Urban Expansion and Housing Quality in Mega Cities of India: A Case Study of NCT-Delhi

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ABSTRACT

Presently, more than half of the humanity lives in urban areas. Urban expansion has been seen as a growing problem, which involves range of social and environmental costs. Tremendous population growth and rapid urbanization has created a serious problems related to housing particularly in cities of developing countries. In mega cities, there is an immense need to improve housing quality, as it not only increases physical and social attractiveness of the area, but also improves property value, which is good for house owners. Good housing quality provides a better place to live safe and healthy. Well-planned and properly built house with availability of civic amenities also contributes to sustainable environment of the area. Rapid urban expansion with poor implementation of effective policies for better housing facilities has resulted in many problems in mega cities of India. NCT-Delhi, the capital has also experienced the rapid urban expansion. Delhi has experienced highest population growth rate among the mega cities of India. To understand the urban expansion, the census data has been collected and then spatio-temporal patterns are analyzed at the sub-district level for the period of 2001-2011. Further, using remote sensing geospatial data, the urban expansion is explained during the years 2001, 2011 and 2021. To understand the patterns of housing quality in Delhi, seven indicators has been identified and finalized. These reflect the housing livable condition, overcrowding, ownership, and availability of selected civic amenities. Finally, a poor quality housing index has been developed using average score method. In addition, a correlation matrix is also developed to understand the relationship between all the indicators. It is quite evident from the analysis that most part of Delhi are now urbanized with 97.5% population is now living in urban built-up areas. During 2001-11, 34.6 lakh of urban dwellers have been added to the total population. The level of poor housing quality has spatial variations depending upon factors like population density, household's density, household size, overcrowding, livable conditions, civic amenities, historical, lower income level, poor financing to house repairing etc. The lack of strong government political is also required to look into all such issue to provide good housing quality in Delhi. Finally, it is expected that the findings of the study will be helpful for the policy-maker, housing developer and other concerned to make suitable plans for the urban dwellers of Delhi.

KEYWORDS: Households, Urbanization, Housing, Households**,** Sub-district, Delhi

1. INTRODUCTION

Urbanization is the continuous process of rise in population concentration in towns and cities. United Nations perceives urbanization as movement of people from rural to urban areas. Misra (1998) defines urbanization as a process in which people living in dispersed agricultural villages starts living in towns and cities characterized by secondary and tertiary functions. Further, it involves increasing population growth with increasing size of town and cities. It includes the demographic, social, economic and psychological changes (Sarkar, 2019). Presently, more than half of the humanity lives in urban areas. Urban expansion has been seen as a growing problem, which involves range of social and environmental costs (Bengston et al., 2003). Tremendous population growth and rapid urbanization has created a serious problems related to housing particularly in cities of developing countries.

One of the major threatening issues in the urban areas is housing quality and its spatial variations in the city. The spatial pattern of housing quality varies in cities because of their long historical background, increasing population, migration, and spatial expansion. These factor increases the gap in the housing quality between the core areas and expanding fringe areas of city (Kuchay et. al, 2016). In mega cities, there is an immense need to improve housing quality, as it not only increases physical and social attractiveness of the area, but also improves property value, which is good for house owners. Good housing quality provides a better place to live safe and healthy. Well-planned and properly built house with availability of civic amenities also contributes to sustainable environment of the area (Anonymous, 2022). On the other hand, poor housing conditions in urban areas caused by social and economic inequality has been a issue of greater interest among the researchers, social scientists, housing scholars and developers of developed and developing countries (Zhou et. al., 2022). Housing quality assessment is a careful examination of living conditions and quality of services available to the urban dwellers or households. Its definition includes the physical condition of the household and availability of other services and facilities that makes the living area favourable. Okewole and Aribigbola (2006) defined housing quality as any neighbourhood, which satisfies health standards and good living standards and affordable to all categories of households.

