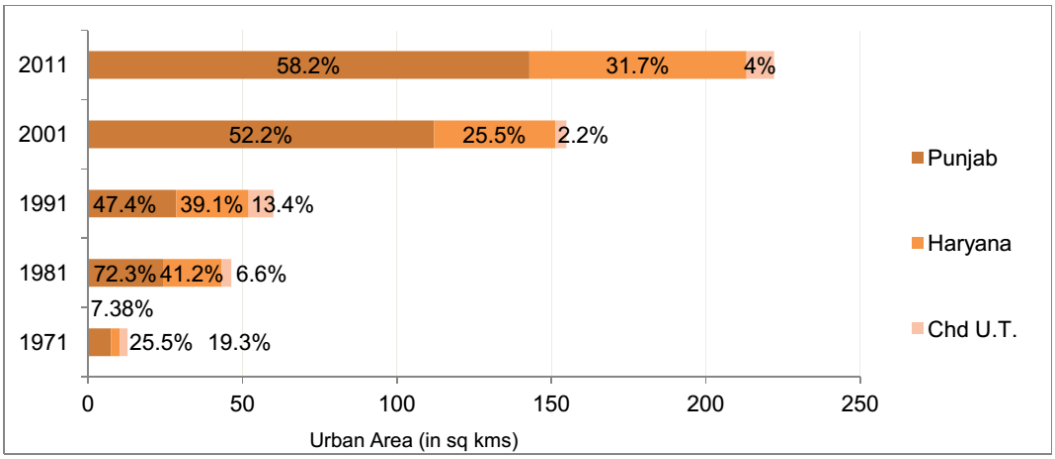
The total urban area in periphery has increased tremendously from approximately 7 sq kms to 222 sq kms. While majority of urban area i.e. 142 sq kms lies in Punjab region, almost half of it, i.e. approximately 70 sq kms lies in Haryana sub-region.

Map 4.1: Location of settlements in the periphery




Source: Author, 2015

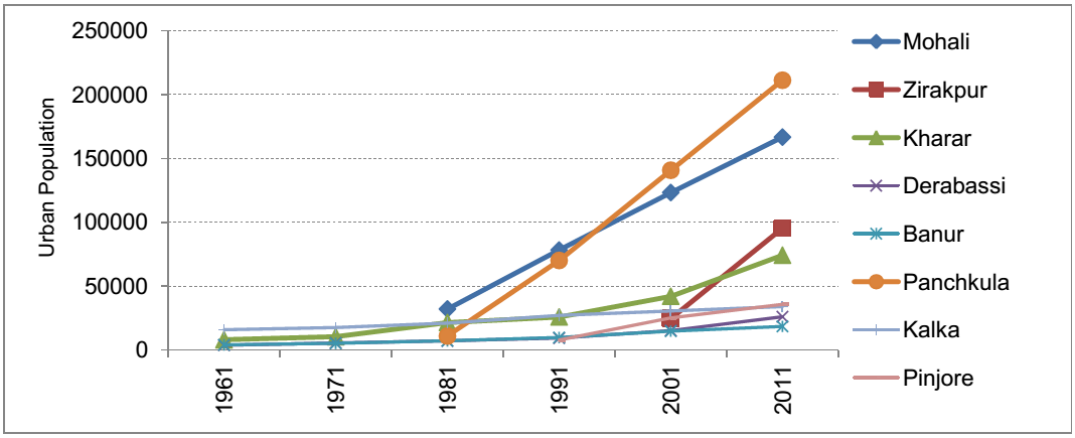
Figure 4.5: Growth of urban area in different sub-regions




Source: Census of India, 1951-2011

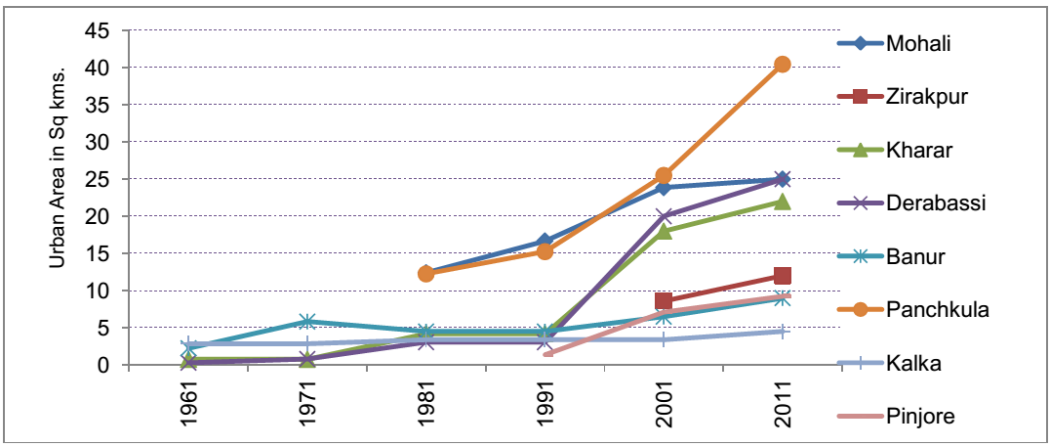
The following figure shows the growth of urban population in towns and cities. It has been observed the satellite city of Punchkula in Haryana sub-region exhibits rapid growth followed by Mohali in S.A.S Nagar. Furthermore, Zirakpur conceived in 1999 is also exhibiting rapid growth rate and urbanization trends. Other settlements like Kharar, Derabassi etc. exhibit moderate growth rates.

Figure 4.6: Growth of urban population in towns and cities




Source: Census of India, 1951-2011

Figure 4.7: Growth of urban area in towns and cities




Source: Census of India, 1951 – 2011

The above figure shows the growth of urban area in towns and cities. It has been observed that Punchkula city exhibits highest growth rate in total periphery.

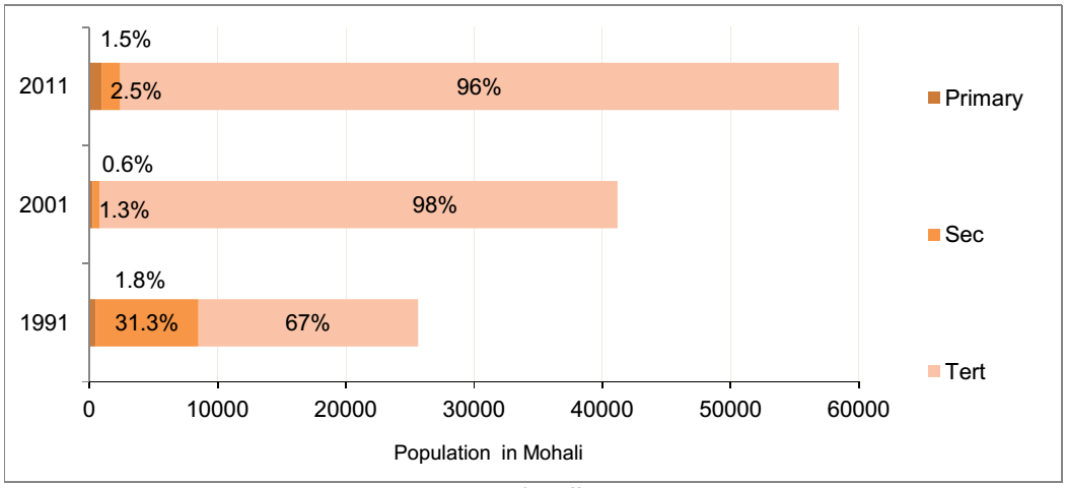
**Inferences**

- It has been observed that majority higher order towns have come up closer to Chandigarh indicating that proximity to the planned city is a major factor for their growth.

### 4.2.3. Economic Transformation

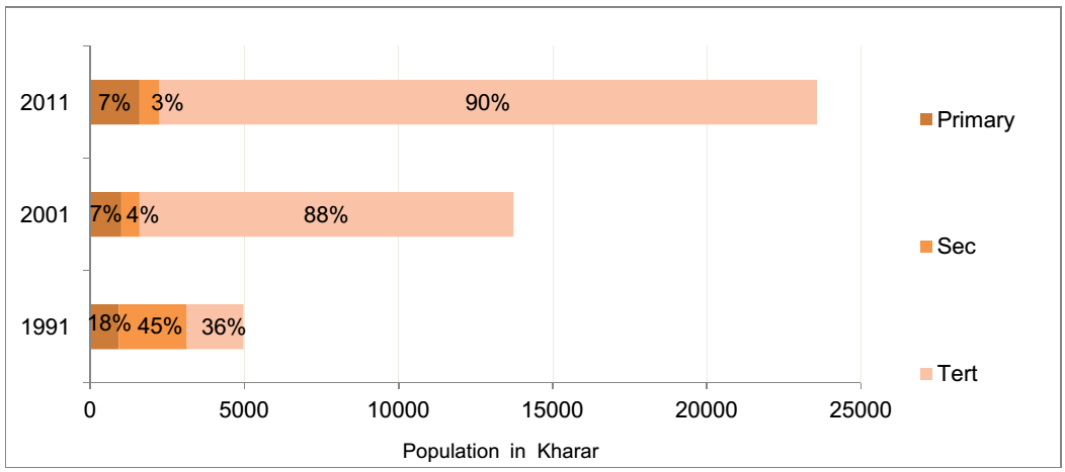
The following figures show transformations in the towns and cities in the periphery. The following figures show the economic transformations in Mohali, Kharar, Punchkula and Zirakpur, where the transformation has happened in a wider scale.

Figure 4.8: Economic transformations in Mohali



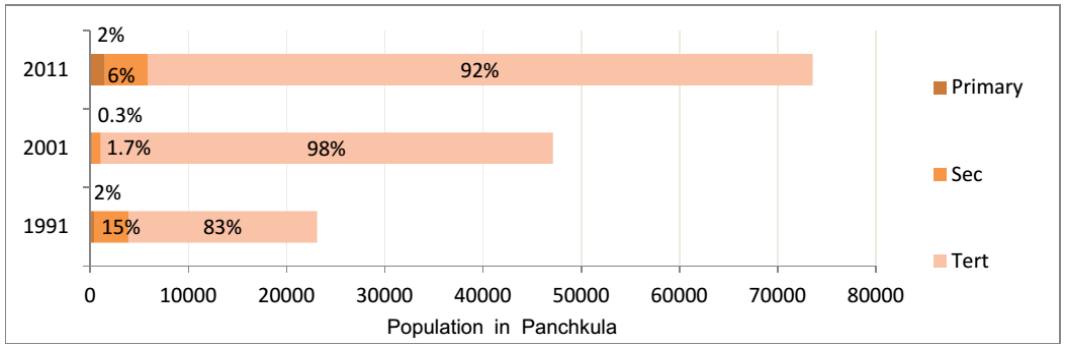

Source: Census of India, 1951 – 2011

Figure 4.9: Economic transformations in Kharar



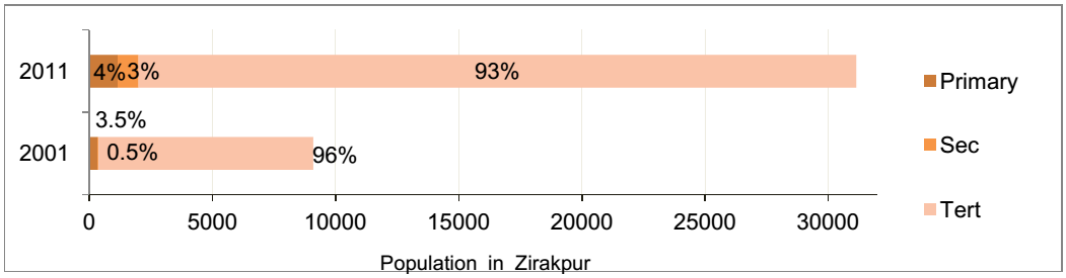

Source: Census of India, 1951 – 2011

Figure 4.10: Economic transformations in Punchkula




Source: Census of India, 1951 – 2011

Figure 4.11: Economic transformations in Zirakpur




Source: Census of India, 1951 – 2011

**Inferences**

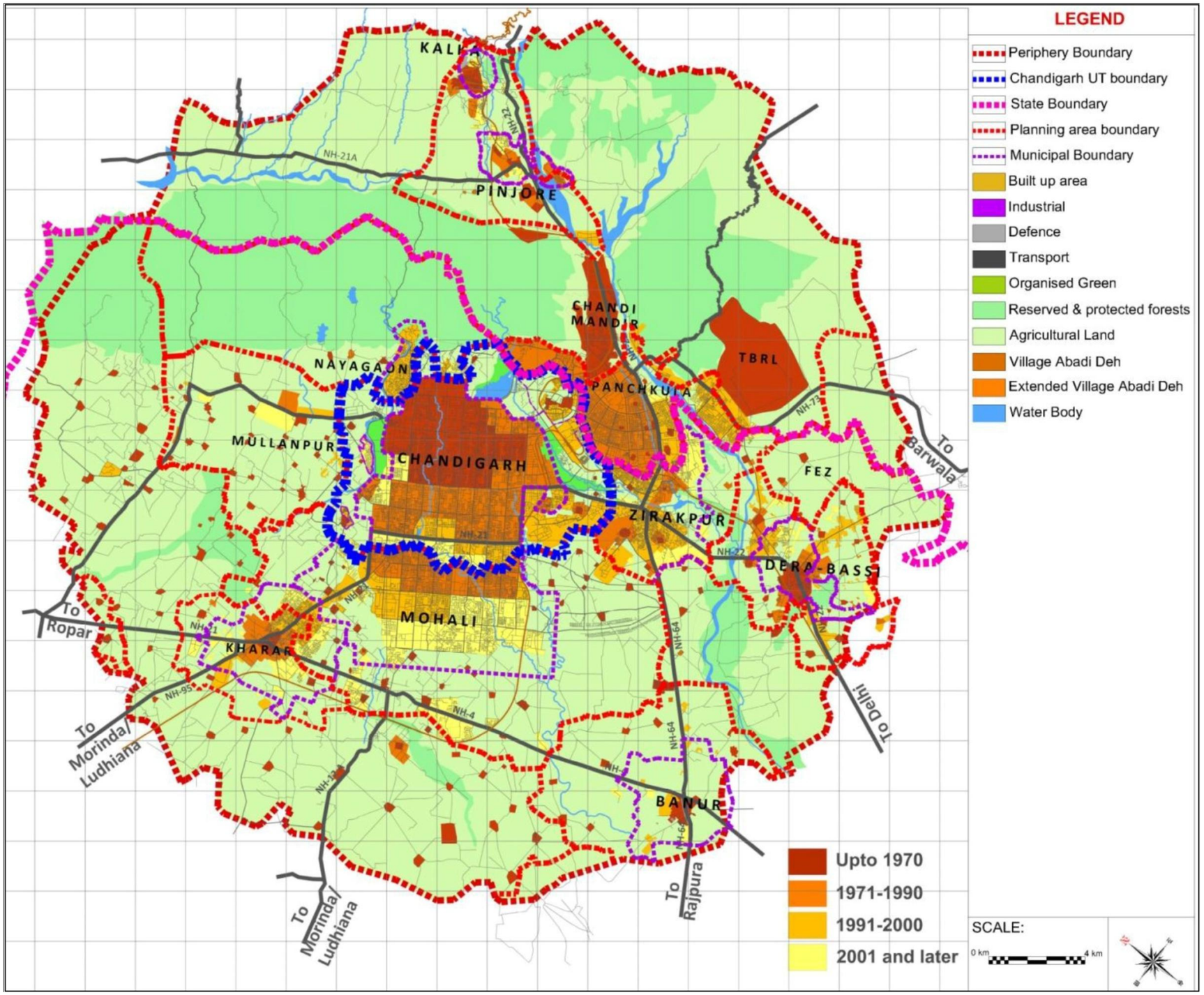
- In all the towns, there is a rapid growth in the tertiary sector while the growth rate of primary and secondary sector is marginal. Mohali conceived as an industrial town also witness heavy dependence on tertiary sector as the economic base is witnessing transformation from industrial to commercial and administrative. Also SEZ comprising of IT

companies and other BPOs are coming up leading to a shift in tertiary sector.

### 4.2.4. Built-Up Area Transformations

The period upto 1970's witnessed growth and development in mainly the UT of Chandigarh. There were small towns in both the periphery sub-regions which were growing at a very slow pace. Zirakpur, Derabassi, Kharar and Banur in Punjab periphery sub-region and Kalka in Punchkula sub-region also exhibited slow growth trends. Also it has been observed that in Haryana sub-region, a number of Central Government projects had come up prior to 1970. These included Chandimandir Cantonment, Terminal Ballastic Research Centre (TBRL), HMT Factory as well as residential townships. It has been observed that upto 1990s growth was happening with Chandigarh, Mohali and Punchkula as different growth centres. However, Chandigarh was the main reason for the development of residential townships of Punchkula and Mohali at periphery.

Map 4.2: Built-up area transformations in the periphery




Source: Author, 2015

Post 1990s period witnessed the filling up of intervening spaces between the settlements of Chandigarh, Punchkula and Mohali and settlements became contiguous with tri-city emerging as dominating centres. NAC Zirakpur, formed in 1999 was also a landmark event witnessed in this period. Furthermore, post 2000 period witnessed growth sprawling beyond the tricity. Both ribbon development along major transportation corridors and development in piecemeal manner have been observed in the periphery in this period. Map 4.2 shows the transformations in Chandigarh and its periphery in terms of built-up area from 1951 to 2014.

**Inferences**

- Emergence of tricity comprising of Chandigarh, Punchkula and Mohali and their consequent urban sprawl and formation of Zirakpur Notified Area Committee (NAC) are the landmark events that have totally negated the spirit of the delineated periphery.

### 4.2.5. Land Utilization Transformations

An attempt has been made to ascertain the quantity of agricultural land, forests, open area, water bodies which have been converted to accommodate urban land-uses and the transformations are observed in the periphery area of sub-regions of Punjab and Haryana. Map 4.3 shows the present land utilization status of the periphery.

It has been observed that though the original periphery controlled plan did not provide for industrial, residential, commercial land-use as per the future need to achieve a balanced growth around city, the current land utilization pattern is quite contrasting. A huge chunk of land was notified as FEZ in 1995 and is one of the biggest violations of the act, as there was no provision of industrial land-use in the development plan of Chandigarh periphery. Detailed land-utilization changes have been discussed for different sub-regions of periphery.

#### 1) Haryana Periphery Sub-Region

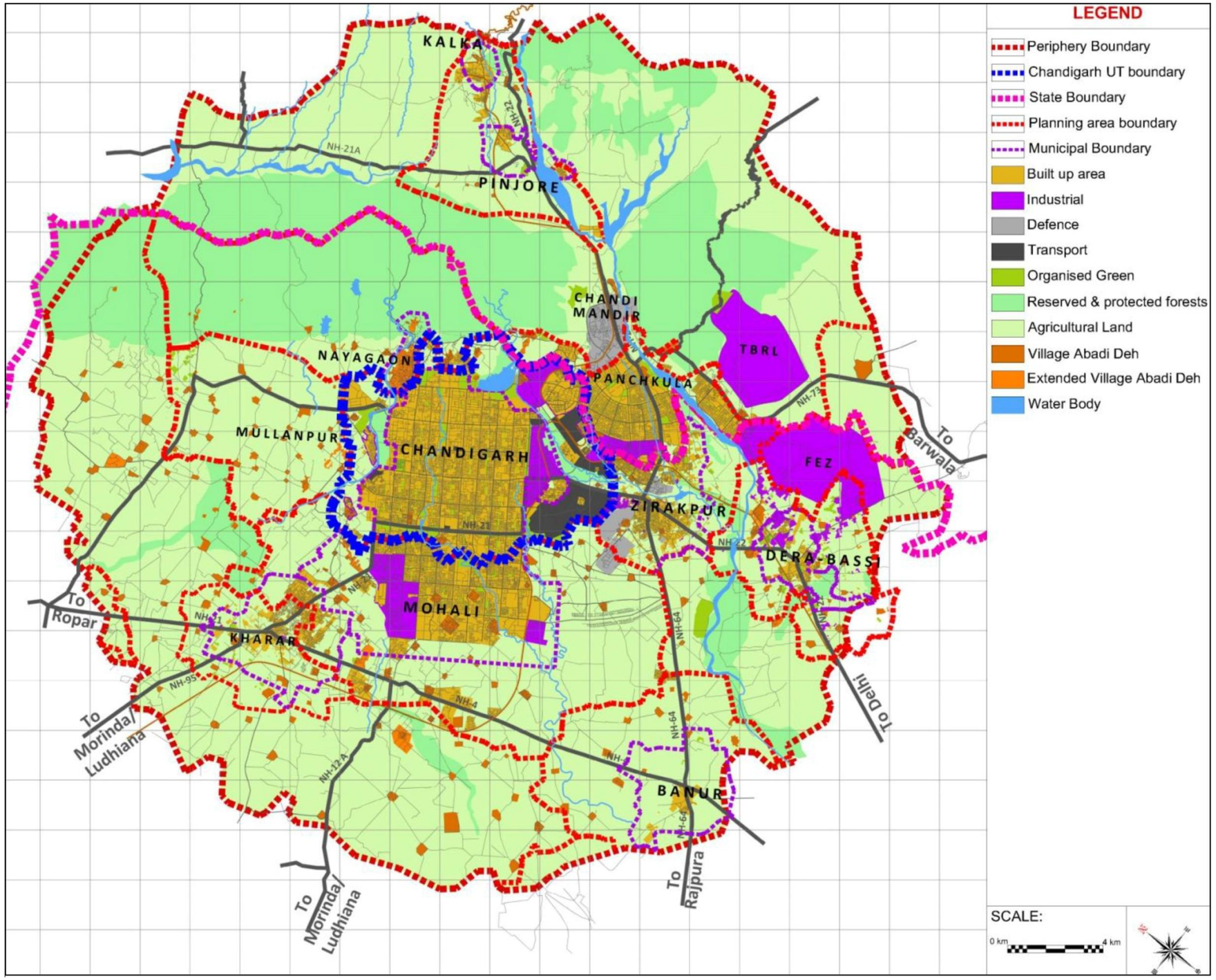
The following table shows the proposed land utilization pattern as per the development plan of Haryana periphery sub-region in 1972. It indicates that the projected agricultural land as per development plan was approximately 32%. The same has been compared with the existing situation.

Table 4.5: Land Utilization as per development plan for controlled area, Haryana Sub-region, 1972

| Zone | Area (ha) | % |
|---|---|---|
| Urbanisable zone | 8510 | 28.8 |
| Agricultural Zone | 9616 | 32.6 |
| Reserve forest Zone | 4774 | 16.2 |
| Restricted Zone | 447 | 1.5 |
| Stone crusher zone | 44 | 0.2 |
| Special project zone | 3282 | 11.1 |
| Water body | 2826 | 9.6 |
| Total | 29500 | 100 |

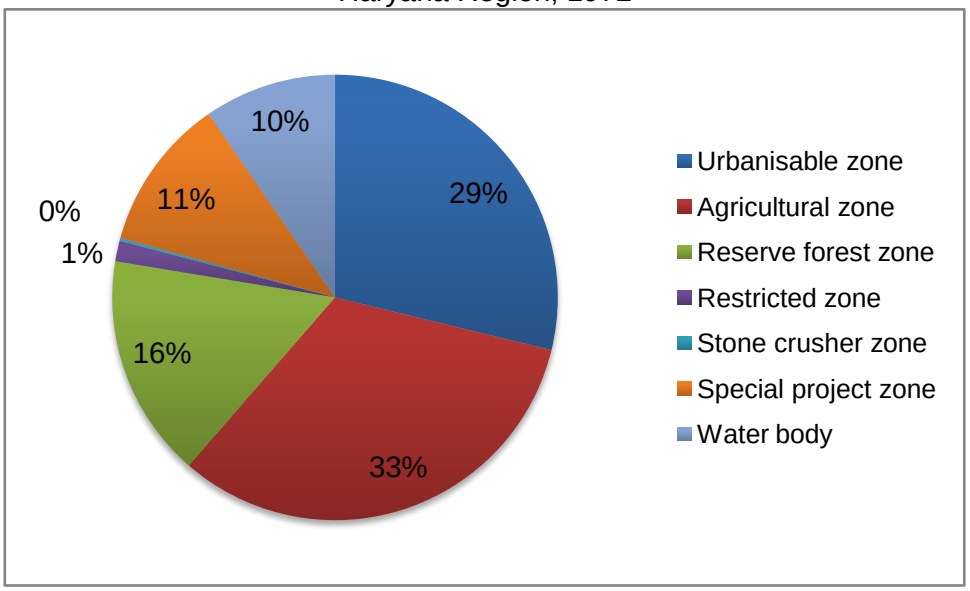
Source: TCPO, Haryana

Map 4.3: Land utilization map, 2015




Source: Author, 2015

Figure 4.12: Land utilization as per proposed development plan for Haryana Region, 1972




Source: Dept. of Town & Country Planning, Haryana

The land cover transformations indicate that even though all the urbanization projects planned for Haryana Periphery have not come up, yet the agricultural land left is approximately 32% which is expected to decrease further when the remaining urbanization projects come up in the periphery. The following table shows the land utilization transformations in Haryana Periphery Sub-region.

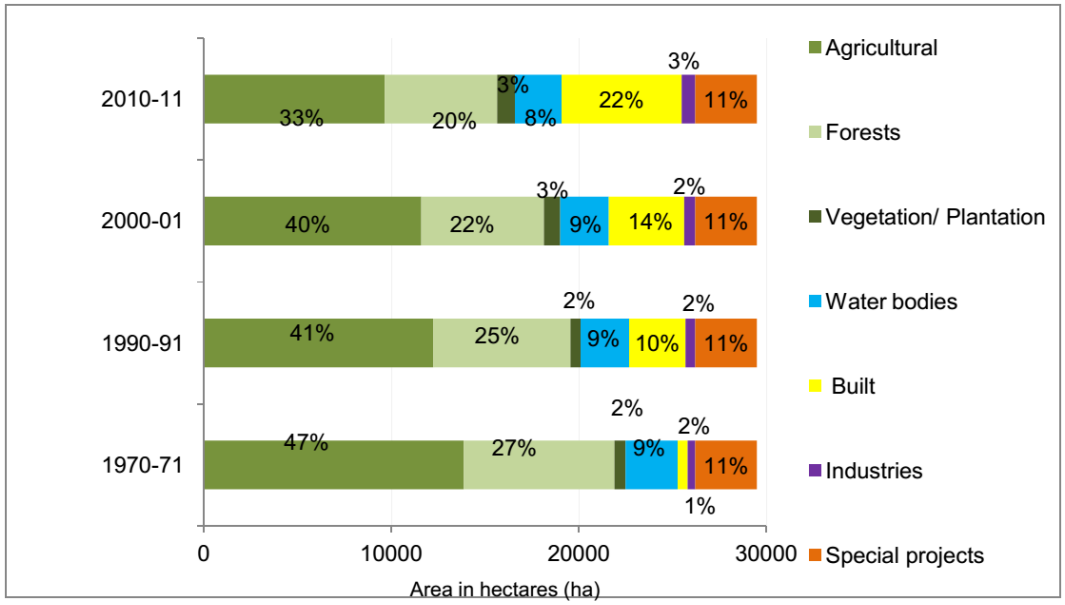
Table 4.6: Land-cover transformation in Haryana region

| Land use/Land cover | Area (in ha) | | | | % | | | |
|---|---|---|---|---|---|---|---|---|
| | 1970-71 | 1990-91 | 2000-01 | 2010-11 | 1970-71 | 1990-91 | 2000-01 | 2010-11 |
| Agricultural | 13851 | 12243 | 11606 | 9647 | 47.0 | 41.5 | 39.3 | 32.7 |
| Protected Forest | 4314 | 3573 | 2795 | 2256 | 14.6 | 12.1 | 9.5 | 7.6 |
| Reserve Forest | 3743 | 3743 | 3743 | 3743 | 12.7 | 12.7 | 12.7 | 12.7 |
| Water bodies | 2779 | 2594 | 2583 | 2495 | 9.4 | 8.8 | 8.8 | 8.5 |
| Vegetation | 371 | 389 | 756 | 845 | 1.3 | 1.3 | 2.6 | 2.9 |
| Plantation | 223 | 148 | 112 | 95 | 0.8 | 0.5 | 0.4 | 0.3 |
| Special Project | 3282 | 3282 | 3282 | 3282 | 11.1 | 11.1 | 11.1 | 11.1 |
| Built up | 346 | 2665 | 3396 | 5347 | 1.2 | 9.0 | 11.5 | 18.1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Communication Zone (Transport) | 185 | 333 | 556 | 956 | 0.6 | 1.1 | 1.9 | 3.2 |
| Slum | - | 19 | 70 | 105 | - | 0.1 | 0.2 | 0.4 |
| Bricklin | 37 | 30 | 63 | 79 | 0.1 | 0.1 | 0.2 | 0.3 |
| Others | 369 | 491 | 539 | 650 | 1.2 | 1.7 | 1.8 | 2.2 |
| Total | 29500 | 29500 | 29500 | 29500 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Dept. of Town & Country Planning, Haryana

Figure 4.13: Land-cover transformation in Haryana Region




Source: Dept. of Town & Country Planning, Haryana

**Inferences**

- It has been observed that the built-up area has increased from 1.2% to 18.1% at the cost of agricultural land and area under forests. While the agricultural land has decreased from 47% to 32.7% since 1970, area under forests also decreased from 14.6% to 7.6%.
- Also it has been observed that the area under water bodies has also shrunk. This is due to drying up of water bodies and encroachment by slums and squatter settlements. But since most of the remaining land is unsuitable for development or is under protected and reserve forests, hence there is not much scope left for development in this part of periphery.

**2) Punjab Periphery Sub-Region**

In the absence of revised development plan for Punjab Periphery Sub-region post reorganization in 1966, development in this part of the periphery has come up in a haphazard manner. Since 1966, the first attempt for planned development has been made in 2008 by notifying a regional plan for GMADA area. It is important to note that the GMADA boundary is not coterminous with that of Punjab Periphery, which implies that there is absolutely no statutory plan in Punjab sub-region which specifically caters to the periphery. The land utilization pattern proposed in the regional plan has been shown in the following table.

Table 4.7: Proposed land-utilization in GMADA Regional Plan, 2056

| Land-Use | Area (ha) | Percentage (%) |
|---|---|---|
| Urbanisable area | 42,740 | 35.9 |
| Industrial | 2,478 | 2.1 |
| Rural settlements | 4,567 | 3.8 |
| Agricultural area within LPA | 18,483 | 15.5 |
| Agricultural area outside LPA | 24,990 | 21 |
| Recreational | 4,370 | 3.7 |
| Forests | 12,281 | 10.3 |
| Water bodies | 2,890 | 2.4 |
| Transportation | 4,885 | 4.1 |
| Restricted development zone | 1,351 | 1.1 |
| Total | 1,19,035 | 100 |

Source: Regional Plan for GMADA, 2058

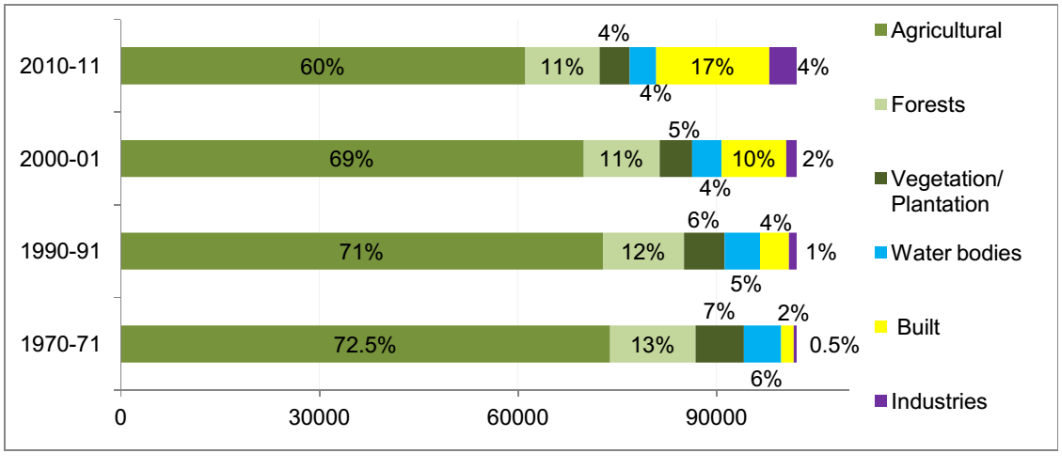
It has been observed that the estimated agricultural land that would be left in GMADA area after all the developments have been realised in 2056 is as low as 36%. The following table shows the land utilization transformations in Punjab Periphery from 1970 to 2011. It has been observed from the table that the agricultural land has decreased from 72% in 1970s to approximately 60% in 2011. The area under forests has also decreased from approximately 13% to 11%. Industrial area has also witnessed increase from 0.4 to 4% as a result of FEZ delineated & due to arbitrary land-use change policy of the state.

Table 4.8: Land-cover transformation in Punjab Region

| Land use/Land cover | Area (in ha) | | | | % | | | |
|---|---|---|---|---|---|---|---|---|
| | 1970-71 | 1990-91 | 2000-01 | 2010-11 | 1970-71 | 1990-91 | 2000-01 | 2010-11 |
| Agricultural | 73900 | 72860 | 69914 | 61107 | 72.4 | 71.4 | 68.5 | 59.9 |
| Forests | 12920 | 12202 | 11464 | 11206 | 12.7 | 12.0 | 11.2 | 11.0 |
| Wasteland | 7310 | 6118 | 4922 | 4553 | 7.2 | 6.0 | 4.8 | 4.5 |
| Water bodies | 5602 | 5362 | 4469 | 4021 | 5.5 | 5.3 | 4.4 | 3.9 |
| Urban Built | 558 | 2145 | 5026 | 9352 | 0.5 | 2.1 | 4.9 | 9.2 |
| Rural Built | 1362 | 2217 | 4724 | 7727 | 1.3 | 2.2 | 4.6 | 7.6 |
| Industries | 448 | 1196 | 1581 | 4134 | 0.4 | 1.2 | 1.5 | 4.0 |
| Total | 102100 | 102100 | 102100 | 102100 | 97.7 | 100.0 | 100.0 | 100.0 |

Source: Regional Plan for GMADA, 2058

Figure 4.14: Land-cover transformation in Punjab Region




Source: Regional Plan for GMADA, 2058

**Inferences**

- Built-up area in both sub-regions is rapidly increasing at the cost of agricultural land, forests, water bodies etc. Furthermore in case of Punjab, increasing built-up area and changing land utilisation pattern may be attributed to absence of policy framework leading to rapid land-use conversions.

## 4.3. Discussion: Identified Determinants for Peripheral Development and their Implications on the Parent City

### 4.3.1. Introduction

In the following section, an attempt has been made to identify all the factors that have been acting as centrifugal forces driving the migrants to the peripheral settlements. However it is important to note that even though peripheral settlements are more preferable for residential purpose due to a number of reasons discussed in the following section, still people commute to the planned city of Chandigarh for infrastructure and other facilities.

Besides, an attempt has been made to ascertain the implications of the inadequacies in the peripheral settlement on the planned city of Chandigarh. In order to assess the implications, the interaction between peripheral settlements and planned city is ascertained through number of trips made to the planned city and the purpose of trips. Also the burden on physical infrastructure like water supply and sewage system has been ascertained to comprehend the implications on planned city.

### 4.3.2. Factors for Peripheral Development

#### 4.3.2.1. Demography

The planned city of Chandigarh was designed for 5 lakh population to be accommodated in two phases. It is important to mention that the housing and infrastructure designed in the city was for an ultimate population of 5 lakhs. However the population increased to 6.4 lakh in 1991 itself. Even though phase 3 was developed to accommodate additional population, but still this factor proved to be a centrifugal force for peripheral development. Thus demographic factor played an important role in channelizing growth in the periphery of Chandigarh.

Table 4.9: Demographic changes in Chandigarh

| Year | Area (sq kms) | MC (pop.) | Urban (pop.) | UT (pop.) | Growth Rate (%) |
|---|---|---|---|---|---|
| 1951 | - | - | - | 24261 | - |
| 1961 | 32.4 | 99262 | 99262 | 119881 | 394.1 |
| 1971 | 57.6 | 232940 | 232940 | 257251 | 114.6 |
| 1981 | 68.33 | 422841 | 422841 | 451610 | 75.6 |
| 1991 | 78 | 575829 | 575829 | 642015 | 42.2 |
| 2001 | 79.34 | 808515 | 808796 | 900914 | 40.3 |

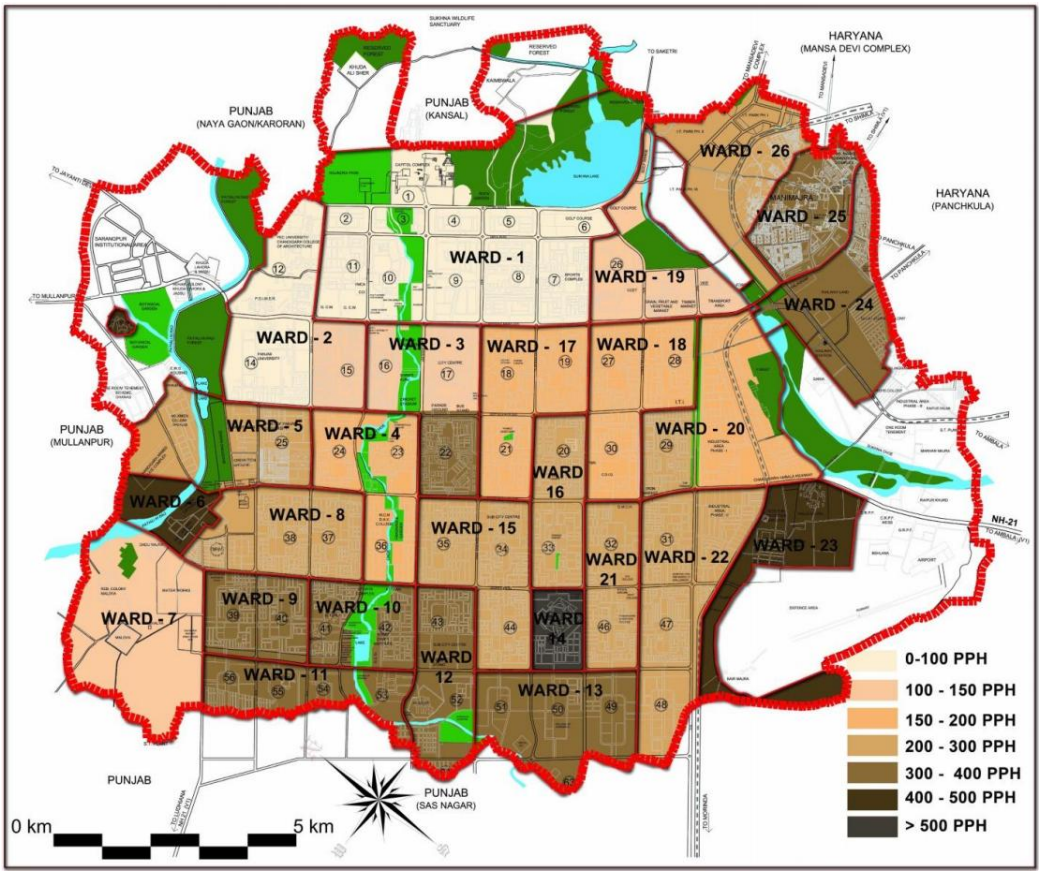
| | | | | | |
|---|---|---|---|---|---|
| 2011 | 90 | 970602 | 1026459 | 1054450 | 17.0 |

Source: Draft Master Plan – Chandigarh, 2031

#### 4.3.2.2. Density

Chandigarh was designed for density of 40 pph in Phase-I sectors i.e. sectors 1-30 and 140 pph in Phase-II sectors i.e. sectors 31-47. But the density rose beyond the designed limit in 1990's itself. Presently the city level density is approximately 92 pph, with most wards exhibiting gross residential density (GRD) greater than 200 pph. Currently, wards in Phase-I have densities upto 150 pph with a few wards having densities as high as 300 pph. Wards in phase-II and phase-III have even higher densities of the order of 300-500 pph. Thus it has been observed that the current densities have exceeded the planned densities which is another important factor leading to peripheral developments.

Map 4.4: Existing density of Chandigarh, 2011




Source: Draft Master Plan, Chandigarh, 2031

#### 4.3.2.3. Housing

Housing sub-systems in planned city of Chandigarh consist of mainly public and private housing. Approximately 1/3 rd of total housing units in the

planned city are private with plots ranging upto area of 13 Kanal (5000 sqmt). Out of the total private housing stock, nearly 1/3 rd of the plots are of one kanal (500 sqmt) or above and they account for approximately 96% of the total area allocated for private residential plots.

On the other hand, Government plots ranging upto 7500 sqmt account for almost 15% of the total housing stock. Out of the total government housing stock, 75% of government housing is single / double storied. This is due to “Frame control and Architectural controls”, applicable to the government housing as a result of which height of most government houses is restricted to single storied or double storied.

Furthermore, a number of government houses are unoccupied reflecting that the potential of housing has not been suitably tapped. It may be concluded that there are limited housing options available within the planned city either due to large plots, which becomes unaffordable or due to architectural controls that restrict the vertical expansion of houses forcing people to opt for affordable housing at peripheral settlements.

#### 4.3.2.4. Development Control Regulations

As defined in Draft Chandigarh Master Plan – 2031, *“Development controls have been defined as the mechanism through which entire process of urban development is regulated to achieve the objective of promoting overall benefit of the society and creating a distinct image of the city. It includes guiding the development and use of land, curbing misuse of land and promoting rational and orderly development of built environment. Development controls are required to meet situations and contexts, which are generally static. In this context, they tend to become rigid and complex. Looking at the far reaching impact and implications of the development controls on the growth and development, character, fabric and personality of a city, they need to be framed with great care and abundant caution. Considering the larger public interest and general welfare of the community, formulation of the development control should satisfy the basic requirements of the health, safety, convenience, economy and amenity”.*

Chandigarh is one of the prime example, which has already a high quality development control regulations in place, aiming towards the urban aesthetics and planned built environment and moreover to ensure that the aesthetic character of the planned city is retained as per Corbusier’s philosophy.

There are Architectural Controls for residential land-uses adjoining commercial streets (V4 roads), where the external facades of the buildings

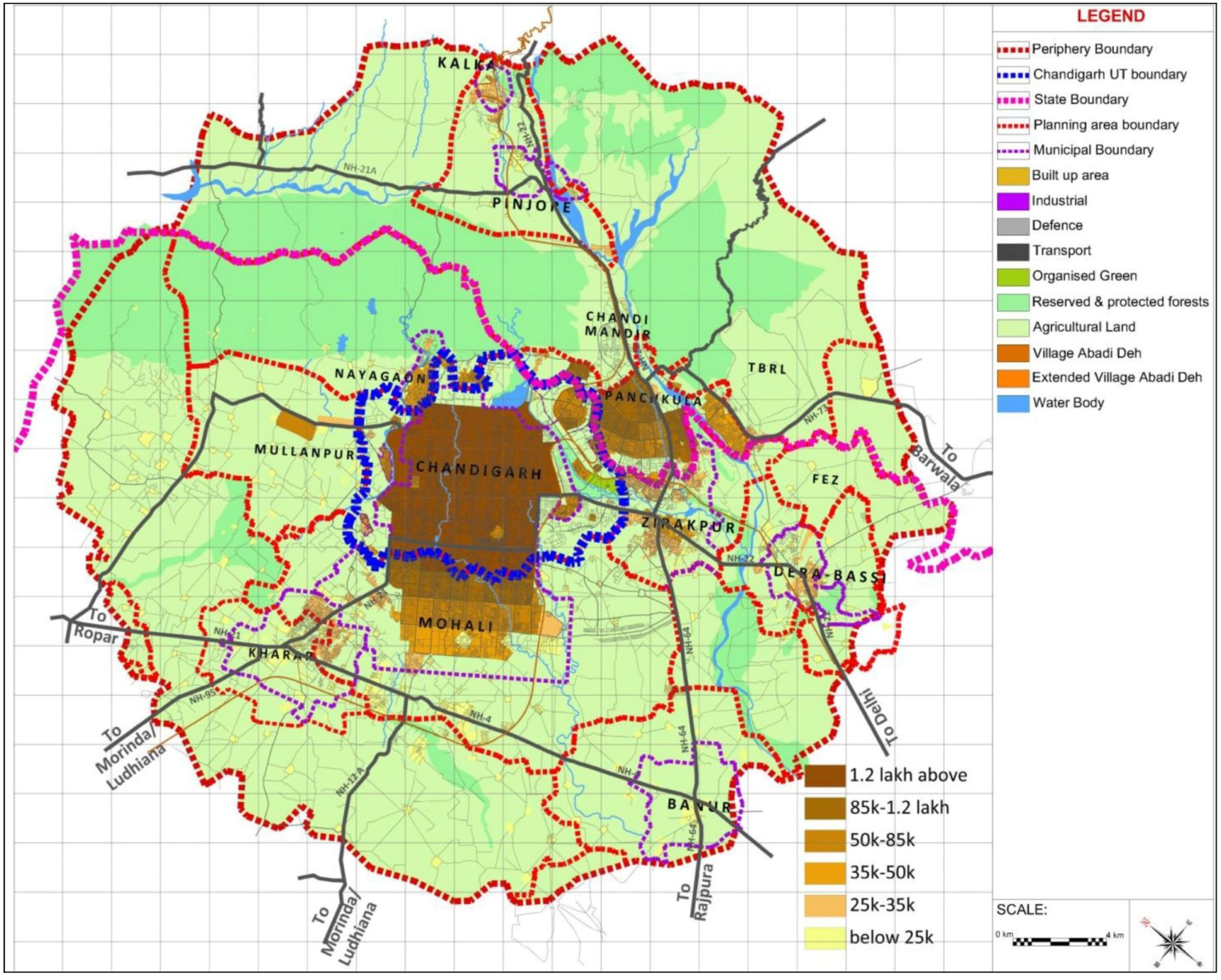
including the height is regulated. Also there are Frame Controls applicable for 5 marla to 14 marla category houses. These control compromise of fixing the extent and height of the marla houses so that there is uniformity in the character of Marla houses. Architectural Control Houses / Building Height Restrictions have been imposed to restrict the footprint, volume and height of the house located in Phase-I along Uttar Marg, Leisure Valley and certain V3 roads. In majority cases, height of these houses is limited to double storey to maintain unobstructed view of Shivalik hills from the northern sectors. Hence it may be concluded that Development Control Regulations have played a critical role in restricting vertical expansion leading to peripheral development (Draft Master Plan, Chandigarh – 2031).

#### 4.3.2.5. Land Values

High land values in the city have rendered it unaffordable for the migrants who in turn have been settling in the peripheral areas which have lower land values as well as rental values.

Map 4.5: Land value for Chandigarh and its periphery (per sq yards)

Map 4.5 shows the difference in residential land values within Chandigarh and outside the planned city i.e. in the periphery. It has been observed that within Chandigarh, land values are extremely high i.e. approximately 1.2 lakh and above per sq yards, while land values in the periphery are comparatively lower. It is observed that in case of peripheral settlement of Panchkula, the average land values range from Rs. 50,000 to 85,000. In case of Mohali, the average land values in the sectors close to Chandigarh are Rs. 85,000 to 1.2 lakh.

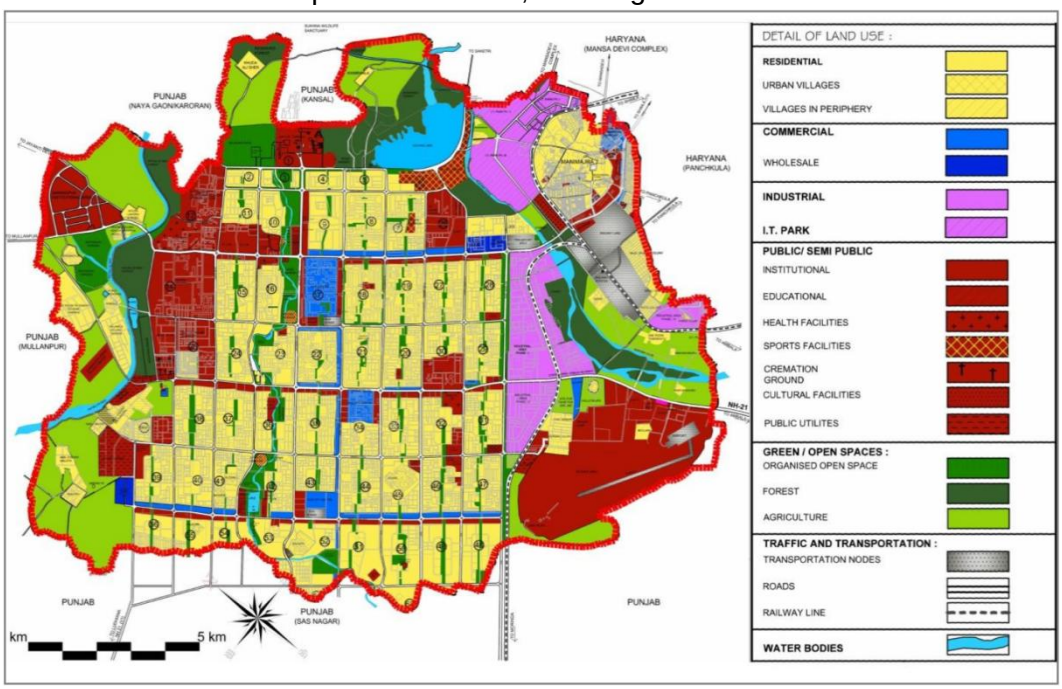



Source: Real estate developers, builders & property dealer

#### 4.3.2.6. Availability of Land for Future Expansion

One of the most critical factors for urbanization in the periphery is the non-availability of vacant land for expansion within the sectoral grid of the city. All the three phases are facing dearth of land for new urban development projects. However, approximately 1250 acres of land is available in the periphery but that is under the purview of Periphery Control Act, 1952. As per the Draft Master Plan-2031, *"Proposals have been given for the urbanization of land in periphery in order to meet the future requirements of the city in terms of rehabilitation of slums, amenities, institutions, para military forces, defence, warehousing, transportation, bulk material market etc. the area available in the periphery is proposed to be planned and developed to meet these requirements. The proposed development in the periphery has been defined in 17 distinct pockets having a total area of 3082 acres and the broad land-use for each pocket has been defined. An area to the tune of 673.86 acres has been kept for agriculture in order to make sure that entire periphery is not subjected to urbanization and to ensure that no urbanization is permitted on the North of the Capitol Complex based on the 'Edict of Chandigarh' given by Corbusier".*

Map 4.6: Land-Use, Chandigarh – 2011




Source: Draft Master Plan, Chandigarh – 2031

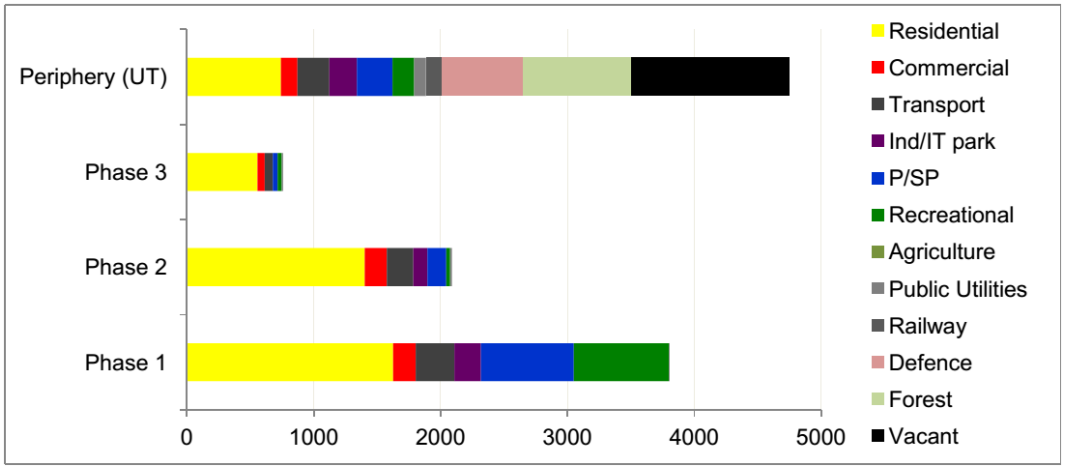
The following table explains land-uses in the three phases as well as periphery of Chandigarh.

Table 4.10: Phase wise land-use, Chandigarh – 2011 (areas in hactares)

| Land-Use | Sectoral Grid | | | Periphery (UT) | Total (ha) | % |
|---|---|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 3 | | | |
| Residential | 1624.6 | 1400.9 | 555.2 | 740.0 | 4320.7 | 37.9 |
| Commercial | 180.0 | 175.5 | 56.9 | 130.0 | 542.4 | 4.8 |
| Transport | 302.8 | 208.2 | 65.4 | 251.9 | 828.4 | 7.3 |
| Ind/IT Park | 209.2 | 110.2 | - | 217.7 | 537.0 | 4.7 |
| P/SP | 734.0 | 150.7 | 37.4 | 279.9 | 1201.9 | 10.5 |
| Recreational | 749.1 | 29.2 | 32.9 | 171.9 | 983.2 | 8.6 |
| Agriculture | - | - | - | - | 0.0 | 0.0 |
| Public Utilities | 5.5 | 13.9 | 9.5 | 93.5 | 122.4 | 1.1 |
| Railway | - | - | - | 128.1 | 128.1 | 1.1 |
| Defence | - | - | - | 636.8 | 636.8 | 5.6 |
| Forest | - | - | - | 855.9 | 855.9 | 7.5 |
| Vacant | - | - | - | 1248.0 | 1248.0 | 10.9 |
| Total | 3805.2 | 2088.5 | 757.3 | 4753.8 | 11405 | 100 |

Source: Draft Master Plan, Chandigarh – 2031

Figure 4.15: Phase-wise Land-use distribution, Chandigarh – 2011




Source: Draft Master Plan, Chandigarh – 2031

The above figure highlights that there is no land available within the sect oral grid of Chandigarh as a result of which there is no scope of future development.

### 4.3.3. Implications on the City of Chandigarh

In the following section, an attempt has been made to ascertain the implications of the inadequacies in the peripheral settlement on the planned city of Chandigarh. In order to assess the implications, the interaction between

peripheral settlements and planned city is ascertained through number of trips made to the planned city and the purpose of trips. Also the burden on physical infrastructure like water supply and sewage system has been ascertained to comprehend the implications on planned city.

#### 4.3.3.1. Trips made from Peripheral Development

The following table details out the number of trips and purpose of trips made from peripheral settlements to the planned city.

