Athens Institute for Education and Research
ATINER

ATINER's Conference Paper Series
PLA2018-2583

Evolving Strategies for Housing Development at a Sub-regional Level

Ratna Ghosh
Assistant Professor
Amity University Uttar Pradesh
India

Uttam Roy
Assistant Professor
Indian Institute of Technology Roorkee
India

An Introduction to
ATINER's Conference Paper Series

Conference papers are research/policy papers written and presented by academics at one of ATINER's academic events. ATINER's association started to publish this conference paper series in 2012. All published conference papers go through an initial peer review aiming at disseminating and improving the ideas expressed in each work. Authors welcome comments.

Dr. Gregory T. Papanikos
President
Athens Institute for Education and Research

This paper should be cited as follows:

Evolving Strategies for Housing Development at a Sub-regional Level

Ratna Ghosh
Uttam Roy

Abstract

The present study is an attempt to integrate the future estimated housing development in a rapidly rising area with its underlying changing parameters and prepare a comprehensive policy road map for sustainable development of housing in the study area. This study draws its approach from the national housing policy thrust to cater to the housing needs in a localized housing market through comprehensive demand assessment. Adopting a sub-regional scale for this study provides an opportunity to explore the local circumstances and plan for customized solutions. The proposed approach builds upon a strategy for housing development that takes into account the existing and estimated growth trends of selected attributes. The recommendations are developed to strike a balance between regulating the intensity and location of development. The same shall take into consideration, important qualitative and quantitative functions such as migration trends, household characteristics, ecological fragility and anticipated future growth in transportation and employment sectors. The quantitative proposals are based on an assumed figure for gross residential density that has been obtained after an empirical analysis of existing densities in the region. The study concludes by providing a detailed phasing plan and defining the role of various stakeholders in the housing delivery process for the region. The recommended typologies and corresponding delivery mechanisms are centered on the core idea of community involvement as well as private sector participation.

Background

Housing is a basic human need and affects everybody regardless of their location, social standing, economic condition or skill levels. Being an issue that directly relates with people first hand, the housing sector is a dynamic one. The functioning of the sector changes and evolves along with the transformations in its user base characteristics and economic environment and therefore, it must be subject to constant monitoring and upgradation. Till yet, the 'piecemeal' approach of housing development implemented in isolation has often lead to the wastage of valuable resources such as land and infrastructure, causing speculations in real estate sector, thereby defeating the core purpose and heightening shortage. The present study is an attempt to integrate the future estimated housing development in a rapidly rising area with its underlying changing parameters and prepare a comprehensive policy road map for sustainable development of housing in the study area.

Regional Scale in Policy Planning Process

Housing development has an important linkage with the regional planning process. A lack of suitable housing contributes to regional disadvantage in many cases, and housing therefore needs to be part of the solution. Suitable housing can make a big contribution to the success of regional development activities, for example by attracting workers to the area and supporting a broader economic and social base. Regional development policies based upon an understanding of local circumstances and local participation will be better able to account for major differences across regions and communities including the local housing market (AHURI, 2003). In order to evolve policies for housing development, fixation of a definite boundary is unpractical since the growth and location of real estate markets is often unprecedented and depends on a number of parameters. Public policy may be appropriately formulated and implemented for areas which are larger than local government authorities (LGAs) but smaller than the State or Nation, usually called 'region's (Murphy, 2010). As housing is a basic need, residential development will inevitably outgrow the recognized ward/municipal/city boundaries in due course of time and therefore limiting such study at city level could produce results which would be neither viable nor totally sustainable. Therefore, a regional scale is seen as the most appropriate in undertaking this research.

Indian Housing Scenario

The housing sector in India is strained with adequate quantity and quality of dwelling units. At present, the total housing shortage in urban India is estimated as 18 million units. With rapid rise in urbanization trends owing to rural-urban migration, the country is plagued with concerns for affordable housing development. About 95% of housing shortage is found among the lower income groups and thus India faces a looming concern for housing affordability.

Housing provision has been traditionally the domain of the government but there is a radical paradigm shift in the schemes and policies recently that encourages private sector participation and active stakeholder involvement in housing sector.

Policy Framework

The national housing policies in India are currently oriented towards localized assessments of housing markets to capture the specific nature of housing demands. The policy thrust is given to implementing market-based instruments to stimulate demand and provide adequate supply. This approach contrasts with the pre 90s era when housing was treated as a social welfare commodity to be mandatorily supplied by the central government agencies. Recent policy interventions give power to the private sector and mandate stakeholder participation at local levels. Financial instruments such as cross-subsidization and flexible financing systems have been introduced to boost involvement of private sector in the housing delivery process.

Research Methodology

Figure 1. *Future Scenario through a Comprehensive Assessment of Future Housing Demand*
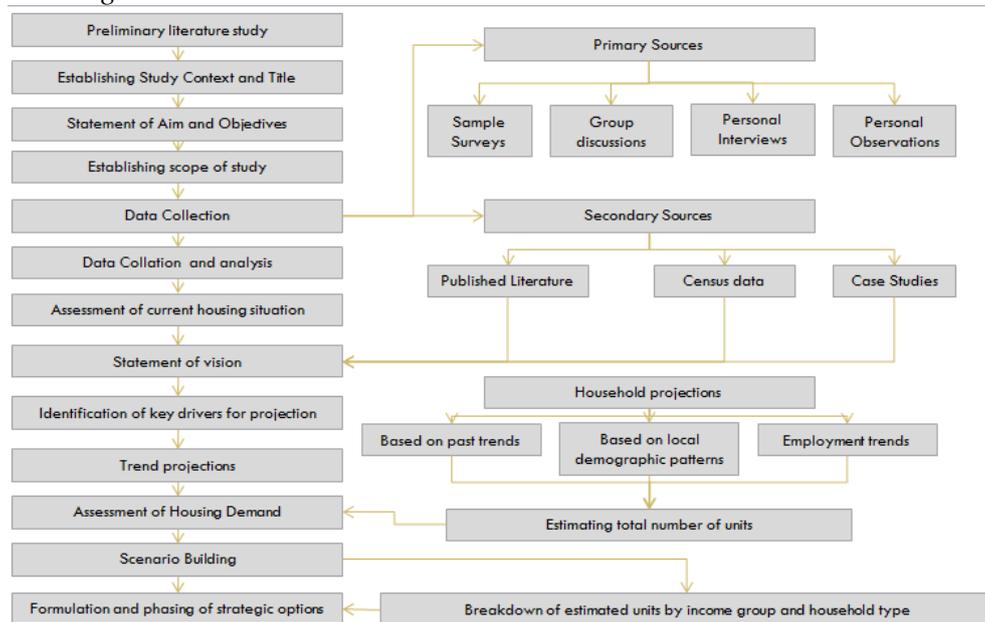

This study draws its approach from the national policy context to cater to the housing demands in a localized housing market in an upcoming region. In alignment to the framework, it undertakes a housing market demand analysis through selected quantity and quality variables. The originality of this research lies in development of an innovative approach to frame a micro-level policy for

housing supply. The key step in the methodology adopted is the building of a future scenario through a comprehensive assessment of future housing demand (Figure 1). This has been estimated based on the past trends, market signals, local demographic patterns and employment structure.