Urban centres have been the focal points in the development of cultural landscape of India for since independence. Rapid urban expansion with poor implementation of effective policies for better housing facilities has resulted in many problems in mega cities of India (Ramachandran, 1989; Kuchay et. al, 2016; Rajaei and Mansourian 2017). According to Census of India (2011), 31.14% urban population of India lives on just 3.1 % geographical area of the country. It reflects huge pressure for the different types of facilities to be available for the urban dwellers. Increase in urban population alongwith migration from other states requires huge amount of housing stock to accommodate all. The present system has failed to provide enough housing for the

population, which is visible in the form of informal housing and slums, scattered throughout the city (Sivam, 2003). Thus, among the various challenges posed by the urban expansion and sprawl, housing availability and its quality is a major challenge for the city planners and decision-makers in Indian mega cities (Abhay and Sharma, 2022). In parallel to rapid urbanization in India, NCT-Delhi, the capital has also experienced the rapid urban expansion. Delhi has experienced highest population growth rate among the mega cities of India and by 2021 the population of Delhi will be around 2.7 crore which is 1.68 crore in 2011 (Sivam, 2003).

The main objectives of this paper are to understand the urban expansion in NCT-Delhi from 2001 to 2021 using geospatial techniques, and to assess the spatial pattern and level of poor housing quality for the urban dwellers in the mega city of Delhi.

2. MATERIALS AND METHODS

2.1 The Study Area

The administrative capital of India, NCT-Delhi has been selected for the study because it is a rapidly growing megacity in the country. The city is situated along the bank of river Yamuna from $28^{o}25'$ to $28^{o}53$ North latitude and $76^{o}50$ to $77^{o}22'$ East longitude and is surrounded by the state of Haryana and Uttar Pradesh (Figure 1). It accounts for a population of 1.68 crores in 2011 against 1.39 crores in 2001 (Census of India, 2011). Delhi has nine districts namely, North, North-East, East, South, South-West, West, North-West, Central Delhi and New Delhi and 27 sub-districts (Figure 2A). The city is home to 34,35,999 households varying from 6,814 in Connaught to 4,55,011 in Saraswati Vihar (Figure 2B). The city covers 1,483 sq km of area and has very high population density (11,320 persons per sq km). Density ranges from 3,071 (Narela in the North-West district) to 89,185 persons per sq km in Gandhi Nagar (East Delhi district). On average, Delhi is home to more than 2000 households per sq km (household density is 2,317 per sq km). Although, it ranges from 607 (Narela sub-district) to 18,135 (Gandhi Nagar sub-district). Overall, the city is developing in terms of infrastructure and the most vibrant cities in the country and, hence, chosen for the study.