Table 4.11: Total trips to Chandigarh from peripheral settlements

Source: RITES study on Comprehensive Mobility Plan

| Total Trips from Peripheral Settlements | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Purpose | Mohali | | Zirakpur | | Mullanpur | | Derabassi | | Kharar | | Nayagaon | | Panchkula | | Pinjore & Kalka | | Total Trips |
| | Trips | % | Trips | % | Trips | % | Trips | % | Trips | % | Trips | % | Trips | % | Trips | % | |
| Work | 51119 | 26.6 | 40041 | 20.8 | 1253 | 0.7 | 5682 | 3 | 11916 | 6.2 | 12771 | 6.6 | 52576 | 27.3 | 17009 | 8.8 | 192367 |
| Education | 29428 | 22.7 | 23753 | 18.3 | 1517 | 1.2 | 7398 | 5.7 | 8666 | 6.7 | 8862 | 6.8 | 40573 | 31.3 | 9267 | 7.2 | 129464 |
| Social Infra (Medical, Shopping, Recreational) | 13955 | 19 | 15779 | 21.5 | 315 | 0.4 | 1598 | 2.2 | 6499 | 8.8 | 4431 | 6 | 27556 | 37.5 | 3402 | 4.6 | 73535 |
| Total Trips | 94502 | | 79574 | | 3.085 | | 14678 | | 27081 | | 26064 | | 120704 | | 29678 | | 395365 |
| % | 23.9 | | 20.1 | | 0.8 | | 3.7 | | 6.8 | | 6.6 | | 30.5 | | 7.5 | | 100 |

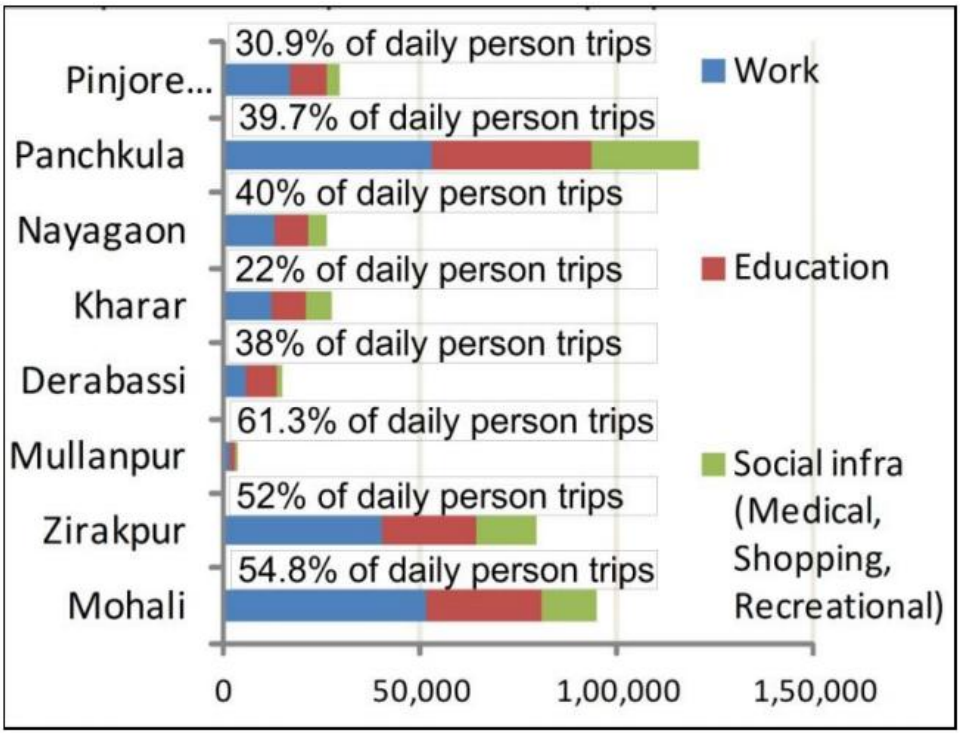
for Chandigarh Urban Complex (CUC)

It has been observed that there is high interaction of the peripheral settlements with the planned city. There are approximately 3.95 lakh person trips made from the peripheral with approximately 75% trips from the contiguous settlements of Mohali, Panchkula and Zirakpur. It may be concluded that maximum burden on Chandigarh is being caused by these settlements as majority trips are from these three settlements. Other than the trips for work and social infrastructure, there are approximately 1.56 lakh through trips which constitute approximately 28.3% of total trips from peripheral settlements. Hence there is a need for by-pass in order to avoid the through trips made to Chandigarh. It has been observed that majority trips made to Chandigarh are for work purpose. The major reason for this kind of economic dependence is that these settlements were conceived as satellite towns for Chandigarh, hence have weak economic base. As a result they are deficient in employment opportunities. Furthermore, there is high dependence for education facilities, health facilities and other social infrastructure, which is leading to congested roads and bottlenecks within the city. The main traffic attracting areas are PGIMER for medical facilities, Punjab University for higher

order educational facilities, commercial complex of Sector 17; which also houses a number of offices of Chandigarh, Punjab as well as Haryana Governments.

The following figure indicates the level of inadequacies within the peripheral settlements. In order to analyze the inadequacies, the trips made to Chandigarh are expressed as a percentage of total daily trips made from the particular settlement. The figure reflects that in case of Mullanpur, out of total trips made in a day, approximately 61% trips are made to Chandigarh indicating the level of inadequacy within the settlement. Furthermore in case of Mohali and Zirakpur also, approximately 55% and 52% daily trips respectively are made to Chandigarh.

Figure 4.16: Total trips to planned city from peripheral settlements




Source: Extrapolated from Comprehensive Mobility Plan for Chandigarh Urban Complex

#### 4.3.3.2. Traffic Volume on Major Roads

The table shown below indicates the traffic volume and v/c of important roads. It may be observed that arterial roads connecting to the peripheral settlements have become extremely congested and the volume of traffic has already exceeded the capacity of the roads. Madhya Marg leading to Panchkula on the east and Mullanpur on the west has v/c ratio 1.2 indicating that volume has exceeded the capacity leading to bottle-necks. This is mainly because there

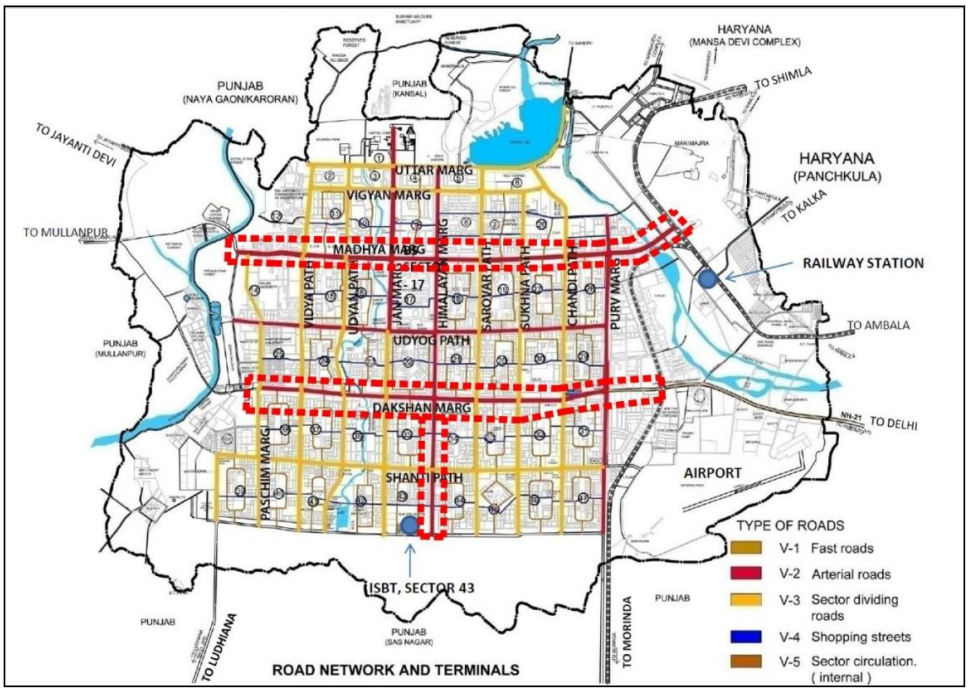
are commercial areas along Madhya Marg that attract a lot of traffic. Table 5.10 indicates that traffic volume along Mdhya Marg is very high with approximately 11% of total traffic concentrated in the peak hours. Hence Madhya Marg is facing acute congestion problems especially in the peak hours which cater to approximately 11% of total population traversing during the day. Similar is the case with Dakshin Marg which connects Zirakpur to Chandigarh. The v/c ratio has already exceeded 1 with high peak hour volume of approximately 9%.

Table 4.12: Traffic volume and v/c of main arterial roads

| Location | Total Traffic | | Morning Peak | | | | Evening Peak | | | | V/C ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Veh | PCU | Veh | % of total traffic | PCU | % of total traffic | Veh | % of total traffic | PCU | % of total traffic | |
| Vidya Path (between 14 & 15) | 36340 | 29143 | 5165 | 14.2 | 3902 | 13.4 | 3521 | 9.7 | 2740 | 9.4 | 0.8 |
| Sarovar Path (between 18 & 19) | 56294 | 45666 | 5278 | 9.4 | 4081 | 8.9 | 4469 | 7.9 | 3583 | 7.9 | 0.8 |
| Chandi Path (between 27 & 28) | 30412 | 25054 | 2589 | 8.5 | 2016 | 8 | 2686 | 8.8 | 2222 | 8.9 | 0.6 |
| Vidya Path (between 37 & 38) | 43999 | 35391 | 5476 | 12.4 | 4256 | 12 | 4119 | 9.4 | 3278 | 9.3 | 0.8 |
| Udyan Path (between 36 & 37) | 33159 | 25957 | 4547 | 13.7 | 3126 | 2 | 3208 | 9.7 | 2388 | 9.2 | 0.7 |
| Sarovar Path (33 , 34) | 54483 | 42757 | 4920 | 9 | 3761 | 8.8 | 4687 | 8.6 | 3582 | 8.4 | 0.8 |
| Sukhna Path (32 , 33) | 44234 | 34275 | 5118 | 11.6 | 3679 | 10.7 | 3399 | 7.7 | 2668 | 7.8 | 0.8 |
| Chandi Path (32 , 33) | 41878 | 34569 | 3868 | 9.2 | 3045 | 8.8 | 3801 | 9.1 | 3073 | 8.9 | 0.6 |
| Himalaya Path (51 , 52) | 73338 | 67198 | 5898 | 8 | 5382 | 8 | 5629 | 7.7 | 4995 | 7.4 | 0.7 |
| Madhya Marg (11 , 15) | 46263 | 36049 | 5160 | 11.2 | 3860 | 10.7 | 3538 | 7.6 | 2803 | 8 | 1.2 |
| Dakshin Marg | 64456 | 61202 | 5603 | 8.7 | 5037 | 8.2 | 5609 | 8.7 | 5123 | 7.8 | 1.1 |

Source: RITES study on Comprehensive Mobility Plan for Chandigarh Urban Complex

Map 4.7: Road network for Chandigarh




Source: Draft Master Plan, Chandigarh – 2031

#### 4.3.3.3. Floating Population

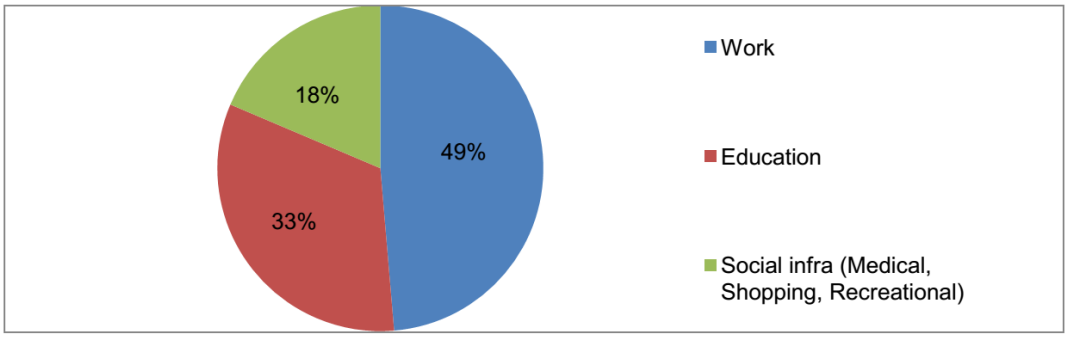
Table 5.11 indicates the total floating population commuting to planned city for the purpose of employment, health, education and recreational facilities. As per Master Plan and RITES study, there is approximately 1.96 lakhs floating population in the city of which approximately 95,000 persons commute to the planned city for employment opportunities offered, approximately 64,000 trips for educational facilities while remaining are for medical and recreational facilities. Facilities in Chandigarh are far superior in quality than that available infrastructure in the periphery.

Table 4.13: Floating population in Chandigarh and their purpose

| Floating Population | | |
|---|---|---|
| **Purpose** | **Nos.** | **%** |
| To Work Centers | 96183 | 48.7 |
| For Education | 64732 | 32.7 |
| For Medical, Shopping etc. | 36767 | 18.6 |
| Total | 197683 | 100.0 |

Source: Extrapolated from RITES study on Comprehensive Mobility Plan for Chandigarh Urban Complex, 2009

Figure 4.17: Floating population in Chandigarh and their purpose




Source: Extrapolated from RITES study on Comprehensive Mobility Plan for Chandigarh Urban Complex, 2009

**Inferences**

- Settlements of Panchkula, Mohali and Zirakpur are instrumental in exerting maximum burden on Chandigarh due to high percentage of daily trips made to the planned city.
- Madhya Marg and Dakshin Marg are facing acute congestion problem as these are the most frequently traversed roads from the peripheral settlements.
- Approximately 1.97 lakh commuter population / floating population in Chandigarh is exerting additional burden on the city.

#### 4.3.3.4. Environmental Degradation

In the following section, mode wise fuel emissions from peripheral settlements have been ascertained. Fuel emissions in terms of CO, HC+NOx and particulate matter have been analyzed to ascertain the degree of environmental degradation caused by the vehicular traffic.

Table 4.14: Fuel emissions from different modes

| Mode | Aspects | Mohali | Zirakpur | Mullanpur | Derabassi | Kharar | Nayagaon | Panchkula | Pinjore & Kalka | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Mode - 1 Car | No of veh. Trips | 12536 | 7148 | 184 | 734 | 2031 | 1694 | 20229 | 2226 | 46783 |
| | Avg. trip length (km) | 9.9 | 12.13 | 11.31 | 15.35 | 12.32 | 8.74 | 11.69 | 24.8 | |
| | Pollution - CO (kg) | 124.11 | 86.71 | 2.08 | 11.26 | 25.02 | 14.81 | 236.48 | 55.2 | 555.67 |
| | Pollution - HC+NOx (kg) | 22.34 | 15.61 | 0.38 | 2.03 | 4.5 | 2.67 | 42.57 | 9.94 | 100.02 |
| | Pollution - PM (kg) | 0.62 | 0.43 | 0.01 | 0.06 | 0.13 | 0.07 | 1.18 | 0.28 | 2.78 |
| | | | | | | | | | | |
| Mode - 2 Two Wheeler | No of veh. Trips | 39799 | 42080 | 1786 | 7486 | 11374 | 11374 | 55435 | 14839 | 184172 |
| | Avg. trip length (km) | 10.48 | 13.3 | 12.7 | 16.74 | 15.2 | 10.16 | 10.97 | 26.41 | |
| | Pollution - CO (kg) | 291.97 | 391.76 | 15.87 | 87.72 | 121.02 | 80.89 | 425.68 | 274.33 | 1689.24 |
| | Pollution - HC+NOx (kg) | 417.1 | 559.66 | 22.68 | 125.31 | 172.89 | 115.56 | 608.12 | 391.9 | 2413.2 |
| | Pollution - PM (kg) | 2.09 | 2.8 | 0.11 | 0.63 | 0.86 | 0.58 | 3.04 | 1.96 | 12.07 |
| | | | | | | | | | | |
| Mode - 3 Auto | No of veh. Trips | 8416 | 2158 | 84 | 587 | 2158 | 1043 | 7823 | 1187 | 23455 |
| | Avg. trip length (km) | 6.3 | 7.87 | 8.9 | 13.6 | 11.34 | 6.84 | 7.28 | 22.49 | |
| | Pollution - CO (kg) | 37.11 | 11.89 | 0.52 | 5.59 | 17.13 | 4.99 | 39.87 | 18.69 | 135.79 |
| | Pollution - HC+NOx (kg) | 53.02 | 16.98 | 0.74 | 7.98 | 24.47 | 7.13 | 56.95 | 26.7 | 193.99 |
| | Pollution - PM (kg) | 0.27 | 0.08 | 0 | 0.04 | 0.12 | 0.04 | 0.28 | 0.13 | 0.97 |
| | | | | | | | | | | |
| Mode - 4 Bus | No of veh. Trips | 567 | 728 | 28 | 171 | 257.2695 | 257 | 440 | 230 | 2679 |
| | Avg. trip length (km) | 10.77 | 12.56 | 12.99 | 14.53 | 13.42 | 9.53 | 13.57 | 25.2 | |
| | Pollution - CO (kg) | 9.77 | 14.64 | 0.59 | 3.98 | 5.52 | 3.92 | 9.54 | 9.27 | 57.24 |
| | Pollution - HC (kg) | 7.08 | 10.61 | 0.43 | 2.89 | 4 | 2.84 | 6.92 | 6.72 | 41.5 |
| | Pollution - NOx (kg) | 27.47 | 41.16 | 1.65 | 11.2 | 15.54 | 11.03 | 26.84 | 26.08 | 160.98 |
| | Pollution - PM (kg) | 0.31 | 0.46 | 0.02 | 0.12 | 0.17 | 0.12 | 0.3 | 0.29 | 1.79 |

Source: RITES study on Comprehensive Mobility Plan for Chandigarh Urban Complex

Table 4.15: Fuel emissions from different modes

| Mode | CO (kg) | HC+NOx (kg) | PM (kg) | Carbon Footprint (kg of CO2 eq) |
|---|---|---|---|---|
| Mode – 1 Car | 555.67 | 100.02 | 2.78 | 94812 |
| Mode – 2 Two-wheeler | 1689.24 | 2413.20 | 12.07 | 164701 |
| Mode – 3 Auto | 135.79 | 193.99 | 0.97 | 21183 |
| Mode – 4 Bus | 57.24 | 202.48 | 1.79 | 4210 |
| Total | 2438 | 2910 | 18 | 284906 |

Source: RITES study on Comprehensive Mobility Plan for Chandigarh Urban Complex

The table indicates that maximum CO emission is in the case of two wheelers which constitute heavy vehicular population. Emissions of HC+NOx are also maximum for two wheelers. Similar is the case of particular matter which are

maximum for two-wheelers. The total carbon foot-print from the vehicular trips made to the planned city is approx. 2.84 lakh kg of CO2 equivalent.

**Inferences**

- Approx. 50% fuel emissions are as a result of trips made from Panchkula, Mohali & Zirakpur trips with Panchkula having the maximum contribution. Off all the modes, two-wheelers cause maximum fuel emissions.

#### 4.3.3.5. Additional Infrastructure Requirement

In the following section, additional water requirement for floating population has been analysed to ascertain the additional burden on water supply and sewerage system.

Table 4.16: Water requirement for floating population

| Purpose | Floating Population | Water Req. (lpcd) | MLD | MGD |
|---|---|---|---|---|
| Work Centres | 96183 | 45 | 4.33 | 1.15 |
| Education | 64732 | 45 | 2.91 | 0.77 |
| Medical, Shopping etc. | 36767 | 15 | 0.55 | 0.15 |
| Total | 197683 | | 7.79 | 2.07 |

Source: RITES study on Comprehensive Mobility Plan for Chandigarh Urban Complex

Currently the water demand exerted by floating population is approximately 2 MGD and does not cause any shortage of water supply for the resident population. Also the sewerage system designed is adequate for the additional floating population. But if same trend continues, there would be acute shortage of water supply in the city of Chandigarh.

## 4.4. Status Analysis of Existing Planning Policies Pertaining to Peripheral Development

### 4.4.1. Introduction

In the following section, status of the periphery has been analysed in terms of the following parameters:

1) Legal framework
2) Institutional set-up
3) Status of developments in periphery

### 4.4.2. Legal Framework

In this section, provisions of the Punjab New Capital (periphery) Control act, 1952 have been discussed in detail along with the amendments that have been made in Punjab and Haryana sub-regions.

#### 4.4.2.1. Punjab New Capital (periphery) Control Act, 1952 - Provisions of the act

The important provisions of the acts have been mentioned below:

- Under section 1 of the act, Peripheral limit was notified, which was initially 5 miles and was extended up to 10 miles by subsequent amendment in 1962. Under section 4, plan showing controlled area along with the nature of restrictions applicable was prepared and published by Deputy Commissioner. Plan also signified a communication belt of 30 mts and designated zones for brick kiln. Section 5 made provision for prior approval of Deputy Commissioner for the followings subjected to provisions and restrictions provided in the controlled area plan:
    i. *"To erect or re-erect building,*
    ii. *To make or extend any excavations*
    iii. *To lay out any means of access to a road"*

- Under section 6, Deputy Commissioner has been given the power to be approached for permission which would not be refused in the following cases:
    i. *"For erection or re-erection of a building which is required for purposes subservient to agriculture.*
    ii. *For erection or re-erection of building which existed on the day when area was declared as controlled area under section 3(2)".*

  Also as per provisions of the act, necessary permission or refusal is to be communicated within three months from date of application.

- Under section 7, persons aggrieved by refusal by DC may appeal to commissioner of the act within 60 days. Under section 8, provision for compensation for those who have been refused permission / granted conditional permission / who have suffered any damages, injury or loss has

been made. Under section 9, provision has been made to appoint arbitrator appointed by government while under section 10, government has been given power and authority to acquire land or to impose restrictions upon use and development of land. Power to grant permission to change use of land for purposes other than on the date of notification vested exclusively with government under section 11. Only after change in land use is permitted by government, DC can grant permission for setting up of charcoal kiln, pottery kiln, lime kiln, brick field, brick kiln or stone crushing. Section 12 lays down the penalty for offences committed by any person who in an unauthorised manner constructs buildings, changes it's use, violates the provisions of controlled area plan or conditions imposed while granting sanction, lays down means of access without permission etc. Penalty may be imprisonment for two years and maximum fine of Rs. 5000 and in case of continued violation further fine of Rs. 500 every day.

- Following operations have been exempted from provisions of act under section 15:
    i. *"Construction of any building for residential purposes or for purposes subservient to agriculture in the abadi area of the village as defined in the revenue record.*
    ii. *Erection or re-erection of a place of worship, tomb, cenotaph or a wall enclosing a graveyard on a land which existed as such on the date of notification of controlled area.*
    iii. *Digging of wells or other excavations made in the ordinary course of agricultural operations the construction of unmettaled road for providing access to the land exclusively for agricultural purposes".*

- Section 16 vests the powers with the state government to make rules for effectively carrying out the provision of the act.

**Inferences**

- The major lack of the act is that powers have been vested at administration level, where there is no technical expertise in planning and development. Also penalty clause in the act was a major drawback as unauthorised construction get regularised by paying small amount of money.

#### 4.4.2.2. Amendments made by the State of Punjab

Punjab State Government amended the uses permitted in the 'Periphery Controlled Area' and the uses permitted as per 15th October, 1966 Punjab State Govt. Instructions. The following activities have been permitted as per the amendments:

- Construction of residences in extended abadi deh.
- Farm houses beyond 8 kms. belt provided owner has minimum 5 acres.
- Cattle sheds.
- Dairy farms beyond 8 kms.
- Small poultry sheds permitted in the first 8 kms & large in next 8 kms.
- Wells and tube-wells.

It is important to mention that the permissible uses in the periphery were amended post reorganization but no revised periphery controlled area plan was formulated to guide the development in this part of the periphery. In the absence of development plan, growth has been happening in a haphazard manner with random land use conversions to facilitate urban development projects.

**Inferences**

- State Govt. has been granting permission for change of land-use for residential, industrial, commercial and other uses from time to time on case to case basis without any broad policy framework.
- Also powers have been delegated regarding regulation of periphery to different officers and departments leading to multiplicity of authorities.

#### 4.4.2.3. Amendments made by the State of Haryana

The major amendment made by the State of Haryana was under Section 4, which provides plan to be published by the Director, TCPO, Haryana and not the DC. Also the monitoring and regulation of periphery has been brought under purview of Director, TCPO, Haryana. In case of change of land use, a clause was inserted for renewal fees after 3 years of license provision. Under section 12, fine increased to Rs. 10000. Also Municipal areas were exempted from the provisions of the act.

**Inferences**

- Devolution of power for regulation of growth and developments in periphery to the Director, TCPO was a wise decision as the DC is not an appropriate authority for regulating construction.
- Also the increased fine under section 12 has somewhat discouraged the occurrence of violations and illegal constructions in the periphery.

- Advisory and Statutory plans undertaken on periphery and influence region of Chandigarh.
- A number of advisory studies and advocacy plans have been prepared pertaining to the influence region of Chandigarh. However, none of the studies undertaken are coterminous with periphery boundary. The same have been discussed in the following section.

#### 4.4.2.4. Advisory Regional Plans

**1) Chandigarh Urban Complex (CUC) Plan, 1977**

This was the 1st Regional Plan for immediate region of Chandigarh, covering 330 sqkm. It was conceived in 1977 for the perspective year of 1991. High powered co-ordination committee was constituted, which was chaired by Secretary, MoUD, Chief Secretaries of Haryana & Punjab, Chief Commissioner, UT Chandigarh to resolve matters pertaining to developments around Chandigarh and to suggest measures for not compromising original intent of Chandigarh Plan. It comprised of Union Territory (UT), parts of Mohali and its adjoining 27 villages and parts of Panchkula and 23 villages. Area of this plan was entirely within the originally conceptualised 8 km radius periphery control belt.

**2) Chandigarh Interstate Capital Region (CISCR) Plan, 2001**

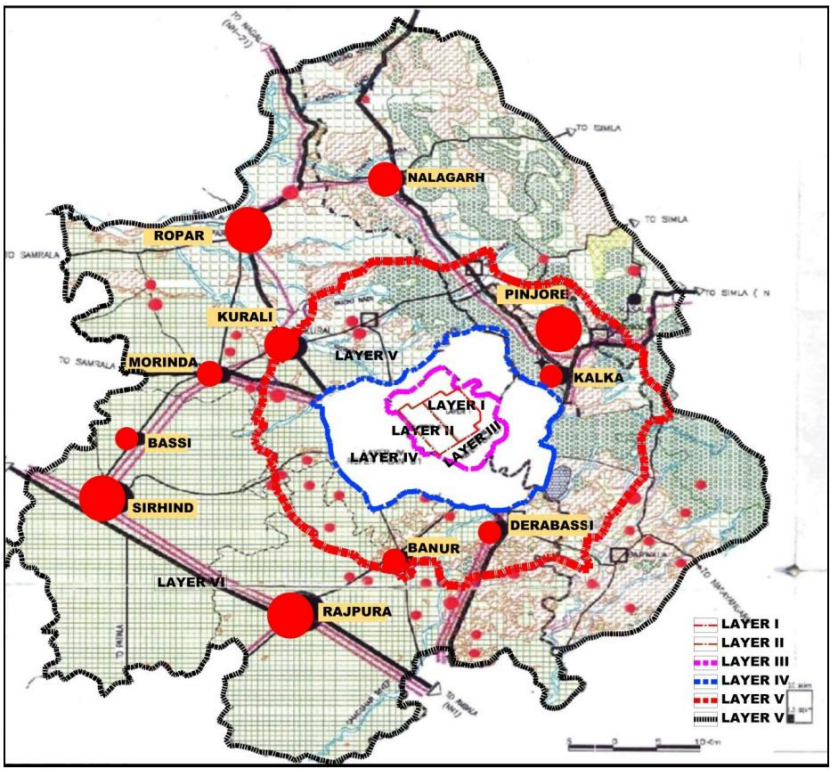
In 1984, it was realised that region of influence of Chandigarh city was beyond CUC Plan. Hence ISCR was delineated in 1984 which took into account the factors for functional linkages, physiography, existing administrative boundaries and requirements of future planning. The plan was delineated for area beyond periphery control act. The region was spread over 2421 sqkms, approx radial distance of 35 kms. The plan projected ultimate population of 25 lakhs in 2001 and assigned 50% population to Chandigarh UT and the remaining to the periphery area in Punjab and Haryana in a planned way. But the plan was advisory in nature; hence no action taken for planned development as per the proposals made in the plan.

**3) Prof. E.F.N. Riberio's Chandigarh Interstate Metropolitan Region (CISMeR) Plan, 2021**

CISMeR Plan prepared by Prof. E.F.N. Riberio was submitted to Chandigarh U.T. Administration in 2000. It covers an area of 5320.17 sq.km. incorporating UT and 10 tehsils from Punjab, Haryana and Himachal Pradesh. Aim of preparing the plan was preserving and protecting Chandigarh through planned interventions in surrounding areas. It aimed at equitable and balanced development of region & redistribution of population and development of villages and small & medium towns. The plan also proposed conceptualisation of satellite towns to take the pressure off from Chandigarh. It was conceived in the following 6 different layers:

i. *"Layer – I: Covering an area of 43 sq.km. comprising the original plan and design of Chandigarh.*
ii. *Layer – II: Comprising of 27 sq.km. originally planned but not designed as part of Chandigarh.*
iii. *Layer – III: Comprising of 44 sq.km. and a part of 8 km. Peripheral belt of Chandigarh as conceived in 1952.*
iv. *Layer – IV: Chandigarh Urban Complex (CUC) comprising of 435 sq.km. area outside the layers I, II & III.*
v. *Layer – V: comprising of 613 sq.km. of 16 km. Periphery.*
vi. *Layer – VI: Newly defined CISMeR outside the Periphery".*

Map 4.8: CISMeR Plan, 2021




Source: Draft Master Plan – Chandigarh, 2031

**Inferences**

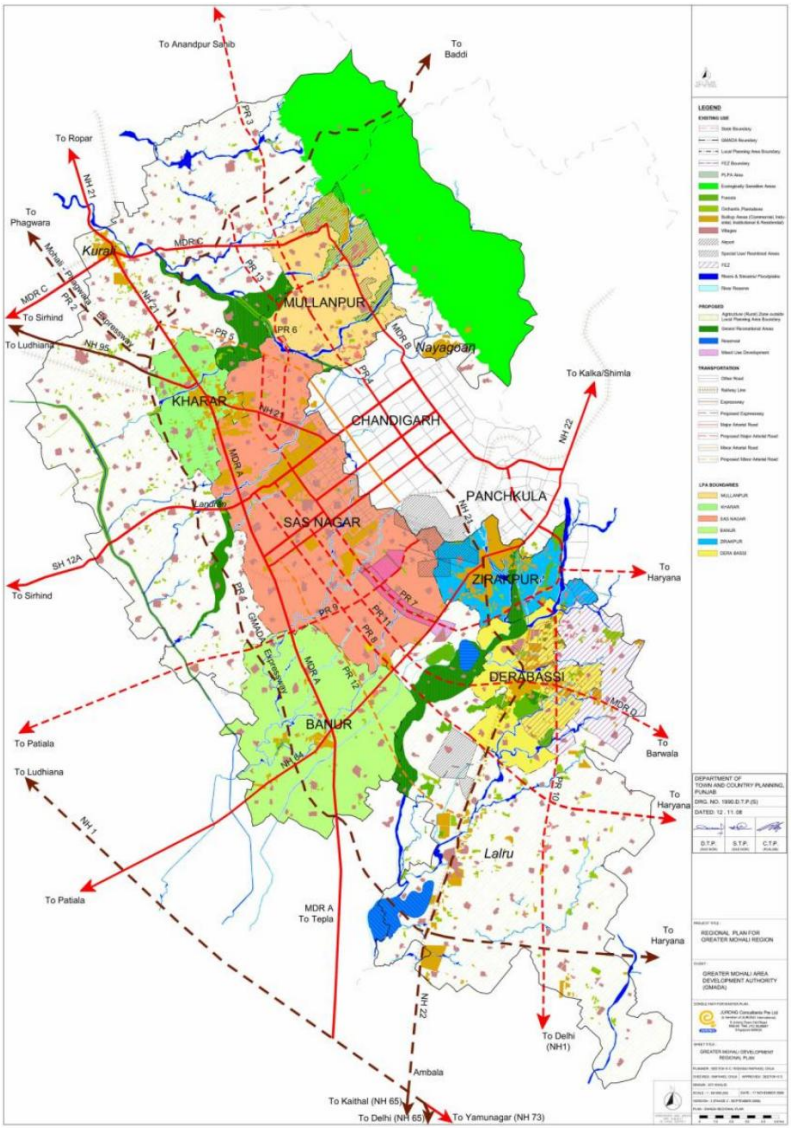
- None of these proposals were accepted by adjoining states as the plans were advisory in nature. As planning is a state subject, hence the discretion to adhere to the proposals was vested in the state government.

#### 4.4.2.5. Statutory Plans for Periphery

##### 1) Greater Mohali Regional Plan, 2056

Greater Mohali Regional Plan, 2056 has been notified in 2008 covering an area of 1021 sq.km. It consists of planning for 7 Integrated Economic Hubs consisting of a huge agglomeration in absolute continuity to Chandigarh UT and containing major drivers of economic growth. It consists of a major part of periphery of Chandigarh falling in Punjab sub-region. Master plans for Local Planning Areas of SAS Nagar, Kharar, Banur, Mullanpur, Zirakpur and Derabassi have also been notified under the same.

Map 4.9: Regional Plan for Greater Mohali Region, 2056




Source: Department of Town & Country Planning, Punjab

**Inference**

- Extensive urbanization has been proposed as per Regional and Master Plans taking advantage of high growth potential due to proximity to Chandigarh, which may be against the spirit of the periphery act; however responds to the present ground reality and attempts to fulfil the rising demands.

**2) Development Plan for Haryana periphery Sub-region, 1972**

Development Plan for Chandigarh Periphery Controlled Area, Haryana Sub-Region was prepared in 1972. It was a

comprehensive plan catering to the entire periphery controlled area lying in Haryana. Purpose of the plan was to guide the development in the periphery and facilitate balanced growth. Initially as per the development plan, 20.24 sq.km. area was shown as Urbanisable zone. Subsequently revisions were made in the Development Plan for Chandigarh Periphery Controlled Area, Haryana Sub-Region and proposals for urbanization at Mansa Devi Complex (MDC) were incorporated covering area 6.27 sq.kms. Also proposals for urbanization at Panchkula Extension were incorporated covering 11.92 sq.kms. Furthermore, proposals for urbanization at Pinjore-Kalka Urban Complex covering 11.61 sq.kms. and Kot-Behla Urban Complex have been incorporated. Latest amendment has been made for the modifications in the urbanization proposals of the development plans of Pinjore-Kalka Urban Complex, Panchkula Extension and Kot-Behla Urban Complex.

**Inference**

- Haryana periphery Sub-region has made ample revisions in the Development Plan to add Urbanisable area time to time as well as maintained a balance between natural open spaces as non-Urbanisable area and urbanized area.

**3) Master Plan for Chandigarh, 2031**

Chandigarh Master Plan – 2031 covering an area of 114 sq.kms. is currently in the draft stage with projected population of 16,00,000 persons. Plan proposes for 40% of additional population to be housed within existing 47 sectors and the remaining additional population in Phase 3 and parts of periphery. Periphery part in U.T. has been subdivided into 17 pockets and new land uses accorded in order to meet the future requirements of the city in terms of rehabilitation of slums, amenities, institutions, para military forces, defence, warehousing, transportation, bulk material market etc. The area available in the periphery is proposed to be planned and developed to meet these requirements.

An area to the tune of 673.86 acres has been kept for agriculture in order to make sure that entire periphery is not subjected to urbanization and to ensure that no urbanization is permitted on the North of the Capitol Complex based on the Edict of Chandigarh.

**Inference**

- Since Chandigarh UT faces dearth of land for future development, hence master plan makes provision for development in periphery. However, unlike in the case of Punjab and Haryana, the development being facilitated in Chandigarh U.T. is demand driven.

### 4.4.3. Institutional Set-Up

#### 4.4.3.1. Planning and Implementation for Periphery

##### 1) Punjab Periphery Sub-region

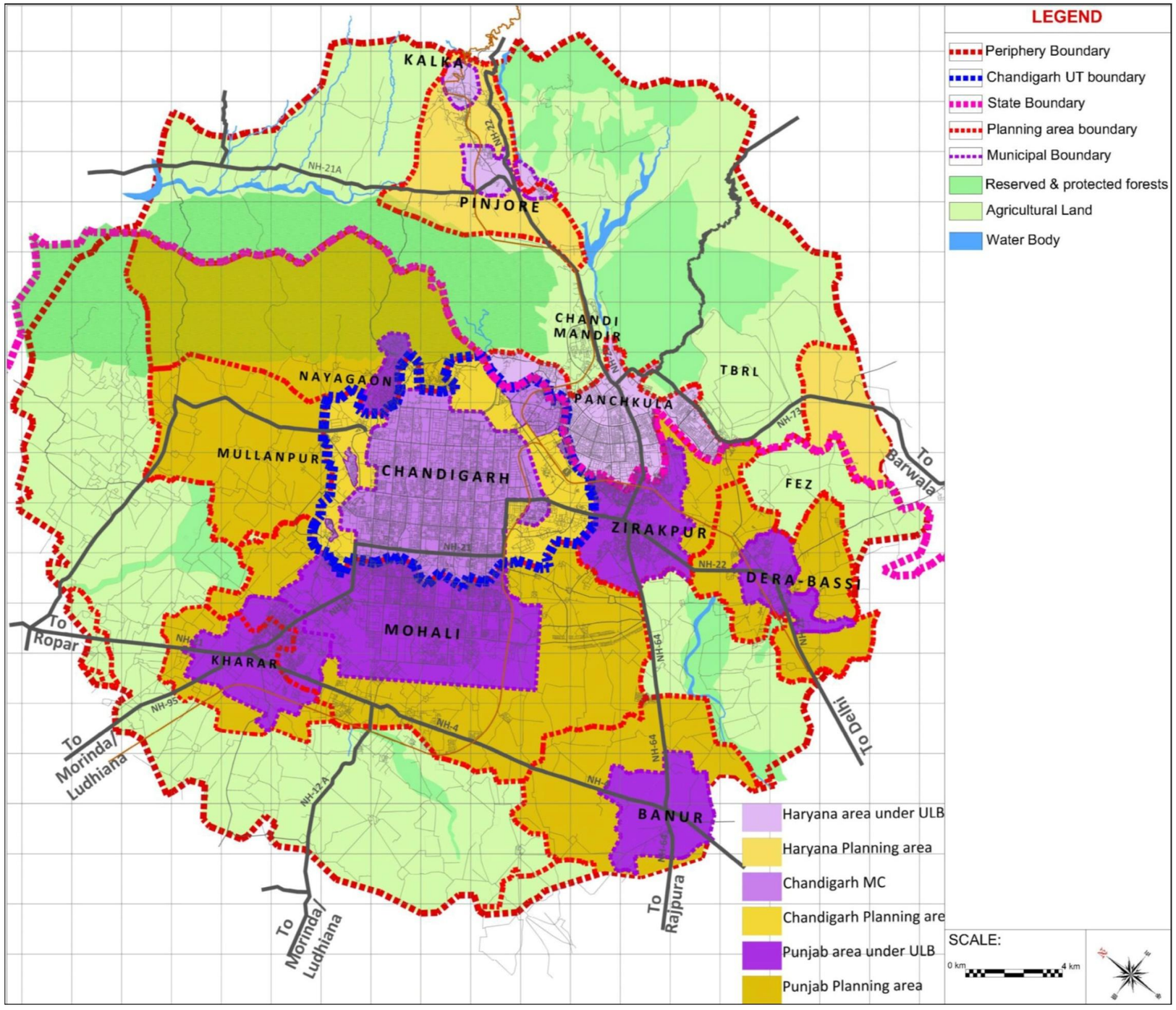
The entire planning for development in Punjab Periphery Sub-region is facilitated by Department of Town & Country Planning, Punjab. For the implementation of plans, Punjab Urban Development Authority (PUDA) was conceived in 1995. It was formed by Directorate of Housing and Urban Development with Punjab Housing Development Board (PHDB) under the Punjab Regional and Town Planning & Development Act, 1995. The authority was empowered to hold, develop and dispose of property in Punjab area including periphery until formation of GMADA in 2006.

Till 2006, implementation was taken care of by PUDA while in 2006, GMADA was formed for Greater Mohali region and the implementation of all development work came under the purview of GMADA. GMADA was one of the 6 regional development authorities established for planning & development of areas in their respective jurisdiction. Periphery area mainly falls under GMADA, where all the policy making decisions and enforcement for the periphery area is done. Also some portion of periphery lies with Patiala Development Authority (PDA). Currently PUDA is working as an umbrella over these regional development authorities.

##### 2) Haryana Periphery Sub-region

For Haryana Periphery sub-region, entire planning for development is facilitated by Department of Town & Country Planning, Haryana; which is instrumental in preparation of development plan for Haryana Periphery in 1972. Most of the development in this part of the periphery has been as per the development plan. The implementation of plan has been taken care of by HUDA as well as private developers with Department of Town & Country Planning being the apex authority, responsible for sanctioning of projects.

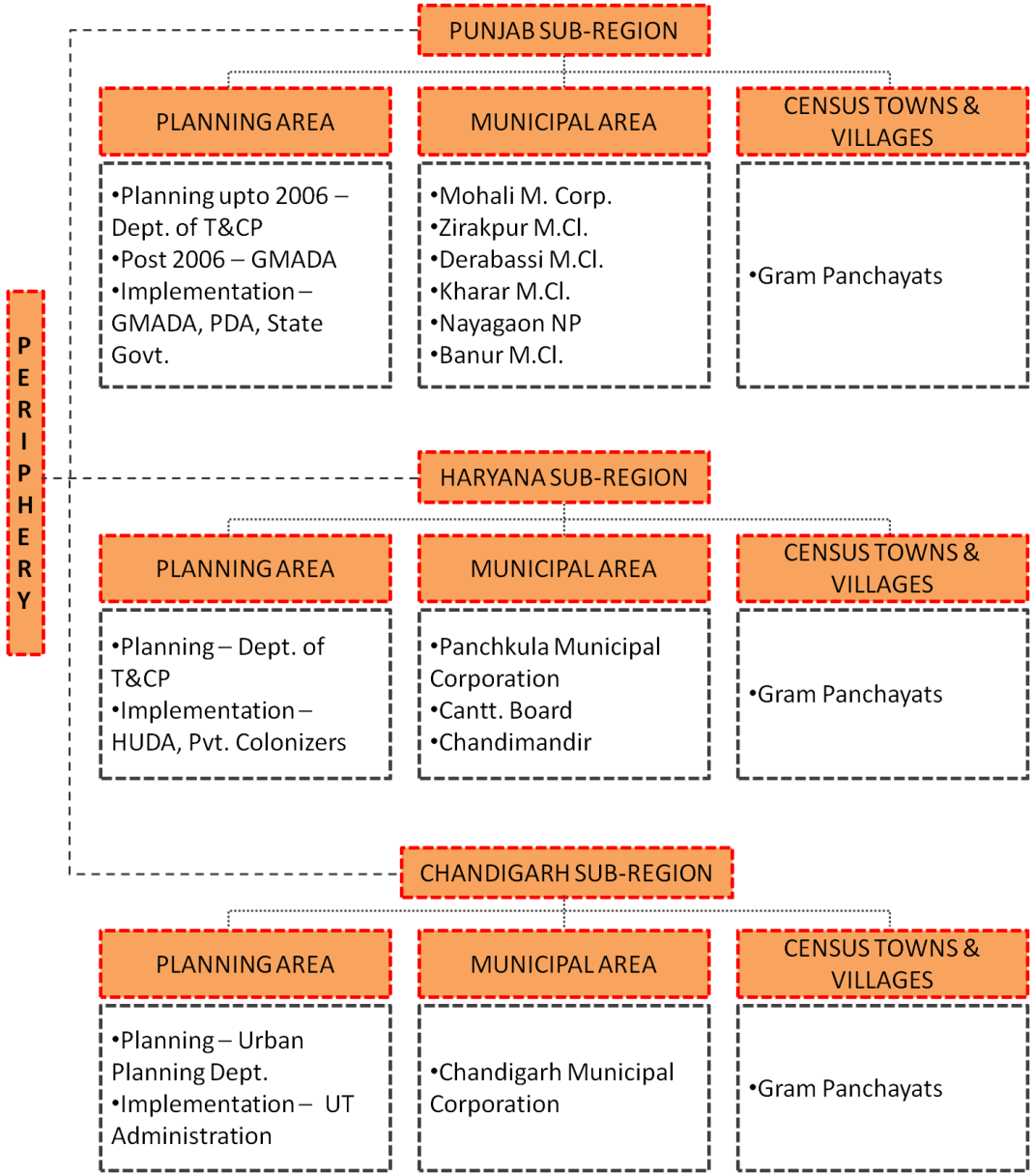
Map 4.10: Institutional set-up for periphery




Source: Author, 2015

The following figure shows the institutional set-up for the periphery, as discussed in the previous section.

Figure 4.18: Institutional set-up for the Periphery




Source: Department of Town & Country Planning, Punjab & Haryana, and Urban Planning Dept., Chandigarh

#### 4.4.3.2. Co-ordination of Development

In 1975, GOI constituted a co-ordination committee to guide and channelize the growth of Chandigarh and its urban centres around coming up in its peripheral area. The committee consisted of the members mentioned herewith. The committee consisted of the following members:

i. Secretary, Ministry of Works & Housing, Govt. of India

ii. Quarter Master General, Army Headquarters, Ministry of Defence
iii. Chief Commissioner, Chandigarh
iv. Chief Secretary, Govt. of Punjab
v. Chief Secretary, Govt. of Haryana

The objectives of committee were to study development plans of UT, Mohali and Panchkula townships and to suggest measures for coordinated development. Assessment of the impact of development programs already implemented and those being implemented in the two townships on the development of the region as a whole were also one of the objectives. The committee suggested remedial measures to be taken by the state governments and the UT.

#### 4.4.3.2. Service provision in Periphery

Various authorities and agencies are responsible for service provision in the periphery area. The role of various agencies has been explained in the following section.

**1) Punjab Periphery Sub-Region**

While urban local bodies are responsible for service provision within the municipal limits, GMADA is responsible for service provision in the areas developed by them outside the municipal limits. Currently Mohali Municipal Corporation is not well equipped to handle the water and sanitation related services in the municipal limits, hence the services have been outsourced to Punjab Department of Water Supply and Sanitation. Remaining services are dealt by Urban Local Body (ULB). Urban local bodies of Banur, Kharar and Dera-Bassi are instrumental in the provision of municipal services while Zirakpur Municipal Council which is a relatively new Urban Local Body, Punjab Water Sewerage and Sanitation Board is responsible for the Municipal Services. For villages in the periphery, Punjab Department of Water Supply and Sanitation is responsible for water and sanitation related services while the rest are taken care of by Gram Panchayat.

**2) Haryana Periphery Sub-region**

For Haryana sub-region, service provision for areas developed by HUDA in Panchkula Urban Estate is still facilitated by them even though the area is under the jurisdiction of Municipal Corporation. This is because the ULB doesn't have adequate funds and capacity to facilitate the service. In the towns that existed before formation of HUDA, water supply and sanitation

services are facilitated by Public Health and Engineering Dept. of Haryana. The following table indicates all the agencies, authorities and para-statals responsible for service provision in the periphery.

Table 4.17: Agencies / authorities responsible for service provision

| Area | Water Supply | Sewerage | Drainage | SWM | Street Lighting | Housing | Roads |
|---|---|---|---|---|---|---|---|
| Mohali | GMADA, PBDWSS (on behalf of Mohali MC) | | | M.Corp | M.Corp | PHDB, GMADA, Pvt. Dev. | M.Corp |
| Zirakpur | M.Cl, Pvt. Dev. | PBDWSS (on behalf of Mohali MC) | | M.Cl | M.Cl | Pvt. Dev. | M.Cl |
| Kharar | M.Cl, Pvt. Dev. | M.Cl | M.Cl | M.Cl | M.Cl | Pvt. Dev. | M.Cl |
| Banur | M.Cl | M.Cl | M.Cl | M.Cl | M.Cl | Pvt. Dev. | M.Cl |
| Derabassi | M.Cl | M.Cl | M.Cl | M.Cl | M.Cl | Pvt. Dev. | M.Cl |
| Mullanpur, Nayagaon, Balongi, Sohana, Bhankarpur, Mirpur, Mubarakpur | PBDWSS | - | Town Panchayat / Gram Panchayat | - | Town Panchayat / Gram Panchayat | Pvt. Dev. | Town Panchayat / Gram Panchayat |
| Planning Area | GMADA, Pvt. Dev. | GMADA, Pvt. Dev. | GMADA, Pvt. Dev. | - | GMADA | GMADA, Pvt. Dev. | GMADA |
| Villages (Punjab Periphery) | PBDWSS | - | Gram Panchayat | - | Gram Panchayat | - | Gram Panchayat |
| Panchkula | HUDA | HUDA | M.Corp | M.Corp | M.Corp | HUDA, Housing Board, Pvt. Dev. | M.Corp |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Kalka | PHED, Haryana | PHED, Haryana | M.Corp | M.Corp | M.Corp | HHB | M.Corp |
| Pinjore | PHED, Haryana | PHED, Haryana | M.Corp | M.Corp | M.Corp | Pvt. Dev. | M.Corp |
| HMT | Estate Office | Estate Office | Estate Office | Estate Office | Estate Office | HMT Ltd. | Estate Office |
| Chandimandir | Cantt. Board | Cantt. Board | Cantt. Board | Cantt. Board | - | MES | Cantt. Board |
| Ramgarh, Birghaghar | PHED, Haryana | - | Gram Panchayat | - | Gram Panchayat | - | Gram Panchayat |
| Villages (Haryana Periphery) | PHED, Haryana | - | Gram Panchayat | - | Gram Panchayat | - | Gram Panchayat |

Source: Dept. of Town & Country Planning, Punjab and Haryana; GMADA, Mohali Municipal Corporation, Panchkula Municipal Corporation, Zirakpur Municipal Corporation

**Inferences**

- Periphery was envisaged to be under jurisdiction of single authority, but it got apportioned to 3 entities post 1966 with no statutory co-ordinating agency. Planning for periphery and implementation of plans is taken care of by separate departments without any agency responsible for enforcement of plans. Hence multiplicity of authorities is a major reason for its current status.
- Also the co-ordination committee responsible for the periphery is advisory in nature without any legal backing; hence the proposals given by them are not followed by the State Governments. Approximately 23 meetings of the co-ordination committee have been held till now but no positive results came out, as planning and development is state subject.

#### 4.4.3.3. Status of Developments in Periphery

In this section, the status of developments in the periphery has been explained in detail for all the three periphery sub-regions. The section covers developments under the following heads:

i. Government led developments (Haryana & Punjab and UT administration for Chandigarh)
ii. By private colonisers
iii. Development in and around Abadi Deh
iv. Unauthorised growth in the three regions
v. Developments within Municipal limits of towns and cities in periphery.

**Haryana Sub-region**

**1) Government led Developments**

After reorganization of Punjab in 1966 on linguistic basis, amended Periphery Control Act was adopted by the State Government of Haryana in 1967. As per section 4 of the amended act, a development plan had to be notified showing the controlled area along with allocated land uses. The amended periphery control area plan was formulated in 1972 and the allocated land uses for the controlled area have been shown in the table below.

Table 4.18: Land-Use as per development plan for Haryana Sub-Region, 1972

| Zone | Area (ha) | % |
|---|---|---|
| Urbanisable zone | 8510 | 28.8 |
| Agricultural zone | 9616 | 32.6 |
| Reserve forest zone | 4774 | 16.2 |
| Restricted zone | 447 | 1.5 |
| Stone crusher zone | 44 | 0.2 |
| Special project zone | 3282 | 11.1 |
| Water body | 2826 | 9.6 |
| Total | 29500 | 100 |

Source: Development Plan for Periphery Controlled Area, Haryana, 1972

Out of 8510 ha of urbanisable land proposed in the development plan, 5220 ha have come up under Panchkula, Panchkula extension, Mata Mansa Devi Urban Complex and existing Kalka, Pinjore towns, remaining area would facilitate future urbanization.

Table 4.19: Existing urban development projects

| Urbanisable Area | Area (ha) | % |
|---|---|---|
| Panchkula township | 2111 | 40.4 |
| Mata Mansa Devi Urban Complex | 654 | 12.5 |
| Panchkula Extension | 1243 | 23.8 |
| Kalka and Pinjore towns | 1211 | 23.2 |
| Total | 5220 | 100 |

Source: Development plan for periphery controlled area, Haryana, 1972

Special Projects zone constitutes 3282 ha, consisting of projects established by GOI under 'The Indian works of Defence Act, 1903', 'Cantonment Board', 'Indian Factory Act'. Special project zone constitutes approximately 11% of the total land in Haryana sub-region of the periphery.

Table 4.20: Special projects in Haryana Periphery Sub-region

| Project | Area (ha) | % |
|---|---|---|
| Terminal Ballastic Research Lab. | 1773 | 54 |
| Chandimandir Cantonment | 1140 | 34.7 |
| HMT Pinjore | 224 | 6.82 |
| ITBP | 146 | 4.44 |
| Total | 3282 | 100 |

Source: Development Plan for Periphery Controlled Area, Haryana, 1972

**2) Developments by Private Colonisers (Government approved)**

Approximately 125 acres of plots and group housing have been developed by private colonisers in Panchkula. In Mansa Devi Complex which forms a part of Panchkula Urban Estate, approximately 16.85 acres of group housing schemes have been developed by private colonisers. Also currently 526 acres of group housing is being developed by private colonisers in Pinjore.

**3) Unauthorized Constructions**

Approximately 8000 cases of unauthorized constructions have been reported in Haryana Periphery Sub-region. The most prominent belt along which unauthorized constructions have come up is

Chandigarh-Kalka Highway. Unauthorized construction in the form of housing, commercial, industrial, illegal marriage palaces, stone crushers, brick kilns etc. have been witnesses. No regulation of illegal construction has taken place as yet.

**4) Village Abadi Areas**

In 1902, first consolidation was done and 'lal dora' delineated around the villages. As per Periphery Control Act, State Government declared construction of residences in lal dora area permissible and also construction of residences in extended abadi area permissible. This clause of construction being permitted in extended abadi deh has been exploited by migrants wanting to stay in Chandigarh but unable to do so because of soaring land prices.

**5) Municipal Areas**

As per amendment made by Haryana Sub-region in the Periphery Control Act, Municipal areas have been exempted from the purview of the Punjab New Capital (Periphery) Control Act, 1952.

Table 4.21: Status analysis of development in Haryana Periphery Sub-region

| Growth / Development | | Area (ha) | | Legal Framework | Remarks |
|---|---|---|---|---|---|
| | | Proposed | Existing | | |
| Govt. led dev. | State | 8510 | 5220 | - Act: Punjab New Capital (Periphery) Control Act, 1952<br>- Plan document: Periphery Development Plan, Haryana Sub-region, 1972 | - Out of 8510 ha Urbanisable area, 5220 ha under Panchkula, Panchkula extension, Mata Mansa Devi Urban Complex & existing Kalka, Pinjore towns. Proposed Urban Complex at Kot Behla.<br>- Against the |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | spirit of Punjab New Capital (Periphery) Control Act, 1952 |
| | Central Special Projects | 3282 | | - The Indian Works of Defence Act, 1903<br>- Cantonment Board, 1924<br>- Factory Act, 1948 | - Special projects under central government.<br>- Against the spirit of Punjab New Capital (Periphery) Control Act, 1952 |
| Private Colonisers | | 270 | | -The Haryana Development and Regulation of Urban Areas Act, 1975 | Group housing projects by private colonisers in Panchkula, MDC and Pinjore |
| Municipal Areas | | 5418 | | - The Haryana Municipal Act, 1973<br>- The Haryana Municipal Corporation Act, 1973 | Amendment in Periphery Control Act. Not under the purview of act anymore. |
| Industries / Kilns / Stone crushers | | 4134 | | -Act: Punjab New Capital (Periphery) Control Act, 1952 | Land use designated in controlled area plan, 1973 conceived under act. However many unauthorised kilns have also come up. |
| Village Abadi Deh | | 154 nos. | | - Exemption from Act: Punjab New | Residential construction |

| | | | |
|---|---|---|---|
| | | Capital (Periphery) Control Act, 1952 | (upto 11 mts) in abadi deh and in extension (60% of abadi deh) exempted from periphery control act. |
| Unauthorised Construction | 8000 nos. | - | - Prominent belt: Chandigarh-Kalka highway.<br>- Unauthorised construction in the form of housing, commercial, industrial, illegal marriage palaces, stone crushers, brick kilns etc.<br>- No regularization of construction as yet. |

Source: Development Plan for Periphery Controlled Area, Haryana, 1972

**Punjab Sub-region**

**1) Government led Developments**

Most significant Government led development in Punjab Sub-region may be seen in the case of Mohali city, which has been planned contiguous with Chandigarh post re-organization. Further in 1990, Punjab Government declared an area of approx. 40.5 sq kms, comprising of 23 villages as FEZ, where change of land use was freely permitted. This area has fast emerged as unplanned conglomerate of industries without any supporting infrastructure and services. In absence of adequate controls, the area inhibited by these villages is being subjected to enormous pollution and sub-standard development.

Furthermore in 2008, 6 new Local Planning Areas (LPAs) have been notified within the Greater Mohali Region. The 6 LPAs notified are SAS Nagar, Mullanpur, Derabassi, Banur, Kharar, Zirakpur. Another LPA identified is Nayagaon, but is does not fall under Greater Mohali Region.

**New Projects by GMADA**

Currently 7 new projects are being developed in periphery by GMADA. Three residential projects are coming up in Mullanpur LPA and four residential in Mohali. Total area of projects is approximately 5215 acres out of which 2212 acres in Mullanpur (42%) and 3003 acres (58%) in Mohali.

**2) Private Colonisers (PUDA / GMADA approved) and Mega Projects**

Under PAPR Act, approx. 50 colonies have come up / are under construction. These are group housing projects less than area of 100 acres, in case of GMADA and in case of Mohali, it is 25 acres. Approximately 14 projects are under construction or have been completed in Zirakpur, approximately 32 have been completed in Kharar, 2 projects in Derabassi and 2 in Mohali.