In order to assess the future zoning patterns, the methodology as depicted in Figure 2 has been followed. The strategy for determining the intensity of development builds upon an assumed average gross density which is derived after comparing the densities existing at various locations in the study area. The development of housing typology options from the assumed gross residential density is discussed subsequently, along with a sample calculation in the recommendations.

Figure 2. *Methodology to Locate Development Zones*
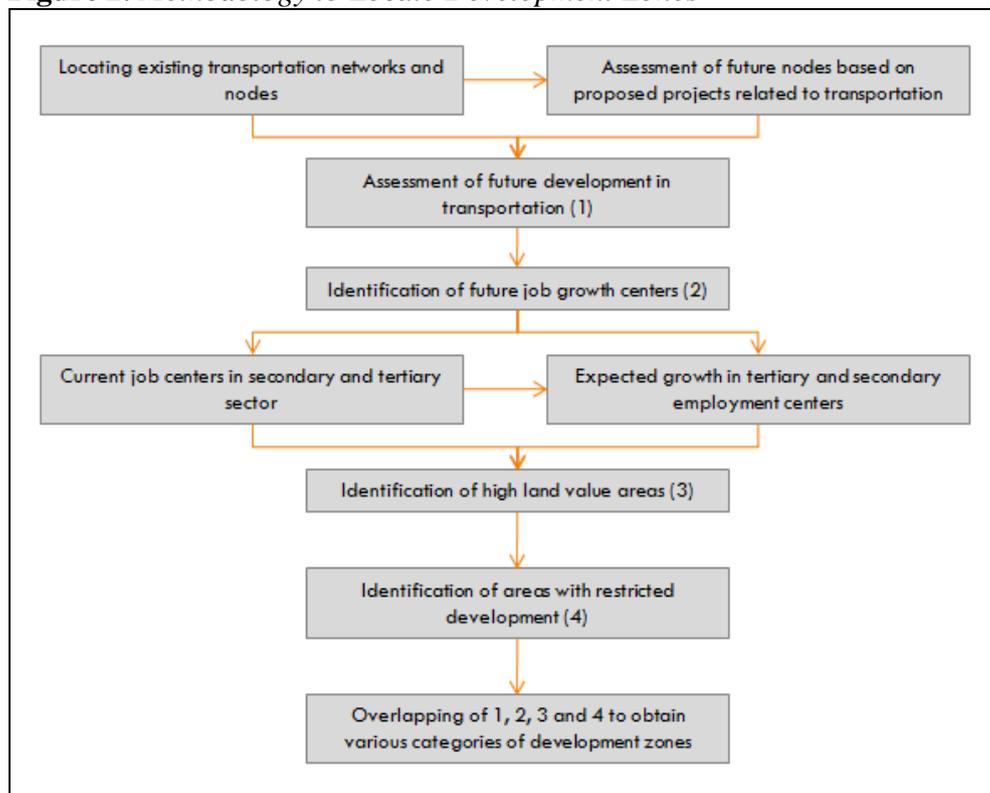
Source: Author, 2015.

Case Examples

Case 1: Leihigh Valley, Pennsylvania, United States

Lehigh valley is a metropolitan region located in eastern Pennsylvania in the United States. The region, being economically active has had dramatic shifts in housing patterns over the last few years, with lower income households more cost burdened, diminished public funding in housing and steep decline in new housing construction. At the same time, the demand of houses, especially high

density apartments, was found to have increased considerably (LVPC,[1] 2014). The analysis of the issues revealed the lack of affordability, variety, unbalanced concentration and sub-standard constructions. Therefore, the policy strategies for the regional plan were to create:

- Livable, mixed-income neighborhoods to reflect the diversity of housing types, tenures and income levels of the region.
- Housing diversity to meet changing needs within existing communities.
- A consortium of housing interests to enhance regional coordination and effectiveness.

Case 2: Greater Mohali Region, Chandigarh, Punjab, India

Greater Mohali Region (GMR) is located on the western side of Chandigarh in state of Punjab, India. Located in the foothills of Shivalik range, a large part of it is designated as environmentally sensitive zone as it includes a large number of protected and reserved forests. The region is strategically located and is intercepted by four national highways. The industrial and service sectors are slowly gaining prominence in the region. As a sub-city and periphery to Chandigarh city, the region is most sought after by investors, developers, companies, professionals and institutions. Their critical concerns included lack of affordability, poor quality of housing stock, land speculation, ineffective governance, and unavailability of funds and reluctance of private developers in participating in the housing sector (PUDA,[2] 2008). The primary strategy was to give the region a strong governance structure to regulate the lopsided market environment. The key postulates of this plan included:

- Provision of public housing
- Setting up of a public housing authority
- Regulating use of public land and common property
- Financial structure of the public housing authority
- Increasing intensity of residential land use along with a phasing plan

Key Learning

The two diverse cases mentioned above demonstrate a diverse range of approaches that may be followed based on the variable baseline conditions and housing concerns. While the first case study lays emphasis on a market-based delivery system of housing to meet the unmet demand, the second case lays stress on an increased role public delivery system of housing in tackling existing housing shortage. While the national policy framework shows a shift from public delivery to market-based delivery approach, still the studies reveal that there is no one particular answer to tackle the housing issue. As such, it should

---

[1]Leihigh Valley Planning Commission.
[2]Punjab Urban Development Authority.

be developed with a mixed approach, with participation from public as well as private agencies.

Study Area Profile

Regional Context

The study area is part of district Haridwar located on the south-west corner of the state of Uttarakhand in India which is sub-divided into 3 sub districts (or Tehsils) – Haridwar, Roorkee and Lakshar (Ahluwalia, 2016) (Illustrated in Figure 3). It forms a part of the National Capital Region (NCR) of Uttarakhand, comprising of the cities of Haridwar, Roorkee, Saharanpur and Dehradun. The area is located on the foothills of Shivalik ranges of the Lower Himalayas and forms a part of the geographical Terai[3] region. It is one of the most significant regions in the northern part of India as it forms an important doorway to the upper Himalayas. Important from the tourism point of view, this region is a vital connection between the national capital city of Delhi with the pilgrimage centers of Kedarnath, Badrinath, Gangotri and Yamunotri.

Identification of Sub-region

Since Haridwar district and its sub-districts are very large and diverse, and the overall housing performance shows stark contrasts, this study takes a sub-regional approach to understand the behavior of the housing markets and prepare its responses accordingly. The study area comprises of 18 towns and 225 villages, with over 60% of the total population as rural population. (District Statistical Diary, 2014). The definition of the boundaries of the study region is based on three primary factors – namely connectivity and ease of access, contiguity of settlements and existing land values.

The extent of the study area has been defined based different factors which are likely to foster future housing growth. They include connectivity, contiguity of settlements and existing land value patterns. Geographically, the study area covers 30% of Haridwar district and 90% of Roorkee sub-district or tehsil. Being of a sub-regional scale covering almost 80000 ha of land area and comprising a population of almost 9.5 lacs, the study area has hereby been termed as the Greater Roorkee Area.

Rationale behind the Study

The region under study is situated 180 km. from New Delhi, the national capital and 50 km from Dehradun, the state capital. It has important linkages with neighboring urban centers of economic importance which include Chandigarh, Sahranpur, Haridwar, Rishikesh, Muzaffarnagar, Ambala, and

---

[3]A belt of marshy jungle lying between the lower foothills of the Himalayas and the plains.