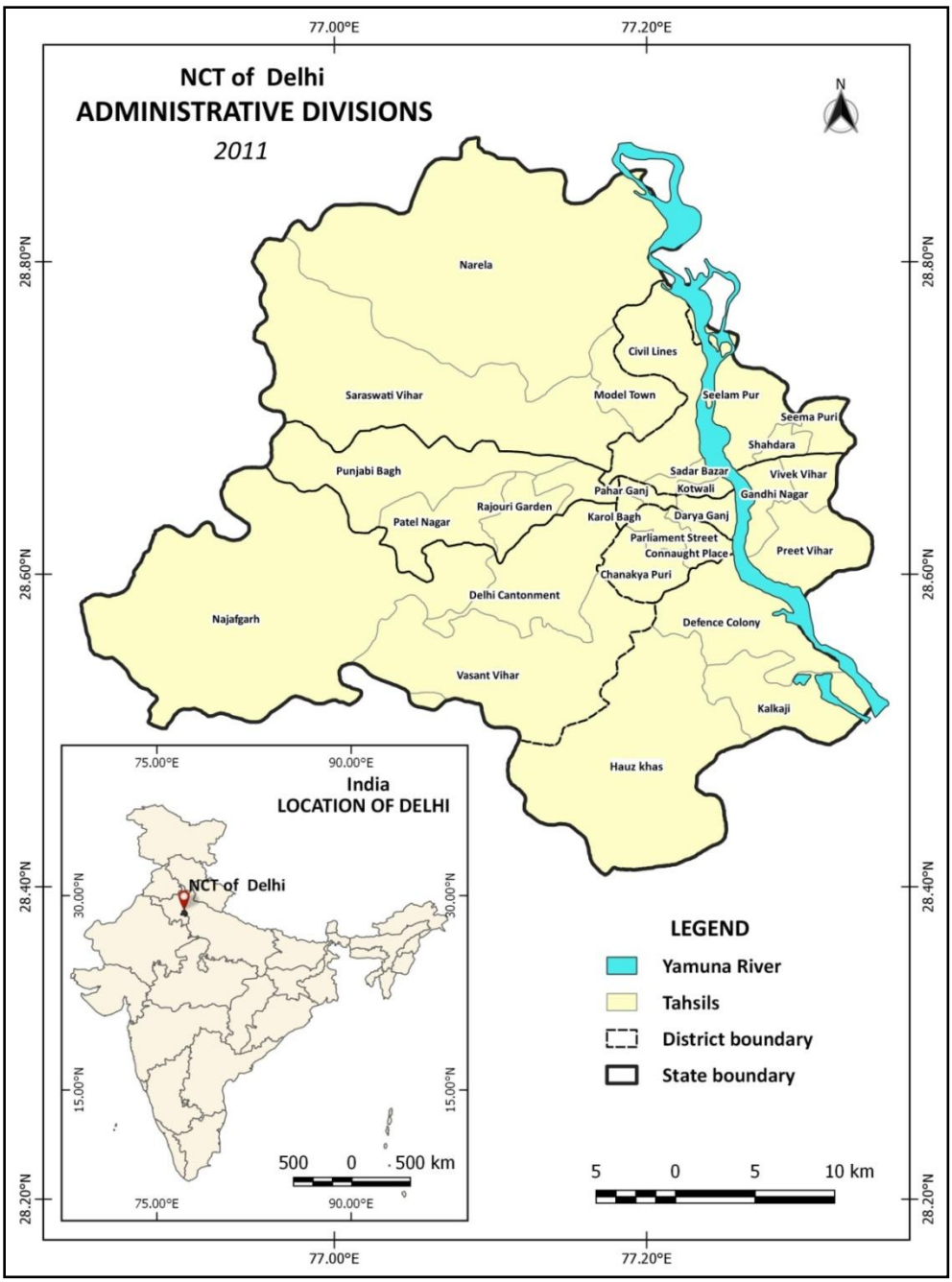


Figure 1: Location of the Study Area

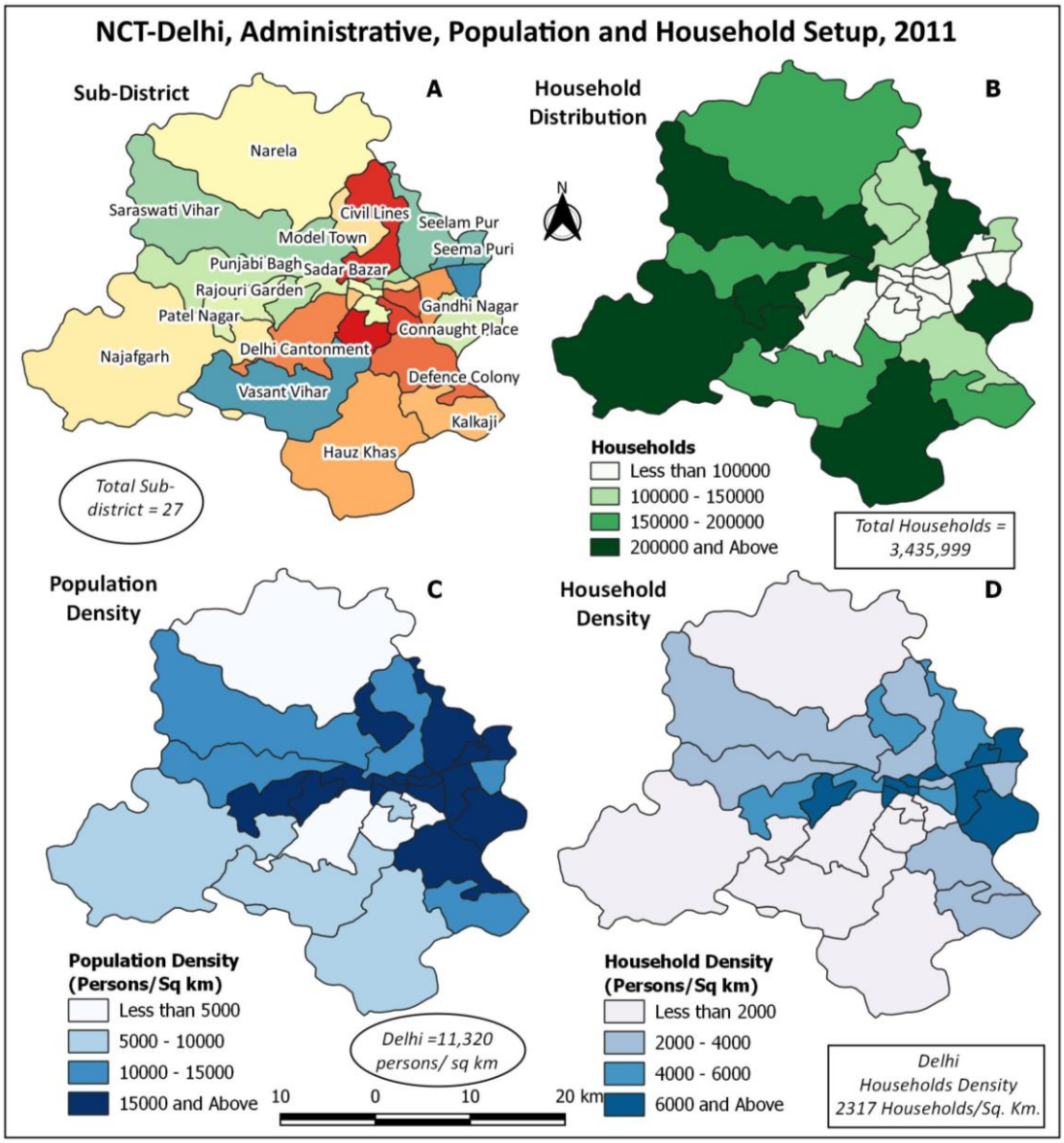


Figure 2: Sub-Districts, Household Distribution with Population and Household Density

2.2 Data Source and Methodology

The present study utilizes secondary data sources collected mainly through the Census of India. It includes Census data for different years and District Census Handbook of Delhi for the year 2001 and 2011. Geospatial data is also collected to understand urban expansion. The LANDSAT imageries for the years 2001, 2011 and 2021, have been downloaded with a spatial resolution of 30 meters and corroborated with the household data for the Census years 2001 and 2011.

The author has also used field-based personal observation and lived experiences to substantiate the arguments.

To understand the urban expansion, initially, census data has been collected and then spatio-temporal patterns are analyzed at the sub-district level for the period of 2001-2011. Further, using remote sensing geospatial data, the urban expansion is explained during the years 2001, 2011 and 2021. A supervised classification technique is used to identify the built-up area through land use/land cover classes. In addition, NDBI (Normalized Differentiated Built-Up Index) is applied to substantiate the findings (Eq. 1). The NDBI method is better to show urban expansion as it implies simple arithmetic operation using different bands as shown in Eq.1.

$$\text{NDBI} = \frac{SWIR - NIR}{SWIR + NIR} \qquad \ldots\ldots \text{Eq.1}$$

Where NDBI is Normalized Differentiated Built-Up Index; SWIR is Short-Wave Infrared Band and, NIR is Near-Infrared Band.