**Mega Housing Projects (above 25 acres) and Mega Industrial Projects**

There are total 11 mega housing projects in periphery with area of 3211 acres. 9 mega housing projects covering area of 2461 acres are coming up in Mohali and 2 mega housing projects in Mullanpur covering area of 657 acres. Other than ongoing projects, there are 3 out of 984 acres of mega industrial projects, 3 projects covering 706 acres coming up in Mohali.

**3) Unauthorized Construction**

More than 18,000 unauthorized construction other than structures that existed before 9.12.98, which have been regularized in the form of marriage palaces, brick kilns, stone crushers, furniture markets etc. along Chandigarh – Ambala & Chandigarh – Kharar Highway.

**4) Municipal areas**

The three municipal areas of Derabassi, Banur and Kharar already existed before the periphery was delineated. Later after re-

organization, two more towns were accorded municipal status – Mohali in 1982 and Zirakpur in 1999 and the already existing municipal limits were expanded. All these led to further regularization of haphazard development.

Table 4.22: Status analysis of development in Punjab Periphery Sub-region

| Growth / Development | | Area (ha) | | Legal Framework | Remarks |
|---|---|---|---|---|---|
| | | Proposed | Existing | | |
| Govt. led dev. | LPA | 36669 | 5500 | - Punjab Regional & Town Planning Act, 1995 | - First legal plan document conceived in 2008 and planning areas notified.<br>- No revised development plan prepared after re-organization under Periphery Control Act unlike Haryana. |
| | FEZ | 4950 | | - Govt. Of Punjab, Dept. of Industries Notification, dated 26.10.1989 | - 23 villages in Derabassi declared as FEZ in 1995, where change of land use freely permitted.<br>- Emerged as unplanned conglomerate of industries without any supporting infrastructure and services. |

| | | | |
|---|---|---|---|
| Private Colonisers | 259 | - Punjab Apartment and Property Regulation Act, 1963 | Private group housing projects less than 25 acres conceived under this act. |
| Mega Private Projects | 4043 | - Industrial Policy, 2009 under Govt. of Punjab, Dept. of Industries & Commerce notification dated 7.10.2009 | - Projects with investment more than 100 crores & area more than 25 acre screened & approved by High powered committee chaired by Chief Minister.<br>- Total 11 mega housing projects.<br>- 9 projects in Mohali & 2 in Mullanpur.<br>- 4 additional projects in Mullanpur at approval stage.<br>- 3 Mega Industrial Projects coming up in Mohali. |
| GMADA | 2111 | - Punjab Regional & Town Planning Act, 1995 | - 7 Projects being developed by GMADA.<br>- 3 in Mullanpur LPA & 4 in Mohali.<br>- Total area – 5215 acres, 2212 |

| | | | |
|---|---|---|---|
| | | | acres in Mullanpur (42%) & 3003 acres (58%) in Mohali. |
| Municipal Areas | 11300 | - Punjab Municipal Act, 1911<br>- Punjab Municipal Corporation Act, 1976 | - 3 municipal areas that already existed were Derabassi, Bnur and Kharar.<br>- 2 more towns accorded municipal status – Mohali in 1982 & Zirakpur in 1999.<br>- Further added to the regularization of haphazard development. |
| Village Abadi Deh | | - Exempted from Act: Punjab New Capital (Periphery) Control Act, 1952 | - Residential construction within Abadi Deh exempted from Periphery Control Act. |
| Unauthorised Construction | 380 | | - Unauthorised construction beyond Abadi Deh, ribbon development along highways, illegal subdivision of land for private colonies.<br>- Regularization |

| | | | |
|---|---|---|---|
| | | | of unauthorised construction from on case to case basis. |

Source: GMADA, 2015

**Inferences**

- Amendments have been made in the development plan of Haryana Sub-region to accommodate more urbanisable areas, which is totally against the spirit of the act. But largely development in Haryana sub-region is coming up as per development plan except for the unauthorised constructions that may be witnessed along highways etc. However, there is not much land left for further urbanization in this part of periphery as the land form is not suitable for developments.
- Private builders are more active in Punjab periphery than in Haryana Periphery.
- Number of unauthorized constructions in Haryana sub-region is higher than Punjab sub-region. This is due to the fact that Punjab has time and regularised unauthorised construction due to political patronage while there has been no regularisation of unauthorised constructions in Haryana.
- FEZ areas in Punjab are one of the major violations of act. Firstly it is a non-conforming land use as per the act and secondly it is instrumental in degrading the environmental quality of surrounding villages.
- There are a number of new projects being facilitated by Punjab State Government in no construction zone and eco sensitive zone to north and west of Chandigarh forest act and also against the edict of Chandigarh formulated by Le Corbusier.
- Punjab has done little to regulate construction in Chandigarh's periphery, especially in the Nayagaon area, despite the UT administration raising the issue repeatedly with the neighbouring state. The area behind the Capitol Complex is a no-construction zone in accordance with the edict of Chandigarh and the Chandigarh Urban Complex plan. However, the master plan of Nayagaon by Punjab state shows it to be urbanized. Since there are no height restrictions in the area, there is a potential danger of multi-storeyed buildings coming up at the foothills of Shivaliks which form

the most powerful natural landmark of Chandigarh and a magnificent backdrop of the Capitol.

## 4.5. Results – Identification of Critical Settlements

### 4.5.1. Indicators for Identification of Critical Settlements

In the following section, an attempt has been made to identify the critical settlements with the help of indicators such as growth rate (2001-2011), density (2011); status of physical infrastructure i.e. water supply, sewerage, drainage, availability of transport terminals; status of social infrastructure i.e. health, education, socio-cultural, safety; dependence on Chandigarh i.e. for work, education, socio-cultural; new developments and land values.

Table 4.23: Comparative analysis of settlements based on identified indicators

| Town | Population (2011) | Population (2001) | Growth Rate 2001-2011 (%) | Density (PPH) | Distance from Chd (kms) | PHYSICAL INFRASTRUCTURE | | | | | | | SOCIAL INFRASTRUCTURE | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Health | | | | | | Education | | | | | | | Socio-Cultural | | | Safety | New Projects | | | | |
| | | | | | | Water Supply | Sewarage | | System of Drainage | | Railway Station | Bus Facility | Hospitals | Dispensary | FWC | HC | NH | No of beds | Arts / Science / Commerce | Medical College | Engg. College | Poly-technics | Higher Secondary | Senior Secondary | Junior Secondary & Primary | Theatre | Auditorium | Public Library | Fire-Fighting Service | Mega Housing (acres) | Group Housing by Pvt. Dev. (acres) | Land Values (Rs. / sq. yard) | Total Trips to Chandigarh | % of Total Trips to Chandigarh |
| Kharar (M.Cl) | 74460 | 42289 | 76.1 | 33.8 | 14 | TW | S (70%) | ST (30%) | OSD (10%) | UD (90%) | Yes | Yes | 1 | 1 | 1 | 1 | 3 | 145 | ASC-1 | Chd (14) | Chd (14) | Chd (14) | 1 | 6 | 10 | 1 | - | 1 | Mohali (6) | - | - | 25000 | 27081 | 6.8 |
| S.A.S Nagar (M.Cl) | 166864 | 123484 | 35.1 | 66.7 | 8 | TW, Canal | S (100%) | | UD (100%) | | Chd (8) | Yes | 3 | 5 | 1 | 1 | 5 | 500 | AS-2 | Chd (8) | Chd (8) | 1 | 6 | 14 | 88 | 1 | 1 | - | Yes | 6171.2 | 30 | 1.2 lakh | 94502 | 23.9 |
| Dera bassi (M.Cl) | 26295 | 15541 | 69.2 | 10.5 | 20 | TW | S (80%) | ST (20%) | OSD (20%) | UD (80%) | Ghagar (2) | Yes | 1 | 3 | 1 | Chd (20) | 3 | 48 | AC-1 | Chd (20) | 1 | Chd (20) | 1 | 5 | 10 | 1 | 1 | 2 | Yes | - | 50 | 30000 | 14678 | 3.7 |
| Zirakpur (M.Cl) | 95553 | 25022 | 281.9 | 79.6 | 10 | TW | S (45%) | ST (55%) | OSD (80%) | UD (20%) | Chd (10) | Yes | Chd (10) | 2 | 1 | Chd (10) | 2 | 15 | Chd (10) | Chd (10) | Chd (10) | Chd (10) | 1 | 1 | 11 | - | - | - | Chd (10) | - | 450 | 40000 | 79574 | 20.1 |
| Banur (M.Cl) | 18775 | 15013 | 25.1 | 20.9 | 25 | TW | S (70%) | ST (30%) | OSD (30%) | UD (70%) | Rajpura (14) | Yes | 1 | 1 | 1 | Kalo Mara (6) | 5 | 54 | Rajpura (14) | Chd (25) | Tangori (6) | Chd (25) | 1 | 3 | 6 | - | - | 1 | Rajpura (14) | - | 26 | 20000 | 2612 | 0.1 |
| Mullanpur Garibdas CT | 6165 | 6147 | 0.3 | 6.2 | 10 | TW | ST & SP (100%) | | OSD (100%) | | Chd (8) | Yes | Chd (10) | 1 | Chd (10) | Chd (10) | Chd (10) | 0 | Chd (10) | Chd (10) | Chd (10) | Chd (10) | 1 | 1 | 2 | - | - | - | Chd (10) | 3818.3 | - | 45000 | 3085 | 0.8 |
| Panchkula (M.Cl) | 211355 | 140925 | 50 | 52.3 | 8 | TW | S (100%) | | UD (100%) | | Yes | Yes | 2 | 14 | 1 | 1 | 10 | 250 | ASC-2 | Chd (8) | Chd (8) | Chd (8) | 20 | 34 | 40 | 4 | 1 | - | Yes | - | 61 | 1.4 lakh | 120704 | 30.5 |
| Kalka (MC) | 34134 | 30830 | 10.7 | 75.9 | 29 | TW | S (60%) | ST (40%) | OSD (30%) | UD (70%) | Yes | Yes | 1 | 1 | Pkl (16) | Pkl (16) | 2 | 66 | ASC-1 | Chd (25) | Chd (25) | 1 | 6 | 11 | 21 | 1 | - | 1 | Yes | - | - | 25000 | 29678 | 7.5 |
| Pinjore (MC) | 35912 | 25410 | 41.3 | 38.9 | 25 | TW | S (60%) | ST (40%) | OSD (30%) | UD (70%) | Kalka (4) | Yes | Chd (29) | 1 | Pkl (20) | Pkl (20) | 1 | 0 | Chd (29) | Chd (29) | Chd (29) | Chd (29) | 4 | 3 | 11 | - | - | - | Pkl (20) | 238.52 | - | 30000 | | |
| Chnadigarh (M.Corp) | 970602 | 808515 | 20.05 | | - | TW, Canal | S (100%) | | UD (100%) | | Yes | Yes | 5 | 43 | 4 | 1 | 5 | 2046 | ASC (11) LUO (4) | 5 | 1 | 2 | 51 | 62 | 81 | 8 | - | 3 | Yes | NA | NA | 1.8 lakh | - | - |

NOTE: TW - Tube Well, S - Sewer Line, ST - Septic Tank, SP - Soak Pit, FWC - Family Welfare Centre, HC - Health Centre, Chd - Chandigarh, Pkl - Panchkula

Source: Author, based on Household Survey across peripheral settlements, 2015

Considering the first indicator i.e. growth rate from 2001 to 2011, it has been observed that Zirakpur town shows the highest growth rate indicating dynamic character of the settlement. Kharar town and class-I city of SAS Nagar also have high growth rate but not compatible to that of Zirakpur. Hence it may be concluded that Zirakpur is the most critical settlement in terms of population growth.

Also among all settlements, density too is highest for Zirakpur town. Zirakpur town has a density of 75 pph followed by Kalka having comparable density. Panchkula and SAS Nagar are also exhibiting high densities.

In terms of physical infrastructure, planned cities of Panchkula & Mohali have 100% piped water supply, sewerage and drainage system while Zirakpur & Mullanpur towns are most critical in terms of coverage of underground sewerage and storm water system. Zirakpur town has approximately 45% households covered by underground sewerage system, while 55% households are still dependent on soak pits and septic tanks.

In terms of social infrastructure, most towns have inadequate facilities but the most critical ones are Mullanpur and Zirakpur, which lack in majority as a result of which they are highly dependent on Chandigarh. Furthermore, Panchkula and Mohali have social infrastructure, which is not at par with that of Chandigarh, hence there is a tendency to depend on the infrastructure of Chandigarh.

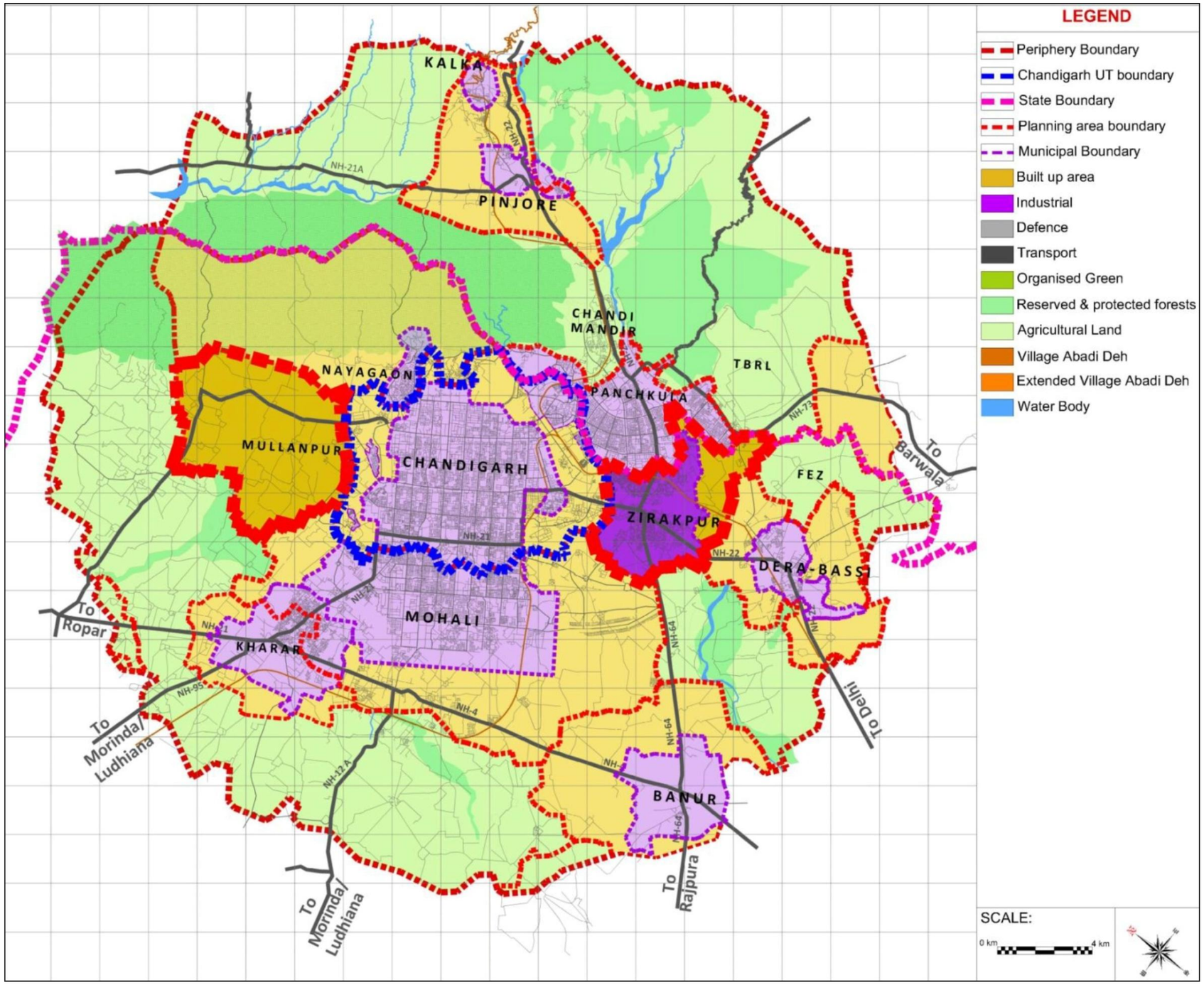
Another parameter considered is new urban development projects proposed in the settlements. It has been observed that approximately 6171 acres of new projects are coming up at Mohali, followed by Mullanpur with 3818 acres of new development. Zirakpur Town has approximately 450 acres of new projects proposed.

**Inferences**

- The analysis based on identified parameters indicates that Zirakpur and Mullanpur are the two most critical settlements. Zirakpur is a dynamic settlement exhibiting high growth rate and density and has inadequacies related to physical and social infrastructure. Hence planning interventions are necessary to cater to these inadequacies, which are having direct negative implications on Chandigarh.
- Mullanpur is a small census town, situated in close proximity to Chandigarh and hence has a high potential for growth and development. Currently it is highly deficient in required infrastructure and if same trend

continues, the core city Chandigarh will be further burdened. Hence, it too calls for planning interventions, a preventive and pro-active approach.

Map 4.11: Location of critical settlements - Zirakpur & Mullanpur at Chandigarh periphery




Source: Author, 2015

## 4.6. Specific Discussion on Critical Settlement – 1: Zirakpur - Process of Transformation as a Peripheral Town of Chandigarh

### 4.6.1. Introduction

On the basis of identification of critical settlements around the planned city of Chandigarh with respect to certain identified indicators / parameters, Zirakpur is one of them, as described in the previous section. In continuation, the following section attempts to study and understand the status of development at this settlement and analyze the process of transformation at the local scale.

### 4.6.2. Town Profile

Zirakpur is the fastest growing town which shares its boundary with Chandigarh. Its name is derived from a small village, which lies at the core of a group of villages now collectively forming this town. When Chandigarh started to expand, the distances between these villages started to shrink and gradually they all fused together into one small town.

Notified Area Committee for Zirakpur was formed in 1999, comprising of 7 villages. In 2005, Municipal Council was formed comprising of 9 villages. In 2006, 3 more villages were added to the Municipal Area. Furthermore in 2011, total 15 villages were brought under the jurisdiction of ULB.

As per Census 2011, 10% of total population of Punjab Periphery lies in Zirakpur. Also urban population in Zirakpur accounts for 20% of total urban population of Punjab Periphery. Furthermore town has been exhibiting very high growth rate as high as 281% in 2001-2011. Currently town level density is approx. 80 pph.

Table 4.24: Profile of Zirakpur town

| Year | Status | Population | Growth Rate (%) | Area (sq kms) | Density (PPH) | No. of HHs | HH Size |
|---|---|---|---|---|---|---|---|
| 2001 | N.P. | 25022 | - | 8.6 | 29.1 | 5072 | 4.9 |
| 2011 | M.Cl. | 95553 | 281.9 | 12 | 79.6 | 20587 | 4.6 |

Source: Census, 2014

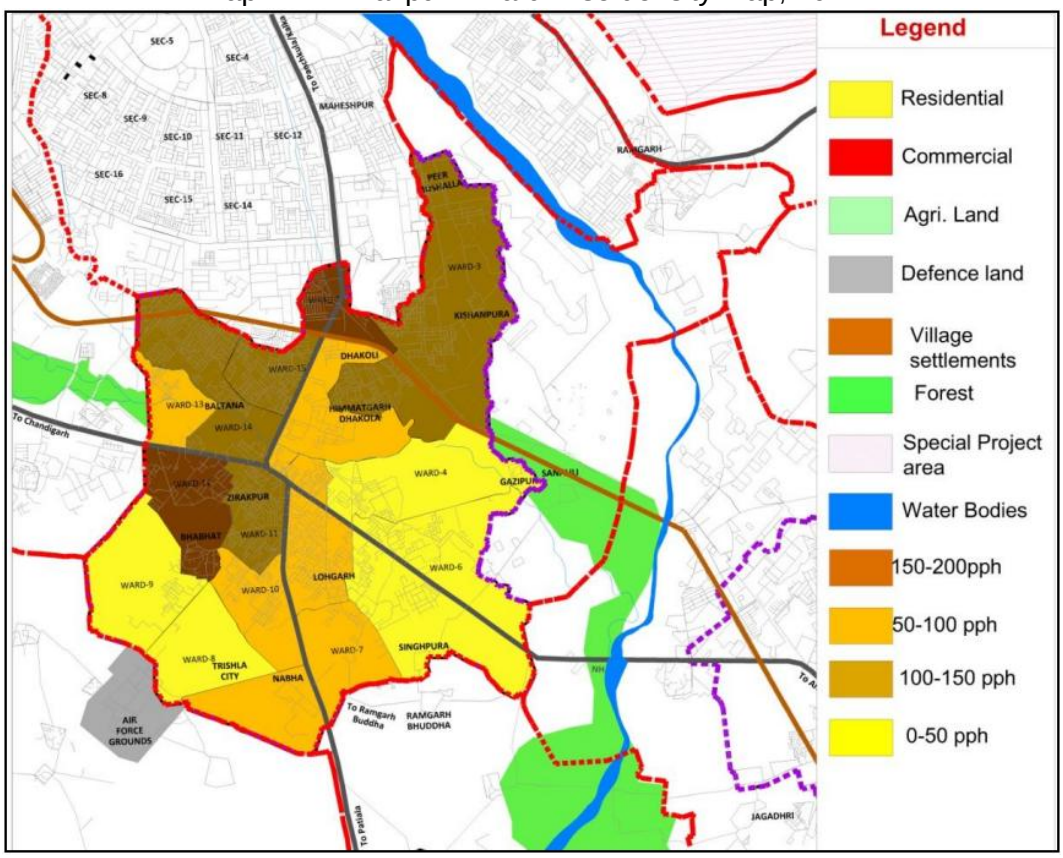
### 4.6.3. Status of Development

Town of Zirakpur was formed by declaring group of 9 villages as Notified Area Committee (NAC). Hence majority development is witnessed as a result of spill over from existing Abadi Deh of villages. The villages forming the town of Zirakpur are Bhabhat, Baltana, Zirakpur, Dhakoli, Lohgarh, Himmatgarh, Kishanpura, Pir Machalla, Bir pir Machalla, Nabha, Gazipur, Singhpura, Bhishangarh and Bhishanpura.

Another phenomenon witnessed is ribbon development along the National Highways passing through the settlement. These are NH-22 to Kalka, NH-22 to Ambala, NH-21 to Chandigarh & NH-64 to Patiala. Commercial as well as residential clusters have come up linearly along these major transportation routes.

Furthermore, a number of plotted colonies and multi-storied apartments have also come up in a piece meal manner within municipal limits as well as outside the municipal limits in the planning area. The following map shows the ward-wise gross residential densities in the settlement. Higher densities are witnessed along National Highway and also closer to the planned cities of Chandigarh and Panchkula.

Map 4.12: Zirakpur – ward-wise density map, 2011




Source: Author, 2015

Majority developments have come up in an unauthorized manner on irregularly subdivided agricultural land due to lack of monitoring and enforcement. Out of 127 colonies built, approximately 113 (89%) colonies have come up illegally, which have been regularized due to political intervention. No byelaws, development control regulations have been followed in these unauthorized developments, which have been regularized now. Only 14 (11%) colonies have come up following proper legal framework. Hence it may be concluded that a major lack is regularization of these haphazard developments in 1998 and 2007. Also majority development was unplanned and haphazard till notification of Master Plan in 2010. Many residential colonies have access roads which are narrow and cannot facilitate movement of fire tender vehicle. Also balconies projecting on the road are obstructing light and ventilation on the road. Hence the status of development in Zirakpur is not very pleasing.

### 4.6.4. Status of Physical Infrastructure

In the following section, status of physical infrastructure in Zirakpur has been assessed. An attempt has been made to analyse the status of traffic and transportation, water supply, sewerage, drainage and solid waste management of Zirakpur Town.

#### 4.6.4.1. Transport

The condition of roads in Zirakpur is not satisfactory. While the arterial roads or the national highways are currently being upgraded, the condition of local and access roads in Zirakpur is in a blighted state. They are poorly maintained with irregular widths and absence of pedestrian pathways. Another major issue is the close proximity of two main national highway intersections in the middle of the town which are constant sources of bottlenecks.

Also in some areas road widths are so less that vehicular movement becomes difficult. This scenario is prevalent mainly in the abadi deh of villages and also in unauthorized colonies, which have been regularized now. Furthermore, most internal roads are covered with paver tiles without any road gullies leading to rapid runoff of rain water causing water clogging as a result of which vehicles find it difficult to ply in monsoons.

Another scenario witnesses is that other that the trips made by the residents of Zirakpur and those commuting to and fro for work and other purpose, there are approximately 28% through trips to and from Kharar, Derabassi, Baddi,

Kalka-Pinjore passing through Zirakpur. These are causing traffic gridlocks and chaos. This also calls for immediate intervention.

#### 4.6.4.2. Water Supply

Water supply in Zirakpur is mainly facilitated through tube-wells in the absence of any perennial source of water. It has been observed that total dependence on ground water in the settlement of Zirakpur is leading to deteriorating water table. The ground water in this area has deteriorated to the order of 4-16mts in the past 30 years.

Considering the supply of water in comparison to the demand, there is not much gap currently as the settlement is not very thickly populated. Hence ground water is able to cater to the needs of the residents. But with increase in population, the water related issues are going to aggravate.

It has also been witnessed that the Municipal area is not covered by 100% piped water supply. Approximately 28% of area is still devoid of piped water connection. This is mainly due to haphazard layouts and congested lanes where laying of pipes is problematic. Also the extent of non-revenue water is approximately 30% which is more than the service level benchmark of 15%.

In the following section, status of water supply, sewerage, drainage and solid waste management has been analyzed with the help of service level benchmarks.

Table 4.25: Status of physical infrastructure at Zirakpur

| Aspect | SLB | Zirakpur |
|---|---|---|
| **2.1: Water Supply** | | |
| Coverage of water supply connections | 100% | 72% |
| Per capita supply of water | 135 lpcd | 130lpcd |
| Extent of metering of water connections | 100% | 95% |
| Extent of non-revenue water (NRW) | 15% | 30% |
| Continuity of water supply | 24 hrs. | 4-6 hrs. |
| Cost recovery in water supply and sewerage services | 100% | 37% |
| **2.2: Sewage Management** | | |
| Coverage of Toilets | 100% | 100% |
| Coverage of sewerage network | 100% | 45% |
| Adequacy of sewage treatment capacity | 100% | 100% |

| | | |
|---|---|---|
| Extent of reuse and recycling of waste water | 20% | 0% |
| Cost recovery in water supply and sewerage services | 100% | 37% |
| **2.3: Solid Waste Management** | | |
| Household level coverage of solid waste management services | 100% | 0% |
| Efficiency of collection of Municipal SW | 100% | 60% |
| Extent of segregation of Municipal SW | 100% | - |
| Extent of municipal solid waste recovered | 80% | 15% |
| Extent of scientific disposal of municipal solid waste | 100% | 0% |
| Cost Recovery in SWM Services | 100% | 0% |
| **2.4: Drainage** | | |
| Coverage of storm water drainage network | 100% | 20% |
| Incidence of water clogging / flooding | 0% | NA |

Source: Municipal Council, Zirakpur & Author, 2015

#### 4.6.4.3. Sewerage and Drainage System

It has been observed that the coverage of Sewerage and drainage system in Zirakpur is inadequate. As a result of this, sewage is being dumped in the Singh Nalah and Sukhna Choe. Dumping of untreated waste to these choes and nalahs is leading to their degradation.

Furthermore, storm water drainage system has not been laid in the internal roads which are leading to water-clogging problems. 80% roads lack proper roadside drainage. These are mainly local & access roads.

#### 4.6.4.4. Solid Waste Management

It has been observed that in case of Zirakpur, there is no household level collection of solid waste. Solid waste is thrown by the residents in the bins provided by Municipal Council of Zirakpur, from where dumper placers collect the waste and transport to the land fill site. Also the landfill site is within Municipal limits causing environmental degradation. Even though there is a site earmarked

for solid waste, still waste is being dumped in Singha nala and Sukhna Choe, which have degraded. Industrial waste is also thrown directly in the choe.

### 4.6.5. Status of Social Infrastructure

In the following section, status of social infrastructure i.e. educational, health care and socio-cultural facilities have been analyzed. Attempt has been made to assess the existing inadequacies and also to ascertain whether the provisions made in the Master Plan for 2031 are sufficient or not.

Table 4.26: Status of social infrastructure

| Social Infrastructure | EXISTING | REQ. (2011) | REQ. (2031) | Area Req. in ha (2031) | Proposed as per Master Plan | Area Proposed in ha (2031) | Remarks (Adequacy / Inadequacy of Master Plan 2031 provisions |
|---|---|---|---|---|---|---|---|
| **Educational** | | | | | | | |
| Nursery and Primary School (1 for 2500) | 11 | 38 | 50 | 4 | – | – | No provision in Master Plan, 2031 |
| Senior Secondary School (1 for 7500) | 1 | 13 | 17 | 27.2 | – | – | |
| Integrated School without hostel facility (1 for 1 lakhs) | – | 1 | 1 | 3.5 | – | – | |
| Integrated School with hostel facility (1 for 1 lakhs) | – | 1 | 1 | 3.5 | – | – | |
| School for Handicapped (1 for 45000) | – | 2 | 3 | 1.2 | – | – | |
| College Campus (1 for 1.25 lakhs) | – | 1 | 1 | 4 | 1 | 20 | In Excess |
| **Health Care** | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hospital (1 @ 500 bedded for 2.5 lakh) | _ | _ | _ | _ | _ | _ | Not required |
| Intermediate Hospital - cat A (1 @ 200 bedded for 1 lakh) | _ | 1 | 1 | 3.7 | 1 @ 100 bedded | 0.8 | Inadequate provision |
| Intermediate Hospital - cat B (1 @ 80 bedded for 1 lakh) | _ | 1 | 1 | 3.7 | _ | _ | |
| Poly-clinic (1 for 1 lakh) | 1 | 1 | 1 | 0.2 | _ | _ | |
| Nursing Home / Child Welfare (1 for 0.45 lakh) | 2 | 2 | 3 | 0.75 | 3 | 1.6 | Sufficient |
| Dispensary (1 for 15000) | 2 | 6_7 | 8 | 0.64 | _ | _ | Inadequate |
| **Socio-Cultural Facilities** | | | | | | | |
| Library and Community Hall (1 for 15000) | _ | 6_7 | 9 | 1.8 | 1 | 0.3 | Inadequate |
| Recreational Club (1 for 1 lakh) | _ | 1 | 1 | 1 | 3 | 1.8 | Sufficient |
| Music, Dance, Drama Centre (1 for 1 lakh) | _ | 1 | 1 | 0.1 | 3 | 0.8 | Sufficient |
| Meditation and Spiritual Centre (1 for 1 lakh) | 1 | 1 | 1 | 0.5 | _ | _ | Inadequate |
| | | | | | | | |
| Police Post (1 for 45000) | 2 | 2 | 3 | 0.48 | 3 | 0.2 | Sufficient |
| | | | | | | | |
| Fire Station | _ | 1 | 1 | 1 | 1 | 1 | Sufficient |

Source: Municipal Council, Zirakpur & Author, 2015

It has been observed that Zirakpur town lacks in social infrastructure i.e. educational facilities, health facilities as well as socio-cultural facilities as a result

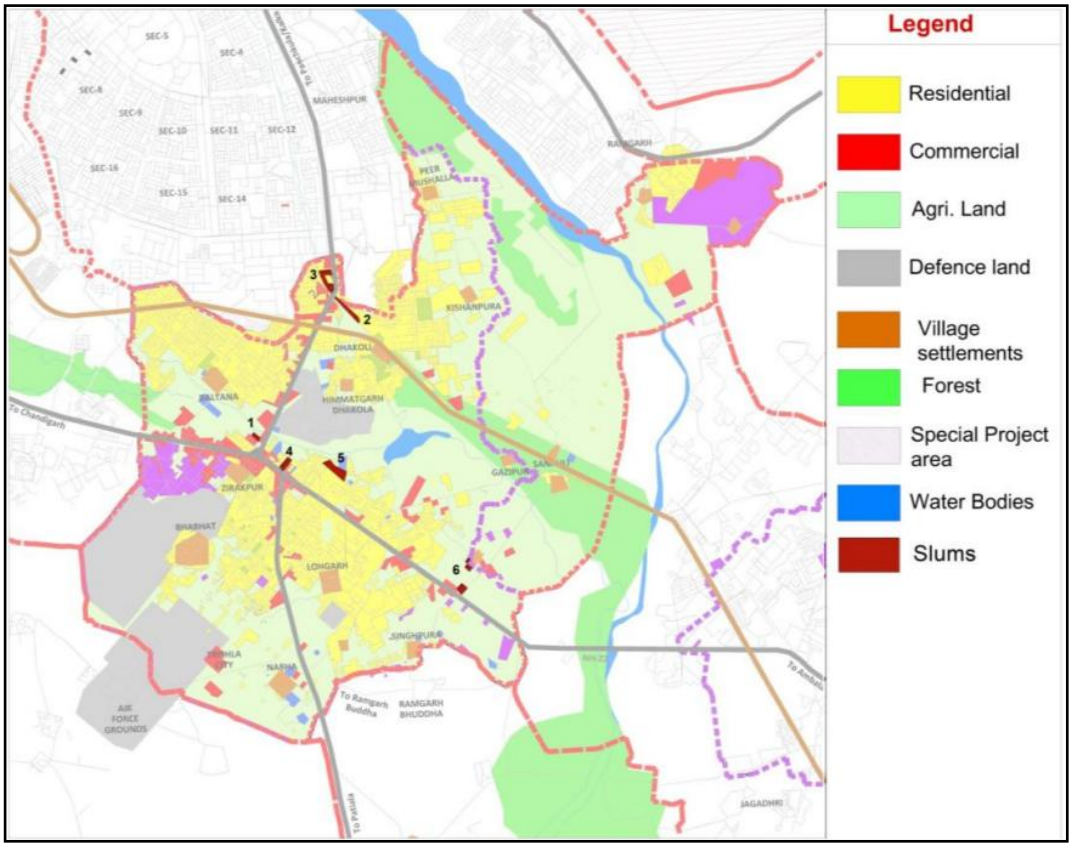
of which the residents are dependent on planned city of Chandigarh. Most primary schools and anganwadis are located in villages with poor infrastructure hence witness low strength of students. Furthermore, private colonies which comprise 70% of residential area lack in primary and secondary schools hence leading to dependence on Chandigarh for quality education. Also there are no colleges in Zirakpur, which is in turn contributing to increased dependence on Chandigarh.

The state of medical facilities is also poor. There is just one polyclinic and two dispensaries as against requirement of a 100 bedded hospital, 1 poly-clinic and approximately 6-7 dispensaries. It has also been observed that the town lacks in socio-cultural facilities like community hall, library, recreational club etc. Also there is no fire station implying dependence on Chandigarh for the same.

### 4.6.6. Status of Slums

In the following section, status of slums in Zirakpur has been explained in detail. Currently six slums have been identified by the Municipal Council of Zirakpur. The map shown below highlights the location of the identified slums in Zirakpur.

Map 4.13: Location of slums




Source: Author, 2015

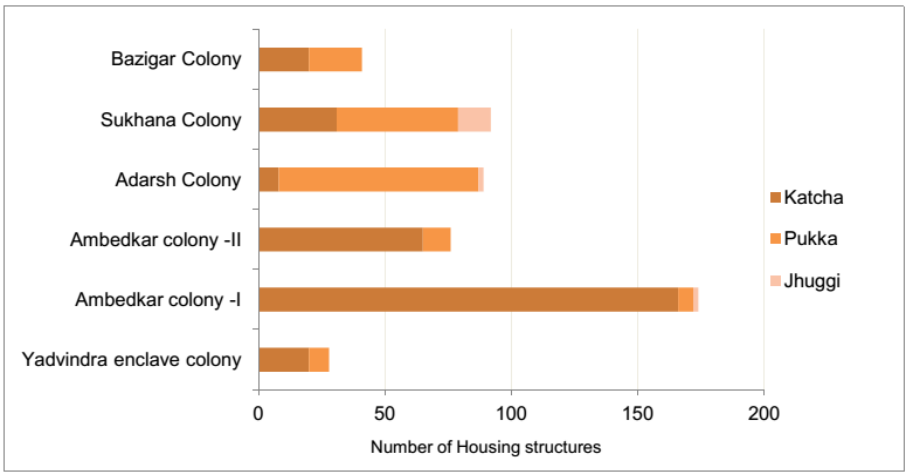
Table 4.27: Profile of slums in Zirakpur

| Slum | Area (ha) | Population | Density (PPH) | No. of HHs | HH Size | Ownership | No. of Houses | | | | Occupation (%) | | | | Water Supply | Sewerage | | Storm Water Drainage | Solid Waste Management | Electric Connection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Katcha | Pukka | Jhuggi | Total | Labourer | Primary | Secondary | Tertiary | | Under-ground Sewer | Septic Tank | | | |
| Yadvindra Colony | 0.8 | 167 | 209 | 28 | 6 | Self Owned | 20 | 8 | _ | 28 | 41 | 13 | 5 | | Piped Connection | | | No | No | Yes |
| Ambedkar Colony - I | 6.1 | 988 | 163 | 174 | 5.7 | Railway Land | 166 | 6 | 2 | 174 | 269 | 32 | 9 | 6 | Own Tubewell | | | No | No | No |
| Ambedkar Colony - II | 1.2 | 445 | 368 | 77 | 5.8 | Railway Land | 65 | 11 | _ | 76 | 90 | 10 | 34 | 4 | Own Tubewell | | | No | No | No |
| Adarsh Colony | 4 | 635 | 157 | 89 | 7.1 | MC Zirakpur | 8 | 79 | 2 | 87 | 39 | 79 | 48 | 18 | Piped Connection | | | No | No | Yes |
| Sukhna Colony | 6.5 | 514 | 79 | 92 | 5.6 | MC Zirakpur | 31 | 48 | 13 | 92 | 118 | 27 | 40 | 6 | Piped Connection | | | No | No | Yes |
| Bazigar Colony | 3.6 | 244 | 67 | 41 | 6 | Self Owned | 20 | 21 | _ | 41 | 16 | 25 | 13 | 5 | Piped Connection | | | No | No | Yes |

Source: Municipal Council, Zirakpur

Out of the six slums identified by the Municipal Council, for slums are located on government land, while the remaining two are located on self-owned land. It has been observed that most critical slums in Zirakpur are Ambedkar Colony-I and Ambedkar Colony-II, which are squatting on the land belonging to the Indian Railways besides Sukhna Choe. The slum dwellers are mainly labourers, who cannot afford housing in Zirakpur town as the land and rental values both are extremely high. Furthermore these squatter settlements on railway land have majority katcha houses with absence of basic infrastructure like piped water supply, sewerage system, solid waste management etc. Approximately 20% slums are covered with sewer system. Rest are dependent on soak pits and septic tanks. Also in the absence of any proper sewerage system, the slum dwellers end up dumping sewage in the Sukha Choe which is leading to degradation of the same. Also majority slums have kutcha roads and rest are covered with paver tiles without any drainage system leading to water-clogging. Slums lack in basic infrastructure, hence dwellers are witnessing low quality of life. The following figure shows the condition of houses in different slums.

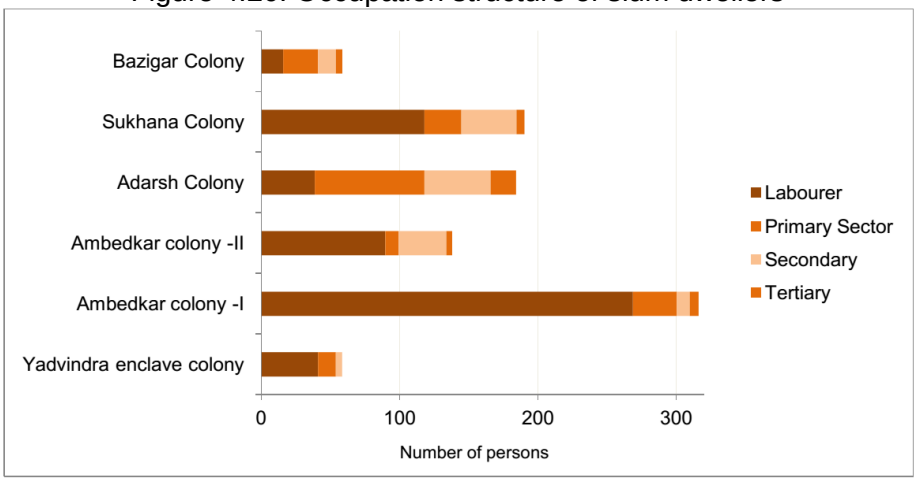
Figure 4.19: Housing condition in slums




Source: Author, 2015

The following figure shows the occupational structure of the slum dwellers in different slums.

Figure 4.20: Occupation structure of slum dwellers




Source: Author, 2015

### 4.6.7. Zirakpur Planning Area

Master plan for local planning area of Zirakpur was notified in 2010. Approximately 38 sq kms consisting of 16 villages has been included as planning area. Development Framework for Zirakpur local planning area has been given below. Zirakpur LPA comprises of 4 key hubs, which are:

1) Regional Centre cum Business Centre around main transportation through fare (i.e. NH21 & NH64) as the centre of commercial activities for the whole of GMADA, supporting a projected population of 4.5 million.
2) Business Parks (aviation related and R&D)
3) FEZ – Industrial Estates
4) Recreation Zone (comprising both passive and active zones)

#### 4.6.7.1. Existing Land-Use

Of the total area, approximately 63% is under agricultural use. Also there is a high percentage of land under restricted use. Restricted land-use consists of 100 mts buffer around defence land & airport. Area under residential use is approximately 10% consisting of rural settlements i.e. within abadi deh and also residential land under colonies.

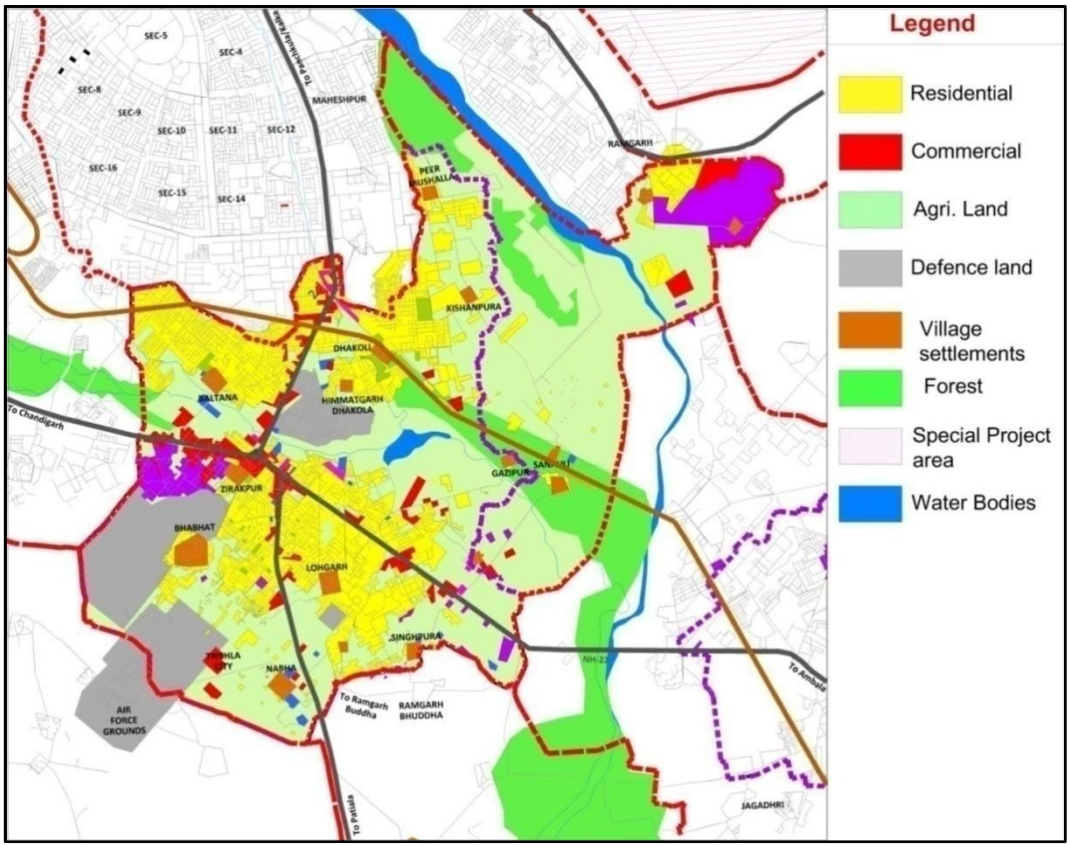
Table 4.28: Land-Use of LPA, 2008

| Land-Use | Area (ha) | % |
|---|---|---|
| Agriculture | 2426.6 | 63.4 |
| Water-body | 89.7 | 2.3 |
| Rural Settlement | 93.2 | 2.4 |
| Defence | 15.7 | 0.4 |
| Green | 65.1 | 1.7 |
| Brick Kiln | 24.7 | 0.6 |
| FEZ | 188 | 4.9 |
| Commercial | 114.1 | 3.0 |
| Colonies | 262.7 | 6.9 |
| Restricted Areas | 549.3 | 14.3 |
| **Total** | **3829.1** | **100** |

Source: Master Plan for Zirakpur LPA, 2031

The following map shows the existing land-use in Zirakpur LPA.

Map 4.14: Existing Land-Use 2010




Source: Google Earth Pro, GMADA

#### 4.6.7.2. Proposed Land-Use 2031

The master plan is proposed for projected population of 129,000 persons in 2031. The planned Gross Residential Density of 175 pph and large portion of Zirkapur LPA is allocated for residential use to accommodate growing population. Residential land-use has been estimated to be 47% approximately while agricultural land is anticipated to decrease from 63% to 11.3%. Industrial Land-use is approximately 8% while area under PSP as low as 5%.

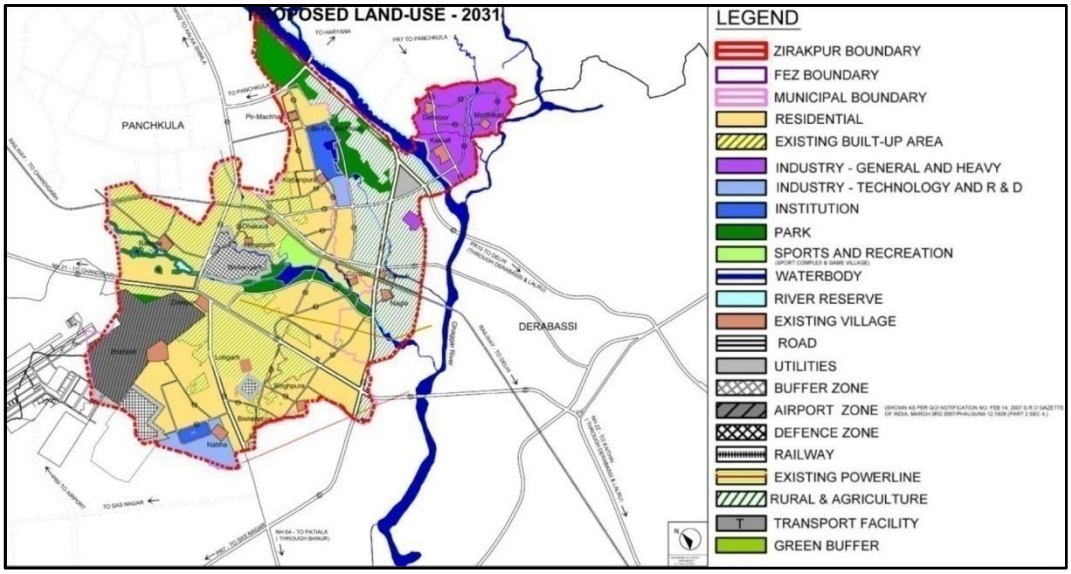
Table 4.29: Proposed Land-Use, 2031

| Land-Use | Area (ha) | % |
|---|---|---|
| Agriculture | 432.7 | 11.3 |
| Rural Settlement | 93.2 | 2.4 |
| Residential | 1691.2 | 44.2 |
| Industrial | 302.5 | 7.9 |
| Defence | 15.3 | 0.4 |
| Green Spaces | 279.5 | 7.3 |

| | | |
|---|---|---|
| Restricted Area | 390.6 | 10.2 |
| Roads | 348.3 | 9.1 |
| Water Body | 89.7 | 2.3 |
| PSP | 186.1 | 4.9 |
| **Total** | **3829.1** | **100.0** |

Source: Master Plan for Zirakpur LPA, 2031

Map 4.15: Proposed Land-Use, 2031




Source: GMADA, 2015

After notification of Master Plan – 2031, planned development is expected to come up in Zirakpur Town. However the trend which has been prevalent in Zirakpur and has still continued to be observed is that even though Master Plan 2031 gives proposals for augmentation of social infrastructure but ground reality is that only residential development involving private players is being undertaken further increasing burden on Chandigarh. Also social infrastructure related proposals in the Master Plan seem to be inadequate when compared to standards followed in other cities.

#### 4.6.7.3. Visual Survey: Image of the settlement

In the following section, the major outcomes of visual survey of the settlement as a whole have been explained, which directly depicts the present scenario of living environment and the degree of quality of life at the place. The survey helps to find out the planning issues as the result of recent transformation, the settlement has undergone. The issues are diverse, including loss of space

beneath flyover, commercialization - spill-over activities, environmental degradation, traffic & congestion, underused / vacant buildings (warehouses / go-downs), violation of building bye-laws, inadequate facilities for daily needs of inhabitants and the overall development pattern.

Figure 4.21: Zirakpur fly-over and the main node of bus-stand

Source: Author, 2015

Figure 4.22: Traffic congestion around the Zirakpur fly-over

Source: Author, 2015

Figure 4.23: Traffic congestion due to presence of only one major shopping centre & recreational facility

Source: Author, 2015

Figure 4.24: Loss of space - unused beneath the Zirakpur flyover


Source: Author, 2015

Figure 4.25: Commercial spill-over, major cause of traffic congestion

Source: Author, 2015

Figure 4.26: Unused / under-used / vacant go-downs & warehouses

Source: Author, 2015

Figure 4.27: Disposal of solid waste in all kinds of vacant lands

Source: Author, 2015

Figure 4.28: Environmental degradation along the natural water course/ canal

Source: Author, 2015

Figure 4.29: Environmental degradation along the existing canal

Source: Author, 2015

Figure 4.30: Change in character along the major linkage of Zirakpur


Source: Author, 2015

Figure 4.31: Violation of building bye-laws: dense built-form

Source: Author, 2015

Figure 4.32: Informal activities for daily needs happening haphazardly

Source: Author, 2015

Figure 4.33: Zirakpur - the dense ribbon development along the main highway / Zirakpur fly-over

Source: Author, 2015

Figure 4.34: The PARAS down town square - the only shopping centre cum recreation option for the inhabitants of Zirakpur and places around


Source: Author, 2015

Figure 4.35: Environmental degradation towards the existing canal (choe) - the place has no connection / link towards the water course except treating as space for solid waste disposal

Source: Author, 2015

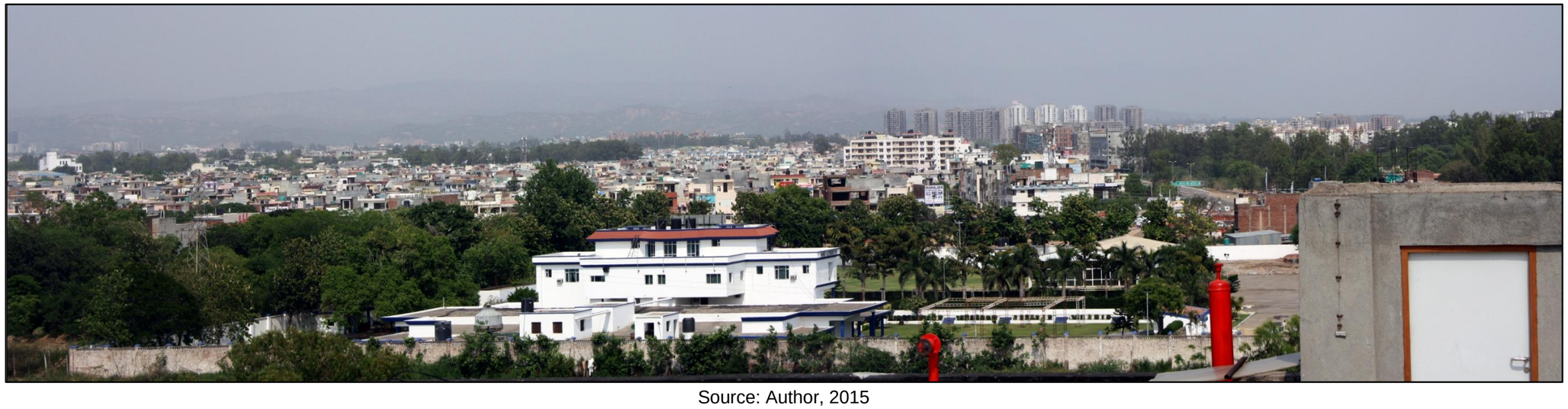
Figure 4.36: The nature of sprawl in Zirakpur

Source: Author, 2015

Figure 4.37: The nature of interface - built fabric & agricultural lands

Source: Author, 2015

Figure 4.38: The nature of interface - built fabric & agricultural lands



Source: Author, 2015

### 4.6.8. Inferences

- **Development Pattern** - Unauthorized constructions are increasing due to lack of monitoring and enforcement. Furthermore political patronage and regularization of unauthorized constructions is giving a further boost to this unplanned and haphazard growth. Non-compliance of building bye-laws is a major reason for low quality of life in unauthorized colonies.
- **Traffic & Transport** - Roads have become extremely congested due to movement of slow and fast moving traffic in the same lane, absence of service lanes, presence of commercial activities, absence of designated parking and presence of informal activities on National Highways.
- **Water Supply** - Depletion of ground water due to excessive use of bore wells and tube wells has been observed. Leakages and wastages have been observed due to worn out water supply network and new pipes, which are difficult to lay because of haphazard layout of colonies. Inadequate cost recovery due to high component of non-revenue water also needs immediate attention.
- **Sewage Management** - Degradation of Nalahs due to dumping of sewage is a major finding of the study.
- **Solid Waste Management** - Degradation of Nalahs has been observed to be a common phenomenon due to dumping of solid waste. Also surface drains at many instances have been found to be choked due to solid waste being dumped in the same. Another significant problem pertaining to solid waste management is that the landfill site is located within MC limits causing environmental degradation. This calls for immediate planning intervention.
- **Status of Slums** - Inadequate coverage of basic services like water supply and sewerage system in slums and squatters is resulting in low quality of life. The condition of housing is adding further woes to the lives of slum dwellers, as there are majority kutcha structures in slums and squatters.
- **Land-Use for LPA** - Proposed agricultural land is as low as 11% as compared to the existing 64% agricultural land. This is clearly indicating level of development / urbanization proposed for the LPA. Also has been proposed that the residential area would increase from 9% to 47% at the cost of fertile agricultural land.

## 4.7. Specific Discussion on Critical Settlement – 2: Mullanpur - Process of Transformation as a Peripheral Town of Chandigarh

### 4.7.1. Town Profile

The second critical settlement identified based on the indicators, is Mullanpur Garibdass; which is a census town located in close proximity to Chandigarh. The following table gives the profile of this census town. Mullanpur Garibdass was classified as a census town in census 2001 and 2011. It is under the jurisdiction of Gram Panchayat currently.

Table 4.30: Profile of Mullanpur town

| Year | Status | Population | Growth rate (%) | Area (sq kms) | Density (PPH) | No of HHs | HH size |
|---|---|---|---|---|---|---|---|
| 2001 | CT | 6147 | - | 8.49 | 7.2 | 1171 | 5.2 |
| 2011 | CT | 6165 | 0.3 | 10 | 6.2 | 1234 | 5.0 |

Source: Census of India, 2001-2011

### 4.7.2. Status of Development

Growth in the census town may be seen as a result of spill over outside abadi deh of the village. Also commercial development has mushroomed along major arterial roads that connect Mullanpur to Chandigarh. A number of unauthorised brick kilns and stone crushers have also been witnessed along Mullanpur Chandigarh Road. Due to high growth potential resulting from its proximity to Chandigarh and Shiwaliks, Mullanpur and surrounding villages have been notified as local planning area.