Meerut. The study area is strategically located around two of the most important transportation corridors, namely NH-58 (New Delhi – Roorkee – Haridwar) and NH-73 (Roorkee – Dehradun). While the former highway is important from tourism/ religious and industrial point of view (as it connects the region with the religious hub Haridwar and SIDCUL[4] industrial estate), the latter has a commercial significance as it links the state capital Dehradun with the national capital Delhi. This makes it an important doorway to two of the most significant development zones in the state. The study region is drained by river Solani and the Ganga Canal which bisects it into almost two equal halves. The study area is defined around the city of Roorkee, which has since long been an established educational and institutional hub of national importance. It extends up to the industrial town Bhagwanpur on its west, which is one of the most prominent industrial estates in the state. Further it stretches up to the religiously important town of Piran Kaliyar and the commercially important Patanjali Yogapeeth on its east.

The recognition of the commercial value of the region has led to the creation of a 'high demand, high value' scenario. Because of its important location and current low rates of development, the region offers an attractive opportunity for the investors and buyers, which is exhibited in the escalation in number of townships in the area. Supported by a surge in the economic activities and physical development, the region is facing the challenge of a high and unprecedented growth in the foreseeable future.

Figure 3. *Location of Study Area*
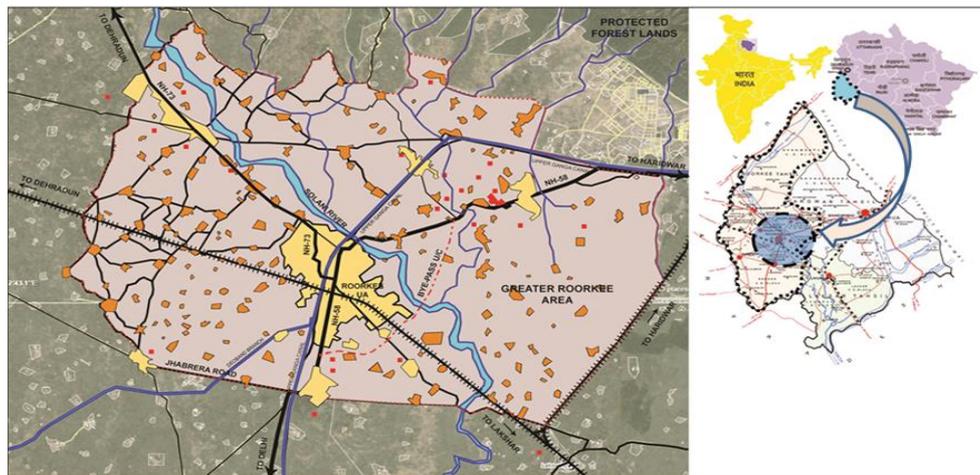
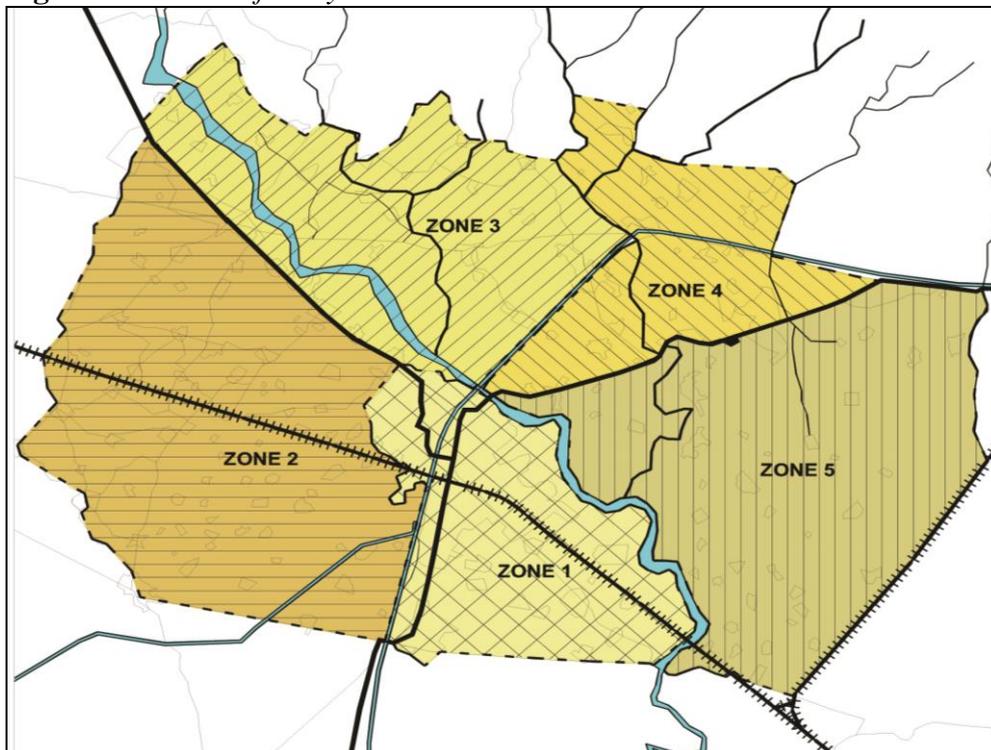*Source:* Author, 2015.

Division into Sub-zones

The regional housing demand is assessed based on its demographic characteristics, socio-economic profile and household characteristics. Most of the data is retrieved from secondary sources that include the Census of India,

---

[4]State Industrial Development Corporation of Uttarakhand Limited.

District Census Handbook and other published reports. For ease of data collation and assimilation, the study region has been divided into 5 zones. The extents of these zones are defined by a physical boundary such as a road or a canal. Administrative extents also play a crucial role in determining zone boundaries. There is no socio-economic or demographic basis for the division of the zones, however they are explicit in terms of the predominant character. The salient attributes of the zones illustrated in Figure 4 are as follows:

- Zone 1: Area designated as Roorkee Urban Agglomeration. It consists of the Roorkee Cantonment Area and a cluster of slums. Brick manufacturing kilns and other manufacturing industries dominate this zone. Exhibits the highest population density, literacy levels and economic status.
- Zone 2: Exhibits nucleated rural settlements dispersed in an irregular fashion. This zone is dominated with a rising number of urban villages.
- Zone 3: This zone exhibits dispersed rural settlements and are characterized by the presence of an ecologically sensitive zone and industrial belt along the NH-73 highway.
- Zone 4: Dominated by ribbon development along NH-58 and commercially important pockets for development. Consists of Piran Kaliyar, a religiously significant place that hosts mega events.
- Zone 5: Characterized by less intensity of settlements and absence of basic infrastructure provisions.

Figure 4. *Division of Study Area in Zones*


Source: Author, 2015.

Data Collection

The techniques applied in surveys include group discussions and personal interviews apart from sample survey and reconnaissance survey tools. A combination of stratified and random sampling has been carried out in the household survey through schedules and questionnaires, in which the number of households surveyed in each zone is proportionate with the number of census households in the particular zone. However within a particular zone, random survey has been carried out. The spatial and inter-sectoral relationships have been identified and analyzed through mapping techniques. In order to capture the diversity in housing preferences, a sample survey was conducted with sample size as 200. The distribution of the samples was done proportionately to the population distribution in each zone.