The NDBI value ranges from -1 to +1 in which the positive value represents built-up areas and the negative values represent various other land use categories like waterbodies, vegetation etc. Thus, the NDBI method is an important statistical method in analyzing the urban built-up areas.

To understand the patterns of housing quality in Delhi, seven indicators has been identified and finalized (Table 1). These reflect the housing livable condition, overcrowding, ownership, and availability of some civic amenities. As discussed, the sub-district is the scale of the study, which are 27 in number, the data on all the indicators have been collected and represented with the help of choropleth maps for the year 2011.

Table 1: Selected Indicators for Assessing Poor Housing Quality

S.No.	Indicator	Variable
1	Housing Condition	Percentage of Dilapidated Houses
2	Availability of Dwelling Rooms	Percentage of HHs with One room or No Exclusive Room
3	Household Size	Percentage of HHs size with 6 or more persons
4	Ownership Status	Percentage of HHs living in Rented Accommodation
5	Location of Drinking Water Source	Percentage of HHs with drinking water near or away from the Premises
6	Latrine Facility	Percentage of HHs not having a latrine facility within the premises
7	Kitchen Facility	Percentage of HHs doesn't have a kitchen or cook outside the house

Finally, a poor quality housing index has been developed using average score method. Since all the indicators are positively related with the poor quality housing, thus, higher the score shows higher the level of poor quality housing and vice-versa. In addition, a correlation matrix is also developed to understand the relationship between all the indicators. The collected data have been analysed and processed using MS-Excel, SPSS and QGIS Softwares.