### 4.7.3. Status of Physical Infrastructure

In the following section, status of physical infrastructure in Mullanpur has been assessed. An attempt has been made to analyse the status of water supply, sewerage, drainage and solid waste management of Mullanpur Town.

#### 4.7.3.1. Water Supply

Water supply to the census town is facilitated by Punjab Department of water supply and Sanitation (PBDWSS). Since there is no perennial source of water, hence total dependence on ground water has been observed. Ground-water is extracted through tube-wells and stored in an over-head tank from where it is supplied to the census town of Mullanpur and also to the neighbouring villages. It has been observed that the per capita supply of

water is 90 lpcd against standard of 135 lpcd. Also approx. 70% area is covered by piped water supply, mainly that within lal dora. Areas that do not have access to piped water use bore wells to meet their water demands.

#### 4.7.3.2. Sewerage & Storm Water

There is no sewerage system for the census town hence there is total dependence on septic tanks and soak pits for the sewage generated. Waste water is let in the drains along roads.

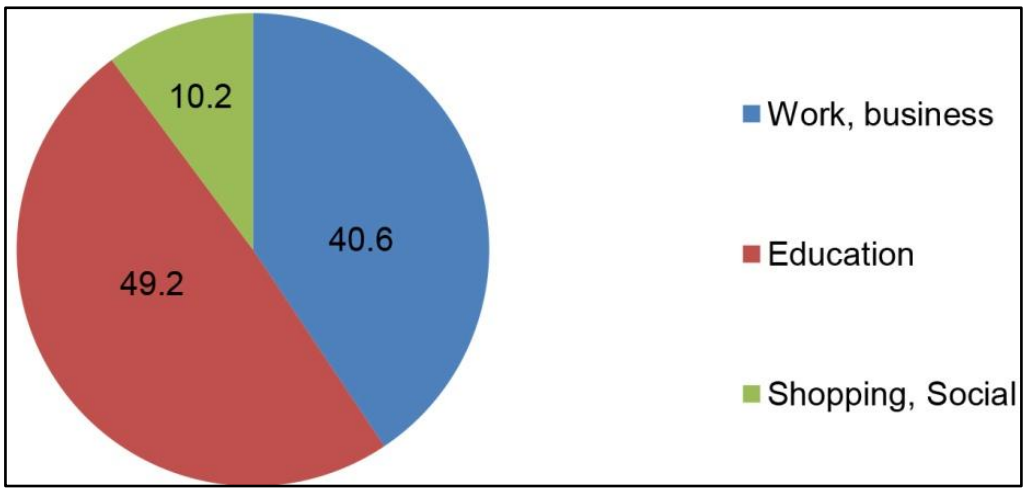
#### 4.7.3.3. Solid Waste Management

There is no solid-waste management system in the census town and heaps of garbage may be seen strewn across the roads or thrown in the drains. This is leading to environmental degradation.

### 4.7.4. Status of Social Infrastructure

Census town is highly deficient in social infrastructure as a result of which residents are dependent on Chandigarh for social infrastructure. As per CMP for Chandigarh Urban Complex, out of total daily trips made, approx 61.3% are made to Chandigarh. Out of total trips made to Chandigarh, approximately 49% are made for education purpose which reflects the state of educational facilities in the town. Similarly there are no health related facilities in the town. Hence the lack of all these facilities is leading to dependence on planned city.

Figure 4.39: Purpose wise trips made to the planned city from Mullanpur (in %)




Source: RITES study on Comprehensive Mobility Plan for Chandigarh Urban Complex

### 4.7.5. Mullanpur Local Planning Area

#### 4.7.5.1. Planning Area Profile

Renamed as New Chandigarh, Local Planning Area of Mullanpur spreads over approx 6123 ha. It is situated at foothills of the Shivalik hills in a highly sensitive ecological area. There are 32 villages which are scattered throughout the planning area. Among villages, largest is Mullanpur census town. There are approximately 27,873 persons in Mullanpur LPA.

#### 4.7.5.2. Characteristics of Local Planning Area

Approximately 1150.2 hectares of land in the planning area has been notified under Punjab Land Preservation Act, 1900, with restrictions on any development to protect ecological balance and ecosystem of the surrounding Shivalik Hills. Punjab Land Preservation Act, 1900 is a State legislation that imposes restrictions on land uses so as to prevent long-term effects of deforestation and/or ecological imbalance. Under PLPA, large areas of land are protected and reserved as they consist of highly erodible soil.

Furthermore, Mullanpur LPA lies within 10 kms of Shiwalik forests which is ecologically sensitive in nature. Hence, Mullanpur LPA exhibits eco-fragile characteristics.

#### 4.7.5.3. Nature of Developments

Development in the planning area mainly consists of commercial development along highways, rural settlements and residential growth in extended abadi deh. Unauthorised development in the form of 35 illegal farm houses exists in the LPA. There are approximately 17 brick kilns which are a source of pollution and are also unauthorised. Unauthorised developments can also be witnessed along both sides of main transport networks and within the no construction zone of defence area.

#### 4.7.5.4. Existing Land-Use

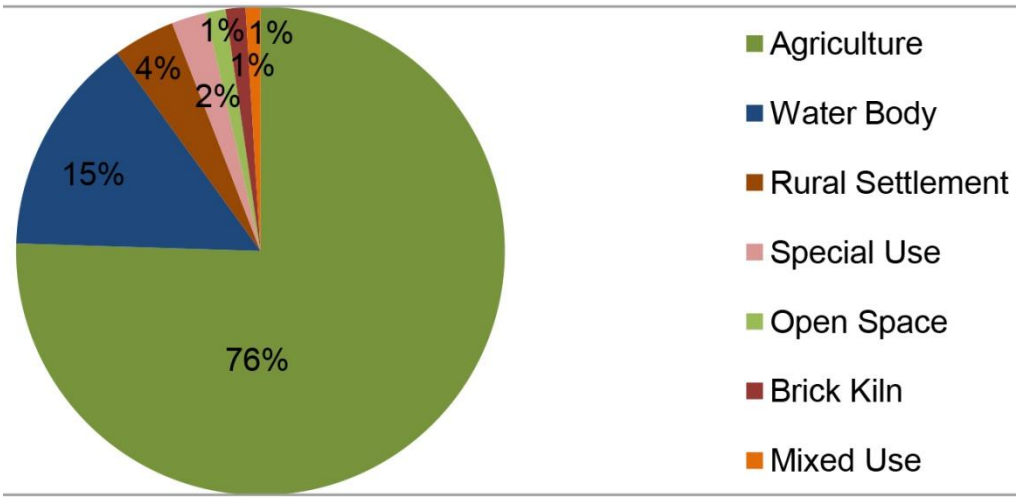
Mullanpur LPA is largely rural area with predominant agriculture land use i.e. 75.5%. The rural settlements constitute approximately 4.1%. There are a number of brick kilns mainly on the south-eastern part of Mullanpur covering 1.3% area.

Table 4.31: Existing land-use of Mullanpur LPA

| EXISTING LAND-USE | | |
|---|---|---|
| Land-use | Area (ha) | % |
| Agriculture | 4622.9 | 75.5 |
| Water Body | 890 | 14.5 |
| Rural Settlement | 250 | 4.1 |
| Special Use | 140.8 | 2.3 |
| Open Space | 80 | 1.3 |
| Brick Kiln | 80 | 1.3 |
| Mixed Use | 60 | 1.0 |
| Total | 6123.7 | 100.0 |

Source: Master Plan, Mullanpur-2031

Figure 4.40: Existing land-use of Mullanpur LPA




Source: Master Plan, Mullanpur-2031

#### 4.7.5.5. Proposed Land-Use, 2031

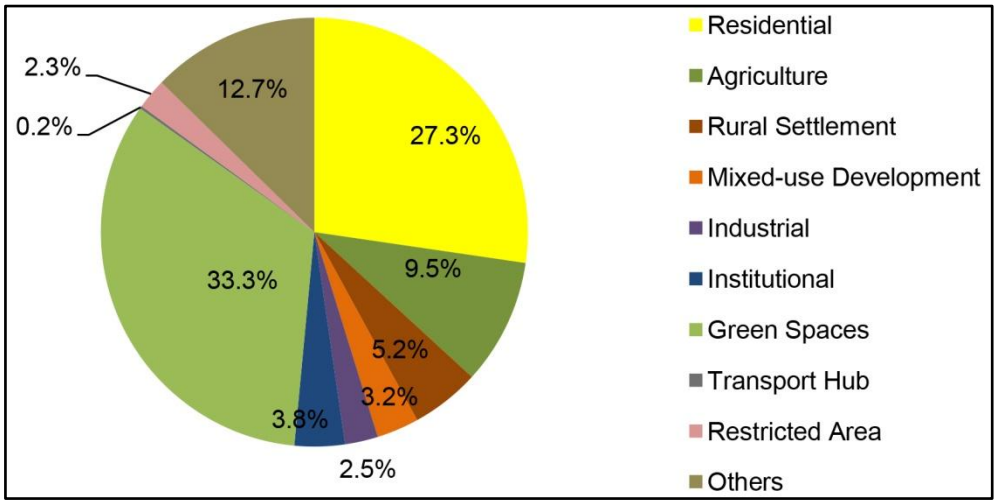
On Master plan - 2031 has been formulated for projected population of 2,00,000 persons and Gross residential density of 250 pph. Proposed land-use indicates tremendous decrease in agricultural land from existing 75.5% to 9.5% indicating pace of development anticipated for Mullanpur LPA. It reflects that development would be facilitated at the cost of fertile agricultural land. By 2031, residential area consisting of rural settlements and new housing would constitute approx. 33% area.

Table 4.32: Proposed land-use of Mullanpur LPA

| PROPOSED LAND-USE | | |
|---|---|---|
| Land-use | Area (ha) | % |
| Residential | 1671.8 | 27.3 |
| Agriculture | 581.8 | 9.5 |
| Rural Settlement | 318.4 | 5.2 |
| Mixed-use Development | 196.0 | 3.2 |
| Industrial | 153.1 | 2.5 |
| Institutional | 232.7 | 3.8 |
| Green Spaces | 2039.2 | 33.3 |
| Transport Hub | 12.2 | 0.2 |
| Restricted Area | 140.8 | 2.3 |
| Others | 777.7 | 12.7 |
| | 6123.7 | 100 |

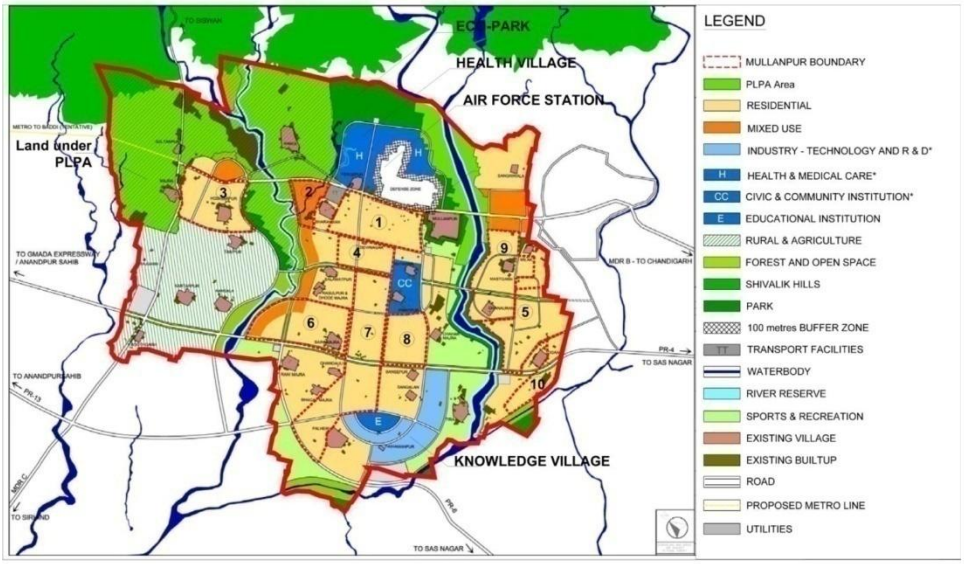
Source: Master Plan, Mullanpur-2031

Figure 4.41: Proposed land-use of Mullanpur LPA




Source: Master Plan, Mullanpur-2031

Map 4.16: Proposed land-use of Mullanpur LPA




Source: Master Plan, Mullanpur-2031

#### 4.7.5.6. Change of land-use due to upcoming mega projects

A large number of mega projects are being undertaken in this LPA threatening the ecologically sensitive belt of reserved and protected forests in vicinity of Shivalik hills. There are four residential projects by GMADA in this LPA and two ongoing projects by private players like DLF and OMAXE. Also there a number of projects at the approval stage.

Table 4.33: List of projects in Mullanpur LPA

| ON GOING MEGA PROJECTS | | | |
|---|---|---|---|
| **Project** | **Area (acres)** | **Project** | **Area (acres)** |
| **GMADA** | | **APPROVAL STAGE** | |
| Eco City -I | 412.00 | Greater Pb. officers Cooperative House Building Society Ltd | 168.64 |
| Eco City -II | 450.00 | | |
| Medicity | 100.00 | D.L.F. India Ltd. Mullanpur LPA GMADA | 126.00 |
| Education City | 1700.00 | | |
| Total | 2662.00 | Innovative Housing & Infrastructure Ltd. | 101.18 |
| **MEGA HOUSING** | | | |
| OMAXE | 461.68 | M/s.Manohar Infra. & Const. Pvt Ltd | 103.00 |
| DLF India Ltd.,Chandigarh | 195.83 | | |
| Total | 657.51 | Total | 498.82 |

Source: PUDA

#### 4.7.6. Inferences

- Taking advantage of Chandigarh's proximity and its own location w.r.t Shivalik Hills, Punjab Govt. has been instrumental in exploitation of the fertile agricultural belt for setting up new township. Numbers of mega projects are being undertaken that are threatening the eco-sensitive belt at the foothills of Himalayas.
- Ground reality is that even though the approved projects have provision for social infrastructure on paper, only the residential part of the mega projects like eco city, medicity and education city are being developed currently.
- To add to the woes, group housing has no height restriction other than those subjected by airforce area which totally defies the character of Chandigarh.
- In contrast to the DCR of Chandigarh, no height restrictions have been imposed to have unobstructed views of Shivalik hills.
- All this is going to further worsen the situation of planned city whose resources would be burden.

## 4.8. Concluding Remarks

The chapter has presented the collected data on the area of study in a systematic fashion. It is focused to understand the transformational process taking place in Chandigarh city periphery in last decade. The study is not limited to spatial planning, but also covers the associated policy, acts and regulations, due to which such major transformation has happened in this entire region. From the several analyses, the critical peripheral settlements are identified in terms of their status of infrastructural quality and these local settlements are studied further to understand the transformation process. Such analytical review helps to extract the various issues of peripheral development at regional as well as at settlement level, discussed in the next chapter.

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# CHAPTER 5. IDENTIFICATION OF KEY ISSUES EMERGING AT PERI-URBAN REALM OF SELECTED STUDY AREA

## 5.1. Introduction

In this chapter, issues related with the planned city of Chandigarh and its periphery has been detailed out. The issues identified are at two levels: issues at city and periphery level (region-based) and issues at peripheral settlement level.

## 5.2. Critical Issues in Planning and Management of Chandigarh Peri-Urban Interface at City & Periphery Level

### 5.2.1. Issues at Planned City and Periphery Level

- **Demographic and Spatial Transformations**
  1) There are rapid transformations in the periphery, which need planning intervention especially in Punjab sub-region.
  2) Also ribbon development is coming up along Chandigarh-Ambala Highway, Chandigarh-Kalka Highway, Chandigarh Kharar Road; which needs to be dealt with a proactive approach.

- **Employment Opportunities, Amenities, Physical and Social Infrastructure**
  1) There are inadequacies in peripheral settlements, causing dependence on Chandigarh, which inturn is leading to congested roads due to high vehicular traffic, burden on social infrastructure and environmental degradation due to fuel emissions.
  2) Extreme dependence on Chandigarh is also exerting burden on its physical infrastructure i.e. power, water supply, sewerage etc.
  3) Furthermore, due to increased number of tube-wells, ground water is reported to be fast depleting.
  4) Another major issue observed in the periphery is poor status of Municipal Services like water supply, sewerage, drainage etc.

- **Development Pattern (Land-Use, Unauthorized Construction & Slums and New Projects)**
  1) Incompatible land-uses like industrial land-use in the periphery are resulting in environmental degradation. For instance the group of

villages around Derabassi FEZ are getting polluted due to the industries located in the vicinity.

2) Another major issue is that the unauthorized constructions lack in essential infrastructure and amenities. Also they do not follow DCR and bye-laws, hence are witnessing low quality of life.
3) Lack of infrastructure is witnessed not only in the unauthorized colonies but also in the new developments undertaken, whose residential component is being developed even though they have provisions made for adequate infrastructure at the time of layout approval. It is important to note that these new developments are coming up without any demand analysis. Many plots are still unoccupied and purchased for land speculation.
4) Furthermore, environmental degradation of ecologically sensitive areas, where new developments are coming up is also a major concern. For e.g. new township of Mullanpur is coming up in the eco-sensitive foothills of shiwaliks.
5) Also another major issue encountered is that the population of Chandigarh & periphery has exceeded 25 lakh, but there is no provision for mass transport other than bus. Also the urban sprawl is increasing day by day increasing the footprint of tri-city. Hence mass transport system is the need of the hour.

- **Governance (Policy, Legal Framework, Acts, Legislations and Plan Documents)**
  1) A major issue related to governance in the periphery is multiplicity of agencies coupled with absence of proper machinery and lack of unified management policy damaging fabric of periphery.
  2) Furthermore, there is a lack of trained staff to deal with the violations of periphery.
  3) As per provisions of 73$^{rd}$ and 74$^{th}$ Constitution Amendment Act, formation of District Planning Committee and Metropolitan Planning Committee have been recommended but there are no such provision made in the periphery as per provisions of 74$^{th}$ CAA.
  4) Another issue pertaining to the periphery control act is that the provisions in the act are unrealistic in terms of regulating authority and penalties levied. Also absence of Periphery Controlled Area

Plan in Punjab Periphery is a major reason for unplanned urbanization in Punjab sub-region.

5) Furthermore, absence of a regional plan is leading to skewed and lopsided development and concentration of population in Class-I cities (Panchkula & Mohali).

The issues mentioned above are tabulated in the following section. Along with the issues, causative factors have also been listed.

Table 5.1: Issues at periphery level and causative factors

| Analysis & Issues | Causative Factors | |
|---|---|---|
| | **Pertaining to Chandigarh** | **Pertaining to Periphery** |
| **1. Demographic & Spatial Transformations** | | |
| <u>Demographic Transformations:</u><br><br>• Periphery growing at faster rate than Chandigarh (17.10%). Growth rate of Punjab Periphery – 84.9% (compared to 26% for Punjab State Urban) and Haryana Periphery – 52.1% (Haryana State urban growth rate i.e. 44.5%).<br>• Punjab Periphery more dynamic with higher growth rates.<br>• Census towns increased from 1 to 15 (population increase from 9941 to 1.34 lakh (13 times) while statutory towns increased from 4 to 10 (population increased 24 times – 32643 to 7.95 lakhs).<br><br><u>Spatial Transformations:</u><br><br>• Percentage of urban area increased from 0.5% to 16% as per Census | • Unaffordable & limited housing options.<br>• Soaring land price, high tax & user charge.<br>• No scope for horizontal & vertical expansion.<br>• Density exceeded the planned density in | • Lower land prices in periphery.<br>• Availability of affordable housing options.<br>• Availability of land for urban development.<br>• Easy land conversion process. |

| Analysis & Issues | Causative Factors | |
|---|---|---|
| | **Pertaining to Chandigarh** | **Pertaining to Periphery** |
| 2011 (30 times).<br>• Strategy of Punjab & Haryana Govt. to exploit high growth potential & infrastructure of Chandigarh by setting up of:<br>▪ Residential townships of Mohali and Panchkula.<br>▪ Special government projects like HMT, ITBP in 1960s.<br>▪ FEZ zone near Derabassi of 49 sqkm for setting up industries. | 1991. | • Low taxes and user charges. |
| **ISSUE**<br>Rapid and uncontrolled transformations in periphery specially Punjab Sub-region that need planning intervention. | | |
| | | |
| **2. Employment Opportunities, Amenities, Social & Physical Infrastructure in Peripheral Settlements** | | |
| <u>Employment Opportunities, Amenities, Social Infrastructure:</u><br>• 1.91 lakh trips from peripheral settlements to Chandigarh for work purpose.<br>• 1.28 lakh trips for education purpose<br>• Approx. 73,000 trips for social infra.<br>• As a result, v/c roads connecting to the peripheral settlements exceeded 1. | • Concentration of Haryana and Punjab Govt. Offices.<br>• High quality Medical & educational infrastructure.<br>• Rajiv Gandhi I.T. Park in UT. | • Peripheral settlements planned as satellite townships, hence weak economic base & unavailability of social infrastructure.<br>• Settlements with substandard |

<table>
<tr><th rowspan="2">Analysis & Issues</th><th colspan="2">Causative Factors</th></tr>
<tr><th>Pertaining to Chandigarh</th><th>Pertaining to Periphery</th></tr>
<tr><td></td><td></td><td>social infrastructure leading to dependence on planned city.</td></tr>
<tr><td colspan="3">ISSUE<ul><li>Inadequacies in periphery causing dependence on Chandigarh, leading to –<ul><li>Congested roads due to high vehicular traffic</li><li>Burden on social infrastructure</li><li>Environmental degradation.</li></ul></li><li>Total population of Chandigarh and Periphery crossed 25 lakh, but no mass transport other than few buses.</li><li>Dependence on Chandigarh also exerting burden on its physical infrastructure.</li></ul></td></tr>
<tr><td><u>Physical Infrastructure:</u><ul><li>Tube-wells and bore-wells – major source of water supply for the periphery.</li><li>Approx. 40% of urban HHs in periphery dependent on soak-pits and septic tanks in the absence of underground sewerage system.</li><li>Approx. 30% of urban area in periphery still witness open drains.</li><li>No solid waste management practised in towns other than Panchkula & Mohali.</li></ul></td><td>-</td><td><ul><li>No perennial source of water supply, hence dependence on ground water.</li><li>ULBs unable to mobilise adequate resources and have low budgetary allocation.</li></ul></td></tr>
<tr><td colspan="3"></td></tr>
</table>

| Analysis & Issues | Causative Factors | |
|---|---|---|
| | **Pertaining to Chandigarh** | **Pertaining to Periphery** |
| **3. Development Pattern** | | |
| <u>Land-Use:</u><br>• Punjab State Govt. granting permission for change of land-use for residential, industrial, commercial and other uses from time to time on case to case basis without any policy framework.<br>• Biggest violation in Punjab sub-region – FEZ in Derabassi in a blighted state.<br>• % of agricultural land decreased from 47% to 32% in Haryana.<br>• % of agricultural land decreased from 72% to 59% in Punjab and expected to decrease to 36% by 2031. | - | • Arbitrary land-use conversions in Punjab sub-region in absence of policy framework for profit maximization.<br>• Power to regulate development to DC with no technical expertise. |
| **ISSUE**<br>• Incompatible land-uses like industrial land-use in the periphery resulting in environmental degradation. | | |
| <u>Sub-Division of Land, Unauthorized Construction and Slums:</u><br>• Unauthorized sub-division of agricultural land on which substandard residential colonies have mushroomed.<br>• Unauthorized constructions (esp. farmhouses) to the north of Capitol | - | • Lack of monitoring and enforcement on part of state governments.<br>• Political patronage, hence |

| Analysis & Issues | Causative Factors | |
|---|---|---|
| | **Pertaining to Chandigarh** | **Pertaining to Periphery** |
| Complex, in Kansal and Nayagaon, as serious violations of periphery and forest acts.<br>• Unauthorized constructions in restricted land adjoining defence installations, air-funnel zone, railways etc.<br>• Unauthorized ribbon development along highways.<br>• Periodic regularization of unauthorized construction in Punjab Sub-region. | | unauthorized constructions are getting regularized. |
| **ISSUE**<br>Unauthorized developments lack in essential infrastructure, amenities, does not follow DCR and Bye-Laws, hence low quality of life. | | |
| <u>New Investments and Projects:</u><br>• Urban development schemes to the north of Capitol Complex (No construction Zone as per edict of Chandigarh)<br>• Mullanpur Township seen a threat to ecosensitive foothills of Shivalik (within 10 kms of reserved and protected forests)<br>• Mohali extended till sector 114 dotted with new group housing schemes even though intermittent sectors have not filled up till date.<br>• Mega housing projects in Punjab Sub-region without any demand | • Proximity to Chandigarh major reason for interest of private developers in peripheral settlements | • Punjab and Haryana State strategy to exploit the natural setting of Shivalik as USP for their new townships.<br>• Punjab State Government's strategy to attract private builders and lure huge investments, |

| Analysis & Issues | Causative Factors | |
|---|---|---|
| | **Pertaining to Chandigarh** | **Pertaining to Periphery** |
| analysis.<br>• In majority mega projects, though plans have provision for social infrastructure, yet only housing component has been developed. | | hence number of mega projects. |
| **ISSUE**<br>• Environmental degradation of ecologically sensitive areas, where new developments are coming up.<br>• Lack of infrastructure in the new developments.<br>• Many plots still unoccupied and purchased for land speculation. | | |
| | | |
| **4. Governance & Legal Framework** | | |
| <u>Institutional Framework:</u><br>• Multiplicity of authorities for planning and enforcement of act and no single entity responsible for co-ordination of peripheral development.<br>• No exdusive machinery to enforce periphery control area plan.<br><br><u>Policy Framework:</u><br>• Haryana and Punjab following state specific policies for their periphery sub-regions without any unified management policies. | | • Re-organization of Punjab state on linguistic basis in 1966 as a result of which periphery apportioned to 3 different entities.<br>• Negligence on the part of state governments to deal with provisions of the act. |

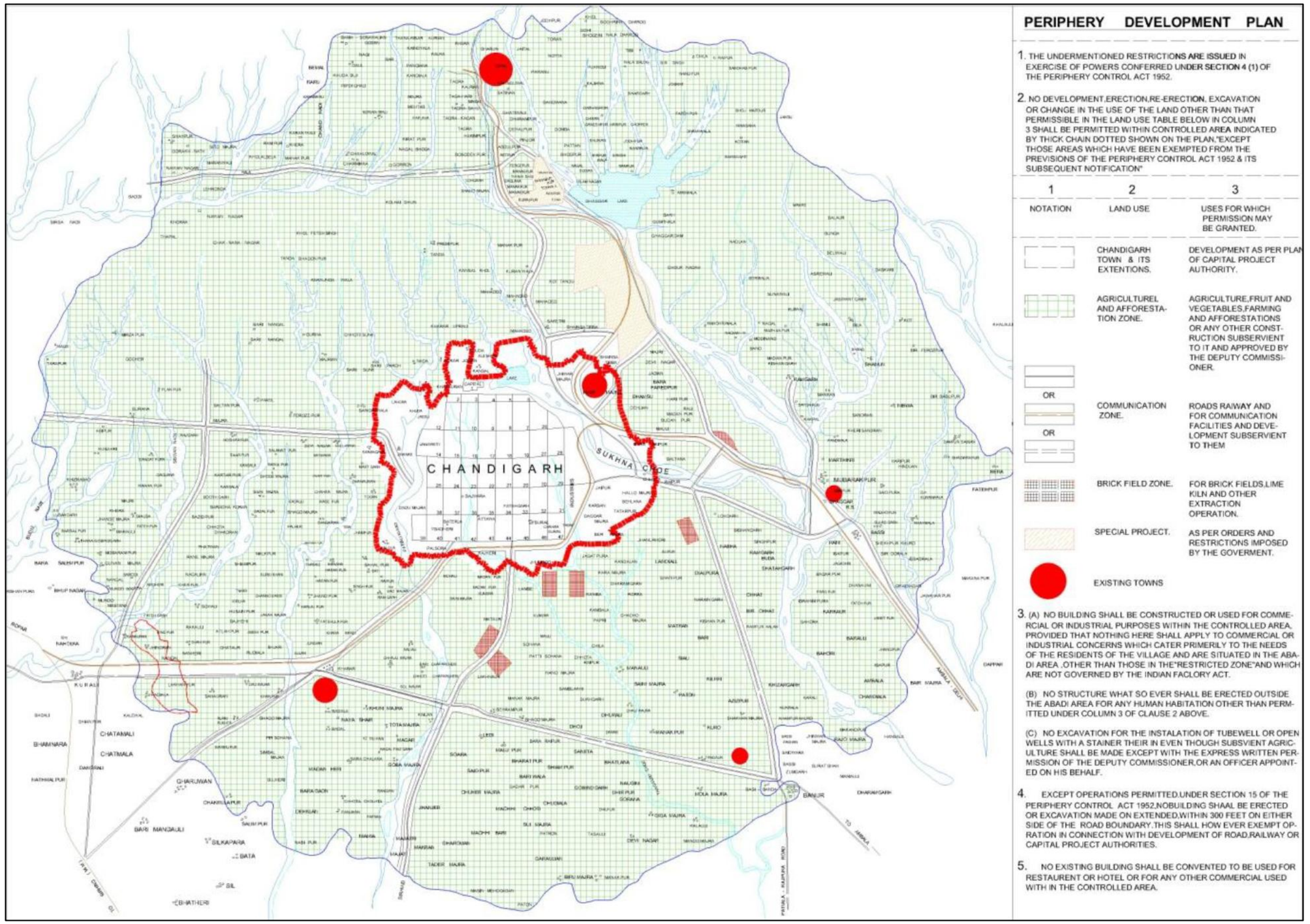
| Analysis & Issues | Causative Factors | |
|---|---|---|
| | **Pertaining to Chandigarh** | **Pertaining to Periphery** |
| **ISSUE**<br>• Multiplicity of agencies coupled with absence of proper machinery and lack of unified management policy damaging fabric of periphery.<br>• Lack of trained staff to deal with the violations of periphery.<br>• No DPC / MPC as per provisions of the 74th Constitutional Amendment Act. | | |
| <u>Periphery Control Act:</u><br>• Act mainly to control and regulate land issues in periphery.<br>• Power of development regulation with DC.<br>• Penalty of act under section 12, in which fine of Rs. 5000 is levied to legalise unauthorised construction exploited tremendously.<br>• Controls levied to regulate unplanned growth and prevent additional pressured from being placed on city services have proved to be counterproductive.<br><br><u>Periphery Controlled Area Plan:</u><br>• As per section 4 of act, plan showing controlled area published and land uses defined.<br>• Periphery control area plan notified in 1963, but after reorganization in 1966, it became redundant.<br>• Post reorganization, no development plan prepared for Punjab Periphery Sub-region as a | • Chandigarh UT with very less land for future expansion, hence many resettlement colonies in the UT periphery making the control counter-productive. | • Controls delineating vast area as agricultural land to protect comparatively smaller city of Chandigarh, hence proved to be counter-productive.<br>• Dynamism of vibrant city in filtering periphery not considered.<br>• Absence of exdusive machinery for periphery.<br>• Role of market forces was never considered. |

| Analysis & Issues | Causative Factors | |
|---|---|---|
| | **Pertaining to Chandigarh** | **Pertaining to Periphery** |
| result of which haphazard development.<br>• Haryana sub-region notified development plan 1967 & again amended plan to add urbanisable area. Hence, planned development but act rendered redundant. | | |
| **ISSUE**<br>Unplanned urbanization due to unrealistic provisions in the act and absence of Periphery Controlled Area Plan. | | |
| <u>Regional Plan:</u><br>• In 1975, Co-ordination committee, comprising of Punjab, Haryana and UT set up for co-ordinating development activities in periphery and CUC plan prepared but proposals not implemented till date.<br>• ISCR-2001 and CISMER-2021 prepared for Planned Development of Region (periphery as a part of region), but no proposals adopted by the State Governments. | | • Wasn't statutory but advisory in nature.<br>• Planning is a state subject, hence discretion to accept proposals vested with the state. |
| **ISSUE**<br>Absence of Regional Plan, leading to skewed and lopsided development and concentration of population in class-I cities (Punchkula & Mohali). | | |

Source: Author, 2015

The map below shows the periphery delineated as per the controlled area plan prepared in 1963. The status of development prior to reorganization has been indicated in the map. It may be observed that there were only 5 towns in the periphery before reorganization. These were the municipal towns of Kalka, Derabassi, Kharar, Banur and Manimajra, which was a census town. It is evident from the map that majority land was under agricultural use, while there was also a very low percentage of land under other uses like special projects, brick fields and communication zone.

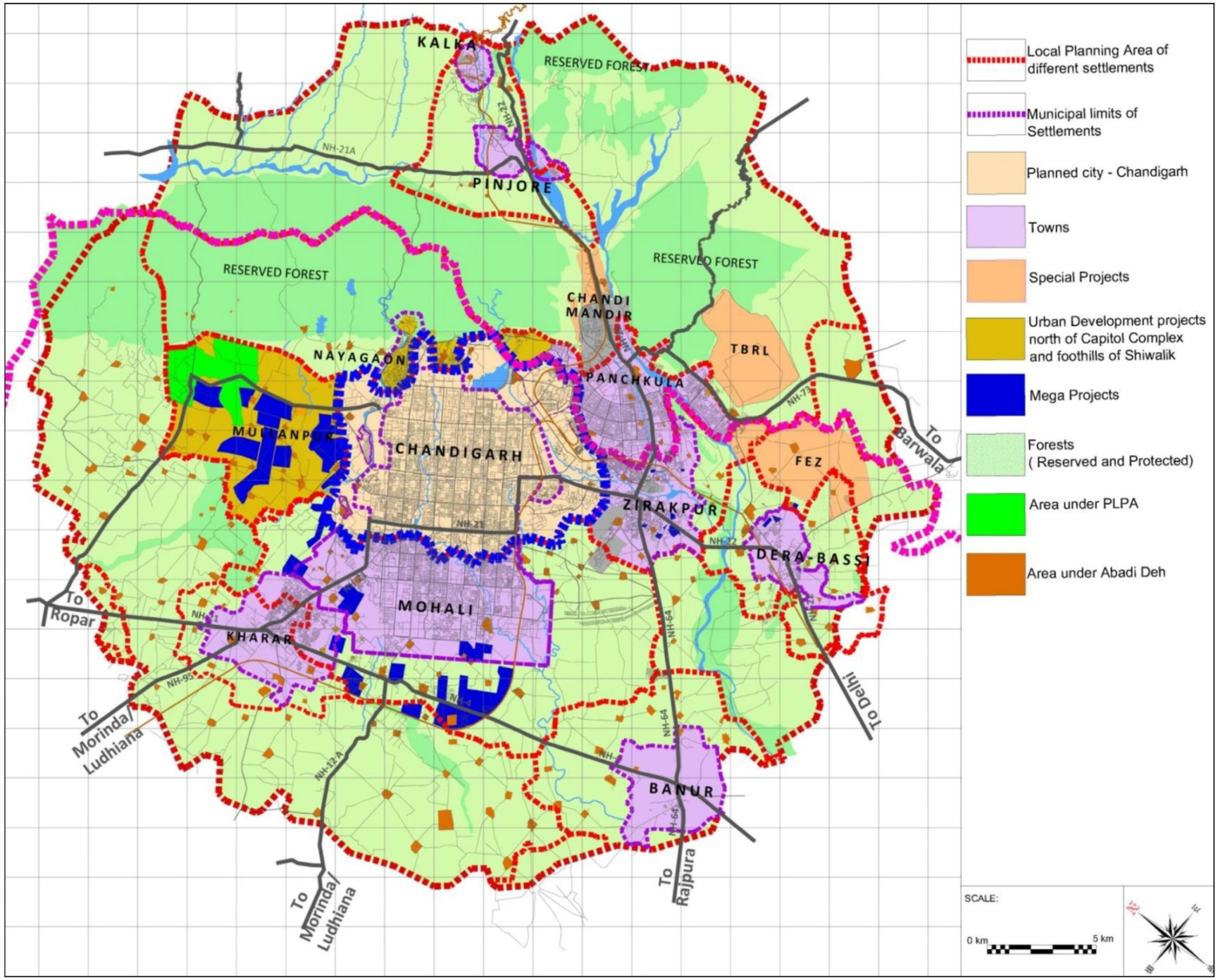
Map 5.1: Periphery Controlled Area Plan, 1963




Source: Draft Master Plan, Chandigarh - 2031

Map 5.2 locates the Issues identified spatially. It also indicates the location of new projects that are coming up in the periphery against the spirit of the periphery control act.

Map 5.2: Issues identified for the periphery




Source: Draft Master Plan, Chandigarh - 2031

### 5.2.2. Issues at Settlement Level

Issues pertaining to various aspects, such as traffic & transport, employment, development pattern, social infrastructure, unauthorized construction, slums & squatters, informal sector, environment and resources have been identified in the following section.

- **Traffic & Transport** - One of the major issues in peripheral settlements is congested roads & nodes due to movement of slow and fast moving traffic in the same lane. Another factor causing congestion on roads is the absence of service lanes, hence commercial activities opening up directly on highways. Also there are no designated parking spaces; hence vehicles are encroaching upon carriageway.

- **Employment** - Approximately 61% persons (tertiary sector) are dependent on Chandigarh for employment opportunities.

- **Development Pattern** - Ribbon development is the common phenomena observed along National Highways. Furthermore, outside Municipal area, development is coming up in piece-meal manner, which needs a proactive approach.

- **Social Infrastructure** - Peripheral settlements witnesses inadequate social infrastructure as discussed in previous chapter, which is causing dependence on planned city.

- **Physical Infrastructure**

**Water Supply** - There is total dependence on underground tube-wells due to non-availability of perennial source of water supply which is causing ground water depletion. There is gap between demand and supply of approx. 4.4 lakh litres avg. in each settlement currently which will increase to 110.44 MLD by 2031. Currently non-revenue water is approx. 30% and extent of metering is not 100%, due to which there is inadequate recovery of water supply cost.

**Sewerage System** - Avg. coverage of sewerage network is only 45% as a result of which 58% sewage is sent to STP and rest 42% in nalahs. Hence choes are getting degraded.

**Storm Water Drainage** - Avg. only 20% roads are covered with proper drainage system. No storm water drains are laid in local / access roads as a result of which, there are high incidences of floods. Most internal roads covered with impervious paver tiles leading to water clogging in the absence of surface drains.

- **Unauthorised Colonies, Slums and Squatters** - Regularisation of unauthorised private colonies from time to time on case to case basis due to political patronage is a major issue, encouraging unauthorised developments. Non-compliance with DCR and bye-laws is also a major issue. Also there are a number of unauthorised farmhouses that have come up in a piece meal manner outside municipal limits. Slums and squatters are witnessing inadequate coverage of basic services.

- **Informal Sector** - Informal activities along NHs are encroaching upon ROW and aggravating congestion problems.

- **Environment and Resources** - Sukhna Choe is being degraded due to indiscriminate dumping of solid waste and sewage. Also degradation of villages around FEZ area is also another issue that calls for immediate attention.

## 5.3. Probable Approaches towards Future Development

### 5.3.1. Periphery Level

Approaches have been categorised into three sub-heads, i.e. policy and legal framework, regulation of development and planning for peripheral settlements. Under policy and legal framework, three scenarios have been analyzed, which have been discussed in detail in the following section.

1. **Policy and Legal Framework**

**Scenario – 1**

The first scenario provides for notification of a 'Revised Periphery Controlled Area Plan' as per proposals of co-ordination committee, which may be rendered as a full time committee responsible for co-ordination of peripheral development. In order to accord co-ordination committee with legal status, the

two states need to amend the act initiated by Central UT, being a representative of Central Government. For the purpose of plan preparation, co-ordination committee would give proposals, which need to be accepted by the State Governments to ensure planned growth and balanced development. Co-ordination committee has the Chief Town Planners of Department of Town and Country Planning of both the states. On the basis of the proposals of co-ordination committee, Department of Town and Country Planning is responsible to prepare development plans of their sub-regions and implementation of plan to be under the purview of development authorities of that area. The success of this model lies in according statutory status to co-ordination committee.

**Scenario – 2**

In the second scenario, periphery control act may be repealed as it has already been rendered redundant. In the absence of Periphery Control Act, Master Plans are required to be formulated under Punjab Regional and Town Planning Act, 1995 for Punjab Sub-region and Punjab Scheduled Roads Act, 1963 (Haryana Amendment) for Haryana Sub-region. This scenario is most easily implementable, considering the legal framework, but poses a threat to the planned city or the region as a whole. Hence, it is not a preferred solution for the integrated development of Chandigarh and its periphery.

**Scenario – 3**

In the third scenario, it is approached to have a Central Regional Legislation to facilitate planning of the region similar to the concept of National Capital Region Planning Board Act, 1985. Under the central Legislation, it is considered to have a Regional Planning Board, responsible for planning and co-ordination of the region. The sub-regional plans would be prepared by the participating states following the provisions of the regional plan. This would ensure equitable and balanced development of the entire region and would take care of the skewed and lopsided development happening in the periphery currently. In the following table, the salient features of the three scenarios have been tabulated:

Table 5.2: Planning approaches pertaining to legal framework

| **1. Legal Framework and Institutional Set-Up** | | | |
|---|---|---|---|
| **Existing** | **Probable** | **Probable** | **Probable** |

| Scenario | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| **a) Act and Plan Document** | | | |
| - Provision of preparation of development plan under section 4 of the act.<br>**- Punjab Sub-region:** No revised Development Plan prepared after 1963.<br>- Haphazard growth in the absence of development plan.<br>**- Haryana Sub-region:** Development Plan prepared and amended time to time to add new urbanisable areas. | **- Punjab Sub-region:** Formulation of revised Perspective Development Plan with appropriate development controls and notify same under section 4 of Periphery Control Act.<br>**- Haryana Sub-region:** Development Plan already revised in 2009. | **- Repeal of Periphery Control Act.**<br>- Planning of settlements as per Regional and Town Planning act.<br>- Punjab settlements under Punjab Regional and Town Planning and Development Act, 1995.<br>- Haryana under Punjab Scheduled Roads Act and Controlled area restriction of urban development, 1963. | **- Periphery Region Planning Act** (On the NCRPB Act, 1985) for setting up a planning board responsible for planning of the entire periphery and preparation of Regional Plan. |
| **b) Plan Preparation** | | | |

| | | | |
|---|---|---|---|
| **- Chandigarh**: Urban Planning Dept.<br>**- Punjab**: Plan Preparation – GMADA<br>Plan Approval – Dept. of T&CP<br>**- Haryana**: Plan Preparation - Dept. of T&CP<br>**- No statutory co-ordination agency.**<br>Coordination committee having representatives of 3 entities have had 23 meetings with no concrete proposals or outcome. | **- Full time Advisory Board / Co-ordination Committee**<br>Consisting of representatives of participating states to prepared advisory periphery plan and send to Department of town and country planning of respective state govt. for preparation of perspective land use plan. | **Chandigarh:** Urban Planning Dept.<br>**Punjab:** Plan Preparation - GMADA<br>Plan Approval - Dept. of T&CP<br>**Haryana:** Plan Preparation - Dept. of T&CP | **- Regional Planning Board / Authority** for Regional Plan<br>- Functional Plans to be prepared by participating states. |
| **c) Plan Implementation** | | | |
| **- Chandigarh:** UT Administration<br>**- Punjab Sub-Region:** GMADA<br>**- Haryana:** HUDA, Private colonisers | | | |
| **d) Remarks** | | | |

| | | | |
|---|---|---|---|
| - Punjab periphery witnessed uncontrolled growth in the absence of Development Plan | - Won't be effective till the time statutory backing given to advisory body.<br>- Hence amendment in act to be initiated by Central Government.<br>- May or may not be adopted by State Governments, if advisory in nature. | - Stand-alone planning of settlements.<br>- Burden on Chandigarh would increase as all settlements catering to their own growth and development at the cost of region's resources. | - Time consuming process<br>- May not be feasible, because of political patronage.<br>Most appropriate for reducing burden on Chandigarh.<br>- Will ensure Planned Development. |

Source: Author, 2015

**2. Regulating Development**

For the purpose of regulating development, it is required to divide the city and periphery into four zones, based on the character of the area and nature of existing development. Two approaches have been worked out to facilitate balanced development of the area. In the first approach, population projection has been done on the basis of zone specific strategy for development.

Zone A consisting of Chandigarh UT (periphery + city) and spreading over an area of 114 sq kms has been considered to have reduced growth. Character of the area is low density low rise with limited land for future expansion. Current population of the area is approx. 10.54 lakh persons while the projection as per the Master Plan for Chandigarh - 2031 is of 16 lakh persons. The strategy for future development in this zone is to have reduced growth accommodating 14.2 lakh persons by densification of existing residential pockets in phase 1 and 2 to maximum three storeys (10mt) and retaining low density low rise character of Chandigarh. The density considered for this area is 125 pph.

Zone B consisting of Panchkula, Mohali, Kharar, Zirakpur, Nayagaon and surrounding areas and spreading over an area of 280 sq kms has been considered to have regulated growth. This is the zone, which has maximum

interaction with the planned city and highest degree of dependence on the planned city. Since maximum pressure is exerted by these settlements, hence controlled development of these has been required. Strategy is to have minimum housing schemes in future and encouraging remaining developable area for institutional use. The density considered for this area is 100 pph.

Zone C consisting of Mullanpur Planning Area and Reserved Shivalik Forests Belt and spreading over an area of 314 sqkms has been considered to have regulated growth. It is currently a Greenfield site at the foothills of Shivalik Protected and Reserved Forests contiguous with Chandigarh. The strategy for this area is to have regulated growth since it lies in the eco-sensitive zone. Due to its eco-sensitive nature, density considered is as low as 50 pph. It is considered to be low-rise as it lies in high seismic zone and also to provide unhindered view to Himalayas. Another regulation is that since Mullanpur is contiguous with Chandigarh, hence sectors planning can be continued as happened in case of contiguous settlements of Mohali and Punchkula.

Zone D consisting of remaining periphery and spreading over an area of 722 sqkms has been considered to have induced growth. The area currently consists of both urban and rural settlements with slow growth rate. Also there is availability of agricultural land for future growth. The strategy for this area is to have accelerated growth due to availability of land for future expansion. Since these settlements are at a distance from the planned city, so making them self-sufficient in terms of employment opportunities and infrastructure can help reduce dependence on planned city. Allocation of land for large scale commercial activities and strengthening of economic base by creating employment opportunities could be some of the options.

Under the 2$^{nd}$ approach, attempt has been made to redistribute the population projected in the Master Plans in a way so as to have balanced and equitable development. Population of Zone 2, which has been observed to be the maximum in 2031, has been strategically redistributed to ensure that not much pressure is further added to this area contiguous with the planned city. New developments are intentionally pushed away from the planned city towards Zone 4.

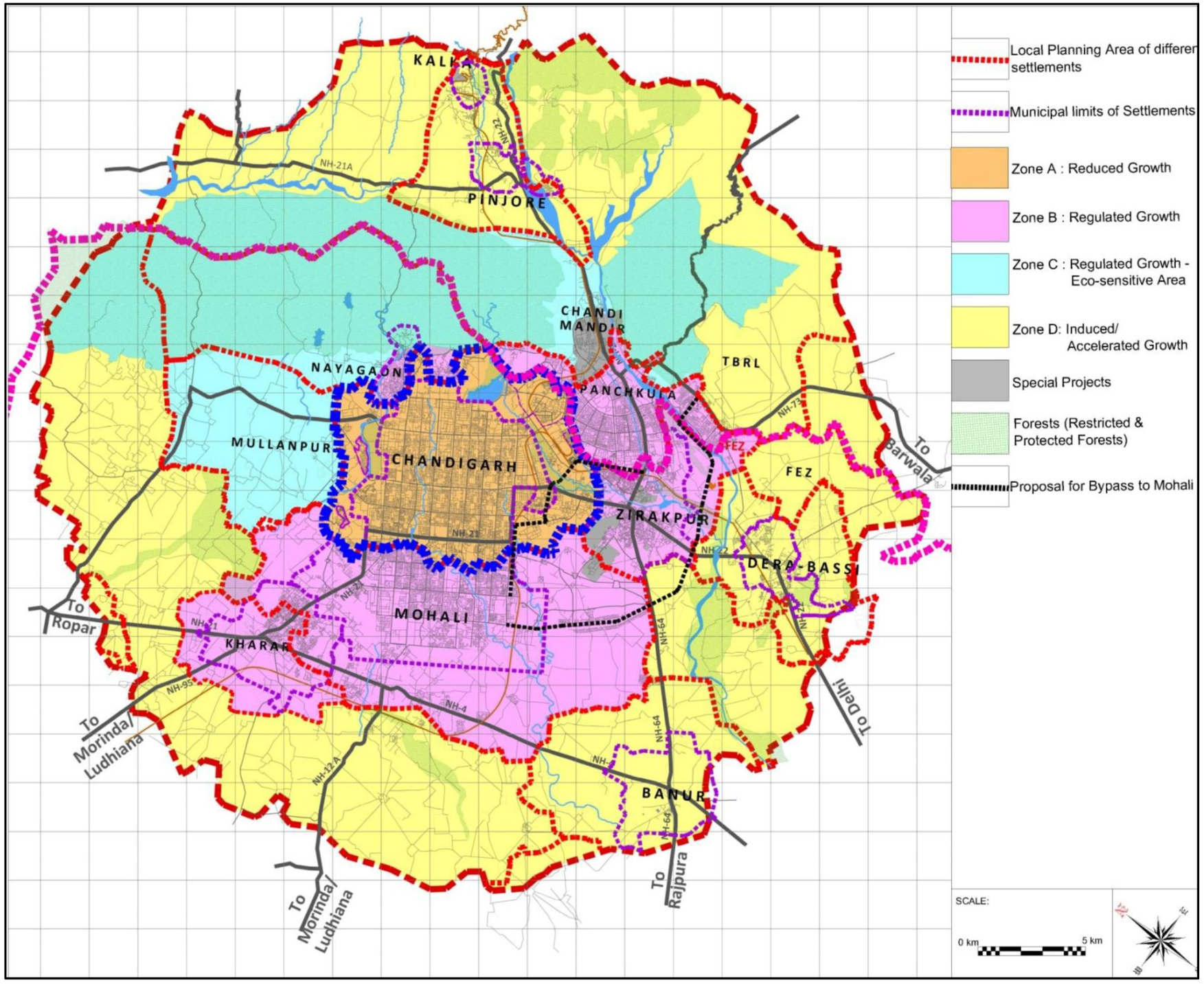
Table 5.3: Probable scenario for regulating development

| Zone | Extents | Area (sq kms) | Urbanisable Area (sq kms) | Population 2011 | | Town Density 2011 (PPH) | Character | Projection as per Master Plans / Development Plans - 2031 * | | PROPOSAL-1 (as per proposed densities) | | | | Proposal - 2 (Redistribution of Population proposed in Master Plan 2031) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total (lakhs) | % | | | Population (Lakhs) | % | Strategy for Future Development | Density (PPH) for 2031 | Population for 2031 (Lakhs) | % | Population (Lakhs) | % | Density (PPH) |
| Zone A | Chandigarh UT (Periphery + City) | 114 | 114 | 10.54 | 44 | 92 | Low density low rise with limited land for future expansion. | 16 | 23 | **Reduced Growth**<br>- Densification of existing residential pockets to max. 3 storeys (10mt) & retaining city's low density low rise character. | 125 | 14.28 | 25 | 16 | 23 | 140 |
| Zone B | Punchkula, Mohali, Kharar, Zirakpur, Nayagaon | 280 | 178 | 8.22 | 34 | 50-75 | Punchkula - Very high growth rate expected to decrease. Mohali & Zirakpur - Very high growth rate expected to inc. Nayagaon - Unauthorised construction north of Capitol Complex & in PLPA. | 39 | 56 | **Regulated Growth**<br>- Since max. pressure exerted by Punchkula, Mohali, Zirakpur, hence controlled development of these.<br>- Strategy to have min. housing schemes in future & utilising remaining developable land for institutional use. | 100 | 17.79 | 32 | 22 | 32 | 125 |
| Zone C | Mullanpur Planning Area and Shivalik Reserved Forests Belt | 314 | 40 | 0.52 | 2 | 10 | Greenfield site at the foothills of Shivalik Protected and Reserved Forests. Contiguous with Chandigarh | 3 | 4 | **Regulated Growth**<br>- Eco-sensitive area, hence proposed density low - 50 pph.<br>- Low rise as high seismic zone & to provide unhindered view to Himalayas.<br>- Mullanpur contiguous with Chandigarh, hence sector planning to be continued (similar to Mohali & Punchkula). | 50 | 2 | 4 | 3 | 4 | 62 |
| Zone D | Remaining Periphery | 722 | 176 | 4.93 | 20 | upto 30 | Availability of land for future expansion. Urban + Rural settlements with normal growth rate. | 12 | 18 | **Accelerated Growth**<br>- Allocation of land for large scale commercial activities and strengthening of economic base by creating employment opportunities. | 125 | 22.03 | 39 | 29 | 41 | 163 |
| | Periphery + UT | 1430 | 508 | 24.21 | 100 | - | - | 69 | 100 | - | - | 56 | 100 | 69 | 100 | - |

* - From Master Plan 2031 for Mohali, Zirakpur, Mullanpur, Kharar, Derabassi, Banur and Regional Plan for GMADA - 2058

Source: Author, 2015

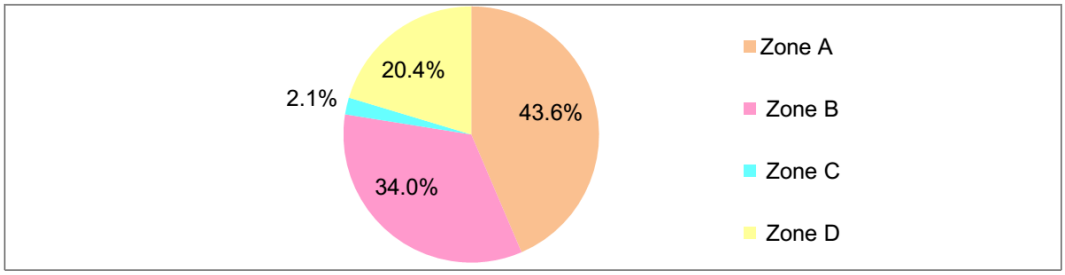
Map 5.3: Probable zoning of planned city & periphery




Source: Author, 2015

The following figure shows the existing population distribution within Chandigarh and its periphery, where maximum population is accommodated in Zone A.

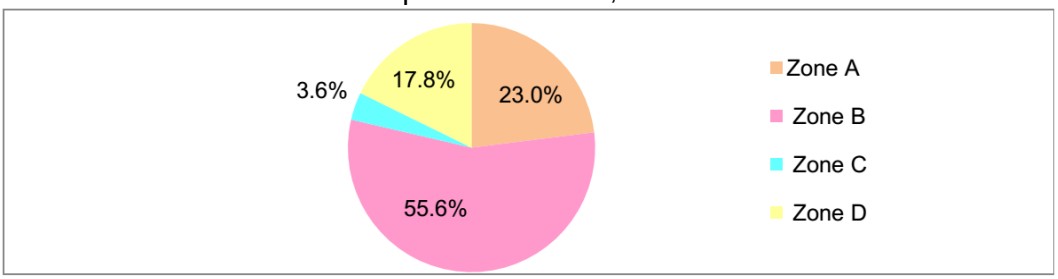
Figure 5.1: Population distribution of periphery + Chandigarh, 2011




Source: Census of India, 2011

The following figure shows the distribution of population, as considered for 2031 in the Master Plan / Development Plan of settlements.