Observations and Discussion

Demographics and Socio-economic Profile

The analysis of this region reveals its increasing dynamism and a gradual shift towards the tertiary economy from a primarily agricultural region. The literacy levels are low and the region faces a big challenge of rising unemployment levels. However, a comparison of statistics shows a gradual and considerable increase in the education levels of younger population, indicating a relatively higher skill levels in the incoming workforce population in the future. The socio-cultural profile of the region shows a preference for large size households that has shifted from a joint family system to an extended nuclear family system with an average household size of 6 persons. It is observed in Figure 5 that a vast majority of the population (40%) falls in the LIG[5] and MIG[6] category. The average monthly household income in the study area comes to Rs.26, 310 (USD 360).

Figure 5. *Share of Population by Income Category*
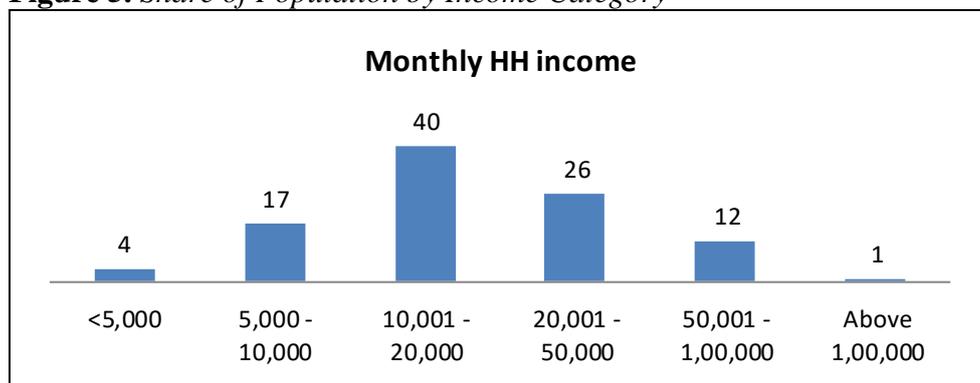

Source: Primary Survey; Sample Size: 200.

---

[5]Low Income Group.
[6]Middle Income Group.

Land Use and Land Value

The overall land cover of the study region is dominated by agricultural use followed by manufacturing use. While the former is understood since the majority of the region follows rural character, the latter fact is attributable to the large number of brick fields present in the area, majority of them located in Roorkee UA (Zone 1). The land use distribution of the developed land area in the overall study region and Roorkee UA is illustrated in Figures 6 and 7 respectively. The share of exclusively commercial zones and parks/open/recreational spaces is extremely less in both the cases. The current ratio of developed to undeveloped land area in the study region equals 80:20. The predominant change in land value over the last decade is seen along the transportation corridors and has increased by 30-50%.

Figure 6. *Land - use distribution Greater Roorkee Area*
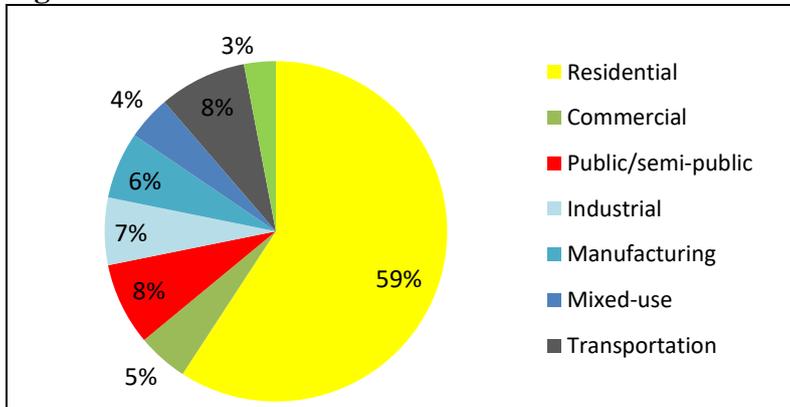
Source: District Census Handbook, Haridwar & Census Tables 2011.

Figure 7. *Land - Use Distribution Zone 1 (RUA)*
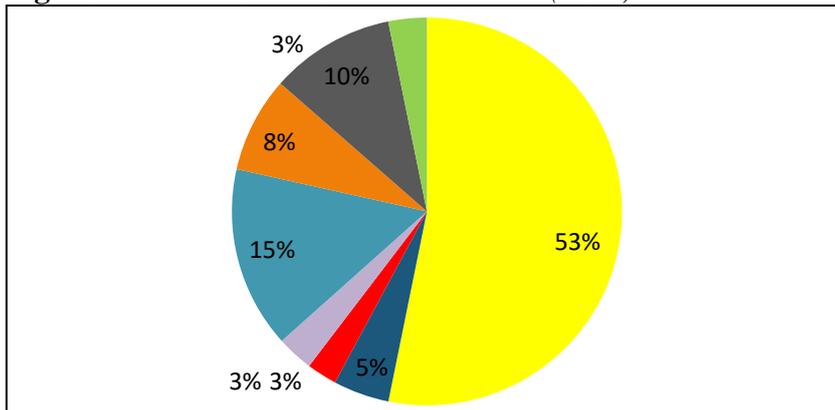
Source: District Census Handbook, Haridwar & Census Tables 2011.

Figure 8. *Housing Typologies in the Study Area*
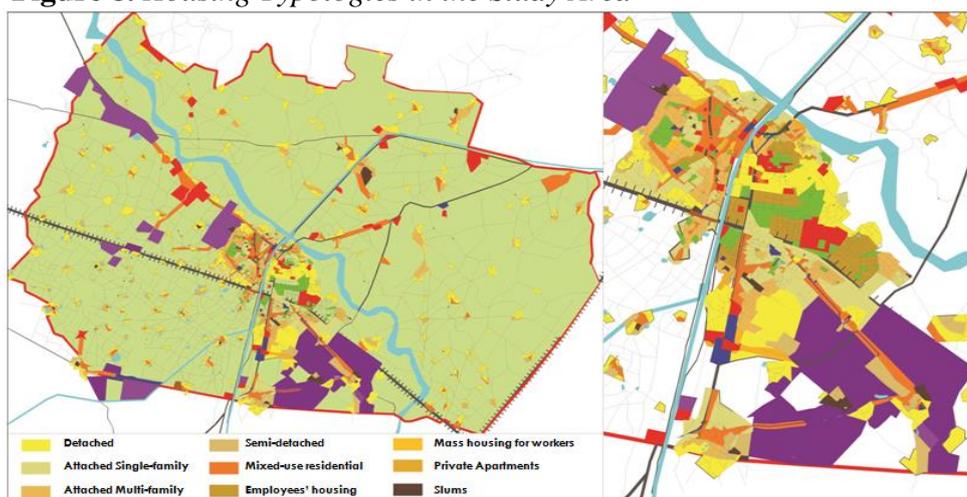

Source: Primary Survey.

Housing Market Assessment

Household Characteristics

Presently, the maximum number of households are located in Zone 1 i.e. Roorkee UA, forming 42% of the total share. Zone 4 has the minimum number of households, contributing 6% (DCHB, 2011.)[7] The total number of households in the study region has nearly doubled in between 2001-2011, showing a growth rate of 46.67%. When analyzed zone-wise, the increase is found to be maximum in Zone 5 (57.51%) while minimum is found in Zone 4 (41.95%). The average household size in the study region is 5.8. It is found to be least in Zone 1 (5.5) and highest in Zones 3 and 4 (6).