3. RESULTS AND DISCUSSION

3.1 Urbanization Pattern and Expansion

1. Trends and Pattern of Urbanization

The process of urbanization has been very rapid in Delhi since its independence. At present, NCT-Delhi has 97.5% population as urban which accounts 1.64 crores (total population is 1.68 crore) during the Census 2011. During the study period (2001-2011), the urban population of Delhi increased at a rate of 4.3% (Table 2). Almost, 34.6 lakh of urban population is added to the total population. Out of the total nine districts, two districts, namely - New Delhi and Central Delhi - are totally urban and located in the core of the city. These districts are followed by East Delhi district where 99.8% population resides in urban areas. The least urbanized district is the South-West district (93.7%). During the same period, the North-East district experienced a maximum increase in the urban population (7%).

Table 2: District-Wise Urban Population in the NCT-Delhi, 2001-11 (In Percent)

S. No.	District	2001	2011	Increase
1	North-West	90.7	94.1	+3.4
2	North	94.0	98.0	+4.0
3	North-East	92.0	99.0	+7.0
4	East	98.8	99.8	+1.0
5	New Delhi	100	100	0.0
6	Central	100	100	0.0
7	West	95.9	99.7	+3.8
8	South-West	87.2	93.7	+6.5
9	South	92.9	99.6	+6.7
Total	**NCT-Delhi**	**93.2**	**97.5**	**+4.3**

Source: Census of India, District Census Handbook-Delhi, 2001 and 2011

At the sub-district level, it is found that out of the 27 sub-district, 12 sub-districts were completely urban in 2001 whereas by 2011, 19 sub-districts have become completely urbanized

(Figure 3). In 2001, there were 4 sub-districts (Narela, Seemapuri, Najafgarh, Punjabi Bagh) which have less than 90% urban population whereas in 2011, only two sub-districts (Narela and Najafgarh) remained with less than 90% urban population. Overall, the spatial patterns suggest that during the study period, urbanisation have trickled down from core to south, west and eastern direction. This urbanization process is attributed to the fact of development of highway corridors. Transportation lines has always been seen as an important factor to bring socio-economic and infrastructure development in nearby areas (Kumar and Sen, 2001). However, the Narela and Najafgarh sub-districts have experienced comparatively less rapid urbanization due to mostly rural background and large areal coverage.