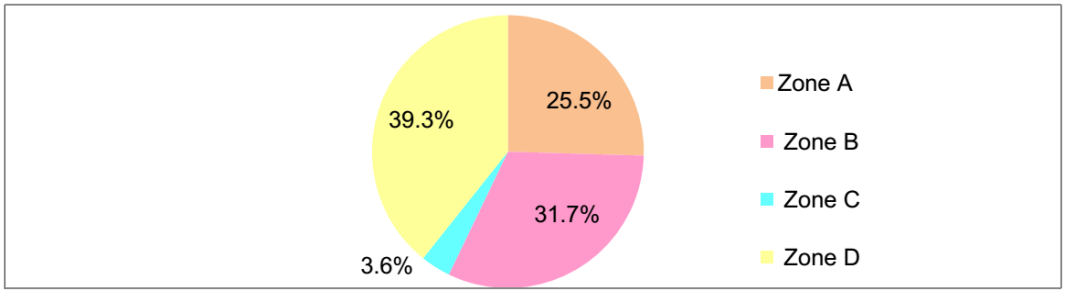
Figure 5.2: Population distribution of periphery + Chandigarh as per Master Plan, 2031




Source: Draft Master Plan for Chandigarh 2031, Regional Plan for GMADA, 2056

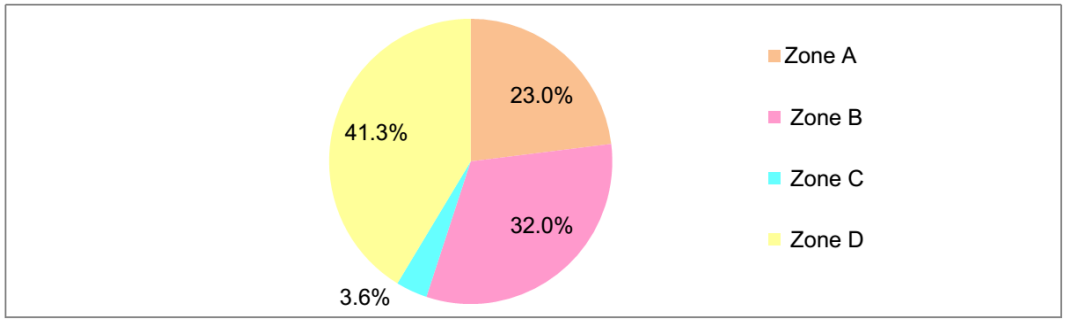
The following figures show the population distribution in Chandigarh and its periphery as per Proposal - 1 & 2, discussed in the previous section.

Figure 5.3: Population distribution of periphery + Chandigarh 2031, as per Scenario - 1




Source: Author, 2015

Figure 5.4: Population distribution of periphery + Chandigarh 2031, as per Scenario - 2




Source: Author, 2015

In the following section, strategies for regulating development as discussed in the previous section have been tabulated. Also the settlement level strategies have been tabulated.

Table 5.4: Strategies for regulating development and overall settlement level strategies

| **2. Regulating Development** | |
|---|---|
| .- Collating base information on followings and preparation of updated land-use & land-cover maps with the help of GIS, showing -<br>• Urban land-uses<br>• Rural Zone<br>• Ecologically fragile afforestation Area<br>• Traffic and Transportation / Communication<br>• Physical conditions (climate, land forms, soil, land suitability)<br>- EIA of all new development proposed in the periphery, especially in the eco-sensitive areas. | - Identification of already developed, developable and prohibited areas in 4 zones:<br>• Zone-A: Strategy for reduced growth - Area: Chandigarh UT.<br>• Zone-B: Strategy for regulated growth - Area: Punchkula, Mohali, Zirakpur, Kharar, Nayagaon.<br>• Zone-C: Strategy for regulated growth - Area: Ecologically sensitive area to north of Capitol Complex & foothills of Shivalik.<br>• Zone-D: Strategy for induced growth - Area: Rest of the |

| | |
|---|---|
| | Periphery.<br>- No new urbanisable area to be added in periphery. |
| | |
| **3. Settlement Level Strategies** | |
| - Master plans for all settlements under respective town planning and Urban Development Authority Act.<br>- Making peripheral settlements self-sufficient in terms of provision of work centres, adequate social infrastructures, recreational facilities and commercial centres and developing these at par with the planned city to reduce dependence on it.<br>- Since Chandigarh & periphery witnessing very high interaction, it is necessary to take steps for decongesting Madhya Marg & Dakshin Marg.<br>• Additional links / bypass to avoid through trips entering planned city.<br>• Strengthening public transport system eg. MRTS system to be introduced to relieve congestion on roads.<br>- Strengthening revenue base of ULB esp., medium, small & census towns through budgetary allocation as they lack in essential infra. | |

Source: Author, 2015

### 5.3.2. Approaches for the Settlement Level

The following table details out the approaches for the peripheral settlements around the city of Chandigarh.

Table 5.5: Strategies for peripheral settlements

| Sr. No. | Issues | Strategies |
|---|---|---|
| **1** | **Traffic & Transport** | |

| Sr. No. | Issues | Strategies |
|---|---|---|
| | - Congested roads and nodes due to<br>• Movement of slow and fast moving traffic in the same lane.<br>• No service lanes, hence commercial activities opening up directly on highways.<br>• No designated parking spaces, hence vehicles encroaching carriageway.<br>- Poor maintenance of roads with irregular widths & absence of pedestrian pathways.<br>- Width of 40% internal roads less than 3mt. Hence vehicular movement difficult.<br>- NH21 linking Mohali and Chandigarh to Punchkula, Kalka, Ambala, Patiala extremely congested. | - Additional links avoiding NH-21<br>• Option 1: Along railway line avoiding two congested intersections of NH-21 & NH-22.<br>• Option 2: Bye-pass from Punchkula to Mohali.<br>- Relocation of traffic attracting commercial activities along NH. |
| **2** | **Water Supply** | |
| | - Total dependence on underground tube wells. No perennial source of water supply. Hence, depleting ground water.<br>- Gap between demand and supply of 4.4 lakh litres avg. each settlement currently. Will increase to 110.44 MLD by 2031.<br>- Non revenue water approx. 30% and extent of metering not 100% (95%).<br>- Old water supply network worn out hence leakage.<br>- 37% cost recovery of water and sewerage.<br>- Haphazard layout of unauthorised | - Laying of new pipes in old abadi areas to reduce distribution losses.<br>- Rain water harvesting potential approx. 8400 million litres yearly of which approx. 5000 million litres to be harnessed for consumption.<br>- Water Demand for 2031 approx. 110 MLD (40 MLD potable and 70 MLD for other sectors). Decentralised water supply system to be adopted |

| Sr. No. | Issues | Strategies |
|---|---|---|
| | colonies, so pipes difficult to lay.<br>- Frequency of water supply in 70% areas for 4 hrs. a day. | with 2 sub-systems.<br>• Potable water supply system<br>• Recycled water and waste water system |
| **3** | **Sewerage System** | |
| | - Coverage of sewerage network only 45%. Hence 58% sewage sent to STP, rest 42% in nalahs. Hence degradation of Nalahs.<br>- No recycling of waste water. | - 100% coverage of sewerage system<br>- Treatment of waste water (approx. 70 MLD) by 2031 for irrigation, industrial and commercial purposes. |
| **4** | **Storm Water Drainage** | |
| | - Only 20% roads covered with proper drainage system. No storm water drains laid in local / access roads.<br>- Most internal roads covered with impervious paver tiles leading to water clogging in the absence of surface drains. | - Provisions of Storm Water Drains along local and access roads following natural gradient. |
| **5** | **Solid Waste Management** | |
| | - No coverage of household solid waste collection.<br>- No scientific disposal of Municipal solid waste.<br>- No cost recovery in SWM services.<br>- Existing dumping site within MC limits with no precautionary measures, hence | - Closure of existing land-fill site within MC limits and shifting towards less inhabited area. |

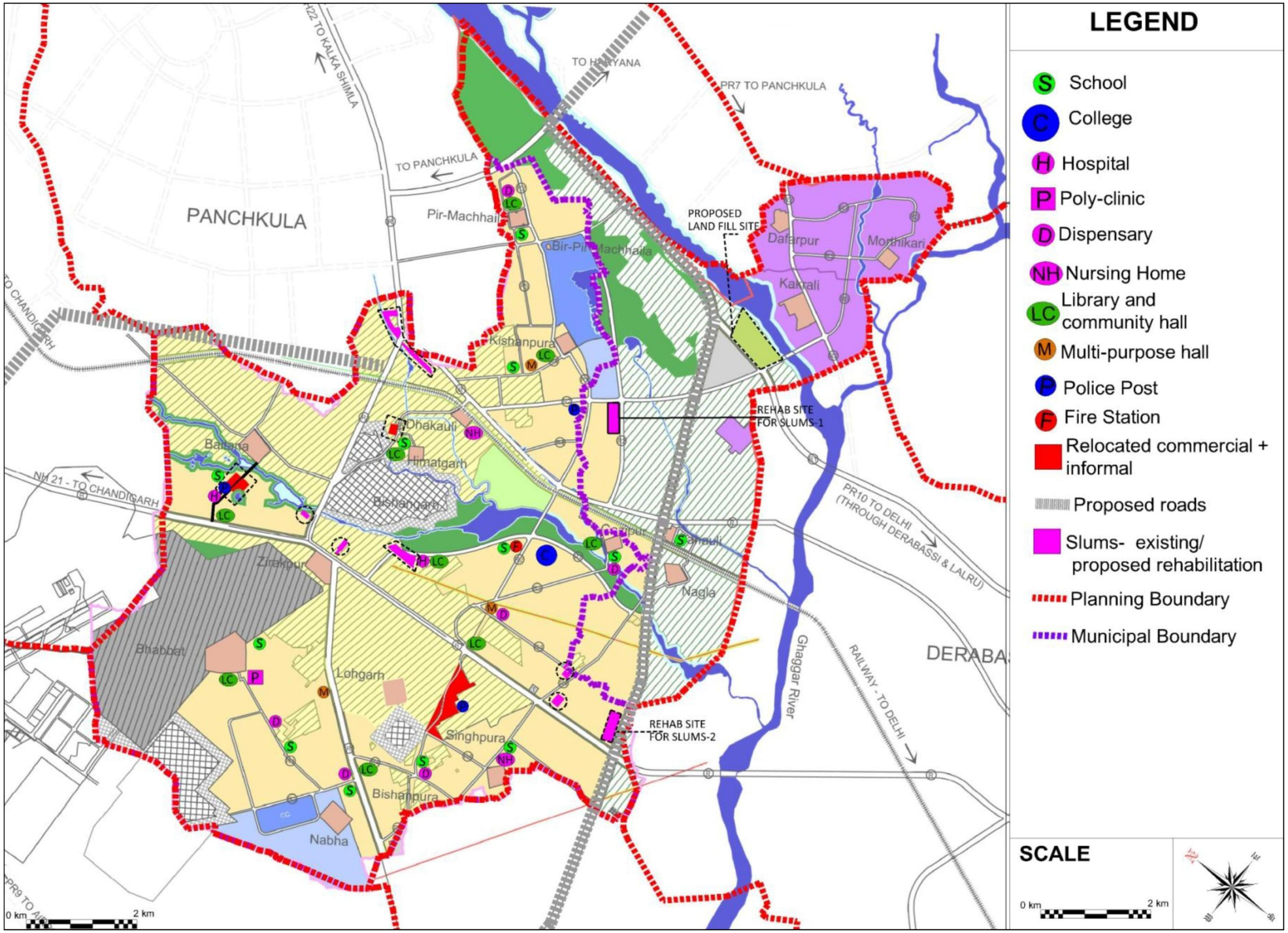
| Sr. No. | Issues | Strategies |
|---|---|---|
| | environmental degradation. | |
| **6** | **Social Infrastructure** | |
| | - Inadequate social infrastructure. | - Provision of required infrastructure. |
| **7** | **Unauthorised Construction** | |
| | - Regularisation of unauthorised private colonies time to time on case to case basis.<br>- Non compliance with DCR and Bye laws major issue.<br>- No of unauthorised farmhouses. | - Enforcement wing to be set up to monitor and control illegal developments within MC. |
| **8** | **Slums & Squatters** | |
| | - Inadequate coverage of water supply in slums and squatters.<br>- Majority kutcha structures in slums and squatters.<br>- Approx. 20% area covered with sewer system. Rest dependent on soak pits & septic tanks. | - Rehabilitation of colonies along nalahs and railway line.<br>- Provision of basic services to identified slums. |
| **9** | **Informal Sector** | |
| | - Informal activities along NH encroaching upon ROW. | - Relocating informal market to suitable area. |
| **10** | **Environmental Resources** | |

| Sr. No. | Issues | Strategies |
|---|---|---|
| | - Sukhna Choe being degraded due to dumping of solid waste and sewerage.<br>- Degradation of villages around FEZ. | - 100% collection of solid waste to ensure no waste is being dumped in the nalah.<br>- Relocation of squatter settlement.<br>- 500mts as No Construction Zone around FEZ. |

Source: Author, 2015

The inadequacies related to social infrastructure at peripheral settlement level is highlighted in previous chapter and also ascertains the requirements for 2031. The same have been spatially located in Map 5.4.

Map 5.4: Probable locations for provisions of social infrastructure




Source: Author, 2015

## 5.4. Concluding Remarks

The chapter is an attempt to provide a comprehensive holistic picture of issues emerging at the parent city / growth centre Chandigarh & its periphery with respect to the emerging scenario of urban transformations happening at the peripheral settlements and the impact of this transformation as a whole. It has been prepared after undertaking an exhaustive stocktaking of the ground realities and enunciating development strategies and directions for the entire area under the Periphery Controlled Area. It has been highlighted through the study that periphery is witnessing rapid transformations, which have a direct implication on the planned city of Chandigarh. Hence, need of the hour is to have a proactive approach for planned, balanced and integrated urban development of Chandigarh and its entire periphery. The probable approaches discussed here, will be only possible to take up through co-ordinated efforts of the three governments involved with - Chandigarh UT, Punjab and Haryana and through a proper legal framework and institutional set-up.

## 5.5. References

1. Department of Urban Planning, UT Chandigarh, Chandigarh Administration, (2013), Draft Chandigarh Master Plan – 2031 (unpublished),
   Available online: http://chandigarh.gov.in/cmp_2031.htm (accessed on 05.02.2016).
2. GMADA (2008), Regional Plan for Greater Mohali Region - 2056.

# CHAPTER 6. IDENTIFICATION OF LACK IN EXISTING RURAL-URBAN CLASSIFICATION (RUC) & DEFINITIONS – GLOBAL OVERVIEW

## 6.1. Introduction

In the previous chapters, the process of transformation in peri-urban settlements around the city of Chandigarh and the issues emerging due to such transformation is discussed. The probable planning approaches, which can be taken in future to govern such developments; are also discussed. Throughout this entire study and analysis, it has been clear that the main issue is very fundamental, lies in the definition and rural-urban classification system only, due to which such transformation has happened in the last decade. In this context, this chapter is an attempt to explore the existing criteria of Census definitions for 'Urban' and 'Rural', discussing a global perspective, highlight the drawbacks and also question upon the issue of non-consideration of 'Peri-Urban' to include, define and delineate the transition areas. As stated by Brenner, 2016; *"While 'Urban' is often specifically defined, 'Rural' is treated simply as residual category. The criteria defining 'Urban' also differ from country to country".* The research questions these parameters, defining 'Urban', also raises debate on: *"can the 'non-urban' necessarily always be classified as 'Rural'?"* A comparative analysis has done using census definitions for rural-urban of eight different countries, where the paper explains that administrative, demographic criteria are being sharpened, however the physical planning parameters are entirely absent in definition. The chapter emphasizes upon multi-dimensional and multi-disciplinary approach being appropriate for RU definitions. Further, it is observed that there is no separate existence of transition areas in existing classification. Here it reflects on this lack and argues that the 'Peri-Urban' has emerged key to the process of urbanization. It concludes with an approach towards restructuring the existing classification to set a common global benchmarking for RUC and recognition of 'Peri-Urban' interface through definition and inclusion in planning and policy level.

## 6.2. The Rural-Urban Classification (RUC) Debate

Conventionally, world-wide, settlements are categorized on the basis of certain nos. of population, their spread in terms of area and population density, the dominant presence of non-agricultural activities, governing body etc. However, there is no consistency exist among different countries in choosing

parameters to define 'Urban' and 'Rural' and the value range against each parameter also differs from country to country. That's how different meaning of 'urban' exists across the world. A simple, yet a crucial problem, to which sociologist Kingsley Davis already devoted extensive critical attention in the 1950's, is that ***"Each national census bureau uses its own criteria for measuring urban conditions, leading to serious inconsistencies in comparative international data on urbanization"*** **(Brenner 2016).** Primarily two issues have come out from this process: first the different parameters for definition among countries and second for each common parameter among few countries, the respective values having a huge range of variation. Rural-Urban Classification (RUC) constitutes an essential and primary framework to formulate the development process, pattern and strategies for different habitable spaces and also act as the determinant for local governance and funding allocation. As stated by Brenner, 2016; ***"..... RUC appears as a statistical artefact constructed through a rather crude aggregation of national census data derived from inconsistent definitions of the phenomenon being measured".***

Even the urbanization patterns evolved with time across the countries are drastically different due to such inconsistencies in numerical figures. A critical debate has raised in physical planning that *"can the urban 'phenomenon' still be anchored exclusively within and confined to the city only"?* As pointed out by Brenner (2016), *"The developmental pathways of capitalist agglomerations have always been intimately intertwined with large-scale transformations of non-city spaces, located at a considerable distance from the major centres of capital, labour and commerce".* Several planning theories describing the city form and pattern have also been developed to rethink the existing rural-urban categorization, which talks about the extended field of the megacity / metacity; peri-urban areas form the basis for multiple hybrid forms of fragmented urbanism in a vast new urban constellation. The definition lacks here to identify such layers or realms of development process.

**This chapter ass the existing parameters behind Rural-Urban Categorization System, which is being used and defined by the Census of various countries and its significance in creation of underlying settlement typologies to further categorize them.** The research further explores the consideration of 'Peri-Urban Interface' as a viable spatial unit in the mainstream urbanization process and its inclusion in RU Classification to formulate a new categorization system. Section 3 focuses upon the need of this study and the method adopted for the same. In Section 4, the comparative study of existing

Census definitions of different countries for Urban and Rural area is presented; while in Section 5, the analytical review of existing parameters / criteria for urban-rural classification in those countries is discussed. Section 6 identifies specific drawbacks on the above issue. In Section 7, the development process in Peri-Urban areas is analysed as emerging urban space through the comparative study of its existing definitions (if any) of different countries, thus explains urgent need of its inclusion in Census definition from physical planning, economic policy and urban governance perspective. In the final sections 8 & 9, it is concluded that a multi-disciplinary approach through redefining these three realms is required to fulfil the identified drawbacks.

## 6.3. Need for Study & Methodology

Due to heterogeneous international data set to define 'urban' and 'rural' realms, certain questions come up: Should the 'Urban Area' be classified only on the basis of its specific administrative status? or Should there be other significant parameter to define 'Urban', which will be more relevant parameter in the field of urban & regional planning? *"What population density criterion, if any is appropriate as international benchmark to be 'Urban'? Should levels of non-agricultural employment figure into the definition of urban areas (as done in India, even considered for male workforce only)?"* Should planning parameters be introduced in definitions, so that physical planning can be linked with governance, funding allocation etc. On the other hand, the most dynamic transition areas in between the Urban and Rural areas are never appear for discussion and seek for its specific identity. A search into these questions necessitates this study and analysis at a global scale. As this chapter discusses on diverse data set to understand the criteria of defining urban, rural and peri-urban, it helps to establish that the existing process of categorization is biased towards administrative domain and hence, a multi-disciplinary approach is required to rectify the existing drawbacks of RUC system.

### 6.3.1. Methodology

A comparative study of existing definitions for urban and rural of eight different countries across the world including India has been done. The countries have been selected from different continents, so that diverse contexts for urban,

rural and peri-urban can be addressed and this study is conducted by collecting data from secondary sources like Govt. Census data of the selected countries.

### 6.4. Comparative Study of Existing Definition for Urban & Rural

Table 6.1: Comparative study of definition of 'Urban' of different countries

| | **Name of Country** | | | |
|---|---|---|---|---|
| | **Africa** | **Canada** | **US** | **China** |
| **Definition of Urban** | Agglomeration of **5000** or more inhabitants where **75** percent of the economic activity is non-agricultural. | Places of **1000** or more inhabitants, having a population density of **400** or more per square kilometre. It is further specified that the core must have a population of at least 50,000 persons in the case of a CMA, or at least 10,000 persons in the case of a CA. The secondary core is a population centre within a CMA that has at least 10,000 persons and was the core of a CA that has been merged with an adjacent CMA. | Agglomerations of **2500** or more inhabitants, generally having population densities of **1000** persons per square mile or more. Two types of urban areas: urbanized areas of 50000 or more inhabitants and urban clusters of at least 2500 and less than 50000 inhabitants. | The city proper refers to the whole administrative area of the district if its population density is **1500** people per square kilometre or higher. |
| **Parameters** | | | | |

| | Name of Country | | | |
|---|---|---|---|---|
| | **Africa** | **Canada** | **US** | **China** |
| **Population (min.)** | **5000** | **1000** | **2500** | **-** |
| **Area** | **-** | **-** | **-** | **-** |
| **Density Profile (min.)** | **-** | **400 per sq. k.m.** | **386 per sq. k.m.** | **1500 per sq. k.m.** |
| **Economic Activity / Occupation** | **75% non-agricultural** | **-** | **-** | **-** |
| **Any Other Parameter** | - | - | - | - |

Table 6.1: Continued

| | Name of Country | | | |
|---|---|---|---|---|
| | **India** | **Japan** | **France** | **UK** |
| **Definition of Urban** | Towns (places with municipal corporation, municipal area committee, town committee, notified area committee or cantonment board); also, all places having **5000** or more inhabitants, a density of not less than **1000** persons per square mile or **400** per square kilometer, pronounced urban | City (shi) having **50000** or more inhabitants with **60** per cent or more of the houses located in the main built-up areas and 60 per cent or more of the population (including their dependants) engaged in manufacturing, trade or other | Communes containing an agglomeration of more than **2000** inhabitants living in contiguous houses or with not more than **200** meters between houses, also communes of which the major portion of the population is part of a multicommunal | The definition is an extent of at least **20** ha and at least **1500** census residents. Separate areas are linked if less than **200** m (220 yd) apart, included transportation features. |

| | | | | |
|---|---|---|---|---|
| | characteristics and at least **three fourths** of the adult male population employed in pursuits other than agriculture. | urban type of business. | agglomeration of this nature. | |
| **Parameters** | | | | |
| **Population (min.)** | **5000** | **50000** | **2000** | **1500** |
| **Area** | **-** | **-** | **-** | **20ha /0.2 sq. k.m.** |
| **Density Profile (min.)** | **400 per sq. k.m.** | **-** | **-** | **-** |
| **Economic Activity / Occupation** | **3/4th or 75% male working population in non-agriculture** | **60% non-agricultural** | **-** | **-** |
| **Any Other Parameter** | - | 60% or more of the houses located in the main built-up areas. | 1. Contiguous houses or with not more than 200 metres between houses.<br>2. Multicommunal agglomeration. | Separate areas are linked if less than 200 m (220 yd) apart. |
| **Source** | *Canada - Statistics Canada, online available at: https://www12.statcan.gc.ca/census-recensement/2011/ref/dict/geo052-eng.cfm*<br>*US - US Census Bureau*<br>*UK - online available at: https://en.wikipedia.org/wiki/Urban_area#United_Kingdom*<br>*For rest of the countries - Demographic Yearbook 2005, table 6, online available at:* | | | |

| | |
|---|---|
| | *http://unstats.un.org/unsd/demographic/sconcerns/densurb/Defintion_of%20Urban.pdf* |

Source: As mentioned in the table

Table 6.2: Comparative study of definition of 'Rural' of different countries

| | **Name of Country** | | | |
|---|---|---|---|---|
| | **Africa** | **Canada** | **US** | **China** |
| **Definition of Rural** | Agglomeration of less than **5000** inhabitants where **75** percent of the economic activity is agricultural. | "Predominantly Rural Region" is having more than **50%** of the population living in rural communities where a "rural community" has a population density less than **150** people per square kilometre. | Rural areas comprise open country and settlements with fewer than **2500** residents; areas designated as rural can have population densities as high as **999** per square mile or as low as 1 person per square mile. | All population, housing and territory not included within an urban area, is considered as rural. |
| **Parameters** | | | | |
| **Population** | **less than 5000** | **-** | **less than 2500** | **-** |
| **Area** | **-** | **-** | **-** | **-** |
| **Density Profile** | **-** | **150 per sq. k.m.** | **less than 386 per sq. k.m.** | **less than 1500 per sq. k.m.** |
| **Economic Activity / Occupation** | **75% agricultural** | **-** | **-** | **-** |
| **Any Other Parameter** | - | - | - | - |

Table 6.2: Continued

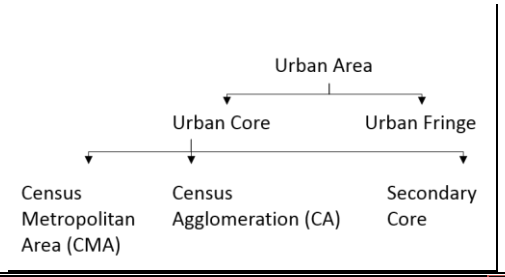
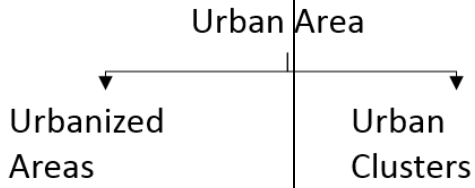
| | Name of Country | | | |
|---|---|---|---|---|
| | **India** | **Japan** | **France** | **UK** |
| **Definition of Rural** | An area with a population density of up to **400** per square kilometre, Villages with clear surveyed boundaries but no municipal board, A minimum of **75%** of male working population involved in agriculture and allied activities. | All population, housing and territory not included within an urban area, is considered as rural. | Rural population refers to people living in rural areas as defined by National Statistical Offices. It is calculated as the difference between total population and urban population. | The majority of the population of an Output Area lives within settlements with a population of more than **10,000** people, that Output Area is treated as urban. All other Output Areas are treated as rural. |
| **Parameters** | | | | |
| **Population** | | **less than 50000** | **-** | **less than 10000** |
| **Area** | | **-** | **-** | **-** |
| **Density Profile** | **up to 400 per sq. k.m.** | **-** | **-** | **-** |
| **Economic Activity / Occupation** | **75% male working population in agriculture** | **60% agricultural** | **-** | **-** |
| **Any Other Parameter** | Villages with clear surveyed boundaries but no municipal board | Less than 60% of the houses located in the main built-up areas. | - | - |

| | |
|---|---|
| **Source** | *UK - Bibby, P. and Brindley, P. (2013): 'Urban and Rural Area Definitions for Policy Purposes in England and Wales: Methodology (v1.0)', Office for National Statistics, August 28. Downloaded from: https://www.gov.uk/government/collections/rural-urban-classification. For rest of the countries - online available at: https://en.wikipedia.org/wiki/Rural_area* |

Source: As mentioned in the table

### 6.5. Analysis of Parameters of Rural-Urban (R-U) Definitions

Table 6.3: Analytical chart I - definition of 'Urban' area

| **Analysis Chart I - Definition of Urban Area** | | | | |
|---|---|---|---|---|
| | **Name of Country** | | | |
| | **Africa** | **Canada** | **US** | **China** |
| **No. of Parameters** | 2 | 2 | 2 | 1 |
| **Name of the Parameters** | Population, Occupation | Population, Population Density | Population, Population Density | Population Density |
| **Sub-Divisions, If Any** | - |  |  | -<br> |

| | |
|---|---|
| **Major Common Parameters** | **1. Population** **2. Population Density** **3. Occupation** |
| **Remarks, If Any** | Definitions majorly driven by demographic and socio-economic parameters, the physical planning parameters are completely ignored. |

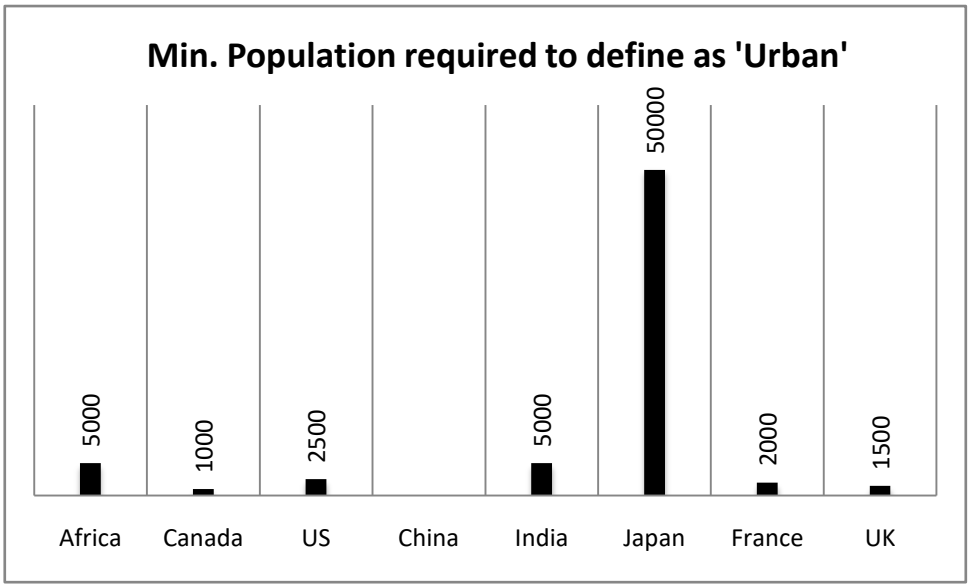
Table 6.3: Continued

| | **Analysis Chart I - Definition of Urban Area** | | | |
|---|---|---|---|---|
| | **Name of Country** | | | |
| | **India** | **Japan** | **France** | **UK** |
| **No. of Parameters** | 4 | 3 | 3 | 2 |
| **Name of the Parameters** | Administrative / Governing Body, Population, Population Density, Occupation | Population, Occupation, Location of majority houses | Population, Contiguity of houses, Nature of Community | Population, Area |
| **Sub-Divisions, If Any** | - | - | - | - |
| **Major Common Parameters** | **1. Population** **2. Population Density** **3. Occupation** | | | |
| **Remarks, If Any** | Definitions majorly driven by demographic and socio-economic | Definition talks about a min. population with 60% or more of the houses located in the main built-up areas. It reflects | This is the only definition, which gives a socio-cultural perspective through the parameter of **'multicommunal** | Definition talks about physical planning |

| | | | | |
|---|---|---|---|---|
| | parameters, the physical planning parameters are completely ignored. | physical planning parameter like compactness of built-up area. The definition itself talks against urban sprawls. | **agglomeration'.** It also considers physical planning parameters like Contiguity of houses / Sparcity of built-form through **'contiguous houses or with not more than 200 meters between houses'.** | parameter like **Area.** |

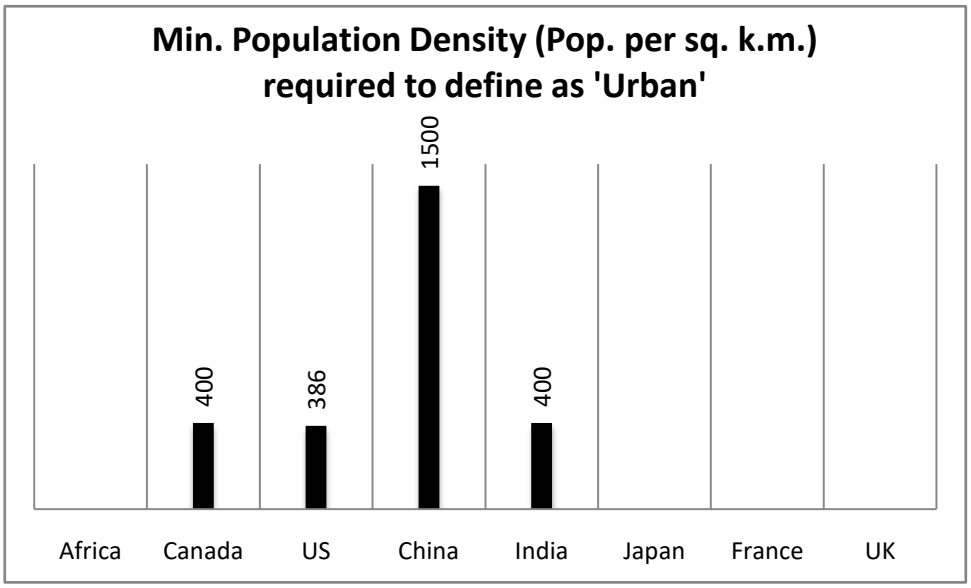
Source: Author

Figure 6.1: Min. population required defining as 'Urban'




Source: Author

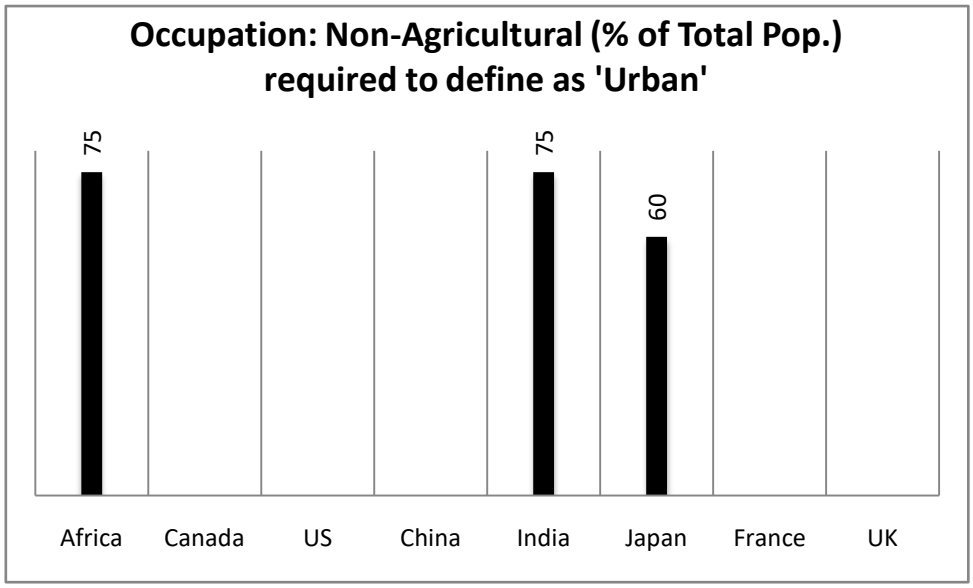
Figure 6.2: Min. population density (pop. per sq. k.m.) required defining as 'Urban'




Source: Author

Figure 6.3: Min. % of total population engaged in non-agricultural activities

required defining as 'Urban'




Source: Author

### 6.6. Drawbacks in R-U Definition

The above study of rural-urban definitions across the countries majorly infers that definition is driven by demographic, administrative and socio-economic parameters; whereas the physical planning parameters are completely ignored. Few exceptional cases have been observed, such as the followings:

i. Urban area in Japan is defined by a min. population along with 60% or more of the houses located in the main built-up areas of the settlement. It reflects physical planning parameter like compactness of built-up area. The definition itself talks against urban sprawls.

ii. The definition of 'Urban' in France is the only one, which gives a socio-cultural perspective through the parameter of **'multicommunal agglomeration'.** It also considers physical planning parameters like Contiguity of houses / Sparcity of built-form through **'contiguous houses or with not more than 200 meters between houses'.**

iii. Urban area in UK is defined by physical planning parameter like **Area.**

In few other cases, it is observed that physical planning parameters like Built-Up Area (Sweden & Brazil), Distance between houses (to understand the degree of sparsity of the settlement), the nature of transformation of a settlement etc. have been used to define 'urban', instead of mere administrative or demographic parameters like existence of municipal body, population, density

and occupational structure, where the morphology of the settlement / the underlying settlement typology is not reflected through the definition.

### 6.7. Peri-Urban Areas to Include in RUC: An Urgent Need

When a town / city starts expanding, it integrates its neighbouring areas, which finally appear as peri-urbanization. Where the city ends and the rural area begin, the boundary has become blurred as the phenomenon of mixed land-use with rural and urban features coexists in areas surrounding cities. In most of cases worldwide, the existing definition of urban and rural lacks to address the process of peri-urbanization and there is no categorization for the transition areas in-between urban and rural and whatever is not urban is categorized as rural. As stated by Bhagat, 2005; *"This dichotomous and bilateral classification led to an underestimation of the growth of urban populations".* **However, there is very few well-justified attempt till date to define such emerging areas, identify and delineate them; so that these areas can be included in the mainstream urbanization process in terms of physical planning, governance, fund allocation and development in an organized manner.**

A comparative study has been conducted across countries to understand the existence of definition for 'Peri-Urban' realm, as done for Urban and Rural definition analysis. The study has been summarized in the table given below (Table 6.4).

Table 6.4: Comparative study of definition of 'Peri-Urban' of different countries

| | **Name of Country** | | | |
|---|---|---|---|---|
| | **Africa** | **Canada** | **US** | **China** |
| **Definition of Peri-Urban** | Peri-Urban is defined as 'Semi-Urban', which includes the settlements (formal / informal) beyond the demarcated boundary of urban area, but having urban characteristics / influences. | The term 'fringe' includes all population centres within a CMA (Census Metropolitan Area) or CA (Census Agglomeration), that have less than **10,000** persons and are not contiguous with the core or secondary core. | US Census Bureau delineates Urbanized Areas (UAs), which comprises of one or more 'central places' and the adjacent densly settled surrounding territory (Urban Fringe); together having a min. population of 50000 persons. Urban Fringe is defined as either contiguous territory, having density same as central place (1000 persons per sq. mile) or outlying territory with desity fewer than **1000** persons per sq. mile, connected with the core by road within a distance of **1.5 mile - 5 mile.** | The peri-urban zone begins just beyond the contiguous built-up urban area and sometimes extends as far as **150** kilometer (km) from the core city, or as far as **300** km. The land that can be characterized as peri-urban shifts over time as cities, and the transition zone itself, expands outward. |
| Parameters | | | | |
| Population | **-** | **less than 10000** | **population of urban fringe is not defined, but population of UA (Core & fringe) is min. 50000** | **-** |
| Area | **-** | **-** | **-** | **-** |

| | | | | |
|---|---|---|---|---|
| Density Profile | - | - | **less than 386 per sq. k.m.** | - |
| Economic Activity / Occupation | - | - | - | - |
| Any Other Parameter | Formal / informal settlements | Not contiguous with the core or secondary core. | Contiguous or discontinued from core within a distance of 1.5 - 5 mile. | Extends as far as 150 - 300 k.m. from the core city. |

Table 6.4: Continued

| | **Name of Country** | | | |
|---|---|---|---|---|
| | **India** | **Japan** | **France** | **UK** |
| **Definition of Peri-Urban** | Peri-Urban' is not defined separately. However, 'Out Growth' (OG) is defined as a viable unit which came up near a statutory town outside its statutory limits but within the revenue limits of a village or villages physically contiguous to the town; possessing the urban features like infrastructure and amenities. | Rural Counties are subdivided into Towns & Villages. | Peri-urban areas are defined in the PLUREL project as 'discontinuous built development, containing settlements of less than **20,000**, with an average density of at least **40** persons per sq. k.m. (averaged over 1 sq. k.m. cells)' | As per UK Census 2011, 'Town & Fringe' and 'Town & Fringe in a Sparse Setting' both comes under Output Area (OA) 'Rural'. |
| Parameters | | | | |

| | | | | |
|---|---|---|---|---|
| Population | **Population of OG is not determined, however population of an Urban Agglomeration (UA) which includes a town along with such Ogs, is 20000 or more.** | **-** | **20000 or more** | **-** |
| Area | **-** | **-** | | **-** |
| Density Profile | **-** | **-** | **at least 40 persons per sq. k.m.** | **-** |
| Economic Activity / Occupation | **-** | **-** | | **-** |
| Any Other Parameter | Satisfying the basic condition of physical contiguity from core to outside. | - | discontinuous built development | - |
| Source | *Canada - Statistics Canada, online available at: https://www12.statcan.gc.ca/census-recensement/2011/ref/dict/geo052-eng.cfm US - US Census Bureau France - PLUREL Synthesis Report on Peri-Urbanisation in Europe, editted by Annette Piorr, Joe Ravetz and Ivan Tosics. UK - Bibby, P. and Brindley, P. (2013): 'Urban and Rural Area Definitions for Policy Purposes in England and Wales: Methodology (v1.0)', Office for National Statistics, August 28. Downloaded from: https://www.gov.uk/government/collections/rural-urban-classification For rest of the countries - online available at: https://en.wikipedia.org/wiki/Peri_Urban_area* | | | |

Source: As mentioned in the table

### 6.7.1. Observations

i. Various terms like 'Peri-Urban' / 'Fringe' / 'Semi-Urban' have been used in different contexts to identify the transition areas. No consistency exists in terminology world-wide.

ii. Most of the cases, it is defined in qualitative way; not in terms of quantitative method.

iii. Few cases are there, it is defined as part of the whole agglomeration (urban + transition), like in India, which shows unavailability of specific data for peri-urban realms.

iv. The 'Peri-Urban' definition of France is the only example, where the character of built environment, population and density profile – these three parameters are used to identify such areas.

v. Cumulatively, we can find few other significant criteria, may be used at different contexts in the study; however may help further to formulate a new definition, like – contiguity of the settlement through distance from the core and distance between houses, as found in the definition in US & China.

### 6.7.2. Inference

As observed from the comparative study among various countries, Peri-Urban areas may lie beyond the administrative boundary of any Urban Local Body like Municipal Council / Municipal Corporation or even these areas may also expand outside the administrative boundary of the city. *"These outgrowths have an unsatisfactory level of environmental quality and infrastructural services like water supply, sanitation, drainage, solid waste management, transport and air pollution control"* (Shaw 2005). Even, in majority of the cases, the basic services networks do not reach the city periphery areas, as these areas are not well defined, they are considered as 'Rural', hence funding and development programmes for these areas are not same as happen in urban area, though they are more urban in nature. *"The unsatisfactory state of the environmental situation and infrastructure in most peri-urban areas is largely due to official neglect and non-recognition of these areas as deserving of urban civic status".* As pointed out by Bhagat (2003), *"there is as yet no data collected on 'transitional areas' by the census".* This needs an early intervention, so that these areas can be defined, identified, delineated and planned to achieve a better quality of life.

## 6.8. Way Forward

Consideration of re-classification of Urban and Rural realms, creation of further settlement typologies and inclusion of planning parameters / criteria in the proposed definitions and categorization should be a multi-disciplinary process. In the existing scenario, the rural-urban classification is outcome of administrative and demographic parameters, which creates a gap between plan preparation for a place and its actual ground reality. The spatial planning system is not linked with the administrative, governance and fund allocation procedures. Thus, it requires a multi-disciplinary approach to correlate all of them and formulate such definitions and classification, which leads towards a coherent development as a whole.

Conventionally, settlements are categorized as 'Urban' and 'Rural' and their definitions are based on parameters like population, population density, occupational structure / economic activities and in certain cases provision of physical and social infrastructure etc. There are several diverse parameters exist in different countries across the globe to define the types of settlements. However, it is believed that settlements should be identified on the basis of their features / characteristics i.e. the degree of urban tendency / rural tendency, instead of mere criteria like population or administrative status, which have less degree of association with the settlement growth. For the evolution of any settlement pattern, there may be several factors like historical, physiogeographical, economic, political etc. Without maintaining any link with such factors, the settlements are been classified as 'Urban' or 'Rural' only based on demographics and administrative scenario. This process can be biased and thus how more fund allocation for urbanization is done on the basis of it's categorization, not on the basis of actual infrastructural scenario. **A multi-disciplinary approach in terms of selection of parameters / criteria to define "Urban" / "Rural" / "Peri-Urban" realms is required to maintain a link or balance among the planning process, governance and funding for development.**

Also, it is necessary to take a note that 'urban', 'rural' or 'peri-urban' realms are not static. These areas are subjected to change with time in terms of their characteristics and nature of growth like today's peri-urban areas may be the cities of future. **Such temporality of these realms should be addressed, which gives a new research direction.**

## 6.9. Concluding Remarks

It is observed that the existing definition of "Urban" in most of the countries worldwide gives a general condition for having the phenomenon of urbanity. However, the nature of urbanity is very different from one place to another place, which is never reflected in the definition. Therefore, *"....there is an urgent need for having a further specific settlement typological classification, which can help to reduce issues in planning and urban governance. Accordingly attempts should be taken to identify the determinants, which can be used to formulate the typology of settlement pattern"* (Firoz, Banerji & Sen 2014). A well-structured framework for Rural-Urban Categorization can be the first aspect to deal with effective manner to enhance planning process and to revitalise urban governance as well. Restructuring of settlement hierarchy will help to solve several issues in present context of urbanization; even this will lead to effective resource management and fund allocation among settlements by the state authorities in a balanced manner.

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# CHAPTER 7. IMPACT OF RURAL-URBAN CLASSIFICATION (RUC) ON FUNDING PATTERN UNDER DEVELOPMENT SCHEMES – INDIAN SCENARIO

## 7.1. Introduction

This chapter attempts to assess the impact of existing Rural-Urban Classification (RUC) on distribution of development funds among different realms of a settlement in the context of Indian cities. The research questions upon the existing parameters of Census definitions for 'Urban' and 'Rural' realms and how it is affecting the 'Plan Preparation Process' for cities. Further, it indicates the role of RUC for creating disparity in distribution of various Government development funds among settlements, by discussing ten diverse contexts of the country. Due to census definition of settlement classification in a dichotomous fashion, all these developmental schemes are being applicable to Statutory Towns only, the Census Towns are completely ignored, especially the peripheral settlements. The research seeks to analyze the interrelationship between present funding pattern and degree of urbanization in the selected cases, if exists at all. The chapter concludes with a framework to establish a relationship between funding pattern and urbanization and develops an approach towards restructuring the settlement classification, where in the future, the Peri-Urban realms / Census Towns will be covered under development schemes, will undergo planned urbanization and as a result, disparity in terms of development as a whole can be minimized in the country.

## 7.2. The Settlement Classification System

The differentiation of settlement into 'Rural' and 'Urban' realms has started in the wake of industrial development process and related growth of infrastructure such as transport, communication and power supply, etc. in the certain segments of space (Bhagat, 2003). In many countries today the classification of settlements into rural and urban areas serves as an important input in the formulation of development strategy and provides an appropriate framework for local governance. In the similar manner, the link between settlement typology and its impact on funding pattern for urban development has for long been debated. Conventionally, depending upon the type of settlement, its demographic and administrative profile, the funds are being allocated. The

chapter intends to analyze such interrelation between these two aspects and attempts to establish whether the parameters defining settlement classification are correct to be the determinants for fund allocation to various classes of cities.

In broader perspective, the research is concerned regarding the haphazard development in Peri-Urban areas around all the major cities of India. While doing thorough research on the issue, it is observed that as these transition areas lie outside the legal jurisdiction of the city / any urban local body and considered as part of 'Rural' realm and thus, they are completely deprived from the various developmental grants of the Central / State Governments. From the last decade, several developmental schemes like Jawaharlal Nehru National Urban Renewal Mission (JNNURM) - (2006-2012), Smart City Mission - (2016 onwards) etc. have been announced from Government of India. However, the schemes primarily follow Census data only; which are completely biased to 'urban' - especially towards statutory towns and its demographic and administrative database. Hence, due to lack of grant allocation, these outgrowths face an unsatisfactory level of environmental quality and infrastructural services like water supply, sanitation, drainage, solid waste management, transport and air pollution control (Shaw, 2005), though they mostly appear with characteristics and amenities of urban area. Their identification, definition, method of delineation in a legal manner or through any planning policy by competent authority does not exist in the country till date. Such background overview necessitated certain questions, whether the two-tier settlement typology (urban & rural) is appropriate at contemporary development scenario or there is an urgent need for restructuring of settlement typology to include a third-tier of development (peri-urban), so that the developmental grants can be distributed in an equal manner with a sense of justice and fairness. Even, it is also questioned, whether administrative and demographic criteria are enough to define such realms, where they create larger impact in long way. The chapter attempts to justify such interdependencies between RUC and fund allocation, if exists at all.

With this overview, this research examines the existing criteria of rural-urban classification used by the Census of India and shows its direct link / relation to create disparity in distribution of development funds among various levels of urban areas in and around a city. In Section 3, the background research on the Rural-Urban Classification scenario in the context of India has been discussed; while in Section 4, Methodology of selection of sample cities and the method adopted for Analysis is elaborated. Section 5 collates the collected data, put for comparative analyses among various planning schemes and explains the critical

observations out of each of them. In Section 6, the overall inferences are discussed and Section 7 concludes with the proposed framework. In the final section, an approach is indicated towards restructuring the R-U classification for its future implication in reality and also to raise further research agenda to fulfil the gap between planning on paper and development on ground.

## 7.3. Background Overview

### 7.3.1. The Rural-Urban Classification (RUC) Scenario in India

The chapter looks deeper into the planning and development process in the contemporary Indian context. In India, the Census of India – an organ of the Central Government – classifies settlements into 'rural' and 'urban', whereas it is State Governments which grant municipal status to urban centres. Census 2011 defines Urban Area as follows:

1. All places with a municipality, corporation, cantonment board or notified town area committee, etc.
2. All other places which satisfied the following criteria:
    i. A minimum population of 5,000;
    ii. At least 75 per cent of the male main working population engaged in non-agricultural pursuits;
    iii. A density of population of at least 400 persons per sq. km.

The first category of urban units is known as 'Statutory Town'. The second category of Towns is known as 'Census Town'. It is significant to mention that Census being the only one agency, which defines settlement classification and all the earlier / latest plan preparation and developmental schemes follow such categorization. It is observed that though Census is followed to prepare plan for any 'Urban' area, however existence of different types of plans, preparation parameters, boundaries etc. creates confusion. Developmental schemes like JNNURM, SMART City Mission etc. follow Census data only; however they are completely biased to 'urban' - especially towards statutory towns. Due to census defines settlement classification in a dichotomous fashion, all these developmental schemes are being applicable to statutory towns only, the census towns are completely ignored. These facts initiate questioning on the parameters of definition. Further, the contemporary urbanization scenario shows that the largest metropolitan cities in India have continued to expand laterally and are better described by the census term 'Urban Agglomeration' (UA). Shaw (2005)

found that in the largest cities, that is, the 'primary metros', the UA was growing faster than the city proper. The large metros mostly show declining growth in the core and continue to expand outwards engulfing many villages and smaller towns in the surrounding area. It is necessary to highlight that for the first time since Independence, the absolute increase in population is more in urban areas that in rural areas. Level of urbanization increased from 27.81% in 2001 Census to 31.16% in 2011 Census and this urbanization has happened by formation of more nos. of Census Towns (increased 2532 in no. in 2011) as compared to Statutory Towns (increased 242 in nos. in 2011). Spatially, these Census Towns are all spreaded around the major metro cities. Thus how 'Peri-Urban Interfaces' are emerging more prominently as transition areas in-between conventionally classified 'urban' and 'rural' realms.

With reference to development funds in India, the 'JNNURM' scheme had launched in December 2005 for duration of 7 years, a flagship project comprising two sub-missions to serve selected urban areas. For various projects under the scheme, a total cost of Rs 62,253 crores have been sanctioned till 2012. Later the present government has announced 'Smart City Mission', to cover 100 cities for duration of 5 years and Rs. 100 crores per city per year is allocated for various projects sanctioned under it. With this background, as JNNURM is already completed, the chapter seeks to analyze the utilization of allocated funds over cities with respect to their degree of urbanization and intends to assess where the funds have been utilized and how the amount relates to the selected cases. Thus, the fund allocation can be justified or not from physical planning perspective.

## 7.4. Discussion on Methodology

### 7.4.1. Selection of Sample Cities, Overview of Data Sources and Methods

As JNNURM and Smart City Mission are two significant urban development projects in India in the last decade and present time, thus 10 common cities from the list of selected cities under both of these projects have been taken in this analysis to conduct a comparative study and analysis to find out the interrelation between funding pattern and degree of urbanization. However, these 10 common cities are selected in such way that they can produce diverse dataset in terms of their population size and other parameters. The study

has been conducted on the basis of secondary data sources by obtaining Govt. Census data of the country and database of the City Development Plan(s) (CDPs) prepared by the Municipal Corporation & Urban Development Authorities of these selected cities under JNNURM for the period of 2006 - 2012.

### 7.4.2. Process of Data Analysis

1) Census, LUDCP, JNNURM & Smart City Mission are put for a comparative analysis to see how the process is linked from Census definition of cities - City Master Plan preparation - Funding for projects through various schemes (Table 7.1).
2) Specific to JNNURM funding for cities, comparative analysis has been done for 10 selected cities to see the allocated fund v/s utilized fund under various projects (Table 7.2).
3) Sector-wise funding pattern under JNNURM has been analyzed to see which part of the city has been covered under the fund (Table 7.3).
4) Further, taking any one specific sector, funding pattern has been analyzed w.r.t area coverage of cities (Table 7.4).
5) The obtained result from the previous analysis has been put into the graph to compare city's urbanization with per capita funding & with per sq.k.m funding to draw final inferences (Figure 7.1 & 7.2).

## 7.5. Comparative Analysis among CENSUS, LUDCP, JNNURM & SMART City

Table 7.1: Comparison of different plans / schemes and selection criteria for respective beneficial areas

| Census | LUDCP & Perspective Plan | JNNURM Schemes | National Smart Cities Mission |
|---|---|---|---|
| Census 2011 defines Urban Area as follows: | Agencies to prepare LUDCP & Perspective Plan are different. | Selection of cities was based upon Census 2001. | 97 cities have been selected for the National Smart City Mission. |
| 1. All places with a municipality, corporation, cantonment board or notified town area committee, etc. | LUDCP - Medium term plan, Perspective Plan - Long term plan. | JNNURM Schemes were applicable to only all the Statutory Towns, not for the Census Towns; as listed by Census 2001. Urban biasness is present in the schemes. | Like JNNURM schemes, this is also applicable to Statutory Towns, as per Census 2011. |
| 2. All other places which satisfied the following criteria:<br>i) A minimum population of 5,000;<br>ii) At least 75 per cent of the male main working population engaged in non-agricultural pursuits; and<br>iii) A density of population of at least 400 persons per sq. km. | LUDCP follows administrative jurisdictions to delineate the planning area, where as Perspective Plan delineate & categorize the planning area w.r.t spatial scenario, creates development zones based on existing situation and future trends. | For big cities, schemes like UIG & BSUP, fund allocation was dependent upon only one parameter - Population size as per Census data. Among selected 65 Mission Cities (7 cities with pop. More than 4 million, 28 cities with pop. More than 1 million, 30 cities with pop. less than 1 million), for fund allocation Metropolitan biasness is present. | Unlike JNNURM, for selection of cities from one state and respective fund allocation, equal weightage (50:50) has given to % of urban pop. Contributed & no. of statutory towns in the state. |

| | | | |
|---|---|---|---|
| The first category of urban units is known as Statutory Town. The second category of Towns is known as Census Town. | For all the 'Urban Area', governed by an ULB as per the definition by Census, these plans are prepared, however for any particular urban area; no clear overlap is existing in LUDCP & Perspective Plan. | For 65 selected Mission Cities contributing 42% urban pop., 70% fund is allocated under UIG & BSUP, whereas for other small towns contributing 58% urban pop. Only 30% fund is allocated under UIDSSMT & IHSDP. Disparity exists in fund allocation for developmental activities among big cities and small towns w.r.t their contribution in urban pop. | Like JNNURM schemes, here the fund is available to only all the Statutory Towns, not for the Census Towns; as listed by Census 2011. Urban biasness is present in the schemes. |

Source: online data sources, available at http://censusindia.gov.in/, http://jnnurmmis.nic.in/, http://smartcities.gov.in/content/

### 7.5.1. Observations

1. Census being the only one agency, which defines settlement classification and all the earlier / latest plan preparation and developmental schemes, are made accordingly.
2. Though Census is followed to prepare plan for any 'Urban' area, however existence of different types of plans, preparation parameters, boundaries etc. creates confusion at the time of implementation.
3. Developmental schemes like JNNURM, SMART City Mission etc. follow Census data only; however they are completely biased to 'urban' - especially towards Statutory Towns. Due to census definition of settlement classification in a dichotomous fashion, all these developmental schemes are being applicable to Statutory Towns only, the Census Towns are completely ignored.