Housing Stock

Roorkee UA (Zone 1) houses almost 40% of the total housing stock of the total study region (DCHB, 2011). One can note a rise in the non-residential use of the census houses, especially as a hotel/lodge/guest house, as a consequence of development of tourism in the region. The share of semi-permanent and temporary houses in the total stock is highest in Zones 2 and 3 respectively. Also, the share of permanent structures in the housing stock is highest in Zone 5, followed by Zone 4 and least in Zone 2.

Adequacy

It is found that the share of households living in single room units is highest in Zone 3 followed by Zone 1, representing a problem of housing congestion in

---

[7]District Census Handbook Haridwar.

the latter. Moreover, the share of households residing in houses having 6 or more rooms is highest in Zone 2 followed by Zone 5 and Zone 1. This is attributable to the large semi-detached typology being constructed in the largely rural areas of Zones 2 and 5.

Typologies

In the study region, the typologies found in housing exhibit a wide variety, ranging from the traditional village house to the newly designed high end apartment buildings (Figure 8). Most of the Roorkee city is developed in an organic fashion, with the exception of prominent institutional areas such as the cantonment area and IIT[8] campus, which are planned colonies. Being home to important institutions of the likes of CBRI[9] and IRI[10], there is substantial stock of employee housing in the area, amounting to roughly 15% of the total housing stock (District Statistical Diary, 2014).

The neighborhood patterns found in the rural communes of the study area exhibit few commonalities such as being centered around a point of interest which may include a tree having religious significance, a temple or mosque and the residence of an influential person in some cases (royal palace, for example). The planning of urban neighborhoods is largely missing from the picture and can be only seen near the employee quarters.

Issues and Concerns

The region offers an attractive place for living, the economic value of which is set to increase in future. Therefore, affordability will be a key issue in controlling the access to quality housing. Zones 1, 3 and 4 have attracted mega investments in township projects recently, targeting and attracting the middle income category from within and beyond the region. Therefore, for a balanced development of housing, the following issues need to be addressed:

- Differential demand across various locations in the region due to sharp variations in land prices.
- Low income amongst the majority of the population due to lack of adequate employment and skill levels.
- Rising workforce in tertiary sector.
- Ongoing unemployment.
- High anticipated migration levels and surge in households.
- Rising younger population as household heads.
- Fragmentation in household sizes.
- Gap between housing demand and delivery.

---

[8]Indian Institute of Technology, Roorkee.
[9]Central Building Research Institute.
[10]Irrigation Research Institute.

- Anticipated increase in slums and urban villages.
- Requirement of land more than available to house the estimated population.

Strategies and Recommendations

The core strategy to tackle the emergent issues from the study was thought to be a balance between regulating the intensity of development and location of development. The intensity or extent of housing is regulated through introducing variations in density patterns while the location of specific typology of residential development is identified after an integration of existing and expected development zones in the region. The exercise of locating a particular kind of residential development takes into consideration the transportation factors, employment factors and ecological factors.

Strategies for Intensity of Development

Figure 9. *Methodology for Determining Intensity of Development*
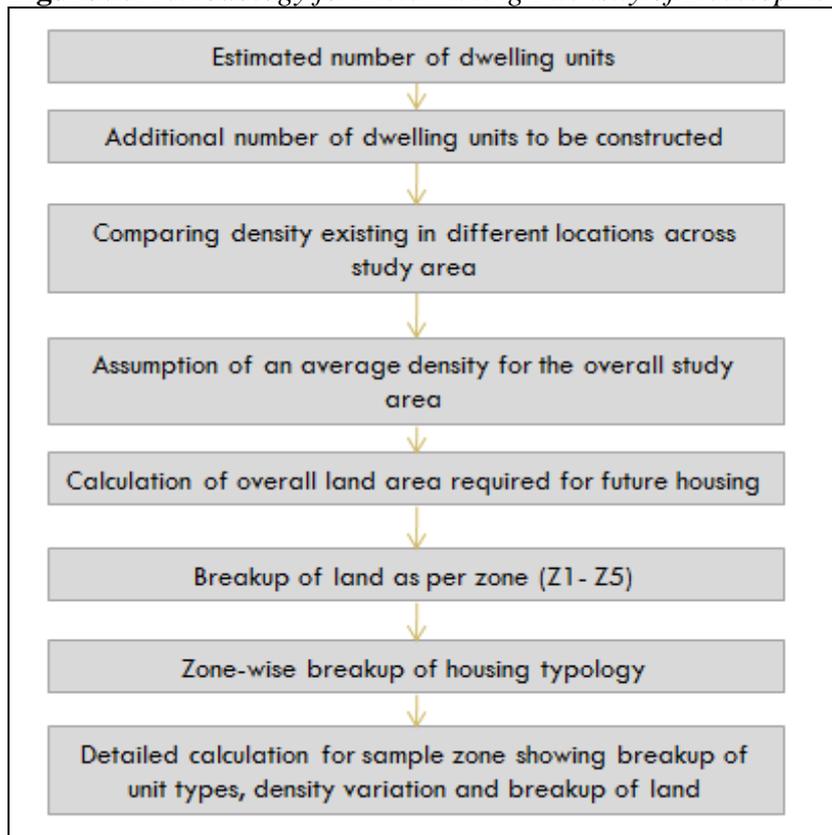
Source: Author, 2015.

The model developed for determination of quantity of housing units and their concentration is illustrated in Figure 9. The calculation for additional number of dwelling units required, takes into consideration the housing target

estimated for the last projected year i.e. 2041, which are almost 9 lacs to house an estimated population of almost 35 lacs. This target also considers the estimated number of households added with the current housing shortage of about 4000 dwelling units. Assigning the density begins with an assumption of overall gross density, taken as an average of the maximum and minimum range of densities existing in the region. The available densities range from under 5 DU/ha to almost 200 DU/ha in the study area. The assumed overall gross density is taken as 100 DU/ha.

From the calculated number of additional dwelling units and assumed density, we have the overall land area required for future residential development as 9026 Ha of land area (Equation 1).

Land area required for future housing = Number of dwelling units / overall gross density   ….. (1)

The land area required for overall residential development so obtained is divided into the various sub-zones in the region, based on the expected levels of development in the particular zone in the ratio shown in equation 2. The anticipated levels of development are based on empirical analysis of the current state of infrastructure in the respective zones and the preferred locations for current large scale investments in the region. Based on this argument, Zone 1 is most likely to develop more intensively due to the central core of Roorkee city, whereas Zone 3 housing the ecologically fragile area is least likely to be taken up for housing investments. Zone 4 also is prone to a high growth scenario as it contains the NH-58 corridor that links Roorkee with Haridwar and further areas of Uttarakhand.

Ratio of land in Z1:Z2:Z3:Z4:Z5 = 4:2:1:3:2   ….. (2)

Applying the same bias of anticipated concentration of settlements in future, the zone-wise breakup of housing typology has been done in Table 1, from where a detailed determination of required housing units of specific typology and their phasing for a sample zone has been presented further.

Table 1. *Zone -wise Breakup of Housing Typology*

S.No.	Zone	Group : Plotted : Mixed
1	Z1	3:1:2
2	Z2	2:1:1
3	Z3	1:2:2
4	Z4	3:1:2
5	Z5	2:1:2

Source: Author, 2015.