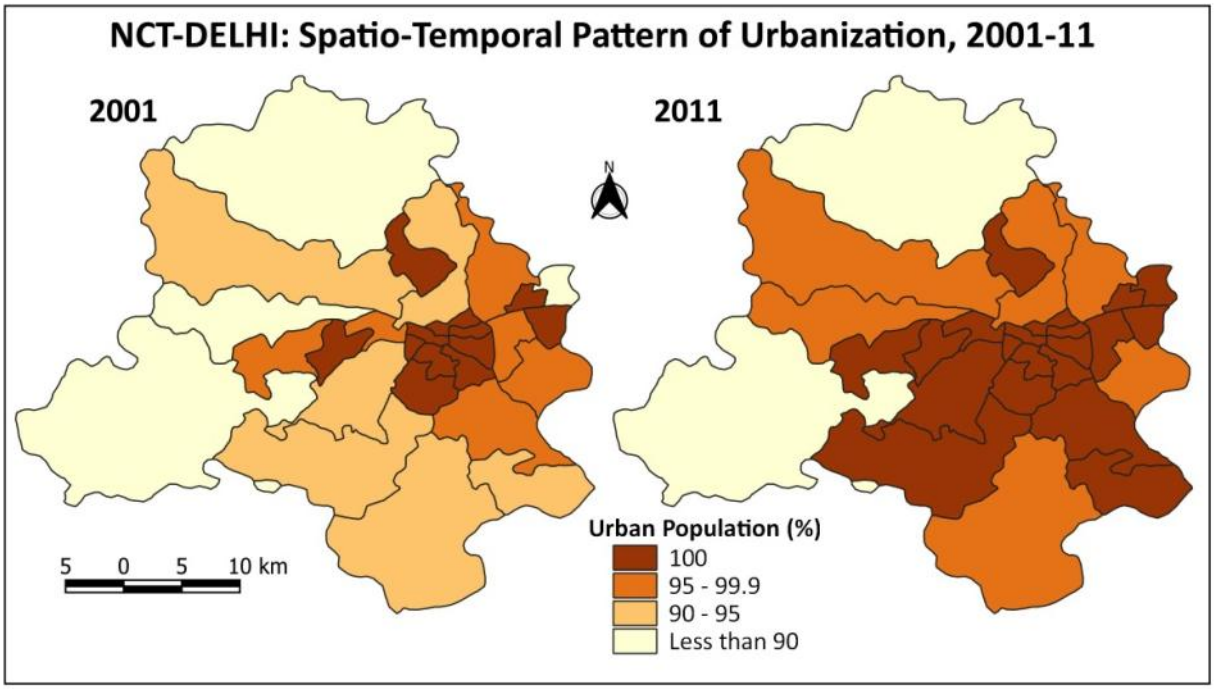


Figure 3: Spatio-Temporal Patterns of Urbanization in NCT-Delhi

2. Urban Expansion, 2001-2011-2021

The urban expansion is analysed with the help of remote sensing geospatial data. The LANDSAT satellite data is collected at a resolution of 30-meter spatial resolution. The geospatial data has been collected for the years 2001, and 2011 so that a spatial correlation can be made and corroborated with census data. Further, the year 2021 data has also been considered to understand the current spatial extent of urbanization.

The NCT-Delhi is experiencing one of the fastest urban expansions in the world. There are rapid changes and vast areas under agriculture and grasslands are getting converted into built-up area. The geospatial data explains that there is urban expansion towards the south, southwest direction and also towards the northern side (Figure 4). In the process most of the rural areas have become urban. The patches of the built-up area in these directions are the clear-cut representation of the development of National Highway (NH) 8 and 24, connecting the satellite towns of Delhi, i.e. Gurugram and Faridabad, respectively. The urban expansion is also seen towards the northern side(Narela sub-district) located on the NH-1 connecting Delhi to Amritsar (Punjab). Cities outside NCT-Delhi, like Ghaziabad, NOIDA, Faridabad, Gurugram, Bahadurgarh have also experienced unprecedented urban growth during last 2-3 decades. With a specialization in service sector, Delhi has attracted large amount of migrants from different states of the country and it is expected that by 2028, Delhi will surpass Tokyo (First in 2018) in term of most populous city in the world. This increase in population will further aggravate the problems related to environment (air pollution), traffic congestion etc (NASA, 2018). Thus, the spatial pattern reflects the relative glimpse of the urbanisation whereas the geospatial data helps to understand actual urban expansion.