### 7.6. Analysis of JNNURM Funding: Allotted v/s Utilized

Table 7.2: Comparison of allotted and utilized funds for projects under JNNURM

| Sr. No. | Selected Common Cities between JNNURM & Smart City Mission for comparative study | JNNURM Category (as per Census 2001) | Funds allotted under different sub-missions of JNNURM (INR Cr.) | | | Funds utilized under JNNURM (INR Cr.) |
|---|---|---|---|---|---|---|
| | | | UIG | BSUP | Total | |
| **1** | NDMC / Delhi | Delhi - >4 million pop. | 699 | 440 | 1140 | 684 |
| **2** | Chennai | >4 million pop. | 820 | 365 | 1185 | 731 |
| **3** | Ahmedabad | >4 million pop. | 653 | 254 | 908 | 818 |
| **4** | Pune | >1 million pop. <4 million pop. | 1322 | 414 | 1736 | 1564 |
| **5** | Jaipur | >1 million pop. <4 million pop. | 183 | 43 | 226 | 226 |
| **6** | Bhopal | >1 million pop. <4 million pop. | 327 | 143 | 470 | 294 |
| **7** | Surat | >1 million pop. <4 million pop. | 723 | 281 | 1004 | 905 |
| **8** | Indore | >1 million pop. <4 million pop. | 210 | 55 | 264 | 264 |
| **9** | Ludhiana | >1 million pop. <4 million pop. | 30 | 25 | 55 | 28 |
| **10** | Bhubaneshwar | <1 million pop. | 185 | 29 | 214 | 100 |

Note. The colour scheme to highlight the selected cities has been followed throughout the chapter to indicate the grouping of cities in terms of their similarity on degree of urbanization.

Source: online data sources, available at http://jnnurmmis.nic.in/, CDPs of selected cities

#### 7.6.1. Observations

1. Most of the cases only 60% fund has been utilized.

2. Unutilized fund: is that excess? Not required for the targeted population? Or the parameters for estimation of fund allocation are not right?

### 7.7. Sector-Wise Funding Pattern under JNNURM: Area Coverage

Table 7.3: Analysis of funding pattern (sector-wise)

| Sr. No. | Selected Common Cities between JNNURM & Smart City Mission for comparative study | Sector-wise Funds Allotted under Different Sub-Missions of JNNURM (Rs. In Crores) *common sectors selected across the cities | | | | | | Project Cost over the Span of (No. of Years) |
|---|---|---|---|---|---|---|---|---|
| | | Water Supply | | | Sewerage | | | |
| | | City | Periphery | Total | City | Periphery | Total | |
| **1** | NDMC / Delhi | 1632 | 0 | 1632 | 2755 | 0 | 2755 | 5 |
| **2** | Chennai | 6321 | 0 | 6321 | 2299 | 0 | 2299 | 7 |
| **3** | Ahmedabad | 254 | 252 | 506 | 400 | 212 | 612 | 6 |
| **4** | Pune | 250 | 0 | 250 | 636 | 0 | 636 | 7 |
| **5** | Jaipur | 210 | 0 | 210 | 186 | 0 | 186 | 7 |
| **6** | Bhopal | 550 | 0 | 550 | 245 | 0 | 245 | 7 |
| **7** | Surat | 257 | 396 | 653 | 389 | 420 | 809 | 7 |
| **8** | Indore | 59.8 | 0 | 60 | 347 | 0 | 347 | 7 |
| **9** | Ludhiana | 35 | 0 | 35 | 488 | 0 | 488 | 6 |
| **10** | Bhubaneshwar | 691 | 0 | 691 | 496 | 0 | 496 | 7 |

Table 7.3 Continued below

| Sr. No. | Selected Common Cities between JNNURM & Smart City Mission for comparative study | Sector-wise Funds Allotted under Different Sub-Missions of JNNURM (Rs. In Crores) *common sectors selected across the cities | | | | | | | | | Project Cost over the Span of (No. of Years) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Storm Water Drainage | | | Solid Waste Management | | | Road & Transportation | | | |
| | | City | Periphery | Total | City | Periphery | Total | City | Periphery | Total | |
| 1 | NDMC / Delhi | 231 | 0 | 231 | 593 | 0 | 593 | 13487 | 0 | 13487 | 5 |
| 2 | Chennai | 1424 | 0 | 1424 | 848 | 0 | 848 | 19504 | 0 | 19504 | 7 |
| 3 | Ahmedabad | 385 | 190 | 575 | 97 | 54 | 151 | 1350 | 2335 | 3685 | 6 |
| 4 | Pune | 850 | 0 | 850 | 161 | 0 | 161 | 2124 | 0 | 2124 | 7 |
| 5 | Jaipur | 0 | 0 | 0 | 13 | 0 | 13 | 480 | 0 | 480 | 7 |
| 6 | Bhopal | 50 | 0 | 50 | 40 | 0 | 40 | 394 | 0 | 394 | 7 |
| 7 | Surat | 55 | 176 | 231 | 8 | 80 | 88 | 1653 | 980 | 2633 | 7 |
| 8 | Indore | 70 | 0 | 70 | 36 | 0 | 36 | 1391 | 0 | 1391 | 7 |
| 9 | Ludhiana | 280 | 0 | 280 | 140 | 0 | 140 | 546 | 0 | 546 | 6 |
| 10 | Bhubaneshwar | 130 | 0 | 130 | 25 | 0 | 25 | 508 | 0 | 508 | 7 |

Source: online data sources, available at http://jnnurmmis.nic.in/, CDPs of selected cities

### 7.7.1. Observation

Except two cities Ahmedabad and Surat, only Municipal limits have been covered for selection of projects to be covered under JNNURM, where in reality all the selected cities have a huge sprawl beyond municipal limits and have a trend to grow further to form densely populated peripheral area.

## 7.8. Analysis of Funding for Each Sector under JNNURM (Water Supply)

Table 7.4. Analysis of funding pattern for water supply sector

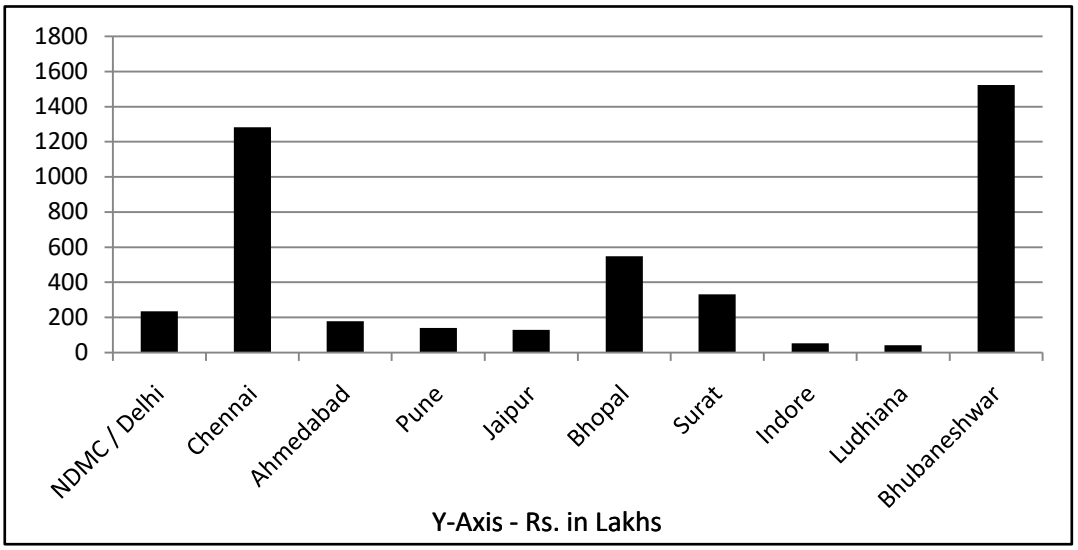
| Sr. No. | Selected Cities | Population as per 2001 Census | Area in sq. k.m. (2001) | Funding for Water Supply (Rs. in Crores) | | | Project Cost over the Span of (No. of Years) | Funding per Anum | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | City | Periphery | Total | | City (Rs. in Crores) | Periphery (Rs. in Crores) | Funding per Capita (Rs. in Lakhs) | Funding per sq. k.m. (Rs. in Lakhs) |
| **1** | NDMC / Delhi | 13850507 | 1483 | 1632 | 0 | 1632 | 5 | 326 | 0 | 236 | 2201057 |
| **2** | Chennai | 7041000 | 1189 | 6321 | 0 | 6321 | 7 | 903 | 0 | 1282 | 7594617 |
| **3** | Ahmedabad | 4709180 | 1330 | 254 | 252 | 506 | 6 | 42 | 42 | 179 | 634047 |
| **4** | Pune | 2538473 | 244 | 250 | 0 | 250 | 7 | 36 | 0 | 141 | 1467238 |
| **5** | Jaipur | 2322000 | 490 | 210 | 0 | 210 | 7 | 30 | 0 | 129 | 612661 |
| **6** | Bhopal | 1433351 | 285 | 550 | 0 | 550 | 7 | 79 | 0 | 548 | 2756892 |
| **7** | Surat | 2811464 | 130 | 257 | 396 | 653 | 7 | 37 | 57 | 332 | 7193795 |
| **8** | Indore | 1639000 | 130 | 60 | 0 | 60 | 7 | 9 | 0 | 52 | 656638 |
| **9** | Ludhiana | 1395467 | 159 | 35 | 0 | 35 | 6 | 6 | 0 | 42 | 366547 |
| **10** | Bhubaneshwar | 648032 | 135 | 691 | 0 | 691 | 7 | 99 | 0 | 1524 | 7314921 |

Source: online data sources, available at http://censusindia.gov.in/, http://jnnurmmis.nic.in/, CDPs of selected cities

The results obtained in terms of funding in water supply sector under various JNNURM projects for selected cities per capita and per sq.k.m. area both for the city and the peripheral area have been further plotted into graph and analysed to check the interrelation between the fund amount w.r.t the city size.

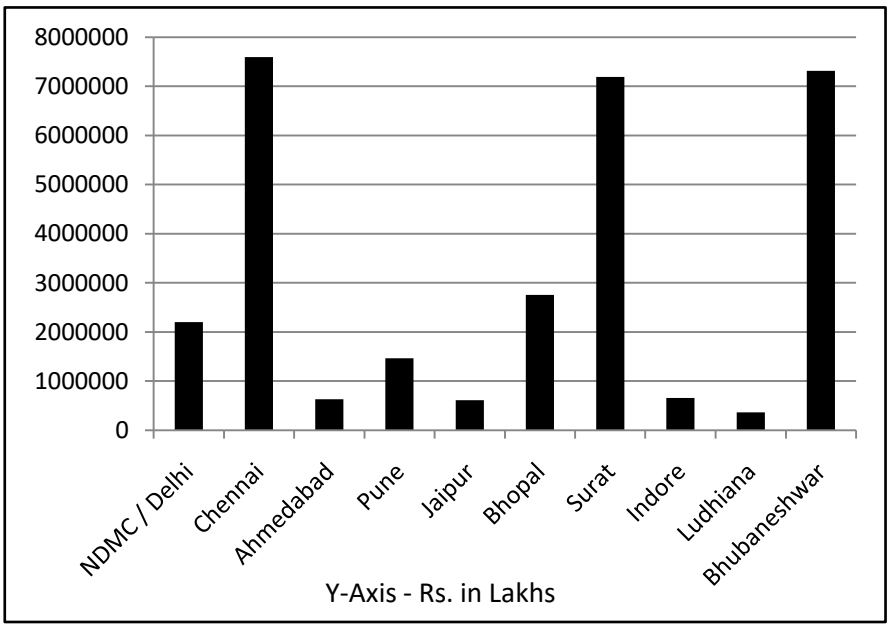
## 7.9. Graphical Analysis of Funding for Water Supply

Figure 7.1. Funding per capita for water supply projects under JNNURM for selected cities




Source: Author

Figure 7.2. Funding per sq.k.m. area for water supply projects under JNNURM for selected cities



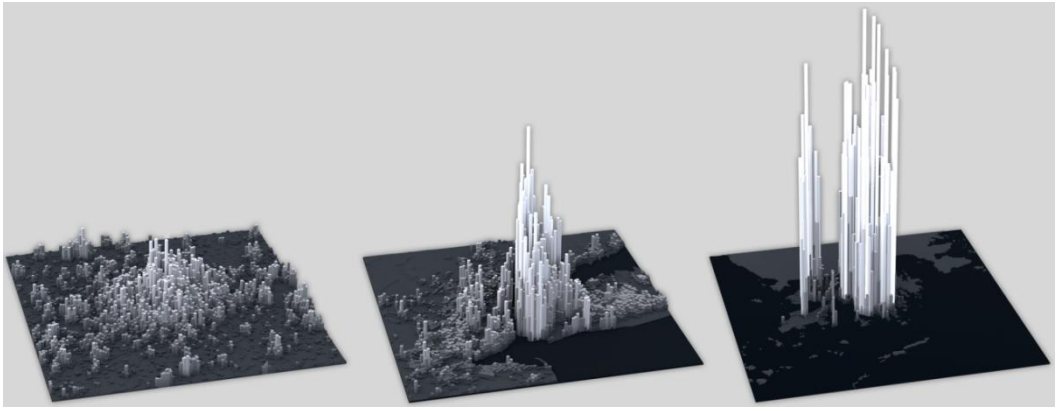

Source: Author

### 7.9.1. Observations from Figure 1 & 2

- Graph showing per year per capita funding (in lakhs) for each city and there is no coherence between its funding and the city's level of urbanization. For example: Chennai being a city having more than 4 million population and Bhubaneshwar being a city of less than 1 million population, are granted equivalent amount of fund for development. As population was the sole criteria behind selection of cities and funding, the amount of funding must be proportionate with the population of the city, which is not been reflected from the graph.
- Graph showing per year per sq. k.m. area funding (in lakhs) for each city and there is no coherence between its funding and the city's level of urbanization. For example: Chennai having an area of 1189 sq. k.m., far bigger than Surat (130 sq. k.m.) and Bhubaneshwar (135 sq. k.m.), still granted equivalent amount of funding. Hence, there is no coherence and interrelation found in between area and funding pattern also.

## 7.10. Inferences: Framework to Establish Relation among Funding & Urbanity of A Settlement

Figure 7.3. Abstraction of area & population link
with nature of urbanity of a city



Source: online data sources, available at https://citygeographics.org/tag/density/

A city and its urbanization cannot be measured only by population / an area (spread). City is a 3-dimensional phenomenon. A certain amount of population (say X) can be spreaded within an area of Y or may be spreaded within an area

of Y+n and there are several variables of any infrastructure sector, measures of which are related with population, area, heights of buildings etc., as reflected in Figure 3. Thus, a certain amount of density can create different urban form in terms of its compactness or sprawlness. Even, if only 'Area' is considered as a determinant of funding calculation, it will be incomplete. Area can consider the effect of water supply variable like 'pipe length', but cannot take consideration of several other variables of water supply sector like 'pressure requirement due to height variations throughout the city', 'selection of pipe diameters' etc.

So, while estimating the total funding for any city, the vertical dimension of the settlement needs to be addressed, which is always missed out in the present practice. Now, F.S.I is one the most important parameter to capture the vertical dimension of a city, which has never been included at the time of estimation of funding. Analyzing the F.S.I component, there are two elements - Area (Floor area / Plot area) and No. of floors. Thinking from a settlement point of view, heights / no. of floors vary. Hence, an average measurement of the same can be considered to address certain variables pertaining to estimation of funding for water supply or similar infrastructural sectors.

Considering the above discussion, it can be inferred that a no. of variables are involved, while estimating the total funding required:

1) The funding per sq. k.m.
2) The total area (where the boundary is delineated across the city and periphery to consider equal distribution of fund throughout the settlement)
3) Avg. no. of floors throughout the city (F.S.I Component)
4) Function of relevant variables (sector-wise), like for water supply the length of pipe network can be one of the variables. These variables are not constant as their values will depend on the structure / morphology / spatial pattern of the city.
5) No. of years (Project Duration for which fund is allotted)

A multiplication of the above can produce the final value for total funding requirement for any specific urban infrastructural sector.

## 7.11. Implications for Practice and Advancement of Research

### 7.11.1. Way Forward: An Approach towards Restructuring the R-U Classification

The analysis is done to find out the interrelationship between the present funding pattern with the demographic and administrative database, if exists. It is observed that the selection of beneficiary towns and cities whether in case of JNNURM or Smart City Mission, is entirely based upon Census definition of 'Urban' realm, specifically for the criteria of population and administrative boundary, within which the projects will be located and applicability for the Statutory Towns only. The analysis also shows that in the present system how disparity exists at different strata / levels:

- Selection of beneficiary towns
- Funding allocation w.r.t administrative boundary
- Funding allocation w.r.t population size of the cities, still no coherence found while comparing among cities.

However, it can be said that the focal issue remains same - the dichotomous definition of 'Urban' area as per Census. The impacts of this phenomenon are analyzed in the chapter and it infers that the relationship of an effective funding pattern for cities and towns can only be achieved, if the definition (the base of all calculations) can be modified. Hence, it is essential to delineate the settlements as the most urbanized to the least and thus grouping them as clusters of settlements having similar characteristics. This clustering should delineate a group of settlements, which have homogeneity amongst themselves within the cluster group and should be heterogeneous when compared between the clusters. Such clustering of settlements under the umbrella of present classification of Census will add another layer further in terms of typological categorization of settlements, which will be helpful for various policy formulation, equity in funding pattern and for the benefit of spatial planning process as a whole (Firoz, 2014).

Currently for all spatial planning process, the unit of assessment is taken as a local body (Municipality, Corporation or Village Panchayats). Hence when preparing Master Plans, and City Development Strategies, the boundary of analysis is taken as the boundary of the administrative unit. However, in reality such a boundary does not exist (Firoz, 2014). Hence the best procedure for spatial planning is to adopt a regional planning approach (long term spatial planning process) for selected regions and then prepare a Master Plan/Development Plan for the local body with in the region, based on the broad frame work of the Regional Plan. Further, the step towards such clustering of settlements is to determine the parameters / indicators, which contribute towards measurement of the type / nature of 'Urban Tendency' or 'Rural Tendency'. The

similar cases of typology delineation by various studies like PLUREL, ESPON, OECD in European context needs to be studied and the parameters used for determining the settlement typology is required to be explored. Apart from these literature reviews, certain other indicators also may be added, which are found relevant specifically for Indian context. These indicators can be analyzed further and settlements can be grouped accordingly. As the settlements will be further classified apart from the conventional 'Urban' and 'Rural' realms, spatial planning becomes easier and efficient. Such typological classification also helps for better infrastructure and resource allocation planning, investment planning, land-use and environmental planning and especially for better fund allocation for urban governance with a sense of fairness and justice.

## 7.12. Concluding Remarks

As per the current practice in the context of Indian cities, the major drawback lies in the definition of 'urban' and 'rural' realms itself, for which the overall estimation of fund amount and also the beneficiary areas / coverage of fund for projects are being wrong. Thus, in the analysis it is observed that there is no coherence in between the degree of urbanization of a city with the fund allocated / utilized for it. Primarily there are two issues to be resolved on urgent basis: first, the focus area for fund allocation towards the statutory towns only, which is due to the census definition of 'urban' in a dichotomous fashion, for which nos. of census towns / peripheral urban areas are being neglected though they contribute larger percentage of urban population at present scenario in the country, secondly, estimating the fund amount on the basis of population and area under administrative jurisdiction - these two parameters are being wrong, as urbanization being a 3-dimensional phenomenon, estimation of funding requirement should be calculated on the basis of other physical planning parameters too. Therefore, the link between the degree of urbanization of a specific place and its funding requirement for future development needs to be established to create a comprehensive structure for planning, governance, finance and implementation.

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# CHAPTER 8. PLANNING PROPOSAL TO DELINEATE PERI-URBAN SETTLEMENT TYPOLOGY AND FOR FUTURISTIC MODEL OF PERI-URBAN INTERFACE AND ITS APPLICABILITY AT POLICY LEVEL

## 8.1. Introduction

From the understanding of peri-urban transformation process, definition & classification system and funding pattern for development projects, this chapter attempts to identify the planning parameters first, on the basis of which homogeneity among the peri-urban settlements around the city of Chandigarh can be analyzed, clustering of settlements can be formed and accordingly the settlement typologies can be defined and delineated in the proposed framework. Further it formulates a futuristic model for delineation of peri-urban interface in the context of Chandigarh region, on the basis of specific planning parameter / indicator / variable evolved from previous study, analysis and historical dataset, which contribute towards measurement of interrelationship among them, understand their degree of association and accordingly frame a probabilistic mathematical model to predict future peri-urban interfaces / new growth centres around a major urban area. From previous study and analysis it is observed that in the current practice in the context of Indian cities, the major drawback lies in the definition of 'urban' and 'rural' realms itself, for which the Master Plan preparation process for cities becomes ineffective, even the fund estimation & distribution for urban development projects appears inappropriate. While preparing a Master Plan for city, the peripheral areas are never taken into consideration; which leads towards unplanned, haphazard, unregulated and inorganic growth there. Thus it is felt that considering Regional Planning framework could be one of the effective ways to resolve the emerging issues in spatial planning for urban areas and their peripheries. Such framework will consider the city core along with its future peri-urban areas, predict them through proposed variables and model and include them in the planning policies for better infrastructure, fund allocation and urban governance.

## 8.2. The Peri-Urban Growth Dynamics at Chandigarh

Traditionally across the world, the hierarchy of settlements appear as 'Urban' and 'Rural', which are defined by parameters like population, density and occupational structure. However, this conventional method of classification has

tremendous drawback in addressing the Peri-Urban area, lying in-between. Urban growth dynamics at peri-urban interfaces and their interaction with multiple variables are intrinsically complex and hence are a potential field of contemporary research in urban planning (Shaw, 2005). This thesis had selected a very significant and unique case of peripheral development, Chandigarh, where its peripheral towns falling within 16 k.m. radius boundary, which includes towns of different states like, Haryana, Punjab and Himachal Pradesh. The research began to study various transformations happening in these peripheral towns in the span of last decade, the factors behind such transformations and their implications on the parent city, Chandigarh. It is also observed that the peri-urban area is the most dynamic realm in the urban-rural system, which is subjected to continuous transformation in a span of time, thus difficult to delineate this ever changing area. *"The proposed categorization for peri-urban settlements may be included in Census of the country in future, which may help in reducing issues in urban planning, policy making and governance level and as a whole distribution of funds for urban development and projects across settlements can be ensured with a sense of justice and fairness"* (Bhagat, 2005).

In the current practice in India, the major drawback lies in the definition & delineation of 'Rural-Urban', for which the Master Plan preparation process for cities becomes ineffective, even the fund estimation & distribution for urban development projects appears inappropriate. The research began to study various transformations happening in the peripheral towns around the selected case city in the span of last decade, the factors behind such transformations and their implications on the parent city, Chandigarh. However it is felt that formation of settlement clusters / typologies and their delineation through a statutory Master Plan and relevant planning policy, to govern the unregulated growth at peri-urban realm is the need of the hour (Saxena, Sharma 2015). Such detailed study and analysis has created a strong base to identify the determinants governing the peripheral growth. Several variables have also been identified from previous literature studies, where the nature of transformation found similar. To derive the peri-urban settlement typologies for Chandigarh Region, eleven sets of variables / parameters under four major aspects along with their several sub-sets / indicators are selected based on the studies carried out by several researchers for different cities and towns of India and abroad (Budiyantini, Pratiwi, 2016; Census of India 2001 & 2011; Firoz, Banerji, Sen, 2014 & Goncalves, Gomes, Ezequiel, Moreira, Ramos, 2017) as well as context specific studies carried out by the author. The analysis of interrelation of these variables leads towards clustering of the

peripheral settlements and also framing mathematical model to predict the future peri-urban areas while preparing Master Plans for cities. As a whole, this chapter attempts to resolve the emerging issues of peri-urban growth as identified earlier, for the case of Chandigarh to demonstrate, analyses the interrelationship among various parameters responsible for the phenomenon of peri-urbanization and finally proposes mathematical model to forecast such growth centres in future to ensure planned urbanization at such places.

## 8.3. Background Overview

Due to its dynamic nature, prediction in the field of spatial planning is difficult. Urban growth / sprawl are the most commonly discussed in today's spatial planning practices, especially for the developing countries like India. As urban growth is a continuous process, temporal in nature, it is being very difficult to measure it. Hence we observe inadequacy at every strata of urban system. In this scenario, as explained by Batty, 1976; *"Urban Modelling has emerged as a revolutionary thought, where the boundaries between traditional disciplines are blurring in response to the need for interdisciplinary cooperation".* Urban Modelling helps to design, develop and operate probabilistic mathematical models, which represents various phenomenon of urbanization happening in towns, cities or metropolitan regions. Till date, conventionally various planning theories are being used to visualize the future cities and prepare their Master Plans. However, it has never been quantified / predicted. In such circumstances, *"....Urban Modelling helps to predict, prescribe and invent the urban future. It overcomes the limitations of planning theory and demonstrates the potential of simulation"* (Batty, 1976). Models are simplifications of reality - theoretical abstractions that represent systems in such a way that essential features crucial to the theory and its application are identified and highlighted (Batty, 2009). In this context, Urban Modelling, evolved from mathematical equations are simulations of the way cities may grow, on the basis of historical dataset. In the present era, there is an urgent need to develop futuristic models for complex urban system to predict, simulate the future scenario, which will help to prepare effective master plans for cities having forecasting capabilities. As stated by Batty, 1976; *"The idea of designing a working model of the city with the notion that future plans for the city can be simulated and evaluated on the computer is an appealing and immensely exciting concept"*.

With this overview on Urban Modelling, this chapter attempts to formulate mathematical model for future predictions of peri-urban interfaces.

## 8.4. Discussion on Methodology

### 8.4.1. Selection of Sample Settlements, Overview of Data Sources and Methods

As discussed earlier, a total of 16 peripheral towns fall within the 16 k.m. radius peripheral boundary around Chandigarh have been taken into consideration to frame the proposed clustering as well as model. This includes 2 settlements at immediate periphery of Chandigarh Municipal Corporation, 7 settlements in the state of Punjab and 4 settlements in the state of Haryana. 3 other settlements in the state of Himachal Pradesh also lies just adjacent to the 16 k.m. peripheral boundary of UT and contributes significantly in the peripheral transformations as per the previous study and analysis of the research. Hence, they are also considered for the proposed scenario.

The entire dataset has been collected from both primary and secondary sources, includes household survey as well as data from various govt. departments and authorities of these 3 states along with Chandigarh UT, as elaborated later (Draft Chandigarh Master Plan - 2031, 2013). The data has been tabulated against each of the identified variables for these 16 selected peripheral towns. The analysis has been conducted in two phases:

1) The range of values against each of the variables has been analyzed through graphical method, spatially mapped, leading towards clustering of settlements.
2) The selected variable is put for statistical analysis, leading towards futuristic model. Three different statistical methods – Linear & Quadratic Regression Model and Matrix method have been applied, using analytical software MINITAB; to evaluate that how the selected parameter varies with the location of a peripheral settlement and through which equation, they can be defined better. Comparing the outputs from various methods applied, the chapter concludes with a hierarchy of settlement structure using a common planning parameter.

### 8.4.2. Methods of Data Analysis

For the purpose of research, 2 parameters have been selected, considering significant contributor towards peripheral transformations. Three statistical methods have been adopted here to compare the output / results based on the experimental values (historical data / collected data) and finally to formulate the model for delineation of peri-urban interfaces.

**1) Linear Regression Model –**

- **Definition –** Simple linear regression is a statistical method that allows us to summarize and study relationships between two continuous (quantitative) variables: One variable, denoted X, is regarded as the predictor, explanatory, or independent variable and the other variable, denoted Y, is regarded as the response, outcome, or dependent variable.
- **Formula – A linear regression line is expressed through the equation like:**

$$Y = a + bX, \qquad (1)$$

  here X is an explanatory / independent variable and Y is the dependent variable. b is denoted as the slope of the line, and a is the intercept (when X = 0, a becomes the value of Y).
- **Interpretation of the formula –** As explained by statistician, Douglas Montgomery, "*The most common method for fitting a regression line is the method of least-squares. This method calculates the best-fitting line for the observed data by minimizing the sum of the squares of the vertical deviations from each data point to the line (if a point lies on the fitted line exactly, then its vertical deviation is 0). Because the deviations are first squared, then summed, there are no cancellations between positive and negative values".*
- **Applicability of the model –** The model is applicable when we want to establish relationship between two variables. The four conditions, which explains "the simple linear regression model" is summarized below:
  - The mean of the response, $E(Y_i)$, at each value of the predictor, $X_i$, is a **Linear function** of the $X_i$.
  - The errors, $\varepsilon_i$, are **Independent**.

- The errors, $\varepsilon_i$, at each value of the predictor, $X_i$, are **Normally distributed**.
- The errors, $\varepsilon_i$, at each value of the predictor, $X_i$, have **Equal variances** (denoted $\sigma^2$).

- **Interpretation of the model output –** Regression analysis generates an equation to describe the statistical relationship between one or more predictor variables and the response variable. The 'p-value' for each term tests the null hypothesis that the coefficient is equal to zero (no effect). A low p-value (< 0.05) indicates that we can reject the null hypothesis. In other words, a predictor that has a low p-value is likely to be a meaningful addition to our model because changes in the predictor's value are related to changes in the response variable. Conversely, a larger (insignificant) p-value suggests that changes in the predictor are not associated with changes in the response.

**2) Quadratic Regression Model –**

- **Definition –** A quadratic regression is the statistical method to establish an equation of parabola that best fits a particular set of data. This is expressed through an equation like:

$$Y=aX^2 + bX + c, \qquad (2)$$

here $a \neq 0$. The least square method is the best way to establish this equation manually, which means that the values of a, b and c should be found in such way that the squared vertical distance between each point ($X_i$, $Y_i$) and the quadratic curve $Y=Ax^2+bX+cY=Ax^2+bX+c$ is minimal.

- **Interpretation of the formula –** As explained by statistician, Douglas Montgomery, *"The interpretation of a quadratic equation is highly dependent on the context. One possible context which occurs commonly is when the minimum X value is zero or near zero and negative value is impossible. In this situation, the intercept, c, represents the estimated value of Y when X = 0. The interpretation of the quadratic term, a, depends on whether the linear term, b, is positive or negative".*

- **Applicability of the model –** This model is applicable when the data points are non-linear in nature.
- **Interpretation of the model output –** The model gives similar output like Simple Linear Regression.

**3) Matrix Method –**

- **Definition –** As explained by statistician, Douglas Montgomery, *"A matrix formulation of the multiple regression model comes while in the multiple regression setting, because of the potentially large number of predictors, it is more efficient to use matrices to define the regression model and the subsequent analyses".* In this research, the basic matrix algebra is applied, as well as some of the more important multiple regression formulas in matrix form, which are found relevant in this research. Considering the following simple linear regression function:

$$Y_i = \beta_0+\beta_1X_i+\epsilon_i, \text{ for } i=1, \ldots\ldots n \qquad (3)$$

If considered i = 1, ... n, n no. of equations are obtained:

$$Y_1Y_2{:}Y_n = \beta_0+\beta_1X_1+\epsilon_1 = \beta_0+\beta_1X_2+\epsilon_2 = \beta_0+\beta_1X_n+\epsilon_n, \qquad (4)$$

Now it is observed that there is a pattern which is emerging out from the above form of equation. By taking advantage of this pattern, as an alternative of the above simple linear regression function, we can formulate it in matrix notation:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ \vdots & \vdots \\ 1 & x_n \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix}$$

$$Y = X\beta + \varepsilon$$

It means that as an alternative of writing out the n equations, if matrix notation is used, one simple linear regression function can be reduced to a very simple form of equation:

$$Y = X\beta + \epsilon, \qquad (5)$$

where, X is expressed as **n × 2** matrix, Y is expressed as **n × 1** column vector, β is expressed as **2 × 1** column vector, and ε is an **n × 1** column vector. The matrix X and vector β are multiplied together using the techniques of matrix multiplication and the vector Xβ is added to the vector ε using the techniques of matrix addition.

So, clearly the **least square normal equations** can be expressed in matrix form as

$$X^T X\hat{b} = X^T y$$

Therefore the regression coefficients can be estimated by

$$\hat{b} = \left(X^T X\right)^{-1} X^T y$$

So, the regression model can be written as

$\hat{y} = X\left(X^T X\right)^{-1} X^T y = Hy$, where $H = X\left(X^T X\right)^{-1} X^T$ is known as the 'hat' matrix, i.e. the matrix that converts observed values of $y$ into vector of fitted values $\hat{y}$.

- $H$ is symmetric, i.e $H = H^T$, so that $h_{ij} = h_{ji}$.
- $H$ is idempotent, i.e. $H^2 = H^T H = H$.

- **Formula –** as described earlier.
- **Interpretation of the formula –** The interpretation of the formula is as similar as Simple Linear Regression.
- **Applicability of the model –** The application of this model is similar to Simple Linear Regression.
- **Interpretation of the model output –** The model gives similar output like Simple Linear Regression.

All the above stated statistical analysis is done over the relevant dataset of the research using **statistical analytical software, 'MINITAB, Version 17'.**

## 8.5. Data Collection and Study

### 8.5.1. Physical Dimension of the Study Area

The study is conducted in the context of Chandigarh and its periphery. The study, survey and analysis of the periphery includes the emerging settlements within the 16 k.m. boundary of Chandigarh UT and few other settlements in the state of Himachal Pradesh lies just adjacent to it and creates

impact in the transformation of peripheral area. The settlements are shown in the Map below (Map 8.1).

### 8.5.2. Aspects / Dimensions, Variables and their Respective Indicators Selected for Deriving Futuristic Model for Peri-Urban Interface

As explained in the previous chapter, to create peri-urban settlement typologies, an approach has been taken to determine the parameters / indicators, which contribute towards measurement of the type / nature of 'Urban Tendency' or 'Rural Tendency' of the settlement. The similar cases of typology delineation by various studies like PLUREL, ESPON, OECD in European context is studied (OECD Regional Typology, 2011) and the parameters used for determining the settlement typology is explored. Apart from these literature reviews, certain other indicators are also added, which are found relevant specifically for Indian context. In the broader way, the parameters found are classified into 4 major aspects / dimensions - Physical, Social, Economic and Governance, under which the variables are determined. The variables are further measured by nos. of indicators as appropriate. All these indicators along with their sources are listed in the Table below (Table 8.1).

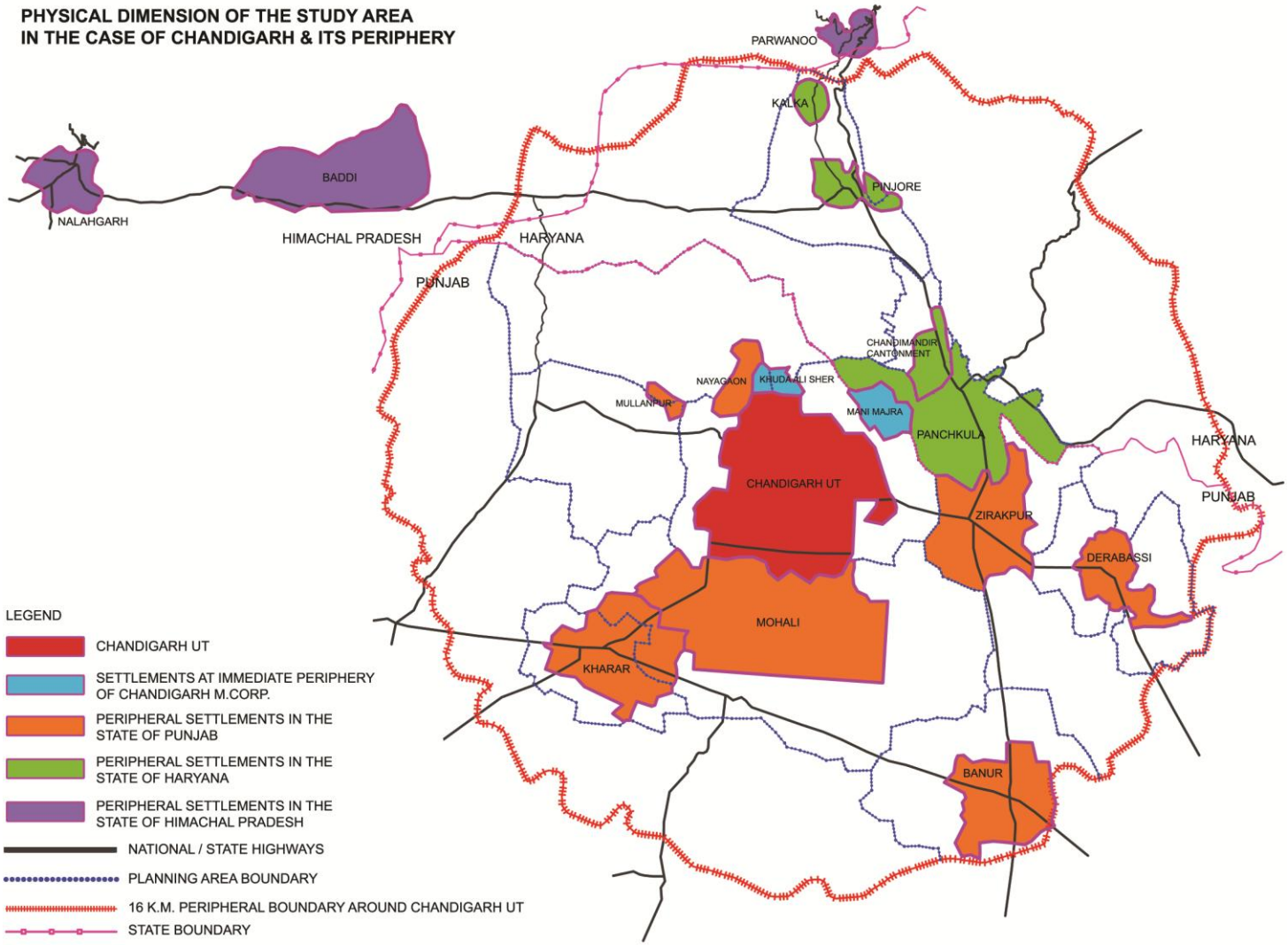
### 8.5.3. Identification of Quantifiable and Non-Quantifiable Indicators for Deriving Futuristic Model for Peri-Urban Interface

The indicators are further categorized in terms of method of quantification, if possible. Certain planning parameters are found non-quantifiable using currently available planning tools and dataset of the context. This may be considered in future research, so that these indicators can be included in the process of classification of peri-urban realms. The selected indicators along with their source of data collection are mentioned in the table below (Table 8.2).

### 8.5.4. The Quantifiable Indicators and their Respective Values for Selected Peripheral Settlements within 16 k.m. Boundary of Chandigarh UT

Data has been collected for each of the selected quantifiable indicators against each of the peripheral settlements and is listed in the table below (Table 8.3). The units, in which data is collected / measured, mentioned in the table itself.

Map 8.1: Physical dimension of the study area




Source: Author, 2016

Table 8.1: List of aspect / dimension, variables and their indicators for deriving peri-urban typology

| Sl. No. | Aspect / Dimension | Variables | Indicators (I) | Sources |
|---|---|---|---|---|
| **1-i** | **Physical** | **Spatial Planning** | % of Houses Located in Main Built-Up Area (HBUA) | Author's own research |
| | | | Distance from the Nearest Core Urban Area (DCUA) | Author's own research |
| | | | Distance between Main BUA & Separate Area (DBMS) | Author's own research |
| | | | Contiguity of Houses - Avg. Distance between Houses (DBH) | Author's own research |
| **1-ii** | | **Land-Use / Land Cover** | Change in Area between 2001 and 2011 (%) (CA) | Author's own research |
| | | | Residential Land-Use Changes between 2001 and 2011 (%) (RLUC) | Author's own research |
| | | | Land Cover Variety - Ratio of Built v/s Open (RBO) (1:x) | Author's own research |
| | | | Area of agricultural land (%) (AL) | Author's own research |
| | | | Area of non-agricultural land (%) (NAL) | Author's own research |
| **1-iii** | | **Density** | Housing Density (Residential Units / sq. k.m.) (HD) | Budiyantini, Y., Pratiwi, V. (2016), Goncalves, J., Gomes, M.C., Ezequiel, S. & Moreira, F. (2017) |
| | | | Population Density (People per sq.k.m.) (PD) - 2011 Census | Already existing in Census, GoI |
| | | | Household Density (HHs per sq.k.m.) (HHD) - 2011 Census | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| **1-iv** | | **Natural Elements** | Change (Increase / Decrease) in Green Cover between 2001 and 2011 (%) (CGC) | Author's own research |
| | | | Change (Increase / Decrease) in Area / Length of Water Courses between 2001 and 2011 (%) (CWC) | Author's own research |
| | | | % of Area Occupied by Green Elements / Green Covers (includes all kind of open spaces) (GC) | Goncalves, J., Gomes, M.C., Ezequiel, S. & Moreira, F. (2017) |
| **1-v** | | **Mobility / Accessibility** | Car Dependency/1000 pop. (CD) | Author's own research |
| | | | Travel Time in Public Transport to the Core Urban Area (min) (TTPC) | Goncalves, J., Gomes, M.C., Ezequiel, S. & Moreira, F. (2017) |
| | | | Commuting - % of Total Pop. Commute to Core City for Work / Study / Other Purposes (TPC) | Author's own research |
| **1-vi** | | **Road** | Black Road Length/1000 pop. | Author's own research |

| Sl. No. | Aspect / Dimension | Variables | Indicators (I) | Sources |
|---|---|---|---|---|
| | | **Infrastructure (RI)** | | |
| | | | Length of Surfaced Road v/s Length of Unsurfaced Road - Ratio | |
| | | | Ratio of Asphalt Roads to the Total Area of Roads | Budiyantini, Y., Pratiwi, V. (2016) |
| | | | Ratio of Paved Roads to the Total Area of Roads | |
| | | | Road Density/1000 pop. | Author's own research |
| **1-vii** | | **Social / Civic Infrastructure (CI)** | Nursery and Primary Schools | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| | | **Educational** | Senior Secondary School | |
| | | | College Campus | Author's own research |
| | | **Health Care** | Hospital (500 / 200 / 100 bedded) | Budiyantini, Y., Pratiwi, V. (2016) |
| | | | Primary Health Centre / Poly-clinic | Author's own research |
| | | | Nursing home / Child Welfare | |
| | | | Dispensary | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| | | **Socio-Cultural Facilities** | Sports Facilities | Author's own research |
| | | | Library and Community Hall | Author's own research |
| | | | Recreation Club | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| | | | Art & Cultural Centre | Author's own research |
| | | | Meditation & Spiritual Centre | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| | | **Other Civic Needs** | Banks | Author's own research |
| | | | Local Everyday Shops | Author's own research |
| | | | Police Post | Author's own research |
| | | | Fire Station | Author's own research |
| **1-viii** | | **Communication and Information Facility (CIF)** | Telephone Connections /1000 pop. | Author's own research |
| | | | No. of Post Offices and Private Couriers | |

| Sl. No. | Aspect / Dimension | Variables | Indicators (I) | Sources |
|---|---|---|---|---|
| **1-ix** | | **Physical & Housing Infrastructure (HI)** | % of Houses Electrified | Author's own research |
| | | **Housing** | % of Pacca Houses | |
| | | **Water Supply** | Piped water supply connections (Coverage) | Goncalves, J., Gomes, M.C., Ezequiel, S. & Moreira, F. (2017) |
| | | | Supply of water (Per capita) | |
| | | | Provision of metering of water connections | |
| | | | Provision of non-revenue water (NRW) | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| | | | Time period of water supply | |
| | | | Cost recovery in water supply and sewerage services | |
| | | **Sewage Management** | Coverage of Toilets | |
| | | | Coverage of sewerage network | Author's own research |
| | | | Adequacy of sewage treatment capacity | |
| | | | Extent of Reuse and Recycling of Waste Water | |
| | | **Solid Waste Management** | Household level coverage of solid waste management services services | |
| | | | Efficiency of Collection of Municipal SW | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| | | | Extent of Segregation Of Municipal SW | |
| | | | Extent of municipal solid waste recovered | |
| | | | Extent of scientific disposal of municipal solid waste | |
| | | | Cost Recovery in SWM Services | |
| | | **Drainage** | Coverage of Storm Water Drainage Network | Author's own research |
| **2-i** | **Social** | **Demography** | Sex Ratio (SR) | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| | | | Dependency Ratio (DR) | Budiyantini, Y., Pratiwi, V. (2016) |
| | | | Population (P) - 2011 Census | Already existing in Census, GoI |
| | | | Growth Rate of Population 2001-2011 (%) (GRP) | Author's own research |
| | | | Household Size (HHS) - 2011 Census | Author's own research |

| Sl. No. | Aspect / Dimension | Variables | Indicators (I) | Sources |
|---|---|---|---|---|
| **2-ii** | | **Labour Force Characteristics** | Main Working population, Marginal Working population (Male & Female) (MW & MRW) | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| | | | Non Working population (Male & Female) (NW) | |
| **2-iii** | | **Live Stock (LS)** | Concentration of Live Stock | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| **2-iv** | | **Literacy (LT)** | Percentage of Literates (Male, Female & Total) | Firoz, C.M., Banerji, H. & Sen, J. (2014) |
| **2-v** | | **Community Dimension / Social Cohesion** | % of Joint Family Houses per 1000 pop. (JFH) | Goncalves, J., Gomes, M.C., Ezequiel, S. & Moreira, F. (2017) |
| | | | % of Multicommunal Agglomeration (MCA) | Author's own research |
| | | | % of Single / Nuclear Family Houses per 1000 pop. (SFH) | Goncalves, J., Gomes, M.C., Ezequiel, S. & Moreira, F. (2017) |
| **3-i** | **Economic** | **Sector-wise Employment** | Employment in Agricultural Sector, % of working pop. (Male, Female and Total) (EAS) | Author's own research, Goncalves, J., Gomes, M.C., Ezequiel, S. & Moreira, F. (2017), Firoz, C.M., Banerji, H. & Sen, J. (2014), Budiyantini, Y., Pratiwi, V. (2016), Already existing in Census, GoI |
| | | | Employment in Non-Agricultural / Manufacturing / Other Sector, % of working pop. (Male, Female and Total) (ENAS) | |
| **4-i** | **Governance** | | Present Administrative Body | Author's own research, Already existing in Census, GoI |

Source: As mentioned in the table

Table 8.2: List of quantifiable & non-quantifiable indicators for deriving peri-urban typology

| Sl. No. | Aspect / Dimension | Variables | Non-Quantifiable Indicators (NQI) | Quantifiable Indicators (QI) | Data Collection Source of Quantifiable Indicators (QI) for Urban Areas |
|---|---|---|---|---|---|
| **1-i** | **Physical** | **Spatial Planning** | % of Houses Located in Main Built-Up Area (HBUA) | Distance from the Nearest Core Urban Area (DCUA) | Arc GIS Map |
| | | | Contiguity of Houses - Avg. Distance between Houses (DBH) | Distance between Main BUA & Separate Area (DBMS) | Arc GIS Map |
| **1-ii** | | **Land-Use / Land Cover** | | Change in Area between 2001 and 2011 (%) (CA) | Census |
| | | | | Residential Land-Use Changes between 2001 and 2011 (%) (RLUC) | Urban Development Authority |
| | | | | Land Cover Variety - Ratio of Built v/s Open (RBO) (1:x) | |

| Sl. No. | Aspect / Dimension | Variables | Non-Quantifiable Indicators (NQI) | Quantifiable Indicators (QI) | Data Collection Source of Quantifiable Indicators (QI) for Urban Areas |
|---|---|---|---|---|---|
| | | | | Area of agricultural land (%) (AL) | |
| | | | | Area of non-agricultural land (%) (NAL) | |
| **1-iii** | | **Density** | Housing Density (Residential Units / sq. k.m.) (HD) | Population Density (People per sq.k.m.) (PD) - 2011 Census | Census |
| | | | | Household Density (HHs per sq.k.m.) (HHD) - 2011 Census | Census |
| **1-iv** | | **Natural Elements** | Change (Increase / Decrease) in Green Cover between 2001 and 2011 (%) (CGC) | % of Area Occupied by Green Elements / Green Covers (includes all kind of open spaces) (GC) | Urban Development Authority |
| | | | Change (Increase / Decrease) in Area / Length of Water Courses between 2001 and 2011 (%) (CWC) | | |
| **1-v** | | **Mobility / Accessibility** | Car Dependency/1000 pop. (CD) | Travel Time in Public Transport to the Core Urban Area (min) (TTPC) | Household Survey by Author, RITES Study Report on Comprehensive Mobility Plan for Chandigarh Urban Complex |
| | | | | Commuting - % of Total Pop. Commute to Core City for Work / Study / Other Purposes (TPC) | |
| **1-vi** | | **Road Infrastructure (RI)** | Black Road Length/1000 pop. | | |
| | | | Length of Surfaced Road v/s Length of Unsurfaced Road - Ratio | | |
| | | | Ratio of Asphalt Roads to the Total Area of Roads | | |
| | | | Ratio of Paved Roads to the Total Area of Roads | | |
| | | | Road Density/1000 pop. | | |
| **1-vii** | | **Social / Civic Infrastructure (CI)** | | Nursery and Primary Schools | Urban Local Body (ULB), Household Survey by Author |
| | | **Educational** | | Senior Secondary School | |
| | | | | College Campus | |
| | | **Health Care** | | Hospital (500 / 200 / 100 bedded) | |

| Sl. No. | Aspect / Dimension | Variables | Non-Quantifiable Indicators (NQI) | Quantifiable Indicators (QI) | Data Collection Source of Quantifiable Indicators (QI) for Urban Areas |
|---|---|---|---|---|---|
| | | | | Primary Health Centre / Poly-clinic | |
| | | | | Nursing home / Child Welfare | |
| | | | | Dispensary | |
| | | **Socio-Cultural Facilites** | Sports Facilites | Library and Community Hall | |
| | | | | Recreation Club | |
| | | | | Art & Cultural Centre | |
| | | | | Meditation & Spiritual Centre | |
| | | **Other Civic Needs** | Banks | Police Post | |
| | | | Local Everyday Shops | Fire Station | |
| **1-viii** | | **Communication and Information Facility (CIF)** | Telephone Connections /1000 pop. | | |
| | | | No. of Post Offices and Private Couriers | | |
| **1-ix** | | **Physical & Housing Infrastructure (HI)** | % of Houses Electrified | % of Pacca Houses | Household Survey by Author, Housing Development Board |
| | | **Water Supply** | | Piped water supply connections (Coverage) | Dept. of Water Supply & Sanitation, Public Health & Engg. Dept., Household Survey by Author |
| | | | | Supply of water (Per capita) | |
| | | | | Provision of metering of water connections | |
| | | | | Provision of non-revenue water (NRW) | |
| | | | | Time period of water supply | |
| | | | | Cost recovery in water supply and sewerage services | |
| | | **Sewage Management** | | Coverage of Toilets | |
| | | | | Coverage of sewerage network | |
| | | | | Adequacy of sewage treatment capacity | |
| | | | | Extent of Reuse and Recycling of Waste Water | |
| | | **Solid Waste** | | Household level coverage of solid waste | |

| Sl. No. | Aspect / Dimension | Variables | Non-Quantifiable Indicators (NQI) | Quantifiable Indicators (QI) | Data Collection Source of Quantifiable Indicators (QI) for Urban Areas |
|---|---|---|---|---|---|
| | | **Management** | | management services<br>services | |
| | | | | Efficiency of Collection of Municipal SW | |
| | | | | Extent of Segregation Of Municipal SW | |
| | | | | Extent of municipal solid waste recovered | |
| | | | | Extent of scientific disposal of municipal solid waste | |
| | | | | Cost Recovery in SWM Services | |
| | | **Drainage** | | Coverage of Storm Water Drainage Network | |
| **2-i** | **Social** | **Demography** | Sex Ratio (SR) | Population (P) - 2011 Census | Census |
| | | | Dependency Ratio (DR) | Growth Rate of Population 2001-2011 (%) (GRP) | |
| | | | | Household Size (HHS) - 2011 Census | |
| **2-ii** | | **Labour Force Characteristics** | Main Working population, Marginal Working population (Male & Female) (MW & MRW) | | |
| | | | Non Working population (Male & Female) (NW) | | |
| **2-iii** | | **Live Stock (LS)** | Concentration of Live Stock | | |
| **2-iv** | | **Literacy (LT)** | Percentage of Literates (Male, Female & Total) | | |
| **2-v** | | **Community Dimension / Social Cohesion** | % of Joint Family Houses per 1000 pop. (JFH) | % of Multicommunal Agglomeration (MCA) | Household Survey by Author |
| | | | % of Single / Nuclear Family Houses per 1000 pop. (SFH) | | |
| **3-i** | **Economic** | **Sector-wise Employment** | | Employment in Agricultural Sector, % of working pop. (Male, Female and Total) (EAS) | Census |
| | | | | Employment in Non-Agricultural / Manufacturing / Other Sector, % of working pop. (Male, Female and Total) (ENAS) | |
| **4-i** | **Governance** | | | Present Administrative Body | Census |