Detailed Calculation for Sample Zone (Zone 1)

Density and Land Area Distribution

The total number of units calculated for this zone are 11, 12,000 (11120 Ha (*physical area of Zone 1*) X 100 units/ha) that have further been subdivided as shown in Table 2.

Table 2. *Typology Wise Break up of Density in Sample Zone (Z1)*

S.No	Mix of units	Proportion	No of units	Proportion of density	Density (units per Ha)	Land Area required (Ha)
1	Group Housing	3x	556000	3	350	1589
2	Plotted Housing	1x	185333	1	125	1483
3	Mixed	2x	370667	2	250	1483

Source: Author, 2015.

The criteria for arriving at the mentioned proportion of density is as under–

- The total required land area with this proportion comes out to be almost 4500 Ha, which is almost 41% of the total land area of the zone. Given that this zone has a high proportion of tertiary and secondary activities, the available land is already occupied. Hence, optimizing land utilization should be preferred during future development.
- As mentioned in several housing policies, group housing developments having a density of 350 DU/ha[11] or more are eligible to be stated as affordable housing projects, thereby receiving central grants and financial aids for development.

Distribution into Income Groups

The ratios seen in Table 3 are assumed based on an empirical analysis of population growth in different income groups and their respective paying capacities. As a rule of thumb, the plotted housing development is generally more affordable to the higher and middle income groups than the lower income groups. The proportion of units in mixed development has been increased so as to promote mixing of different income groups and built forms, thereby generating interesting built spaces and cohesive communities.

---

[11]Dwelling Units per Hectare.

Table 3. *Typology Wise Break up of Housing Units*

S.No	Mix of units	No of units	HIG:MIG:LIG	HIG units	MIG units	LIG/EWS units
1	Group Housing	556000	1:2:3	92667	185333	278000
2	Plotted Housing	185333	3:2:1	92667	61778	30889
3	Mixed	370667	2:2:3	105905	105905	158857

Source: Author, 2015.

Phasing of Units

The phasing of units, shown in Table 4, into various time frames has been done pro rata to the estimated households in the corresponding income category and the estimated household formations in the various years obtained from detailed analysis.

Table 4. *Phasing of Units for Sample Zone*

Typology	Sub-typology	Target (2021)	Target (2031)	Target (2041)
GH[12]	HIG	55600	74134	92667
	MIG	150120	166800	185333
	LIG/EWS	345276	319700	278000
PH[13]	HIG	55600	74134	92667
	MIG	50040	55600	61778
	LIG/EWS	38364	35522	30889
MH[14]	HIG	63543	84724	105905
	MIG	85783	95315	105905
	LIG/EWS	197300	182686	158857

Source: Author, 2015.

Distribution of Dwelling Units into Heights

The number of units so obtained is accommodated into buildings of varying rises based on the proportion of population in different income groups and their corresponding capacities to afford. Thus the proportions of group housing units in medium to units in high rise buildings is equal in case of HIG, lower in MIG and further lower in LIG[15] category.

In plotted housing, the units have been divided into low and medium rise buildings, suggesting a higher proportion of the latter to achieve a fair amount of density. The mixed housing typology is again proposed to have more HIG units in low and medium rise buildings while maximum of MIG and LIG/EWS units

---

[12]Group Housing.
[13]Plotted Housing.
[14]Mixed typology housing.
[15]Lower Income Groups: Defined in India as households with annual income from Rs. 1,00,001 to Rs 2,00,000 (USD 1,370 – USD 2,740).

are proposed to be accommodated into medium and high rise buildings. Table 5 shows the distribution of units into buildings of varying heights.

Table 5. *Building Height - Wise Distribution of Units*

Mix	HIG units			MIG units			LIG/EWS units		
GH	HR : MR = 1:1			HR : MR = 2:1			HR : MR = 3:1		
Units	46333		46333	123556		61778	208500		69500
PH	LR : MR = 1:2			LR : MR = 1:2			LR : MR = 1:3		
Units	30889		61778	20593		41185	7722		23167
Mixed	LR : MR : HR = 2:2:1			LR : MR : HR = 1:2:2			LR : MR : HR = 1:2:3		
Units	42362	42362	21181	21181	42362	42362	26476	52952	79429

*HR, MR and LR represent High Rise, Medium Rise and Low Rise respectively.
GH and PH represent Group Housing and Plotted Housing respectively.
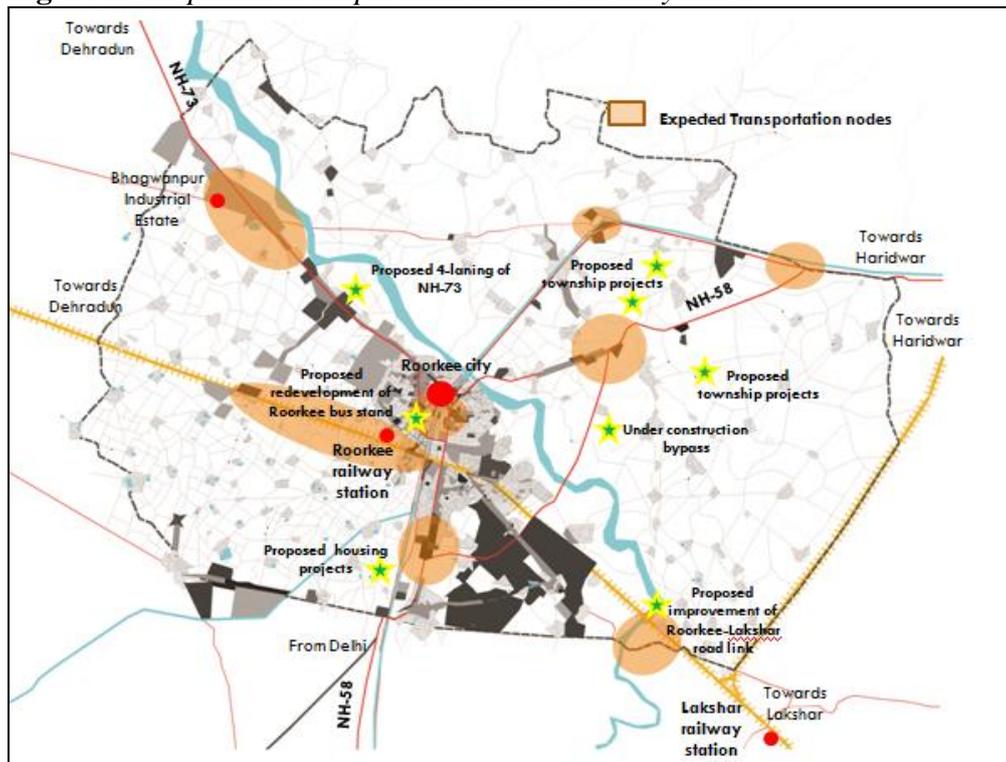*Source:* Author, 2015.

Strategies for Location of Development

As a primary strategy, the spatial pattern of future residential development has been proposed based on the growth patterns expected to ensue in the region based on various growth parameters such as transportation networks and nodes, land value, employment generation centers and restricted areas for development seen in Figures 10, 11 and 12 respectively. Overlapping these factors, the different typologies of residential development are obtained (Figure 13).

Proposals for Development in Various Residential Zones

In addition to the identification of various types of residential zones, an overall pattern of development has been proposed by specifying the proportion of housing typologies and building heights, based on the proportion of residential area available in each corresponding zone. The core residential areas have been proposed to contain more plotted and mixed housing units of predominantly low heights to maintain a human scale and achieve more community spaces at a neighborhood level. The residential areas around existing and anticipated commercial zones are proposed to have more group housing development, preferably high rise, to accommodate more workers and encourage planning of mixed-use buildings.

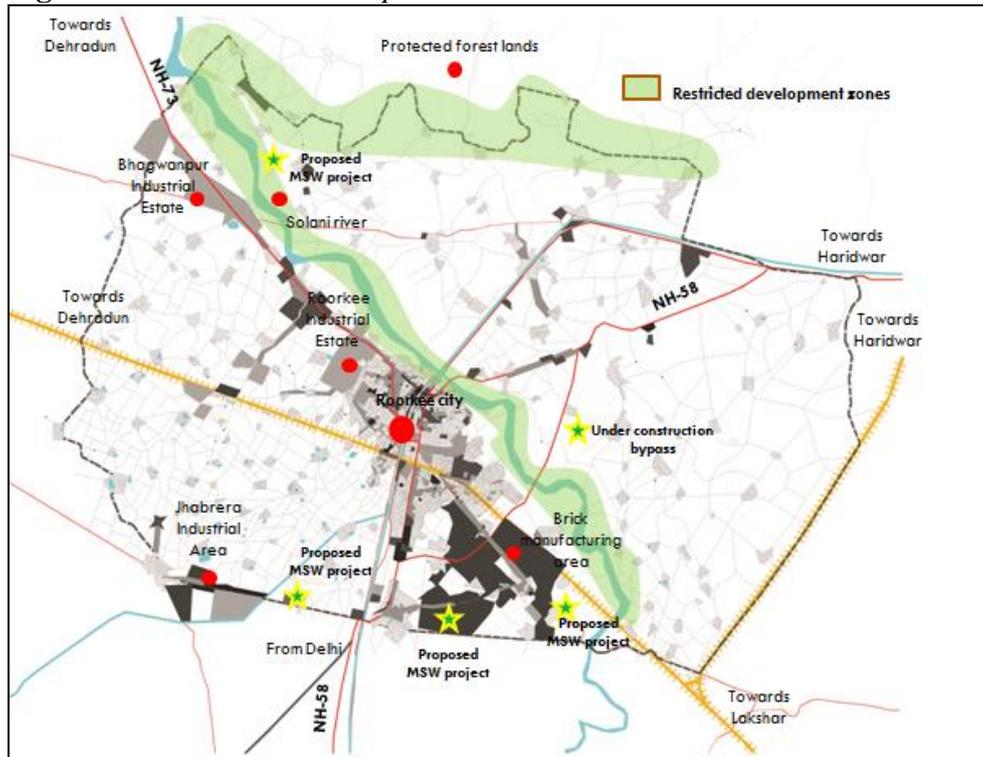**Figure 10.** *Expected Transportation Nodes in Study Area*

Source: Author, 2015.

Figure 11. *Expected Employment Centers in Study Area*
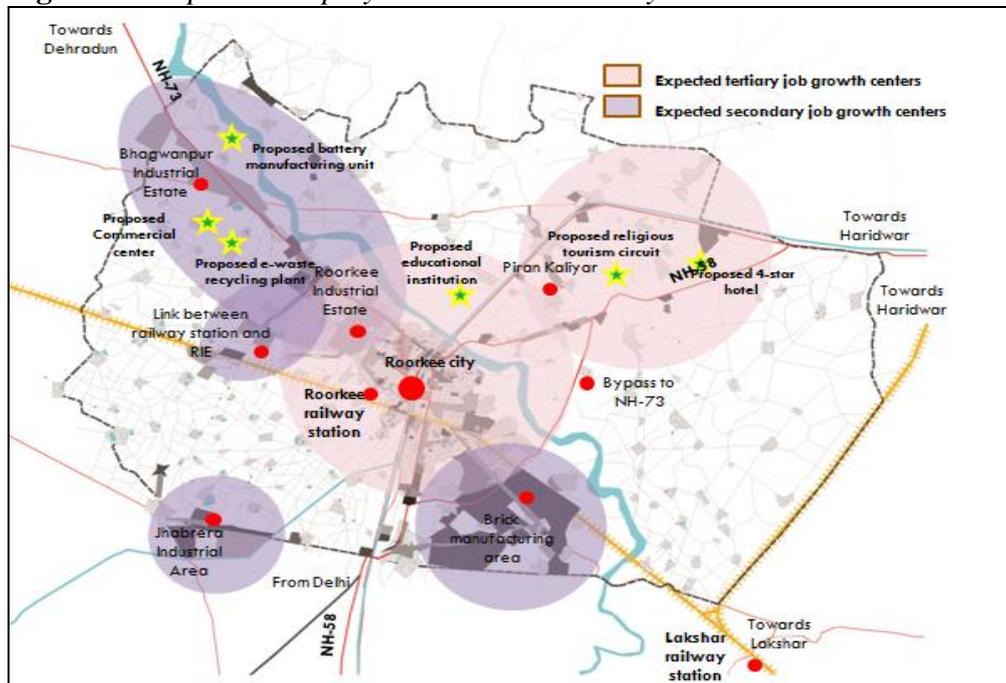
Source: Author, 2015.

Figure 12. *Restricted Development Areas*

Source: Author, 2015.

Figure 13. *Residential Zoning in Study Area*
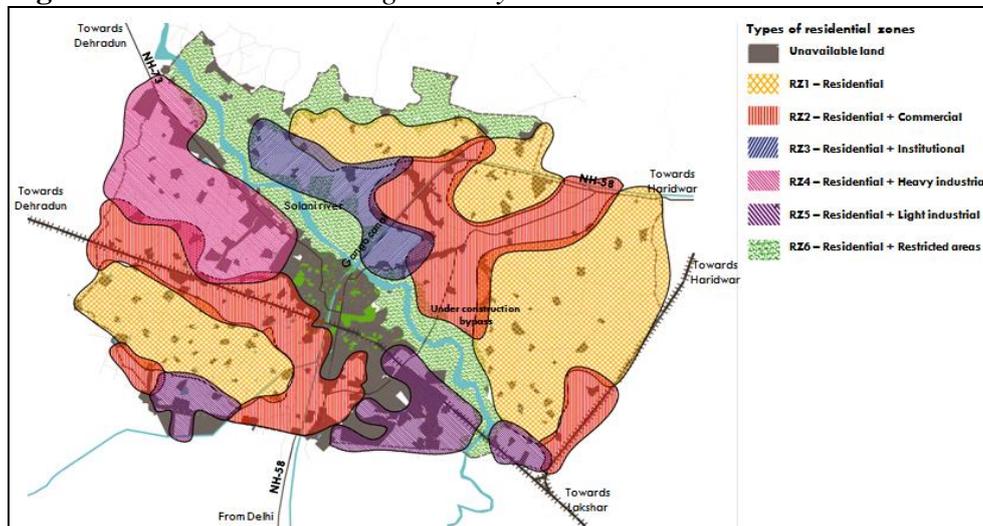
Source: Author, 2015.