Source: As mentioned in the table

Table 8.3: Indicators & peripheral settlements value matrix

| LIST OF SELECTED INDICATORS FOR DERIVING PERI-URBAN TYPOLOGY | | Chandigarh UT | PERIPHERAL SETTLEMENTS WITHIN / AROUND 16 K.M. BOUNDARY FROM CHANDIGARH UT | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Indicators | | Settlements at Immediate Periphery of Chandigarh M.Corp. | | Peripheral Settlements in Punjab | | | | | | | Peripheral Settlements in Haryana | | | | Peripheral Settlements in Himachal Pradesh | | |
| | | | Mani Majra | Khuda Alisher | Mohali | Zirakpur | Kharar | Nayagaon | Derabassi | Banur | Mullanpur | Panchkula | Pinjore | Kalka | Chandimandir Cantonment | Nalagarh | Baddi | Parwanoo |
| 1-i | Distance from the Nearest Core Urban Area (DCUA) | - | 8 k.m. | 6 k.m. | 9.5 k.m. | 13 k.m. | 16 k.m. | 6 k.m. | 22 k.m. | 32 k.m. | 9 k.m. | 12 k.m. | 25 k.m. | 29.5 k.m. | 14 k.m. | 46 k.m. | 36 k.m. | 36.5 k.m. |
| | Distance between Main BUA & Separate Area (DBMS) | 1.5 k.m. | 0.4 k.m. | - | 3 k.m. | 1.5 k.m. | 1.2 k.m. | 0.7 k.m. | 1.2 k.m. | - | 0.7 k.m. | 1.4 k.m. | 0.5 k.m. | 0.5 k.m. | 1.2 k.m. | 1.5 k.m. | 2 k.m. | 1.2 k.m. |
| 1-ii | Change in Area between 2001 and 2011 (%) (CA) | 14% | 14% | 10% | 8 | 40% | 32 | 8% | 25 | 50 | 18% | 60 | 50 | 25 | 6% | 19.50% | 24.00 % | 15% |
| | Residential Land-Use Changes between 2001 and 2011 (%) (RLUC) | 12% | 10% | 8% | 10 | 30% | 27% | 6% | 24.50% | 15% | 8% | 15 | 25% | 15% | 1.50% | 10% | 15% | 12% |
| | Land Cover Variety - Ratio of Built v/s Open (RBO) (1:x) | 0.43 | 2.6 | 3.2 | 0.27 | 2.1 | 2.3 | 4.0 | 1.9 | 1.1 | 10.5 | 0.35 | 1.2 | 0.9 | 2.3 | 0.4 | 0.25 | 0.35 |
| | Area of agricultural land (%) (AL) | 0 | 67.5 | 65 | 0 | 63.4 | 67 | 71 | 61.2 | 18 | 75.5 | 0 | 15 | 10 | 0 | 20 | 10 | 8 |
| | Area of non-agricultural land (%) (NAL) | 100 | 32.5 | 35 | 100 | 36.6 | 33 | 29 | 38.8 | 82 | 24.5 | 100 | 85 | 90 | 100 | 80 | 90 | 92 |
| 1-iii | Population Density (People per sq.k.m.) (PD) - 2011 Census | 9200 | 1290.8 | 853.9 | 6538.5 | 8000 | 3333.3 | 4239.1 | 1000 | 2222.2 | 620 | 5500 | 4444.4 | 8000 | 1005.7 | 1784.7 | 2848.8 | 1751.6 |
| | Household Density (HHs per sq.k.m.) (HHD) - 2011 Census | 2423.2 | 309.7 | 195.3 | 1339.7 | 1716.0 | 708 | 944.3 | 234.8 | 404.3 | 123.4 | 1219.3 | 962.8 | 1475.4 | 206.8 | 396.7 | 818.4 | 457.2 |
| 1-iv | % of Area Occupied by Green Elements / Green Covers (includes all kind of open spaces) (GC) | 23 | 26 | 20 | 31 | 36 | 48.5 | 21 | 53 | 58 | 26 | 34.5 | 55 | 56.6 | 42 | 67.4 | 61 | 61 |
| 1-v | Travel Time in Public Transport to the Core Urban Area (min) (TTPC) | - | 20-30 mins | 10 mins | 15-20 mins | 45 mins | 45 mins | 10 mins | 1 hr | 1 hr 30 mins | 15-20 mins | 20-30 mins | 1 hr 15 mins | 1 hr 30 mins | 40 mins | 2 hr 15 mins | 1 hr 45 mins | 1 hr 45 mins |
| | Commuting - % of Total Pop. Commute to Core City for Work / Study / Other Purposes (TPC) | - | 63.5 | 62.5 | 73 | 68.5 | 65.5 | 63 | 65 | 26 | 59.8 | 72.5 | 55 | 48.5 | 10% | 15 | 22 | 24.5 |
| 1-vi | Nursery and Primary Schools | 300 | 15 | 6 | 85 | 11 | 6 | 6 | 6 | 4 | 5 | 70 | 8 | 6 | 8 | 3 | 4 | 3 |
| | Senior Secondary School | 100 | 3 | 1 | 50 | 1 | 1 | 1 | 2 | 1 | 0 | 45 | 2 | 2 | 3 | 1 | 2 | 2 |
| | College Campus | 10 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 2 | 1 |
| | Hospital (500 / 200 / 100 bedded) | 4,10,8 | 0,0,1 | 0 | 1,4,2 | 0 | 0 | 0 | 0 | 0 | 0 | 1,4,1 | 0 | 1 | 0,1,1 | 0 | 1 | 0 |
| | Primary Health Centre / Poly-clinic | 15 | 6 | 2 | 10 | 1 | 1 | 3 | 2 | 1 | 1 | 12 | 1 | 2 | 2 | 1 | 2 | 1 |
| | Nursing home / Child Welfare | 15 | 2 | 0 | 12 | 2 | 2 | 0 | 2 | 0 | 0 | 10 | 2 | 2 | 2 | 1 | 2 | 1 |
| | Dispensary | 50 | 5 | 2 | 40 | 2 | 2 | 2 | 3 | 1 | 1 | 45 | 1 | 1 | 3 | 1 | 2 | 1 |
| | Library and Community Hall | 50 | 1 | 0 | 35 | 0 | 1 | 0 | 0 | 1 | 0 | 25 | 1 | 1 | 2 | 0 | 1 | 1 |
| | Recreation Club | 15 | 0 | 0 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 6 | 0 | 1 | 3 | 0 | 1 | 0 |
| | Art & Cultural Centre | 10 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Meditation & Spiritual Centre | 5 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | Police Post | 25 | 2 | 0 | 12 | 2 | 1 | 1 | 1 | 1 | 1 | 10 | 1 | 1 | 2 | 0 | 1 | 1 |
| | Fire Station | 4 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 1 |
| 1-vii | % of Pacca Houses | 100% | 55% | 36% | 100% | 80% | 76% | 45% | 80% | 62% | 20% | 100% | 65% | 71% | 100% | 55.60% | 60% | 62% |
| | Coverage of piped water supply connections | 100% | 80% | 63% | 100% | 72% | 70% | 67% | 74% | 65% | 70% | 100% | 63% | 68.50 % | 100% | 59% | 60% | 55% |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Per capita supply of water | 135 lpcd | 90 lpcd | 76 lpcd | 130 lpcd | 130 lpcd | 100 lpcd | 80 lpcd | 125 lpcd | 88 lpcd | 90 lpcd | 130 lpcd | 90 lpcd | 85 lpcd | 130 lpcd | 75 lpcd | 75 lpcd | 70 lpcd |
| | Extent of metering of water connections | 95% | 10% | 0 | 90% | 95% | 85% | 5% | 90% | 10% | 0 | 90% | 15% | 10% | 95% | 0 | 0 | 0 |
| | Extent of non-revenue water (NRW) | 15% | 0 | 0 | 10% | 30% | 15% | 0 | 15% | 0 | 0 | 10% | 0 | 0 | 30% | 0 | 0 | 0 |
| | Continuity of water supply | 20 hrs | 12 hrs | 9-10 hrs | 24 hrs | 4-6 hrs | 6 hrs | 12 hrs | 9 hrs | 4 hrs | 9-10 hrs | 20 hrs | 4 hrs | 5 hrs | 24 hrs | 3 hrs | 4 hrs | 4 hrs |
| | Cost recovery in water supply and sewerage services | 80% | 0 | 0 | 70% | 37% | 20% | 0 | 25% | 10% | 0 | 65% | 10% | 10% | 70% | 0 | 0 | 0 |
| | Coverage of Toilets | 100% | 85% | 72% | 100% | 95% | 85% | 85% | 90% | 68% | 70% | 100% | 70% | 72% | 100% | 60% | 66% | 65% |
| | Coverage of sewerage network | 90% | 45% | 20% | 95% | 45% | 40% | 40% | 43% | 30% | 20% | 90% | 35% | 37% | 90% | 26% | 33% | 35% |
| | Adequacy of sewage treatment capacity | 90% | 20% | 15% | 85% | 85% | 75% | 22.50% | 80% | 10% | 25% | 100% | 15% | 10% | 80% | 0 | 10% | 8% |
| | Extent of Reuse and Recycling of Waste Water | 20% | 0 | 0 | 8% | 0% | 0% | 0 | 0% | 0 | 0% | 10% | 0 | 0 | 0% | 0 | 0 | 0 |
| | Coverage of solid waste management services at household level | 100% | 0 | 0 | 90% | 0% | 0% | 0 | 0% | 0 | 0% | 80% | 0 | 0 | 60% | 0 | 0 | 10% |
| | Efficiency of Collection of Municipal SW | 95% | 30% | 20% | 90% | 60% | 45% | 25% | 55% | 18% | 20% | 75% | 15% | 25% | 90% | 10% | 15% | 12% |
| | Extent of Segregation Of Municipal SW | 70% | 10% | 0 | 70% | 0% | 0% | 0 | 0% | 0 | 0% | 65% | 0 | 0 | 60% | 0 | 0 | 0 |
| | Extent of municipal solid waste recovered | 50% | 0 | 0 | 30% | 15% | 0% | 0 | 10% | 0 | 0% | 40% | 0 | 0 | 15% | 0 | 0 | 0 |
| | Extent of scientific disposal of municipal solid waste | 75% | 0 | 0 | 60% | 0% | 0% | 0 | 0% | 0 | 0% | 75% | 0 | 0 | 50% | 0 | 0 | 0 |
| | Cost Recovery in SWM Services | 50% | 0 | 0 | 30% | 0% | 0% | 0 | 0% | 0 | 0% | 45% | 0 | 0 | 10% | 0 | 0 | 0 |
| | Coverage of Storm Water Drainage Network | 100% | 25% | 10% | 100% | 20% | 25% | 13% | 30% | 15% | 10% | 95% | 10% | 15% | 100% | 6% | 10% | 10% |
| **2-i** | Population (P) - 2011 Census | 1054450 | 15489 | 6831 | 170000 | 95553 | 75000 | 50869 | 25000 | 20000 | 6165 | 220000 | 40000 | 40000 | 9051 | 10708 | 25639 | 8758 |
| | Growth Rate of Population 2001-2011 (%) (GRP) | 17% | 10% | 8% | 36 | 281.9 | 88 | 6.70% | 150 | 100 | 0.3 | 52 | 60 | 33 | 30 | 25 | 30 | 28 |
| | Household Size (HHS) - 2011 Census | 4.8 | 4.2 | 4.4 | 4.9 | 4.6 | 4.7 | 4.5 | 4.3 | 5.5 | 5 | 4.5 | 5.2 | 5.4 | 4.9 | 4.50 | 3.5 | 3.8 |
| **2-ii** | % of Multi-communal Agglomeration (MCA) | 25% | 10% | 5% | 10% | 85% | 83% | 14% | 85% | 60% | 20% | 15% | 70% | 75% | 90% | 55% | 65% | 55% |
| **3-i** | Employment in Agricultural Sector, % of working pop. (Male, Female and Total) (EAS) | 0% | 22 | 24 | 0% | 20% | 24 | 22 | 20 | 22% | 24% | 0% | 15% | 10% | 0% | 20 | 12 | 18 |
| | Employment in Non-Agricultural / Manufacturing / Other Sector, % of working pop. (Male, Female and Total) (ENAS) | 100% | 78% | 76% | 100% | 80% | 76% | 78% | 80% | 78% | 76% | 100% | 85% | 90% | 100% | 80 | 88 | 82 |
| **4-i** | Present Administrative Body | M.Corp. | NP | NP | M.Corp. | M.Cl. | M.Cl. | NP | M.Cl. | M.Cl. | GP | M.Corp. | M.Cl. | M.Cl. | Cantt. Board | M.Cl. | M.Cl. | M.Cl. |

Source: Author, 2016

## 8.6. Analytical Process - I, Results and Discussion

The collected data as shown in the Table 8.3 is plotted in graph and accordingly settlements are grouped against a certain value range. Graphs and respective settlement clusters are shown below.

### 8.6.1. Graphical Analysis of Each of the Indicator

The collected data is analyzed by plotting graphs and the result in form of settlement clusters is mentioned below each of the graph (Figure 8.1 - Figure 8.9).

### 8.6.2. Result – Formulation of Settlement Clusters & Proposed Hierarchy for Peri-Urban Area

A total of 36 graphs have been plotted to understand the relationship among settlements, their degree of familiarity with respect to all the selected indicators. In each case, the settlements are grouped against a certain value range. As a whole, it is analyzed that how many times two / three specific settlements are being repeated in the same / adjoining clusters. Cumulatively, this analysis reveals that on the basis of homogeneity (80% case of repetition), the settlements can be grouped into total 5 clusters and can be mapped with respect to their distance from the core urban area, Chandigarh. In this analysis, it is also observed that there may be one or more peripheral settlements, which cannot be grouped with others in terms of their heterogeneity in values. Such settlements are considered as Exceptional Outcome of the research, like Chandimandir Cantonment, which may be termed as 'Peripheral Independent Centre'. For rest of the peripheral settlements, to frame their hierarchy; terminologies are proposed with respect to their distance from the core urban area. The findings are tabulated below.

Table 8.4: Findings – derivation of peri-urban settlement typology

| Clusters found on the basis of Commonality of Values assigned to Each Parameter | Cities under Each Cluster | Proposed Terminology for Settlement Typology |
|---|---|---|
| **CLUSTER 1** | Panchkula & Mohali | Extended Urban Centre - Tri-City Urban Agglomeration |
| **CLUSTER 2** | Mani Majra, Khuda Ali Sher, Nayagaon, | Adjacent Urban Node |

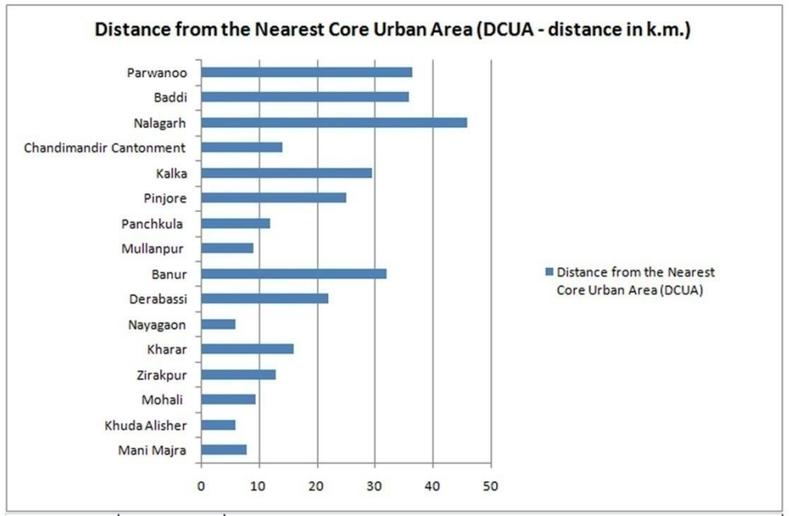
| | | |
|---|---|---|
| | Mullanpur | |
| **CLUSTER 3** | Zirakpur, Derabassi, Kharar | Peripheral Urban Centre - Tier I |
| **CLUSTER 4** | Pinjore, Kalka, Banur | Peripheral Urban Centre - Tier II |
| **CLUSTER 5** | Baddi, Nalahgarh, Parwanoo | Peripheral Urban Centre - Tier III |
| **EXCEPTIONAL OUTCOME** | Chandimandir Cantonment | Peripheral Independent Centre |

Source: Author, 2017

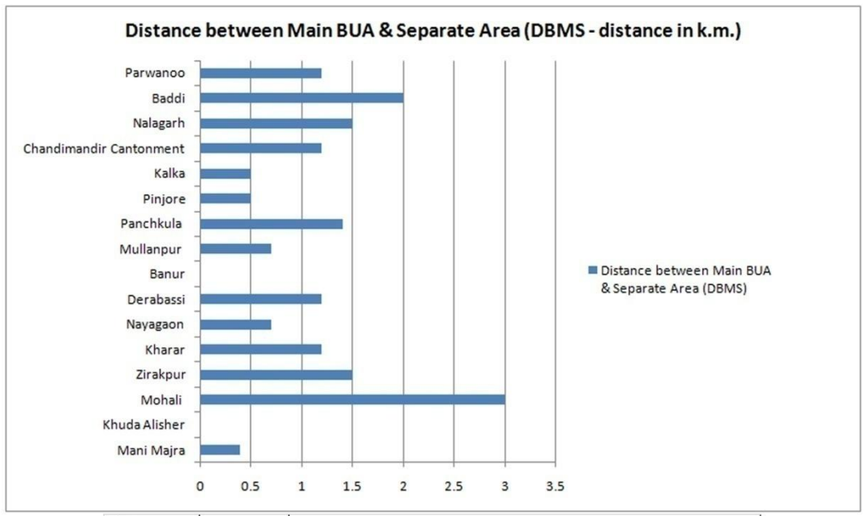
**Discussion:** Such hierarchy of settlements are mapped spatially to prepare the Proposed Regional Plan for Chandigarh & Periphery, shown in Map 8.2. Since the inception of Chandigarh, the 16 k.m. peripheral boundary around the city was envisioned as 'no construction zone' and to protect agriculture & dairy to serve the city people. However, due to absence of effective regulatory framework, planning policy this 16 k.m. peripheral boundary is diluted, lost its significance and violated continuously. The research has already investigated the relevance of this boundary at present time, where the developments have already sparred out beyond and continuously create impact over the core urban area. Therefore, the proposal takes a Regional Planning approach, considering the parent city and periphery as a whole. In present time, Chandigarh is solely being developed and boosted with several urban development funds, as it comes in the list of Statutory Towns as per Census of India and all the peripheral towns are considered like other towns under 'Rural' category. They are deprived from getting funds like Chandigarh being the Census Towns, though they are facing comparable amount of urbanization and related issues. In this context, the proposal has created hierarchy among these peripheral settlements on the basis of their degree of urbanization measured by selected planning parameters, instead of considering all of them under one category like 'Census Town'. Thus, the further categorization of 'Urban' has been derived for the case of Chandigarh Region. Accordingly, the Regional Plan can be considered as 'Statutory Plan' to regulate plan preparation, fund distribution and governance of all these peripheral towns in future.

This research evolves a context specific proposal for derivation of peri-urban settlement typologies. However, the similar approach may be adopted for other urban areas to formulate such settlement categories and regional plan to govern them as a whole.

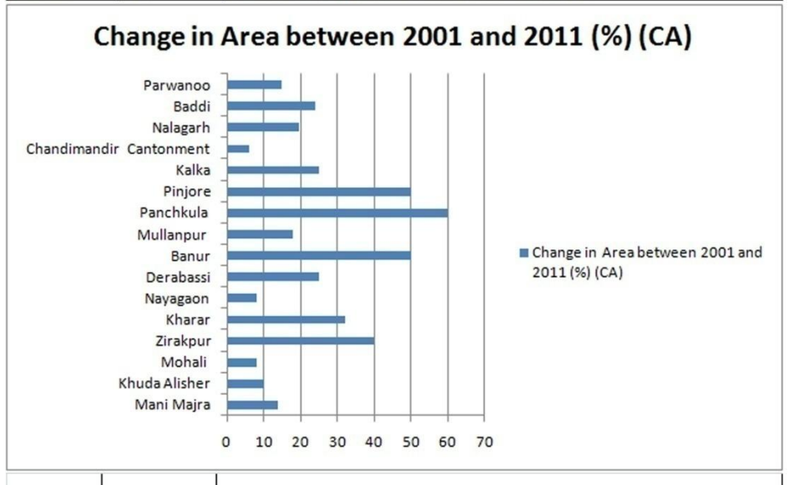
Figure 8.1: Graphical analysis of selected indicators



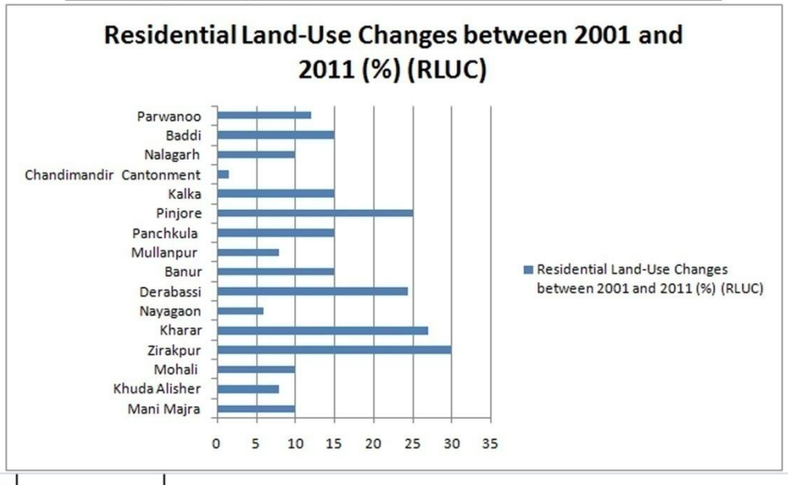

| Clusters on the basis of DCUA | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >35 | Parwanoo, Baddi, Nalagarh |
| Cluster 2 | 20-35 | Pinjore, Kalka, Banur, Derabassi |
| Cluster 3 | >10, <20 | Chandimandir Cantonment, Panchkula, Kharar, Zirakpur, Mohali |
| Cluster 4 | <10 | Mullanpur, Nayagaon, Khuda Alisher, Mani Majra |




| Clusters on the basis of DBMS | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >1.5, <3 | Baddi, Mohali |
| Cluster 2 | >1, <1.5 | Parwanoo, Nalahgarh, Chandimandir Cantonment, Panchkula, Derabassi, Kharar, Zirakpur |
| Cluster 3 | >0.5, <1 | Mullanpur, Nayagaon |
| Cluster 4 | <0.5 | Kalka, Pinjore, Mani Majra |
| Cluster 5 | 0 | Khuda Alisher, Banur |



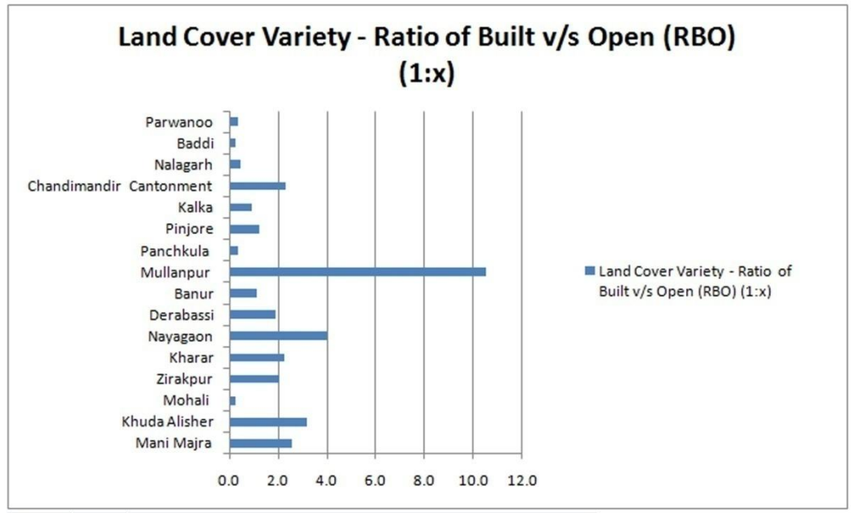

| Clusters on the basis of CA | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 45-60 | Pinjore, Panchkula, Banur |
| Cluster 2 | 30-45 | Kharar, Zirakpur |
| Cluster 3 | 20-30 | Derabassi, Kalka, Baddi, Nalahgarh |
| Cluster 4 | 10-20 | Mullanpur, Khuda Alisher, Mani Majra, Parwanoo |
| Cluster 5 | 0-10 | Nayagaon, Mohali, Chandimandir Cantonment |



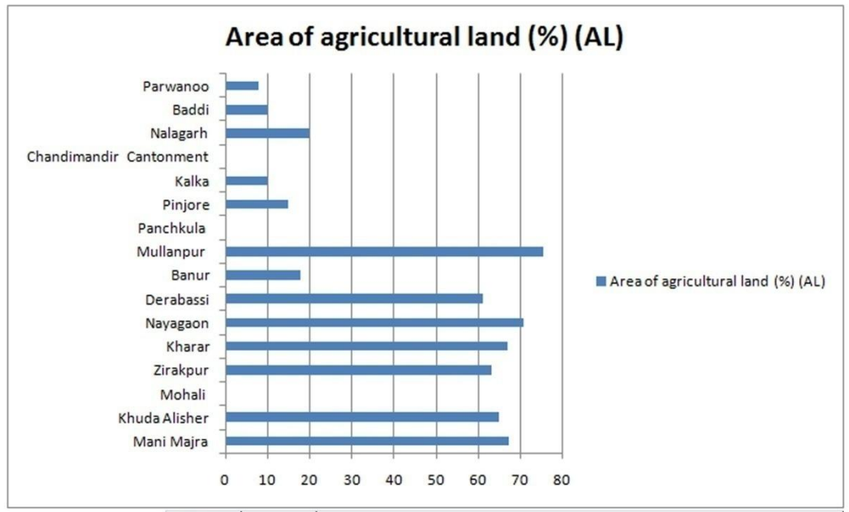

| Clusters on the basis of RLUC | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 20-30 | Pinjore, Derabassi, Kharar, Zirakpur |
| Cluster 2 | 10-20 | Parwanoo, Baddi, Kalka, Panchkula, Banur |
| Cluster 3 | 5-10 | Nalahgarh, Mullanpur, Nayagaon, Mohali, Khuda Alisher, Mani Majra |
| Cluster 4 | 0-5 | Chandimandir Cantonment |

Source: Author, 2017

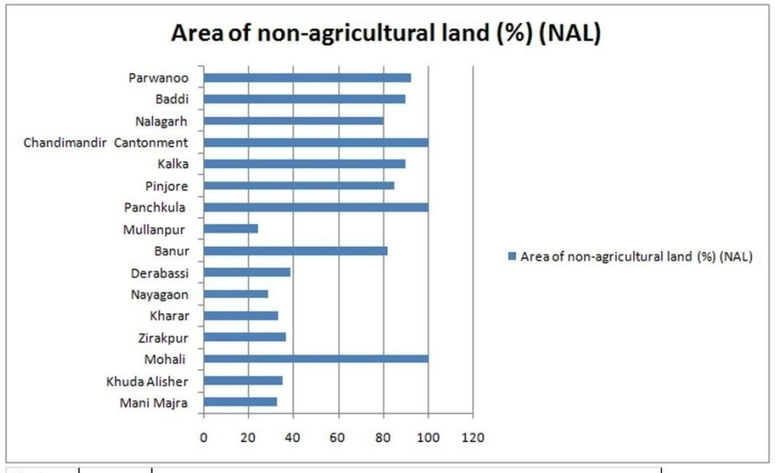
Figure 8.2: graphical analysis of selected indicators



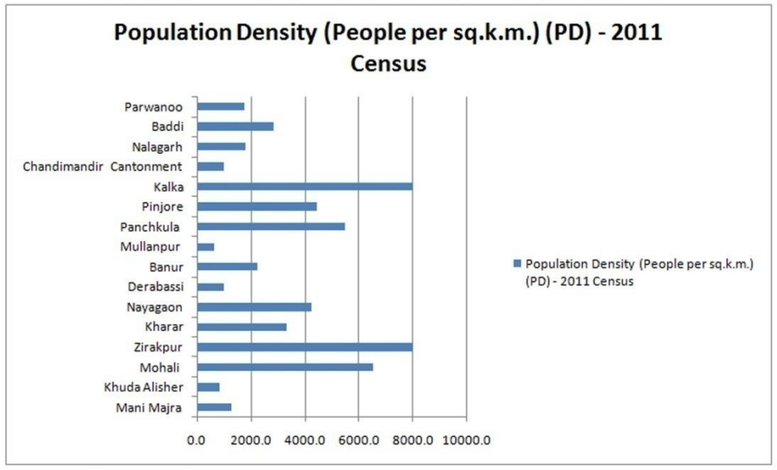

| Clusters on the basis of RBO | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >4 | Mullanpur |
| Cluster 2 | 2.5-4 | Mani Mazra, Khuda Alisher, Nayagaon |
| Cluster 3 | 2-2.5 | Zirakpur, Kharar, Chandimandir Cantonment, Derabassi |
| Cluster 4 | 0.5-2 | Banur, Pinjore, Kalka |
| Cluster 5 | <0.5 | Mohali, Panchkula, Parwanoo, Baddi, Nalahgarh |




| Clusters on the basis of AL | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >70 | Mullanpur, Nayagaon |
| Cluster 2 | 60-70 | Mani Mazra, Khuda Alisher, Zirakpur, Kharar, Derabassi |
| Cluster 3 | 10-20 | Banur, Pinjore, Nalahgarh, Baddi, Kalka |
| Cluster 4 | 0-10 | Mohali, Panchkula, Parwanoo, Chandimandir Cantonment |



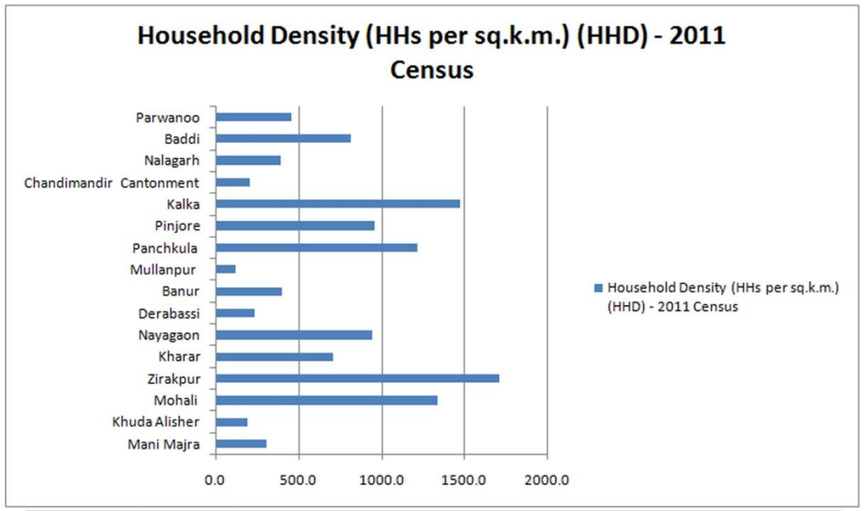

| Clusters on the basis of NAL | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 0-30 | Mullanpur, Nayagaon |
| Cluster 2 | 30-40 | Mani Mazra, Khuda Alisher, Zirakpur, Kharar, Derabassi |
| Cluster 3 | 80-90 | Banur, Pinjore, Nalahgarh, Baddi, Kalka |
| Cluster 4 | 90-100 | Mohali, Panchkula, Parwanoo, Chandimandir Cantonment |



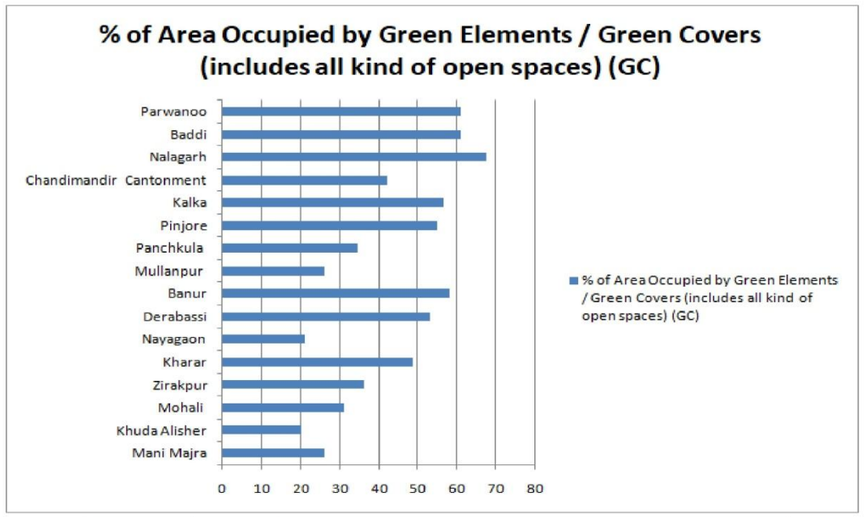

| Clusters on the basis of PD | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 6500-8000 | Zirakpur, Kalka |
| Cluster 2 | 5000-6500 | Panchkula, Mohali |
| Cluster 3 | 4000-5000 | Pinjore, Nayagaon |
| Cluster 4 | 2000-4000 | Kharar, Banur, Baddi |
| Cluster 5 | 1000-2000 | Derabassi, Chandimandir Cantonment, Nalahgarh, Parwanoo, Mani Mazra |
| Cluster 6 | <1000 | Khuda Alisher, Mullanpur |

Source: Author, 2017

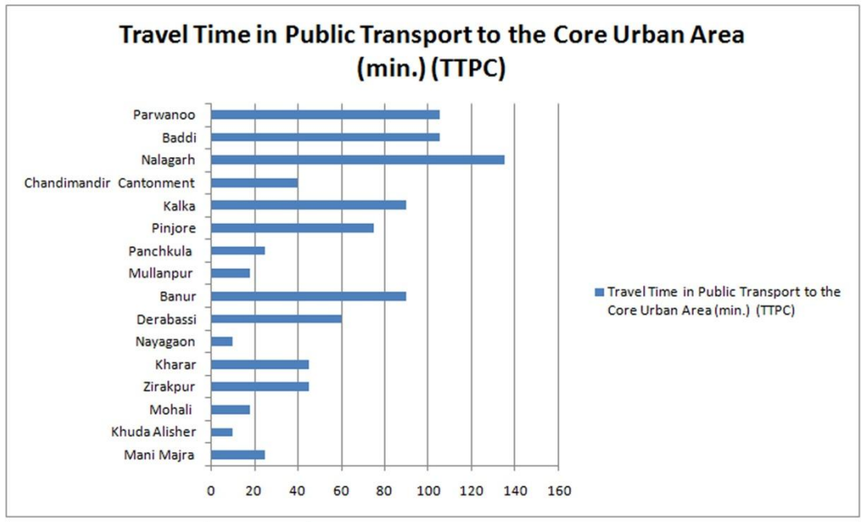
Figure 8.3: Graphical analysis of selected indicators



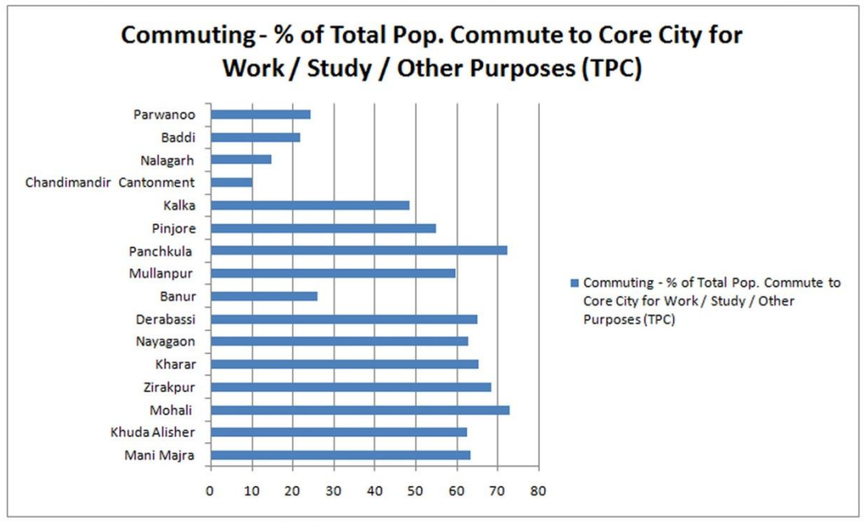

| Clusters on the basis of HHD | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >1500 | Zirakpur, Kalka |
| Cluster 2 | 1000-1500 | Panchkula, Mohali |
| Cluster 3 | 500-1000 | Pinjore, Nayagaon, Kharar, Baddi |
| Cluster 4 | 200-500 | Banur, Nalahgarh, Parwanoo, Chandimandir Cantonment, Derabassi, Mani Mazra |
| Cluster 5 | <200 | Khuda Alisher, Mullanpur |




| Clusters on the basis of GC | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 60-70 | Baddi, Nalahgarh, Parwanoo |
| Cluster 2 | 50-60 | Derabassi, Banur, Kalka, Pinjore |
| Cluster 3 | 40-50 | Kharar, Chandimandir Cantonment |
| Cluster 4 | 30-40 | Mohali, Zirakpur, Panchkula |
| Cluster 5 | 20-30 | Mani Mazra, Khuda Alisher, Nayagaon, Mullanpur |



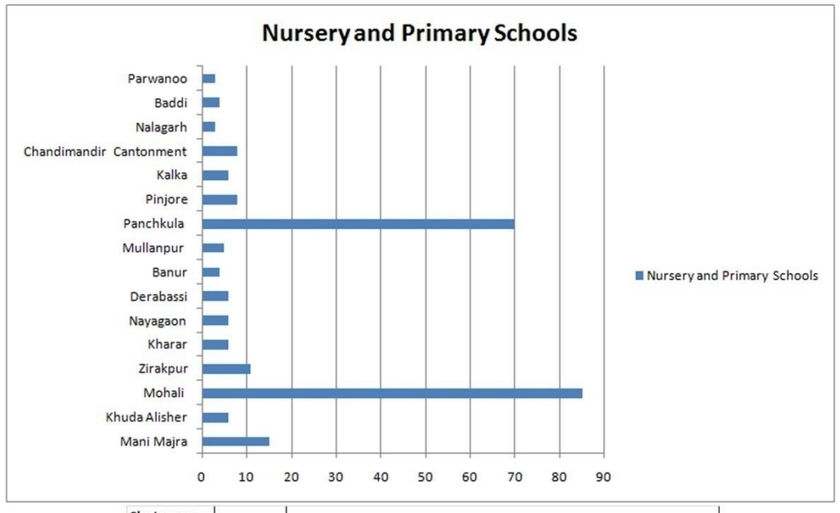

| Clusters on the basis of TTPC | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >100 | Baddi, Nalahgarh, Parwanoo |
| Cluster 2 | 65-100 | Kalka, Pinjore, Banur |
| Cluster 3 | 40-65 | Kharar, Derabassi, Zirakpur, Chandimandir Cantonment |
| Cluster 4 | 15-40 | Mani Mazra, Mohali, Mullanpur, Panchkula |
| Cluster 5 | 0-15 | Nayagaon, Khuda Alisher |



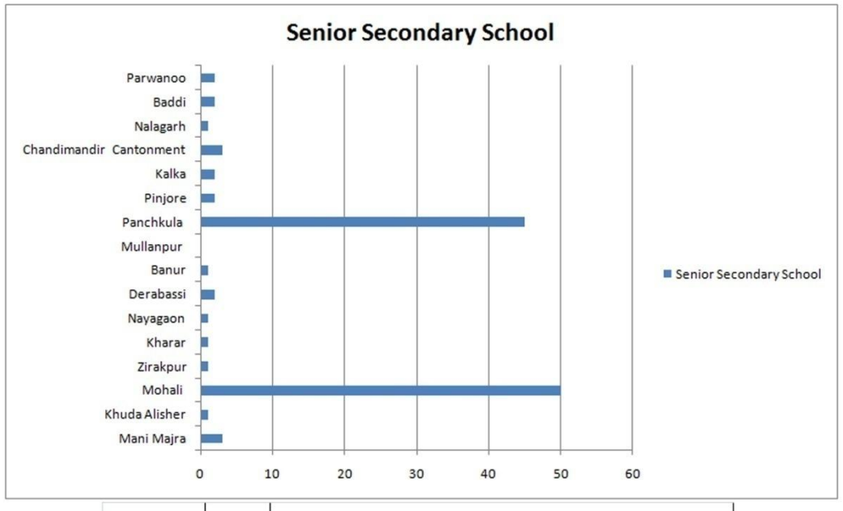

| Clusters on the basis of TPC | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >70 | Mohali, Panchkula |
| Cluster 2 | 60-70 | Mani Mazra, Nayagaon, Khuda Alisher, Kharar, Derabassi, Zirakpur, Mullanpur |
| Cluster 3 | 40-60 | Kalka, Pinjore |
| Cluster 4 | 20-40 | Banur, Parwanoo, Baddi |
| Cluster 5 | 0-20 | Chandimandir Cantonment, Nalahgarh |

Source: Author, 2017

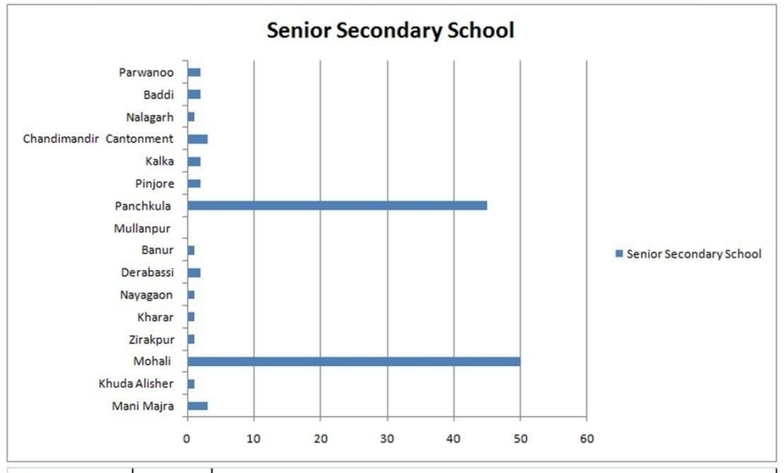
Figure 8.4: Graphical analysis of selected indicators



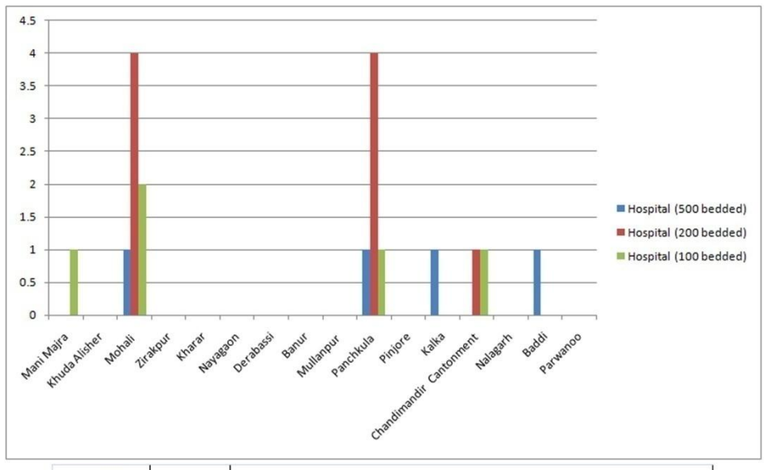

| Clusters on the basis of CI (Nursery & Primary School) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >70 | Mohali, Panchkula |
| Cluster 2 | 10-20 | Zirakpur, Mani Mazra |
| Cluster 3 | 5-10 | Nayagaon, Khuda Alisher, Kharar, Derabassi, Mullanpur, Kalka, Pinjore, Chandimandir Cantonment |
| Cluster 4 | 0-5 | Banur, Baddi, Nalahgarh, Parwanoo |




| Clusters on the basis of CI (Sr. Secondary School) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >40 | Mohali, Panchkula |
| Cluster 2 | 3-5 | Mani Mazra, Chandimandir Cantonment |
| Cluster 3 | 0-3 | Nayagaon, Khuda Alisher, Kharar, Derabassi, Mullanpur, Kalka, Pinjore, Zirakpur, Banur, Baddi, Nalahgarh, Parwanoo |



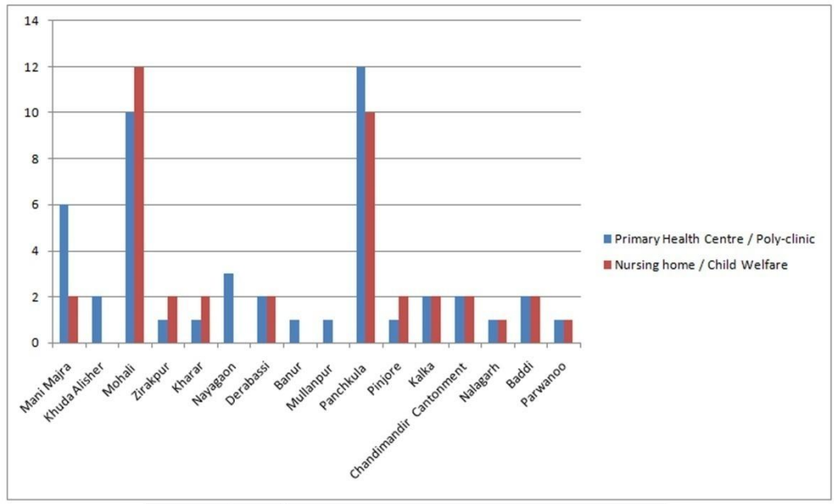

| Clusters on the basis of CI (Sr. Secondary School) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >40 | Mohali, Panchkula |
| Cluster 2 | 3-5 | Mani Mazra, Chandimandir Cantonment |
| Cluster 3 | 0-3 | Nayagaon, Khuda Alisher, Kharar, Derabassi, Mullanpur, Kalka, Pinjore, Zirakpur, Banur, Baddi, Nalahgarh, Parwanoo |



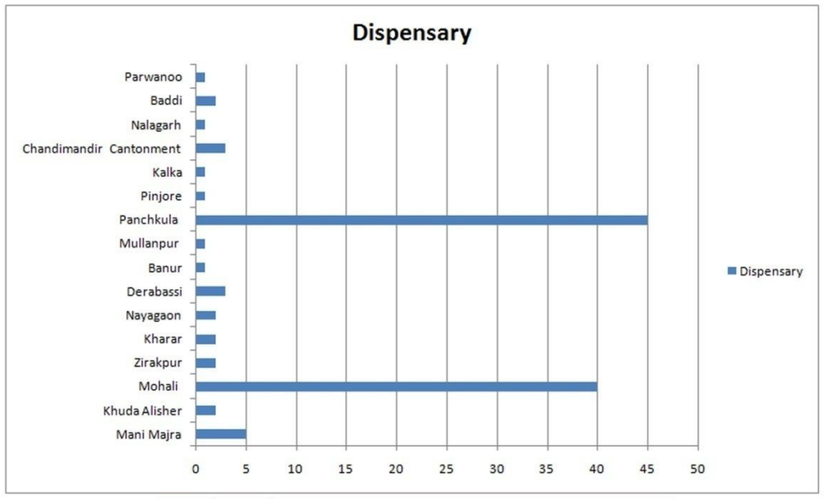

| Clusters on the basis of CI (Hospital - 500,200,100 bed) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 0 | Nayagaon, Khuda Alisher, Kharar, Derabassi, Mullanpur, Pinjore, Banur, Nalahgarh, Parwanoo |
| Cluster 2 | 1 | Kalka, Baddi, Zirakpur, Chandimandir Cantonment, Mani Mazra |
| Cluster 3 | >1 | Mohali, Panchkula |

Source: Author, 2017

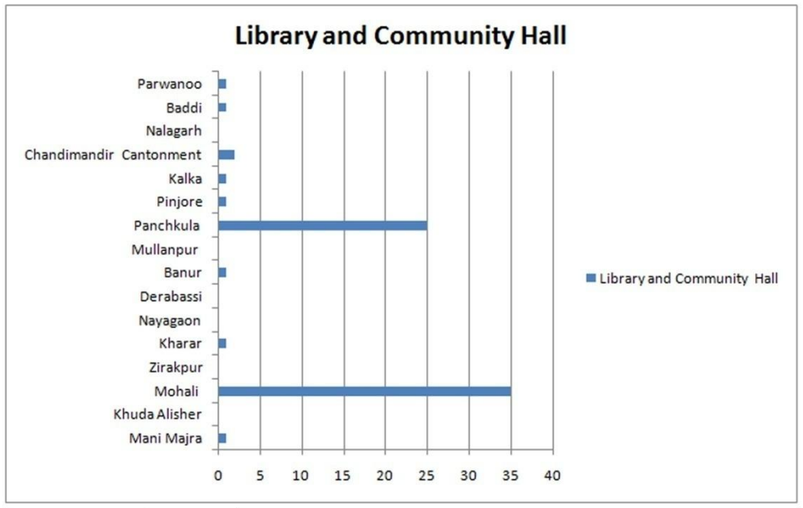
Figure 8.5: Graphical analysis of selected indicators



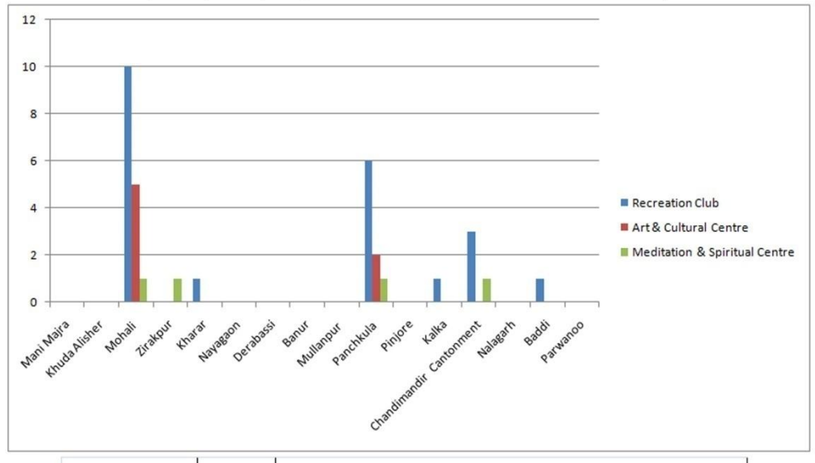

| Clusters on the basis of CI (PHC & Nursing Home) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 0-2 | Mullanpur, Banur, Nalahgarh, Parwanoo |
| Cluster 2 | 2-6 | Khuda Alisher, Kharar, Nayagaon, Derabassi, Pinjore, Kalka, Baddi, Zirakpur, Chandimandir Cantonment, Mani Mazra |
| Cluster 3 | 10-12 | Mohali, Panchkula |




| Clusters on the basis of CI (Dispensary) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 0-3 | Khuda Alisher, Kharar, Nayagaon, Mullanpur, Banur, Nalahgarh, Parwanoo, Pinjore, Kalka, Baddi, Zirakpur |
| Cluster 2 | 3-5 | Derabassi, Chandimandir Cantonment, Mani Mazra |
| Cluster 3 | 40-45 | Mohali, Panchkula |



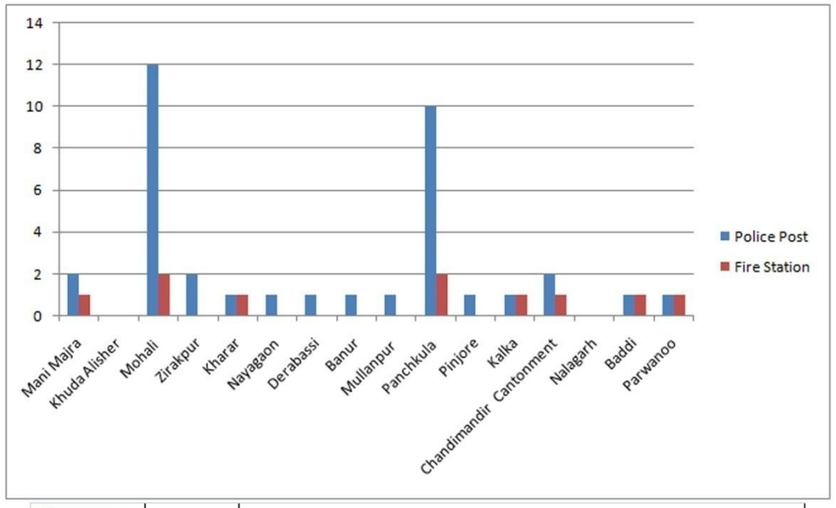

| Clusters on the basis of CI (Library & Community Hall) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 0 | Nayagaon, Khuda Alisher, Derabassi, Mullanpur, Nalahgarh, Zirakpur |
| Cluster 2 | 1-2 | Parwanoo, Kharar, Kalka, Baddi, Chandimandir Cantonment, Mani Mazra, Pinjore, Banur |
| Cluster 3 | >20 | Mohali, Panchkula |



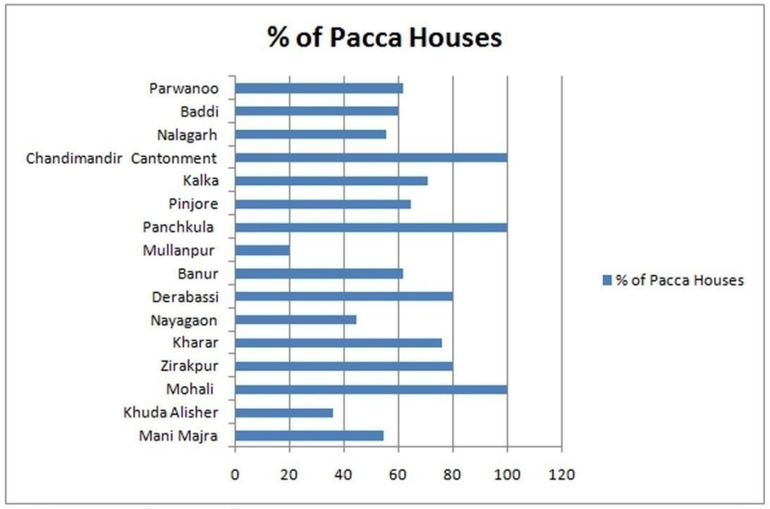

| Clusters on the basis of CI (Recreation Club, Art & Cultural Centre, Meditation & Spiritual Centre ) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 0 | Banur, Nayagaon, Khuda Alisher, Derabassi, Mullanpur, Nalahgarh, Mani Mazra, Parwanoo, Pinjore |
| Cluster 2 | 1-2 | Kharar, Kalka, Baddi, Chandimandir Cantonment, Zirakpur |
| Cluster 3 | >4 | Mohali, Panchkula |

Source: Author, 2017

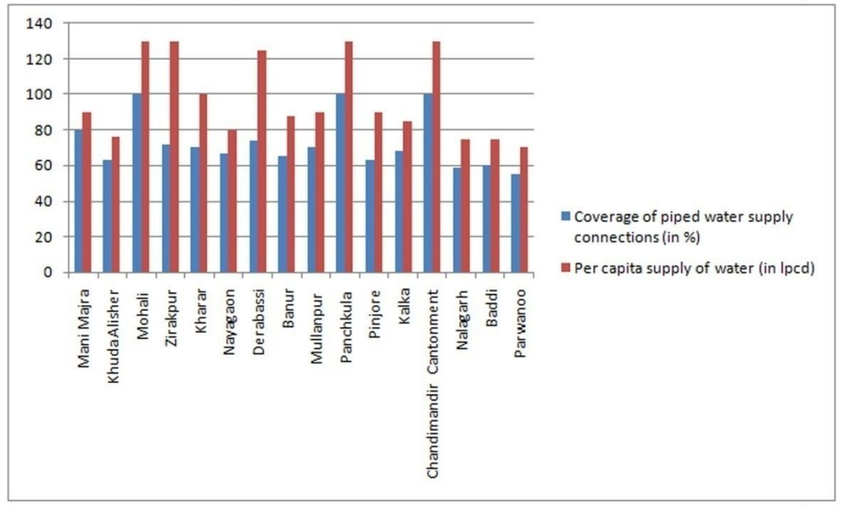
Figure 8.6: Graphical analysis of selected indicators



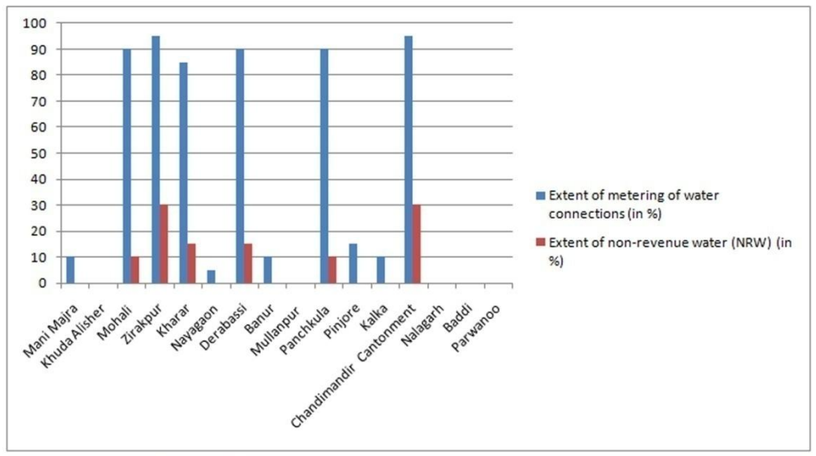

| Clusters on the basis of Police Post & Fire Station | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >2 | Panchkula, Mohali Mullanpur, Nayagaon |
| Cluster 2 | 1-2 | Mani Mazra, Chandimandir Cantonment, Zirakpur |
| Cluster 3 | 0-1 | Kharar, Derabassi, Kalka, Pinjore, Banur, Baddi, Parwanoo |
| Cluster 4 | 0 | Khuda Alisher, Nalahgarh |




| Clusters on the basis of HI (Pacca Houses) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 80-100 | Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 60-80 | Kalka, Pinjore, Banur, Kharar, Derabassi, Zirakpur, Parwanoo |
| Cluster 3 | 40-60 | Baddi, Nalahgarh, Nayagaon, Mani Mazra |
| Cluster 4 | <40 | Khuda Alisher, Mullanpur |



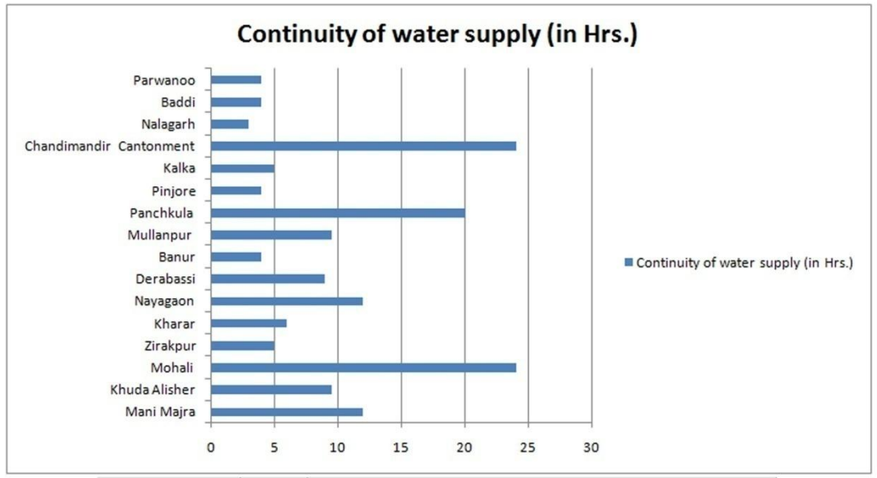

| Clusters on the basis of HI (Coverage of piped water supply connections & Per capita supply of water) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >100 | Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 80-100 | Kharar, Derabassi, Zirakpur |
| Cluster 3 | 60-80 | Nayagaon, Mani Mazra, Kalka, Pinjore, Banur, Khuda Alisher, Mullanpur |
| Cluster 4 | 40-60 | Parwanoo, Baddi, Nalahgarh |