The residential areas around existing and upcoming institutions are proposed to have more mixed form of development of medium rise, to achieve a medium density as also get some free land to incorporate the other activity spaces. Residential areas around heavy industrial locations would have less proportion in terms of land coverage and therefore to house the workers, generally mid and low income categories, a high rise group housing development is preferred here (illustrated in Table 6). The same explanation is

applicable for areas around light industry/manufacturing units except that a possibility of medium rise residential buildings can be explored, given the low worker population employed here. The residential areas located around the restricted development zones are proposed to be very low density comprising of mostly plotted development, so that the ecological footprint can be controlled. In certain pockets where the density can be increased, mixed housing development should be prioritized over group housing.

Table 6. *Development Proposals in Residential Zones*

Name	Type of residential zone	Proportion of residential land - use	Proposed GH:PH:MH	Proposed LR:MR:HR
RZ1[16]	Core Residential	-	1:2:2	2:2:1
RZ2	Residential around Commercial	Commercial : Residential = 60:40	3:1:2	1:3:1
RZ3	Residential around Institutional	Institutional : Residential = 50 : 50	2:1:2	2:3:1
RZ4	Residential around Heavy Industrial	Heavy Industrial : Residential = 80 : 20	3:1:2	1:2:3
RZ5	Residential around Light Industrial	Light Industrial : Residential = 70 : 30	3:1:2	1:2:2
RZ6	Residential around Restricted Development Areas	Restricted Area : Residential = 90 : 10	1:3:1	3:2:1

*HR, MR and LR represent High Rise, Medium Rise and Low Rise respectively; GH and PH represent Group Housing and Plotted Housing respectively.
Source: Author, 2015.

Delivery Mechanisms

Herein, the estimated numbers of units of different typologies are sub-divided into the corresponding delivery systems which are best suited for them. Table 7 gives the detailed distribution. For instance, the mechanism of procuring HIG group housing units has been maintained at the ratio as per equation 3.

Private housing: Institutional housing: Social housing: Co-operative housing = 3:1:1:2   …… (3)

---

[16]RZ: Residential Zones.

The delivery mechanism identifies four types of delivery systems – institutional, social, co-operative and private housing. Considering a national policy trend towards market based delivery of housing, considering the quality and cost parameters, it is considered of paramount importance to give the maximum responsibility to private developers for housing delivery. The second most important mechanism would be through group co-operative housing societies, since the national policy structure advocates self-help housing and Public-Private-People-Partnership mode of procuring housing. The housing typologies, group housing, plotted housing and mixed housing are divided in these systems based on the targets for their income-based sub typologies.

Table 7. *Proposed Delivery Mechanism of Targeted Units*

Typology	Sub-typology	Target (2041)	Private developers	Institutions	Development Authority	Co-operative societies
GH	HIG	92667	3x	x	x	2x
	MIG	185333	4x	2x	x	3x
	LIG/EWS	278000	3x	2x	2x	x
PH	HIG	92667	2x	2x	x	x
	MIG	61778	3x	x	2x	2x
	LIG/EWS	30889	x	2x	3x	x
MH	HIG	105905	3x	2x	2x	x
	MIG	105905	3x	2x	2x	3x
	LIG/EWS	158857	4x	x	2x	x

Source: Author, 2015.

The various delivery systems employ and involve a different range of stakeholders who have a different kind of role to play each time. However, the role of local government is identified to be the most pronounced among all the stakeholders. This is in conjunction with the decentralization of housing policy-making as postulated in the National Housing and Habitat Policy, which seeks to empower the state and local governments for housing.

Role of Stakeholders

Details of the diversity of stakeholders involved in the housing market are shown in Table 8. While the role of private developers is largely seen as service providers, ensuring the development of targeted housing stock complying with the required quality standards within stipulated timeframe, the key role of customers as end users is to upgrade awareness levels and facilitating market assessments though active participation. The customers may help is securing finance through forming Housing Improvement Trusts as help in quality control through engaging in local level supervision and management of housing construction activities. They are also seen as key sources to disseminate

knowledge related with local construction techniques and help in the training of workers.

Table 8. *Types of Stakeholders in Different Delivery Systems*

Typology	Key stakeholders involved
Private housing	Local Authority Housing/Planning Department
	Developers/ Builders
	Registered social landlords
	Non-registered providers
	Regional Administrative Office
	Investors/Funding agencies
	NGOs/social organizations
	End users
Institutional housing	Government departments/institutions of learning, industry
	Local Authority Housing/Planning Department
	End users
Social housing	Local Authority Housing/Planning Department
	State Government
	Private sector developers/agencies
	NGOs/social organizations
	End users
Co-operative housing	Housing associations
	End users
	Local Authority Housing/Planning Department

Source: Author, 2015.

Conclusions

This study is an attempt to tackle the existing and upcoming issues related to housing at a sub-regional level, which is a balance between the diversity of housing markets prevalent in larger areas and incomplete markets prevailing in the small pockets. Adopting this scale of study provides the researcher an opportunity to explore the issues in details and therefore the results that are produced are location specific apart from covering the regulatory framework aspect. Thus this scale allows a fair degree of customization of the solutions and hence can be seen as sustainable. This also puts in check the wastage of infrastructure and valuable resources by integrating housing development with the overall development of the region, giving it a comprehensive nature.

The key learning that this study provides is the customization of housing strategies at a local level and incorporating them into the policy framework. The solutions provided herein are not applicable to any other location unless it has comparable characteristics in terms of demographics, socio-economic condition or ecological parameters. The reference cases used in this study showed comparable characteristics with the region and brought out the various ways in

which housing situation under these circumstances can be addressed. Local level studies of this kind are very important to capture the demand-supply dynamics of housing at a particular location and makes targeted provision more effective due to market responsiveness. In the wake of resource constraints and burgeoning housing demand that the nation faces, such studies are extremely important as a guideline or road map to guide the future housing development in any given area and ensure smart and sustainable development in future, responsive to the local context.

References

Ahluwalia, D. *Haridwar Development Region - A Regional Profile.* Shodhganga.inflib. ac.in. [Accessed January 14, 2016].

AHURI (Australian Housing and Urban Research Institute), 2003. *Research and Policy Bulletin,* Issue 20, ISSN 1445-3428.

Census of India. *Household and Houselisting Tables.* Census Tables, District Haridwar: Census of India, 2001 & 2011.

Directorate of Census Operations, Uttarakhand. District Census Handbook. Village and Town Primary Census Abstract, Haridwar: Directorate of Census Operations, Uttarakhand, 2011.

Directorate of Economics and Statistics, Uttarakhand. District Statistical Diary. District Statistical Diary, Haridwar: Directorate of Economics and Statistics, Uttarakhand, 2014.

Murphy, P. 2010. *Regional Planning: Purpose, Scope and Approach in New South Wales*, Australian Planner, Volume 22, Issue 4, p. 16-19.

Punjab Urban Development Authority. "Regional Plan for Greater Mohali Region." puda. gov.in. 2008-2058. https://bit.ly/2PYmcwy [Accessed March 13, 2016].

RKG Associates. LVPC Regional Housing Plan. Pennsylvania: Lehigh Valley Planning Commission, 2014.