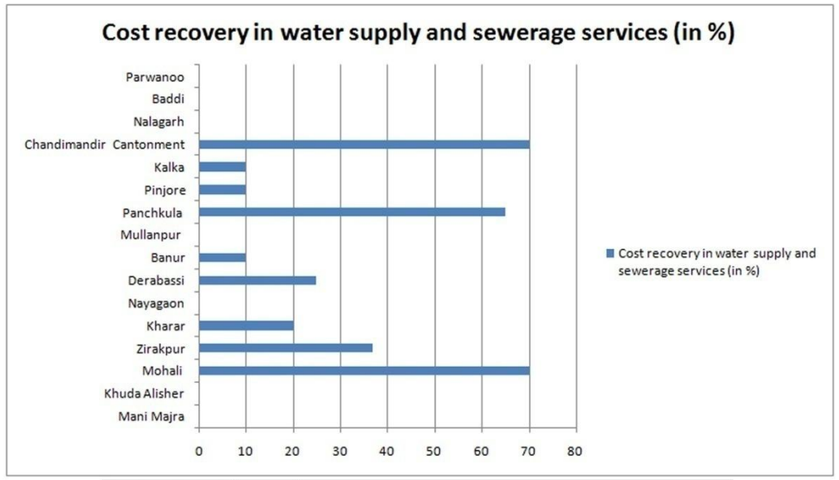

| Clusters on the basis of HI (Extent of metering of water connections & Extent of non-revenue water ) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >20 | Kharar, Derabassi, Zirakpur, Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 0-20 | Nayagaon, Mani Mazra, Kalka, Pinjore, Banur |
| Cluster 3 | 0 | Parwanoo, Baddi, Nalahgarh, Khuda Alisher, Mullanpur |

Source: Author, 2017

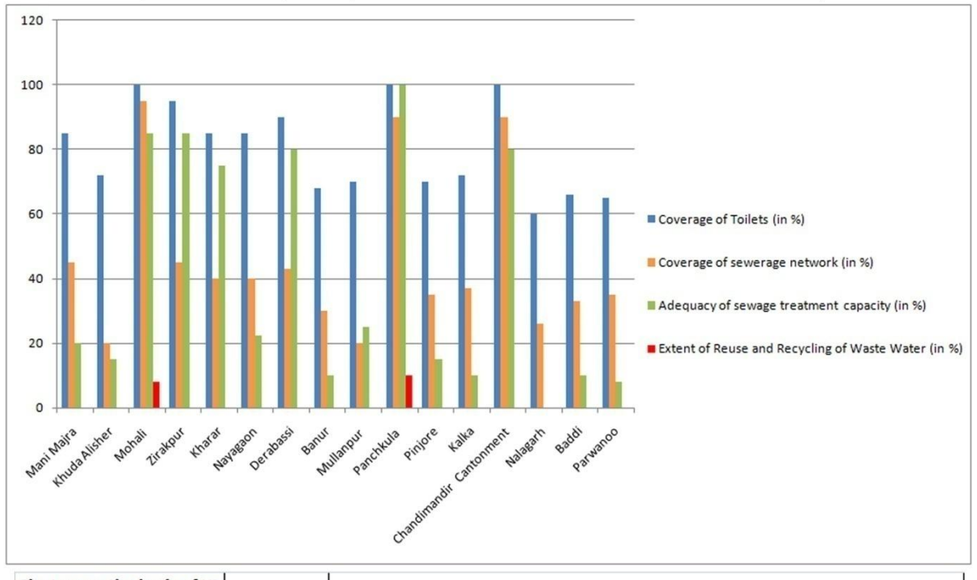
Figure 8.7: Graphical analysis of selected indicators



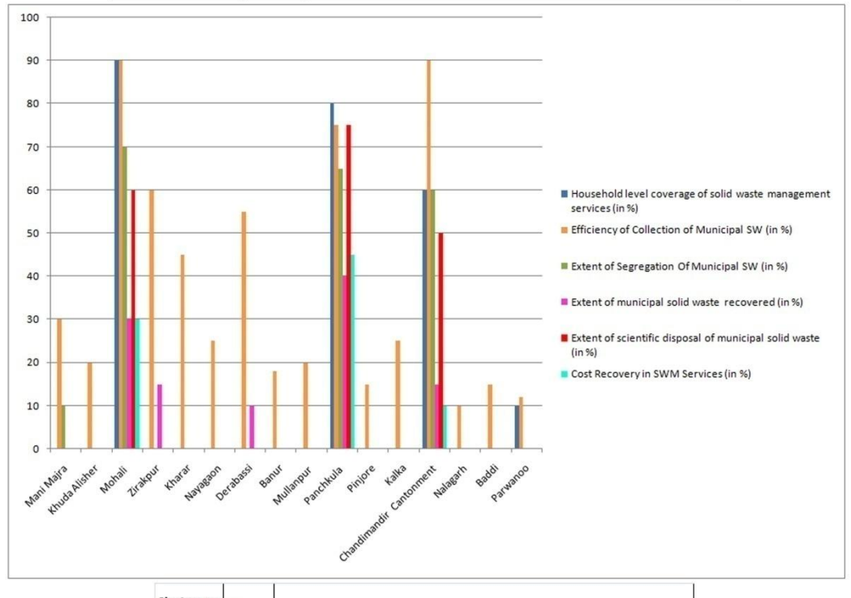

| Clusters on the basis of HI (Continuity of water supply) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >15 | Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 7.5-15 | Derabassi, Nayagaon, Mani Mazra, Khuda Alisher, Mullanpur |
| Cluster 3 | 0-7.5 | Parwanoo, Baddi, Nalahgarh, Kharar, Zirakpur, Kalka, Pinjore, Banur |




| Clusters on the basis of HI (Cost recovery in water supply and sewerage services) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >40 | Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 20-40 | Kharar, Zirakpur, Derabassi |
| Cluster 3 | 0-10 | Kalka, Pinjore, Banur |
| Cluster 4 | 0 | Nayagaon, Mani Mazra, Khuda Alisher, Mullanpur, Parwanoo, Baddi, Nalahgarh |



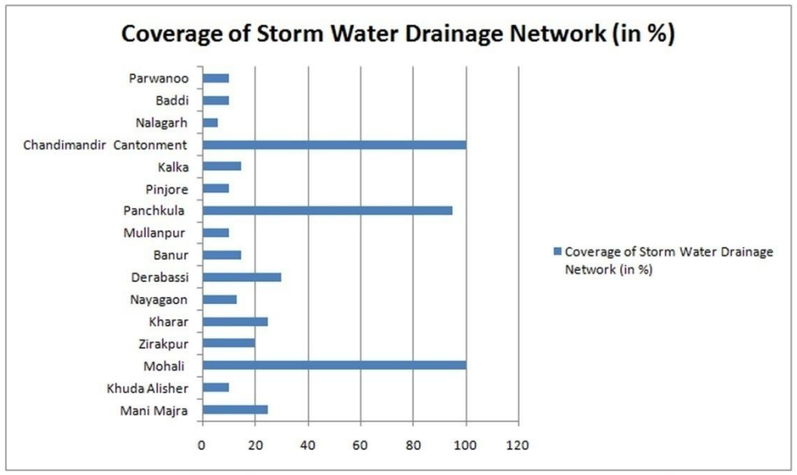

| Clusters on the basis of HI (Sewage Management) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >60 | Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 50-60 | Kharar, Derabassi, Zirakpur |
| Cluster 3 | 30-50 | Nayagaon, Mani Mazra, Kalka, Pinjore |
| Cluster 4 | 20-30 | Khuda Alisher, Mullanpur, Baddi, Nalahgarh, Banur, Parwanoo |



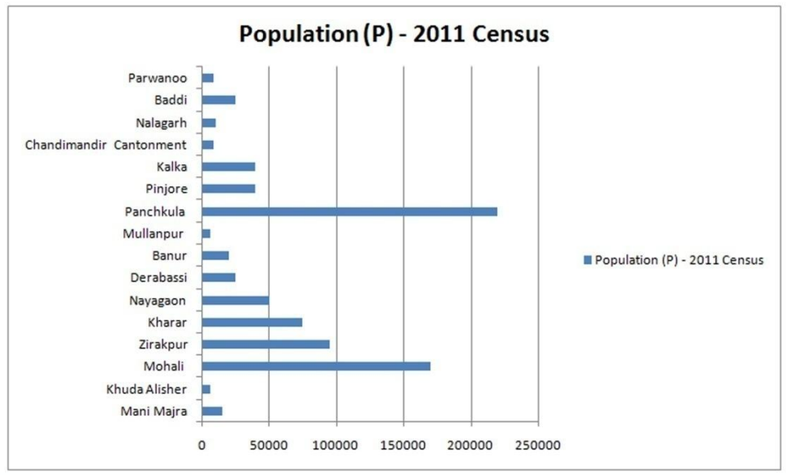

| Clusters on the basis of HI (SWM) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >40 | Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 5-15 | Kharar, Derabassi, Zirakpur, Mani Mazra |
| Cluster 3 | 0-5 | Nayagaon, , Kalka, Pinjore, Khuda Alisher, Mullanpur, Baddi, Nalahgarh, Banur, Parwanoo |

Source: Author, 2017

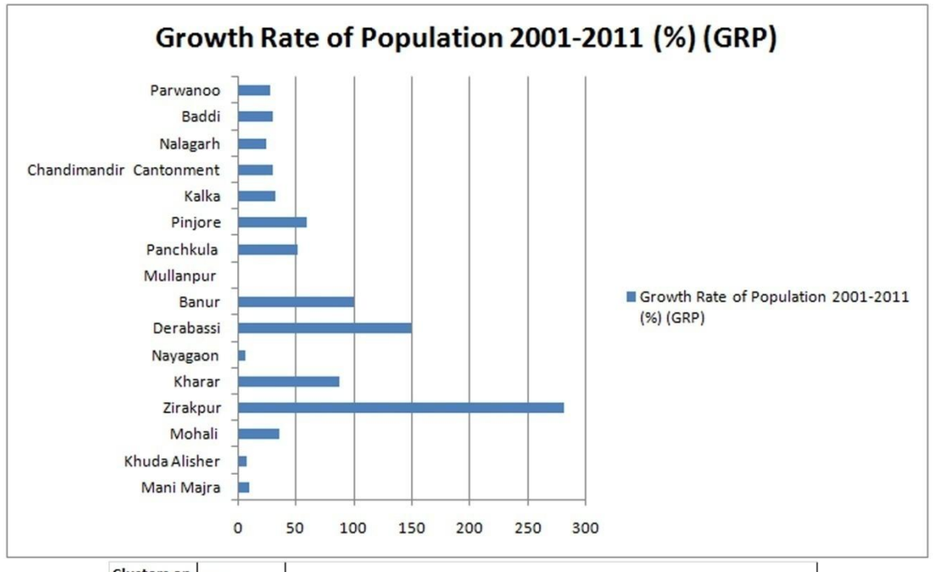
Figure 8.8: Graphical analysis of selected indicators



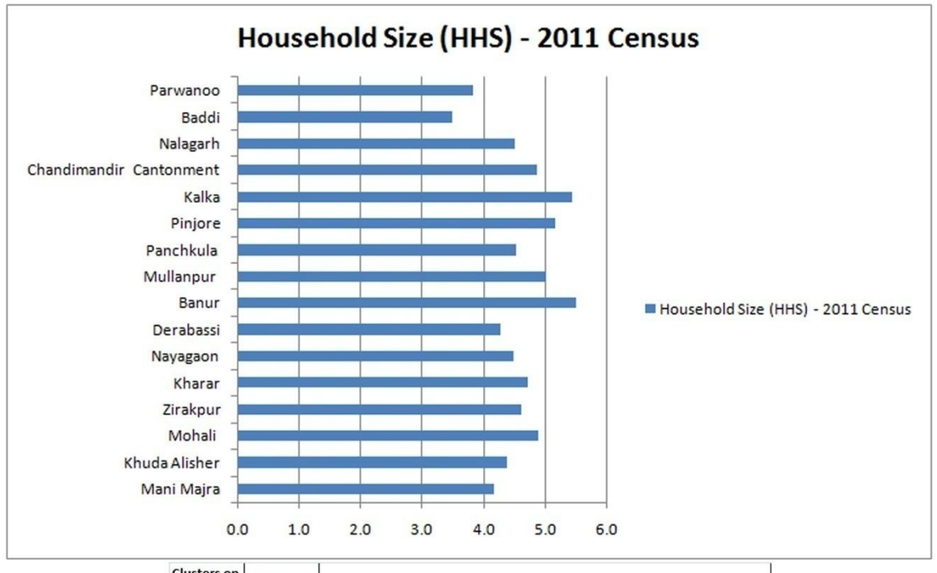

| Clusters on the basis of HI (Drainage) | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 80-100 | Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 20-40 | Kharar, Derabassi, Zirakpur, Mani Mazra |
| Cluster 3 | 10-20 | Nayagaon, Kalka, Pinjore, Khuda Alisher, Mullanpur, Baddi, Banur, Parwanoo |
| Cluster 4 | 0-10 | Nalahgarh |




| Clusters on the basis of P | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >150000 | Panchkula, Mohali |
| Cluster 2 | 50000-100000 | Kharar, Nayagaon, Zirakpur, Mani Mazra |
| Cluster 3 | 20000-50000 | Kalka, Pinjore, Baddi, Banur, Nalahgarh, Derabassi |
| Cluster 4 | 0-20000 | Khuda Alisher, Mullanpur, Parwanoo, Chandimandir Cantonment |



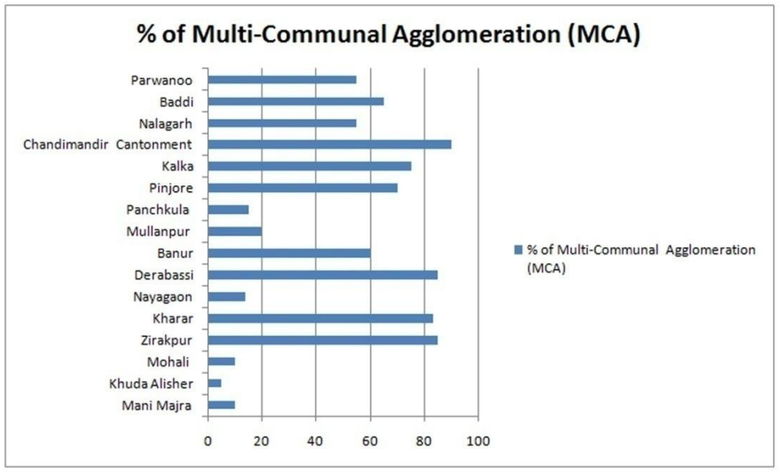

| Clusters on the basis of GRP | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >75 | Zirakpur, Kharar, Derabassi, Banur |
| Cluster 2 | 30-75 | Baddi, Chandimandir Cantonment, Kalka, Pinjore, Panchkula, Mohali |
| Cluster 3 | 10-30 | Nalahgarh, Parwanoo |
| Cluster 4 | 0-10 | Khuda Alisher, Mullanpur, Nayagaon, Mani Mazra |



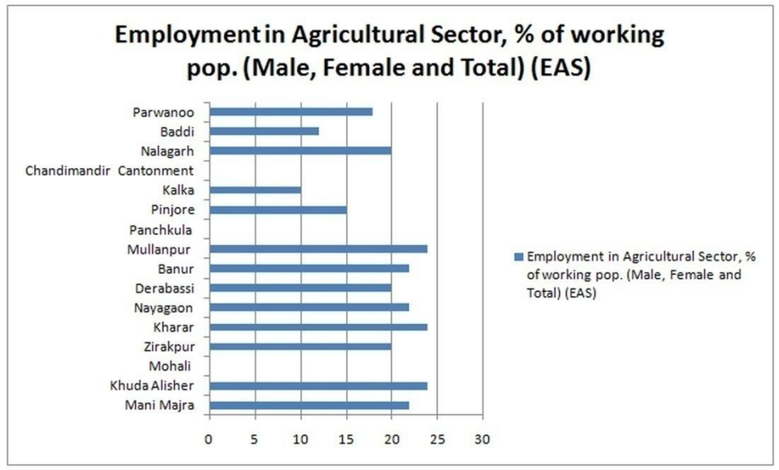

| Clusters on the basis of HHS | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >5 | Kalka, Pinjore, Banur |
| Cluster 2 | 4.5-5 | Panchkula, Mohali, Chandimandir Cantonment, Zirakpur, Kharar, Mullanpur, Nayagaon |
| Cluster 3 | 4-4.5 | Nalahgarh, Khuda Alisher, Mani Mazra, Derabassi |
| Cluster 4 | 3.5-4 | Parwanoo, Baddi |

Source: Author, 2017

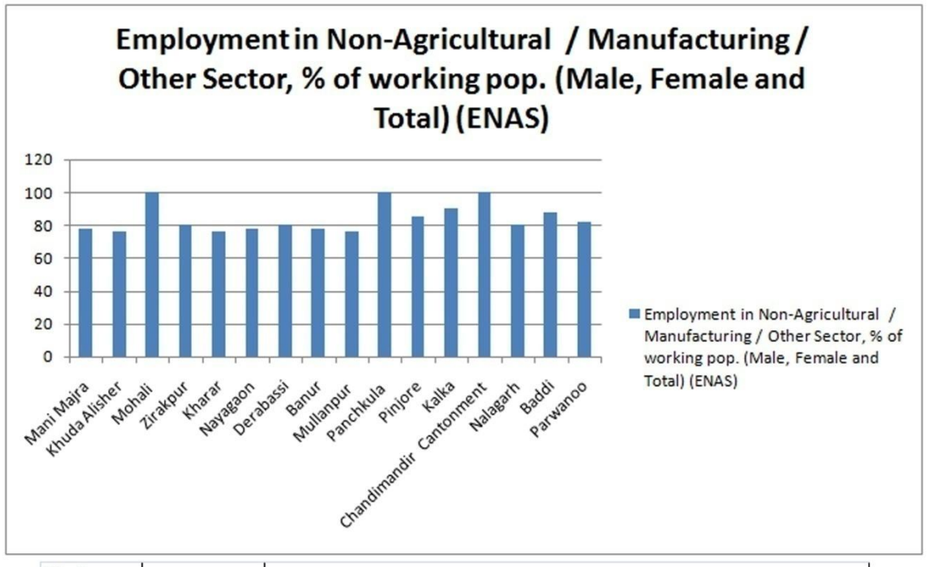
Figure 8.9: Graphical analysis of selected indicators



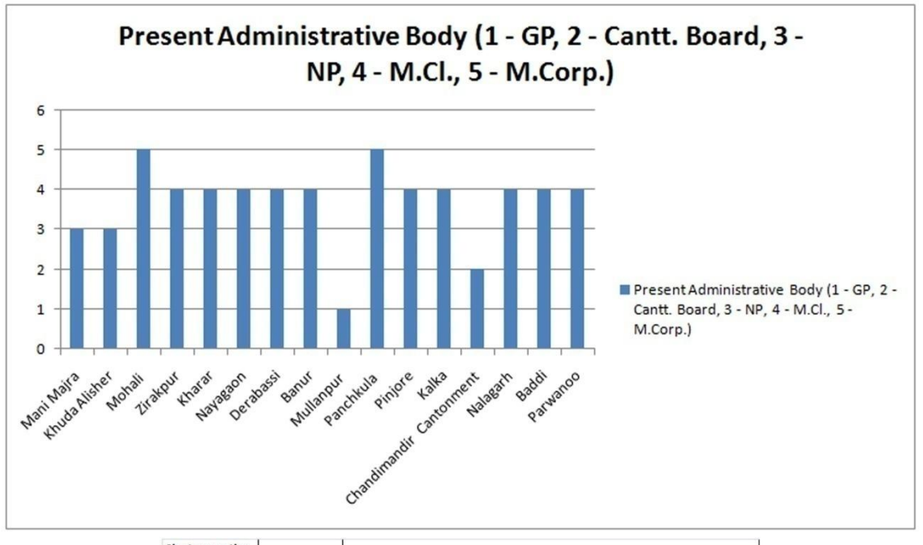

| Clusters on the basis of MCA | Value Range | Settlements |
|---|---|---|
| Cluster 1 | >80 | Zirakpur, Kharar, Derabassi, Chandimandir Cantonment |
| Cluster 2 | 60-80 | Baddi, Kalka, Pinjore, Banur |
| Cluster 3 | 40-60 | Parwanoo, Nalahgarh |
| Cluster 4 | 0-20 | Khuda Alisher, Mani Mazra, Panchkula, Mohali, Mullanpur, Nayagaon |




| Clusters on the basis of EAS | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 20-25 | Khuda Alisher, Mani Mazra, Kharar, Mullanpur, Nayagaon, Banur |
| Cluster 2 | 15-20 | Parwanoo, Nalahgarh, Derabassi, Zirakpur |
| Cluster 3 | 10-15 | Baddi, Kalka, Pinjore |
| Cluster 4 | 0-10 | Panchkula, Mohali, Chandimandir Cantonment |



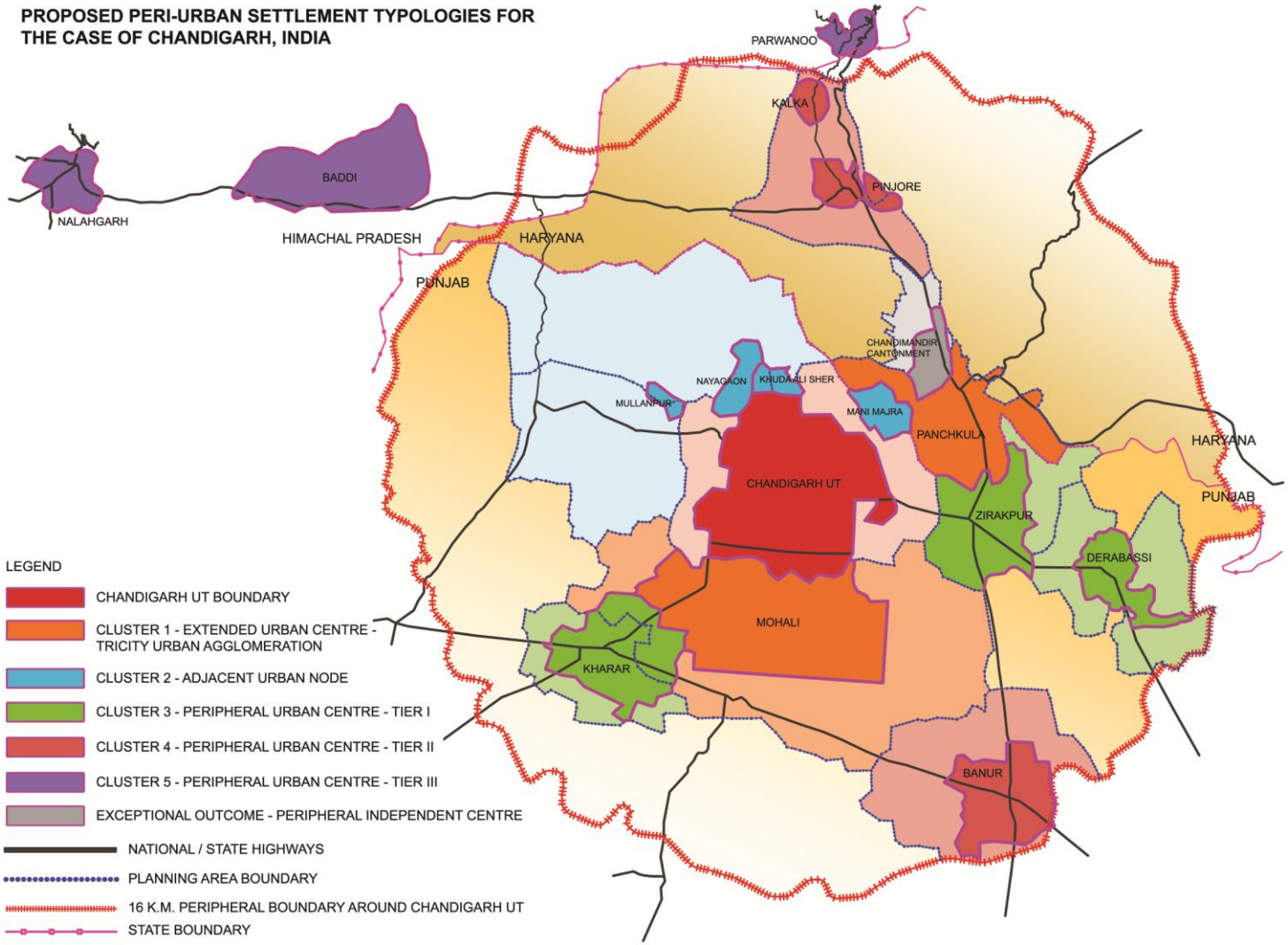

| Clusters on the basis of ENAS | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 90-100 | Panchkula, Mohali, Chandimandir Cantonment |
| Cluster 2 | 80-90 | Baddi, Kalka, Pinjore, Parwanoo, Nalahgarh, Derabassi, Zirakpur |
| Cluster 3 | 75-80 | Khuda Alisher, Mani Mazra, Kharar, Mullanpur, Nayagaon, Banur |




| Clusters on the basis of Present Administrative Body | Value Range | Settlements |
|---|---|---|
| Cluster 1 | 5 | Panchkula, Mohali |
| Cluster 2 | 4 | Zirakpur, Kharar, Derabassi, Nayagaon, Baddi, Kalka, Pinjore, Banur, Parwanoo, Nalahgarh |
| Cluster 3 | 3 | Khuda Alisher, Mani Mazra |
| Cluster 4 | 2 | Chandimandir Cantonment |
| Cluster 5 | 1 | Mullanpur |

Source: Author, 2017

Map 8.2: Proposed Regional Plan for Chandigarh & Periphery – formulation of peri-urban settlement typologies




Source: Author, 2017

## 8.7. Analytical Process - II, Results and Discussion

In the second part of the research proposal, the collected data from 16 peripheral towns against each of the variables are analyzed with the aim of formulating a mathematical model, based on selected parameter. The presence of a peri-urban settlement is measured through 'distance of the town from the core city / core urban area' in k.m. The attempt has made to find how the emergence of the peri-urban settlements is evolved with respect to any of the planning parameters. Such relationship may be established through the statistical analysis of the collected data. The preliminary observation of the collected data shows that with increasing distance of a peripheral settlement from the core city, the total area of open space increases and hence total area of built space decreases. Considering these two variables (% of total open space as dependent variable and distance from the core city as independent variable), statistical analysis is done to find whether they are interrelated and if so, then how.

### 8.7.1. Selection of Parameters

X - Distance from the Nearest Core Urban Area (in k.m.), Y - % of Area Occupied by All kind of Open Spaces. Data of these two parameters are collected for all the selected 16 peripheral towns around the study area of Chandigarh.

### 8.7.2. Methods of Analysis

As described earlier, three methods are applied: Linear Regression Model, Quadratic Regression Model & Matrix Method.

### 8.7.3. Results from Experimental Values

1. Applying Linear Regression Model, the equation for X & Y is established, estimated values of Y and the related error values are analyzed, as shown in Table 8.5.

Table 8.5: Results of Linear Regression

| X | Y | Y^(LINEAR MODEL) | ERROR=Y-Y^ |
|---|---|---|---|
| 8 | 26 | 29.24 | -3.24 |
| 6 | 20 | 26.86 | -6.86 |
| 9.5 | 31 | 31.025 | -0.025 |
| 13 | 36 | 35.19 | 0.81 |
| 16 | 48.5 | 38.76 | 9.74 |
| 6 | 21 | 26.86 | -5.86 |

| | | | |
|---|---|---|---|
| 22 | 53 | 45.9 | 7.1 |
| 32 | 58 | 57.8 | 0.2 |
| 9 | 26 | 30.43 | -4.43 |
| 12 | 34.5 | 34 | 0.5 |
| 25 | 55 | 49.47 | 5.53 |
| 29.5 | 56.6 | 54.825 | 1.775 |
| 14 | 42 | 36.38 | 5.62 |
| 46 | 67.4 | 74.46 | -7.06 |
| 36 | 61 | 62.56 | -1.56 |
| 36.5 | 61 | 63.155 | -2.155 |
| | | | 0.085 (sum of the errors) |

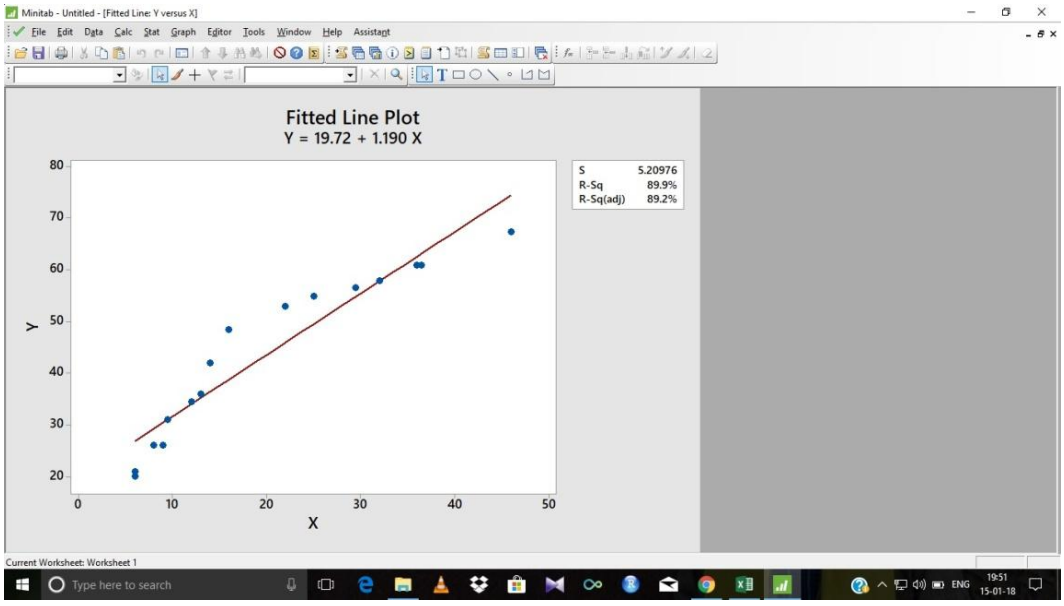
Source: Author, 2017

The linear regression equation is

$$Y = 19.72 + 1.190\ X \qquad (6)$$

Here, Pearson correlation of Y and X = 0.948 & value of R-SQ = 89.9%. As shown in Figure 8.10, the value of Pearson Correlation is positive, indicating the proportional relationship between X & Y. The model summary also shows that value of R-sq is 89.9%, which means such percentage of variation of historical data is explained by the model. The total value of errors due to difference between collected values of Y & estimated values of Y is minimal, i.e. 0.085.

Figure 8.10: Graphical representation of the Linear Regression Model results




Source: Author, 2017

2. Applying Quadratic Regression Model, the equation for X & Y is established, estimated values of Y and the related error values are analyzed, as shown in Table 8.6.

Table 8.6: Results of Quadratic Regression

| X | Y | Y^ (QUADRATRIC MODEL) | ERROR=Y-Y^ |
|---|---|---|---|
| 8 | 26 | 26.54204 | -0.54204 |
| 6 | 20 | 22.00796 | -2.00796 |
| 9.5 | 31 | 29.773865 | 1.226135 |
| 13 | 36 | 36.75234 | -0.75234 |
| 16 | 48.5 | 42.10716 | 6.39284 |
| 6 | 21 | 22.00796 | -1.00796 |
| 22 | 53 | 51.08124 | 1.91876 |
| 32 | 58 | 60.89564 | -2.89564 |
| 9 | 26 | 28.71266 | -2.71266 |
| 12 | 34.5 | 34.83884 | -0.33884 |
| 25 | 55 | 54.7005 | 0.2995 |
| 29.5 | 56.6 | 59.044665 | -2.444665 |
| 14 | 42 | 38.60156 | 3.39844 |
| 46 | 67.4 | 63.83676 | 3.56324 |
| 36 | 61 | 63.02156 | -2.02156 |
| 36.5 | 61 | 63.214985 | -2.214985 |
| | | | -0.139735 (sum of the errors) |

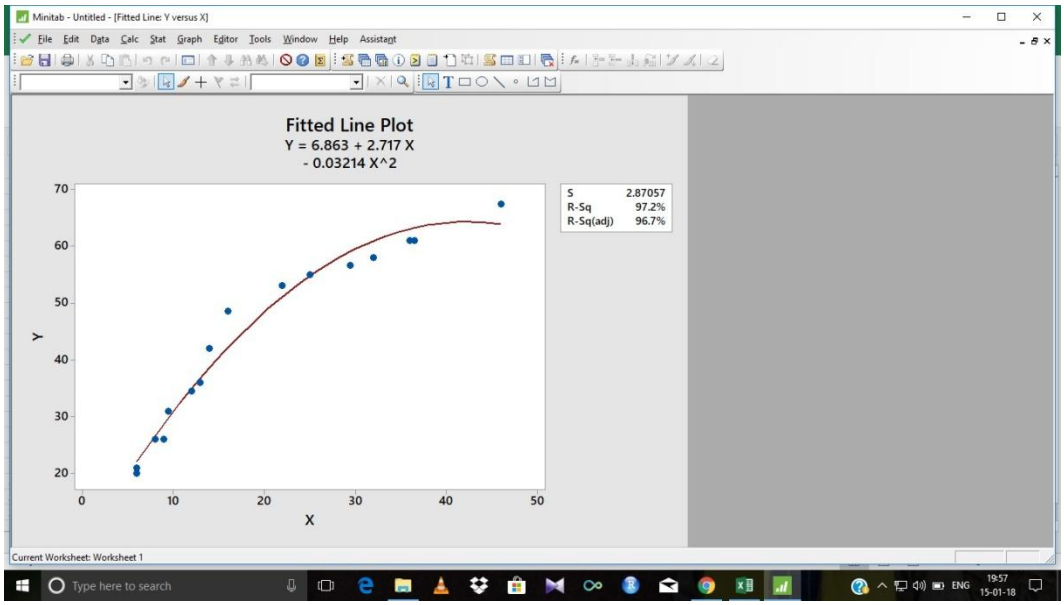
Source: Author, 2017

The quadratic regression equation is:

$$Y = 6.863+2.717X-0.03214X^2 \quad (7)$$

Here, the model summary shows that value of R-sq is 97.2%, which means such percentage of variation of historical data is explained by the model. The total value of errors due to difference between collected values of Y & estimated values of Y is minimal, but higher than what is obtained from the first method, i.e. -0.139735, as explained in Figure 8.11.

Figure 8.11: Graphical representation of the Quadratic Regression Model results




Source: Author, 2017

3. From Matrix method, no equation is formed. Here we get the values of estimated Y and as per the model summary, the total value of errors due to difference between collected values of Y & estimated values of Y is quite high, i.e. 85.84877122, as shown in Table 8.7.

Table 8.7: Results of Matrix Analysis

| X | Y | Y^ | ERROR=Y-Y^ |
|---|---|---|---|
| 8 | 26 | 15.25494 | 10.74505513 |
| 6 | 20 | 11.44121 | 8.558791349 |
| 9.5 | 31 | 18.11525 | 12.88475297 |
| 13 | 36 | 24.78929 | 11.21071459 |
| 16 | 48.5 | 30.50989 | 17.99011026 |
| 6 | 21 | 11.44121 | 9.558791349 |
| 22 | 53 | 41.9511 | 11.04890161 |
| 32 | 58 | 61.01978 | -3.01977947 |
| 9 | 26 | 17.16181 | 8.838187023 |
| 12 | 34.5 | 22.88242 | 11.6175827 |
| 25 | 55 | 47.6717 | 7.328297287 |
| 29.5 | 56.6 | 56.25261 | 0.347390799 |
| 14 | 42 | 26.69615 | 15.30384648 |
| 46 | 67.4 | 87.71593 | -20.315933 |
| 36 | 61 | 68.64725 | -7.64725191 |
| 36.5 | 61 | 69.60069 | -8.60068596 |
| | | | 85.84877122 (sum of the errors) |

Source: Author, 2017

### 8.7.4. Inferences & Discussion

Comparing the results obtained from the above three methods, it is observed that the best result is obtained from Linear Regression Model, where the deviation of estimated values of Y from its collected data, i.e. the total error value is least. Hence, this model is taken for further outcomes. Considering the core urban area / the parent city, X (distance) = 0 and Y = 19.72 (from equation no. 6), which is quite near of the value of total % of open space in the study area – Chandigarh (23% as per Chandigarh Master Plan).

Further, considering the avg. distance of a peri-urban settlement from its core city in this study, X = 20.03 k.m. and Y = 43.6 % (from equation no. 6). A range of relation can be proposed in reference of the above.

- For Urban, open space = 20%, built space = 80% (obtained from the 1st case, where X=0)
- For Peri-Urban, open space = 44%, built space = 56% (obtained from the 2nd case, where X is considered an average value of 20 k.m.)
- For Rural, open space > 44%, built space < 56% (for the settlements in a distance beyond 20 k.m. from the core city)

**Thus, a hierarchy of settlement structure is created using a common parameter like 'total % of open spaces'.** The same may be used for future master plans of cities to judge the saturation / capacity of the place, leading towards its categorization as 'urban' / 'peri-urban' / 'rural'.

**Discussion:** In India, till date, the Census of India only defines 'Urban' area through 'Statutory Town' and 'Census Town' and rest of the settlements are considered as 'Rural' area. Even within this classification framework, Census Towns do not get Municipal status by State Governments and thus not being able to obtain facilities like other urban areas under Statutory Towns. In such classification, Peri-Urban areas are not at all captured. The only exception that we can find post 2011, where 'Urban Agglomeration (UA)' has been coined by Census to identify the urban sprawl in the case of large metropolitan cities in India. However, UAs are not defined separately. The total population of 'Urban areas' along with its sprawl is counted to designate the UAs of Indian cities. From the outcome of the research proposal here, it is quite evident that there is an urgent need to identify / classify / delineate the Peri-Urban areas of Indian cities and thus a Third-Tier of development - 'Peri-Urban' needs to be included in the existing R-U Classification, defined by Census of India. The framework to delineate the Peri-Urban areas, as demonstrated in the research proposal for the

case of Chandigarh; can be followed for all the big cities of the country and the same needs to be included in planning process.

Till date, Census defines 'Urban' or 'Rural' area on the basis of administrative status, population, density and occupational structure. However, from the research it is inferred that these parameters have lesser degree of association to predict the future peri-urban areas. Certain planning parameters are proposed here to be included in the definition of 'Urban' / 'Rural'. One of them is found truly relevant to delineate the future peri-urban areas, i.e. total % of open spaces. This can be even included as criteria of definition of 'Urban', 'Rural' and 'Peri-Urban' areas. Other quantitative parameters may be explored further for better definition. By the inclusion of such planning parameters, the transition areas of development can be better captured / explained in future.

## 8.8. Implication of Peri-Urban Modelling in Future Planning & Policy

To achieve a sustainable habitat, there is a need to fulfil multi-faceted goals through effective utilization and optimization of resources. At present, in India there is a great opportunity to take such attempt. In a rapidly urbanizing economy with fast technological changes, there is a need for governments to quickly and continuously adapt to these changes ensuring smooth and sustained workflow through interactions between government and people. Thus, governance becomes the key factor to manage the urban planning affairs. In this regard, planning policies can be proposed to strength physical planning and governance and such policies can act as significant component towards sustainable urbanization and habitat management with optimized use of resources. The following planning policies are proposed accordingly.

### 1) From Urban Planning towards Regional Planning:

In India, as per 73$^{rd}$ Constitutional Amendment Act (1992), formation of Rural Local Bodies for management of Rural Areas were made mandatory and as per the 74$^{th}$ Constitutional Amendment Act (1993), formation of Urban Local Bodies for administering, managing and preparing Master Plans / Development Plans for Urban Areas were made mandatory. We can see that considering the Census classification for settlements in India, such acts and mandates were formulated. However, there is no specific act to govern, manage the Peri-Urban areas in India, as they do not exist in settlement classification system. As the

research gives a proposal towards restructuring of settlement classification, accordingly it demands for certain change in existing planning policies / acts too. As the 'Peri-Urban' areas are mostly 'Urban' in nature, having urban characteristics in their appearance and as a whole having more 'Urban Tendency' than Rural; hence it may be proposed to include them also along with 'Urban' areas under the provisions of existing 74$^{th}$ Constitutional Amendment Act and empower them to prepare Master Plans and Development Control Regulations and Building Bye-Laws under the proposed framework of Regional Plan.

Mostly, these existing plans have very limited forecasting capabilities. These plans are majorly indicates permissible land-use within a certain administrative and planning boundary of an area and prepare applicable Development Control Regulations & Building Bye-Laws for that specific area. To achieve the same, there is a tremendous lack of multi-disciplinary approach, coordination among various govt. departments and culminating the whole process into effective planning process. As a result, several organizations / authorities are being involved or catering to different urban facilities, who work in isolation. As stated by Shaw, 2005; *"Lack of coordination among many agencies has lead to unsustainable use of land and other resources and also uncoordinated urban growth".* However, these authorities are only concerned with 'Urban' areas, defined and delineated as per the Census of India. The peripheral areas around a major city core are completely ignored from the urban planning process, as they are considered under 'Rural' category as per Census definition. Even, for a specific city / town, it's administrative and planning boundary do not overlap with each other and the planning process is followed with respect to the administrative boundary only, though at many cases, developments spread beyond it. From this research, it is felt that the discipline of planning and city administration cannot concentrate only towards urban areas, but they as authority need to resolve larger issues at regional level, integrating urban as well as peri-urban areas together. A Regional Planning Policy is thus recommended to ensure balanced development across the region.

**2) Inclusion of Peri-Urban Realm in Rural-Urban Classification by Census of India:**

In India, till date, the Census of India only defines 'Urban' area through 'Statutory Town' and 'Census Town' and rest of the settlements are considered as 'Rural' area. Even within this classification framework, Census Towns do not get Municipal status by State Governments and thus not being able to obtain

facilities like other urban areas under Statutory Towns. In such classification, Peri-Urban areas are not at all captured. The only exception that we can find post 2011, where 'Urban Agglomeration (UA)' has been coined by Census to identify the urban sprawl in the case of large metropolitan cities in India. However, UAs are not defined separately. The total population of 'Urban areas' along with its sprawl is counted to designate the UAs of Indian cities. From the outcome of the research proposal here, it is quite evident that there is an urgent need to identify / classify / delineate the Peri-Urban areas of Indian cities and thus a Third-Tier of development - 'Peri-Urban' needs to be included in the existing R-U Classification, defined by Census of India. The framework to delineate the Peri-Urban areas, as demonstrated in the research proposal for the case of Chandigarh; can be followed for all the big cities in India and the same needs to be included in planning process.

**3) A Common Jurisdictional Unit for the country – "Key for Coordination"**

The main reason behind the tremendous lack of effective coordination, as found, is the absence of a "common jurisdictional unit". As explained by Bhagat, 2005; *"Much of the planning process is currently facing issues because of having different jurisdictions for different parastatal agencies. With multiple organizations addressing urban governance, it is rather incomprehensive that none of these organizations have a common jurisdictional unit. Due to this, it is not possible to collate and assimilate data for different city functions, which has lead to isolated interventions, evident from the current planning practices".* As observed in this case, the 'City Beautiful', Chandigarh is spatially expanded in different directions and created a huge agglomeration by including its neighbouring small and medium towns (Census Towns), villages, governed by Municipal Councils / Nagar Panchayat / Village Panchayat to create a large region. However, accepting such developmental fact, a common jurisdictional unit can be proposed. Preparation of the proposed Regional Plan and its implementation would become effective only when all the stakeholders will come under their one common jurisdictional unit.

**4) Inclusion of Planning Parameters for Definitions of 'Urban', 'Rural' & 'Peri-Urban':**

Till date, Census defines 'Urban' or 'Rural' area on the basis of administrative status, population, density and occupational structure. However, from the research it is inferred that these parameters have lesser degree of

association to predict the future peri-urban areas. Certain planning parameters are proposed to be included in the definition of 'Urban' / 'Rural'. By the inclusion of planning parameters, the transition areas of development can be better captured / explained in future.

## 8.9. Concluding Remarks

To summarize the research proposal, both the new scientific achievements are required to mention. First, formulation of hierarchy of transition area of development, creating peri-urban settlement typologies, which can be experimented further for other similar contexts in India and secondly, development of peri-urban modelling to predict the emergence of future peri-urban areas around a major urban centre, on the basis of specific planning parameter, quantifying the 'Urban', 'Peri-Urban' & 'Rural' realms and regulate their developments accordingly.

## 8.10. References

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# CHAPTER 9. AVENUE FOR FUTURE WORKS

## 9.1. Introduction

Chapter 9 attempts to illustrate the limitations faced in the entire process of research, in terms of applications of technological advancement or data collection etc. faced during the research and also explains the possible further research directions for the peri-urban areas, which may lead towards a sustainable future of large areas of peri-urbanization of major cities in India.

## 9.2. Limitations of Research

**First of all,** this research was an attempt to study, understand and analyze the process of peri-urbanization in case of Chandigarh and its peripheral areas, which is a unique case in terms of peripheral development, where development is spreaded across the adjoining states, involving multiple boundaries as well as here the core city is being stagnant in terms of degree of urbanization and the periphery is rapidly expanding. The research does not compare with peri-urbanization scenario of other cities in India. Thus, the outcome is limited or applicable only for the context of Chandigarh and not generic one. It is subjected to further experiment for other similar contexts using the same methodology to prove the viability of this research to be considered as a generic one.

**Secondly,** the analysis is conducted considering only 16 major peripheral settlements around Chandigarh due to limiting factor of data availability. More precision in the outcome of the research may be expected, if data can be collected for more no. of peripheral settlements.

**Third,** the time span considered for analysis in this research is a shorter time period in most cases (2001-2011 timeline) rather than taking a long term time span. Unavailability of sufficient data restrains the analysis from 1981 till date. As we know that the outcome of any analysis, especially in the discipline of urban and regional planning could be more effective if analyzed over a larger time span. The outcome could be more error-free, précised in that case. Thus, there may be immediate consequence for change of scale (time span), which may affect the scenario, studied here and its related spatial behaviour.

**Fourth,** the statistical analysis is carried out using MINITAB software. For the purpose of conducting statistical analysis, a single planning parameter is

considered to run the test. Increasing no. of variables would call for higher computational resources. Large no. of variables may produce better result or equation to predict future peri-urban areas.

**Fifth,** the data (primary survey) has been collected at a specific time / year. However, peri-urban areas face constant change throughout a span of time, which could not be captured in this research (the real-time scenario). A multi-disciplinary approach, integrating remote sensing data in GIS platform could be used effectively to study the gradual change / transformations in peri-urban areas and also to predict the probable future scenario, the possible direction, rate and spatial distribution of possible changes. This research has limitations in terms of use of GIS technology in spatial planning.

## 9.3. The Way Forward

From the process of this study, analysis and outcome, it is felt that further research can be done in multiple directions on peri-urbanization, which may lead towards a planned development in the transition areas. The further research directions are furnished as mentioned below.

1. **Use of Remote Sensing Techniques and GIS Technology** for data collection as well as understanding them. Planning is always multidisciplinary in nature. Data availability and data collection become a tedious process for the case of peri-urban settlements. For such scenario, the research would have better result / outcome using remote sensing techniques and GIS technology. Such advancement in technology must be further used to conduct research in the field of spatial planning. Also these tools would be very much useful to capture data throughout a larger span of time as well as capture the gradual changes and finally helps to do spatio-temporal modelling for peri-urban realms. Use of high resolution remote sensing datasets is a boon as sub-metric level availability of data, which can help to model multiple land-use categories change predictions with greater ease.

2. **The number of variables**, which could explain any city's growth pattern are not finite, but are constrained due to the working of mathematical models. Greater number of variables imposes greater complications in the

smooth working of a model. In this research, a few identifiable variables (found from background research as major determinants in the process of transformation of peri-urban areas) were employed to develop the predictive model. There is a great scope to further experiment on some more variables, which may contribute in the process of prediction of future peri-urban growth. Planning constraints could also be applied to bring out diverse scenarios.

3. **There is immense scope of further research on Urban Modelling** to formulate new simulations and models by integrating machine learning algorithms.

4. **Integration of 3D data** with this study could bring out more practical outcomes, matching more precisely with ground reality. With the help of 3D data, urban growth could be mapped through their spatial pattern (2D) as well as through representation through urban form (3D). Hence, it could include both the space and form. Integration of 2D with such 3D data in one platform becomes much more informative, useful and helps in analyzing the urban transformation.

5. In this research, a list of parameters is prepared, classified into 4 major aspects. From the list, certain parameters were found as non quantifiable either due to non availability of data or nature of parameter. This may lead to a new research direction that may find the **quantification of such planning parameters.** This can be used further to predict future peri-urban scenario.

## 9.4. Concluding Remarks

Considering all the above limitation in tools and techniques, this research was just a small attempt to raise a concern towards city periphery and tries to formulate a predictive model equation to govern future growth. However, still there are many more challenges left to be resolved, which provide enormous research direction. This research on peri-urbanization may be just the footstep towards understanding the peripheral developments in the context of our country and resolving its emerging issues to create a sustainable future.

## 9.5. References


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## CHAPTER 10. CONCLUSION

Urbanization is a direct result of socio-cultural and economic transformation. World-wide, small scale and large scale urban areas are expanding due to migration and a gradual increase of urban population. One of the most important aspects of urbanization observed in the developing countries, specifically in our country; is the "tendency towards concentration of population in large urban centres", which has a large implication in urban & regional planning. While the urban areas are facing tremendous amount of growth, but the basic services and physical / social infrastructure is not able to fulfil the expected demand as per the continuously growing need. The large urban centres / the Metropolitan cities are being stagnant in their cores and facing a contiguous / non-contiguous expansion towards the city peripheries, leading towards conversion of land and land-use, spatial pattern, socio-economic status of those areas at a large. Thus, a new layer of urbanization has been evolved, termed as 'Peri-Urban Interface' here in the research.

Such growth is generally seen in a linear / radial fashion or may be through the formation of isolated clusters. Generally, their developments happen to be in a haphazard, spontaneous and unplanned manner. In this type of development, there is a huge flow of people from the city to the countryside. It is a continuous process through which rural landscape on the periphery of the cities is being replaced by urban and semi-urban development. This rural urban interaction between the town and countryside has created a rural urban fringe around them, which exhibit an intermixing and overlapping of urban and rural character. The term "Peri-Urban Interface" has been used in this research to designate that edge or such areas where we have a mixture of rural and urban land uses".

The term "Peri-Urban Interface" is conventionally defined as *"The zone of transition between built up urban areas and the surrounding countryside". ".....It is a zone of mixed land use pattern and characteristic in which rural activities and modes of life are in a rapid retreat and into which not only residential, but also commercial, educational, recreational, public service and other largely extensive uses of land is going through transformation".* It is the zone of mixing and overlapping of rural and urban character. The term "Peri-Urban" denotes such transitional character and its study is relevant in view of land use planning of cities and surroundings. The city of Chandigarh is no exception of this

phenomenon of accelerated population growth – stagnation at core and resultant peri-urbanization.

Taking the case of Chandigarh & its periphery as the area of study; in the previous 10 chapters of this thesis, the research first sets the objectives and methods of study, reviews the earlier works in this field, understands the nature of context, analyzes the gradual transformation process happened in the periphery and focuses to identify the critical settlements of peripheral development, over which the proposal will be framed. **After study and analysis of these settlements, the key issues of Peri-Urban areas have been identified. The scenario is also been compared with global context and it is found that definition, delineation, categorization and prediction of Peri-Urban plays a significant role to solve the current problems. Even, the analysis has been conducted over funding pattern for recent urban development schemes like JNNURM & Smart City Mission in India to ensure the root of the problem and it is established that due to absence of effective categorization of settlements, the peri-urban areas are largely deprived from getting urban development funds.**

Thus the thesis evolves a list of parameters; using which settlements can be categorized as well as their future emergence can be predicted. The planning proposal comprises of typological classification of peri-urban settlements on the basis of their homogeneity in degree of urbanization using selected parameters to measure degree of urbanization, also formulates mathematical model to predict and delineate future 'Urban', 'Peri-Urban' and 'Rural' areas, on the basis of specific planning parameter. It is proved from statistical analysis that the existing criteria, which define 'Urban' or 'Rural', i.e. Population, Population Density and Occupational Structure are not significant contributor to measure or predict peri-urbanization. The degree of association of these three parameters with peri-urban is found poor. Alternatively, the model proposes new planning criteria to measure and predict future peri-urban growth. **The new scientific achievements in this research are summarized here.**

1. **Identification of the lack in existing Rural-Urban Definitions & Classification System:**

   Research on 'Peri-Urban' area is not new in planning discipline. Several detailed research has already been done to understand the process of transformation in peri-urban settlements - its causes and consequences. However, the lack / the drawback, for which such

unorganized development happen in peripheral areas of cities, has not been identified clearly so far. Hence, identifying this lack in our existing system of development is considered as the first task of this research. Through a comparative analysis of global scenario, this lack is identified here. Primarily two issues have come up from such analysis, which has been taken further to resolve: (1) non-existence of 'Peri-Urban' in the existing Rural-Urban definition and classification system and (2) non-existence of planning related criteria in existing Rural-Urban definition.

2. **Identification of the disparity in development of Indian towns due to existing Rural-Urban Classification System:**
   In ground reality, disparity is observed in terms of development among small, medium and large towns and mega cities in India. However, the reason behind the same has not been cleared so far. From detailed analysis, it is identified that the existing Rural-Urban Classification system has a direct impact in creation of such disparity in development scenario of Indian cities. This identification further ensures the need of restructuring the settlement classification, so that in future, the peri-urban areas / the Census Towns can be covered under development schemes, will undergo planned urbanization and as a result, disparity in terms of development as a whole can be minimized in the country.

3. **Framing a methodology to create Peri-Urban Settlement Typologies for a specific context:**
   A methodology is proposed showing the process of creating peri-urban settlement typologies, defining them with new terms for a specific context. Such methods can be further experimented and applied for any other similar context too. The proposed methodology is framed through the following stages:
   i. **Identification of planning parameters, which can define 'Peri-Urban':** As identified earlier, the basis of existing R-U definition by Census, i.e. the criteria, have tremendous drawback in addressing the peri-urban areas. The main issue is that the criteria is more administrative based, instead of planning based, which can govern the development process.

Hence, finding appropriate planning parameters, which can be a value addition to the existing definition in future, is considered a significant part of the proposal. The research has proposed a list of planning parameters, of which few are generic, experimented and applied already in other contexts and few of them are evolved from context specific studies, for Indian cities carried out by the author. The parameters are so selected that they have direct impact in the phenomenon of peri-urbanization.

ii. **Cluster formation of peri-urban settlements:** The proposed clusters of peri-urban settlements are formed on the basis of homogeneity among them in terms of their degree of familiarity with respect to the selected planning parameters / variables. The proposed clusters of settlements are also mapped spatially to link it with 'Master Plan / Regional Plan Preparation Process'.

4. **Formulation of a mathematical model for delineation / quantification of 'Urban', 'Peri-Urban' and 'Rural' on the basis of specific planning parameter and inclusion of such parameter as an addition in the exiting definition of Rural-Urban:**

   The final scientific achievement in this research has come up through formulation of a futuristic mathematical model, which benefits the development process and resolves the peri-urbanization issues in the following ways:

   i. **Inclusion of a planning based parameter as a new addition to the existing R-U definitions.**
   ii. **Inclusion of 'Peri-Urban' area in the existing Rural-Urban Classification system.**
   iii. **A mathematical model, which will help to quantify and delineate Urban, Peri-Urban and Rural areas for a particular settlement in the physical planning process.**

Summarizing the entire journey of this study, analysis and proposal; the thesis also recommends other directions of further research, felt as required for a better sustainable peri-urbanization scenario in the country.

## ANNEXURE-1

### Papers Published based on Ph.D. Thesis

1. Dutta, S. and Roy, M., 2015. Impact of Internal Migration in Development of Peri-Urbanization: An Indian Perspective, Proceedings of the National Conference on Urban Issues and Architectural Interventions 2015 (NCUIAI-2015), ISBN: 978-81-929293-0-9, pp. 34-46, held at Sinhgad College of Architecture, Pune, India, 18-19 February, 2015.
   Status: Published in Conference Proceeding.

2. Dutta, S. and Roy, M., 2015. Chandigarh periphery: A Quest for Sustainable Urban Landscape, JA *Journal of Architecture*, ISSN: 2249-9326, Volume 05, Number 02, December Issue, pp. 40-46.
   Status: Presented paper in "Concrete Action 2015": 2nd International Conference on 'Urban Landscape: Historic and Cultural Fourth Skin of a Community', held at Chandigarh College of Architecture, Chandigarh, India, October 15-17, 2015 and further Published in Journal.

3. Dutta, S. and Roy, M., 2015. The Role of Chandigarh City Periphery in Conservation of the City Landscape: A Modernist's Approach, JA *Journal of Architecture*, ISSN: 2249-9326, Volume 05, Number 02, December Issue, pp. 47-53.
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