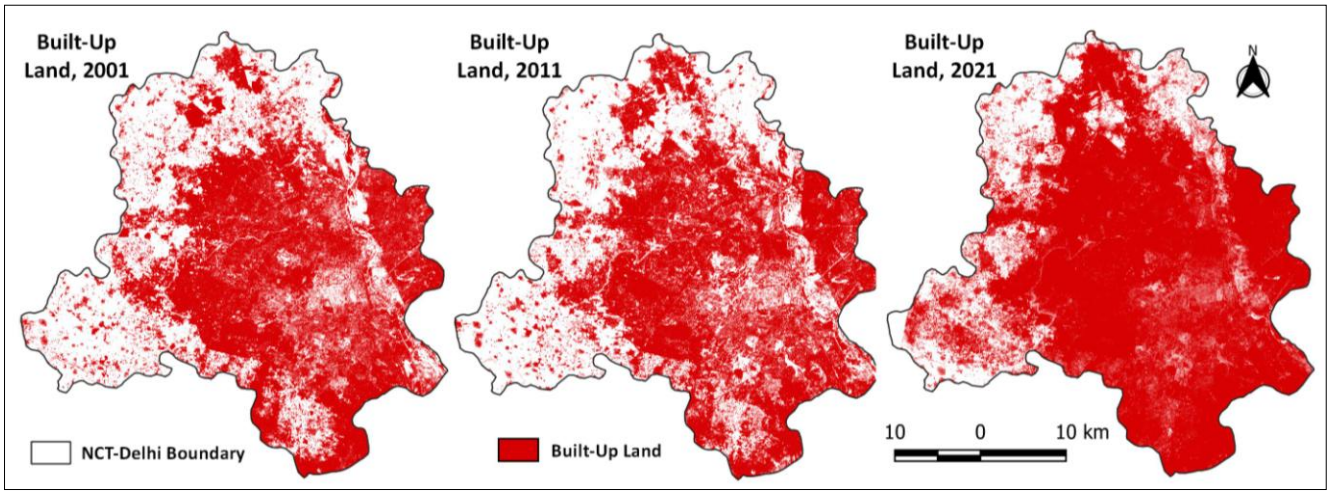


Figure 4: Spatial Urban Expansion in NCT-Delhi, 2001-2021

Source: Prepared by Author based on Landsat Satellite Imageries

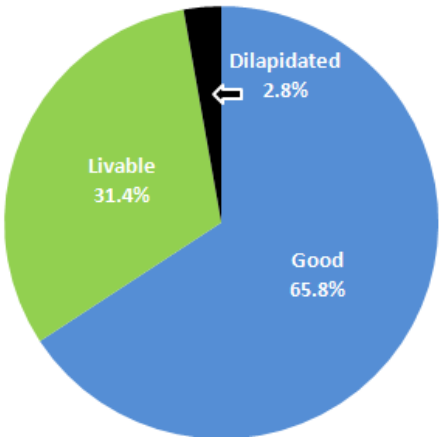
3.2 Selected Indicators to Assess Poor Housing Quality and Spatial Disparities

1. Housing Condition

Housing condition means the structure of the house and is directly linked with the housing quality. The census records the condition of house based upon the response and perception of the respondent since it varies from person to person. The Census defines housing conditions in three ways-'good condition, 'livable condition, and 'dilapidated condition'. Generally, it is understood that the condition of the house is good if it does not require immediate repair work. While if instead of major repair, only minor repair works are required, the condition of the house is livable. Finally, if the house requires major repairing and maintenance then it is dilapidated housing condition.

Out of the total household (34,35,999) in the city, two-thirds of households are in good condition, while 31% are in livable condition while the rest of the households are in dilapidated condition (2.8%) (Figure 5). It constitutes approx. 25,000 households, distributed across the sub-districts. Looking at the spatial distribution of the dilapidated HHs, their concentration is found to be more concentrated in the central part of Delhi (Figure 6A). The reason has been attributed to the fact of its historically developed infrastructure, being the prominent central business district of the city, and densely populated and congested. The maximum percentage of dilapidated HHs is in the Delhi Cantonment sub-district (5.6%) followed by Sadar Bazar (5.4%, Darya Ganj (4.8%) and Kotwali (4.2%) sub-district. The lowest is in Karol Bagh (0.8%) followed by Connaught Place (1.3%), Vivek Vihar (1.7%) and Preet Vihar (1.8%) sub-districts (Table 3). The peripheral regions show good housing due to new development projects by the public and private housing sectors.

Figure 5: Housing Condition in Delhi



2. Availability of Dwelling Rooms

The number of rooms available to the household affects the quality of living. If there are fewer rooms, with more family members, then more congestion will degrade the quality of living conditions. Under this indicator, the percentage of households having one room or no exclusive rooms is considered. The percentage of such households ranges from 21% to 58% across the sub-districts (Figure 6B). The sub-districts with high percentages are Darya Ganj, Sadar Bazar, and Chankya Puri, which are located in the central part of Delhi and some sub-districts towards

the south. On the other side, the sub-district of East and South-West Delhi districts have less percentages of such households due to more spaces and plotted housing societies like Vivek Vihar (East), and Najafgarh (South-West).

Table 3: Various Statistics related to Indicators

Selected Indicators		Dilapidated HHs	HHs with One room or No Exclusive Room	HHs size with 6 or more persons	HHs living in Rented Accommodation	HHs with drinking water near or away from the Premises	HHs not having latrine facility within the premises	HHs doesn't have the kitchen or cook outside the house
Total Sub-districts		27	27	27	27	27	27	27
Minimum Value		0.8	21	20.7	17.1	2.3	1.7	8.8
Maximum Value		5.6	57.7	44.3	77.5	36.1	31	38.1
Mean		3.07	35.56	30.90	30.90	18.21	12.24	20.22
Range		4.8	36.7	23.6	60.4	33.8	29.3	29.3
Percentiles	35^{th}	2.2	30.24	28.54	23.9	11.56	8.58	16.66
	65^{th}	3.44	39.66	32.16	32.36	23.78	12.44	20.74

3. Household Size

Household size is also related to the housing quality in megacities. It is hypothesized that larger the size of the household alongwith less number of dwelling rooms results in overcrowded housing. Thus, in each sub-district percentage of HHs in which 6 or more persons lives, is taken into consideration. The spatial patterns of such households across sub-districts were found to be more concentrated towards the northern parts whereas low towards the southwest (Figure 6C). On average, 31% of households have the size of six or more persons in the study area. At the sub-district level, the percentage varies from 20.7% (Vasant Vihar in the South-West district) to 44% (Seelampur in the North-East district).

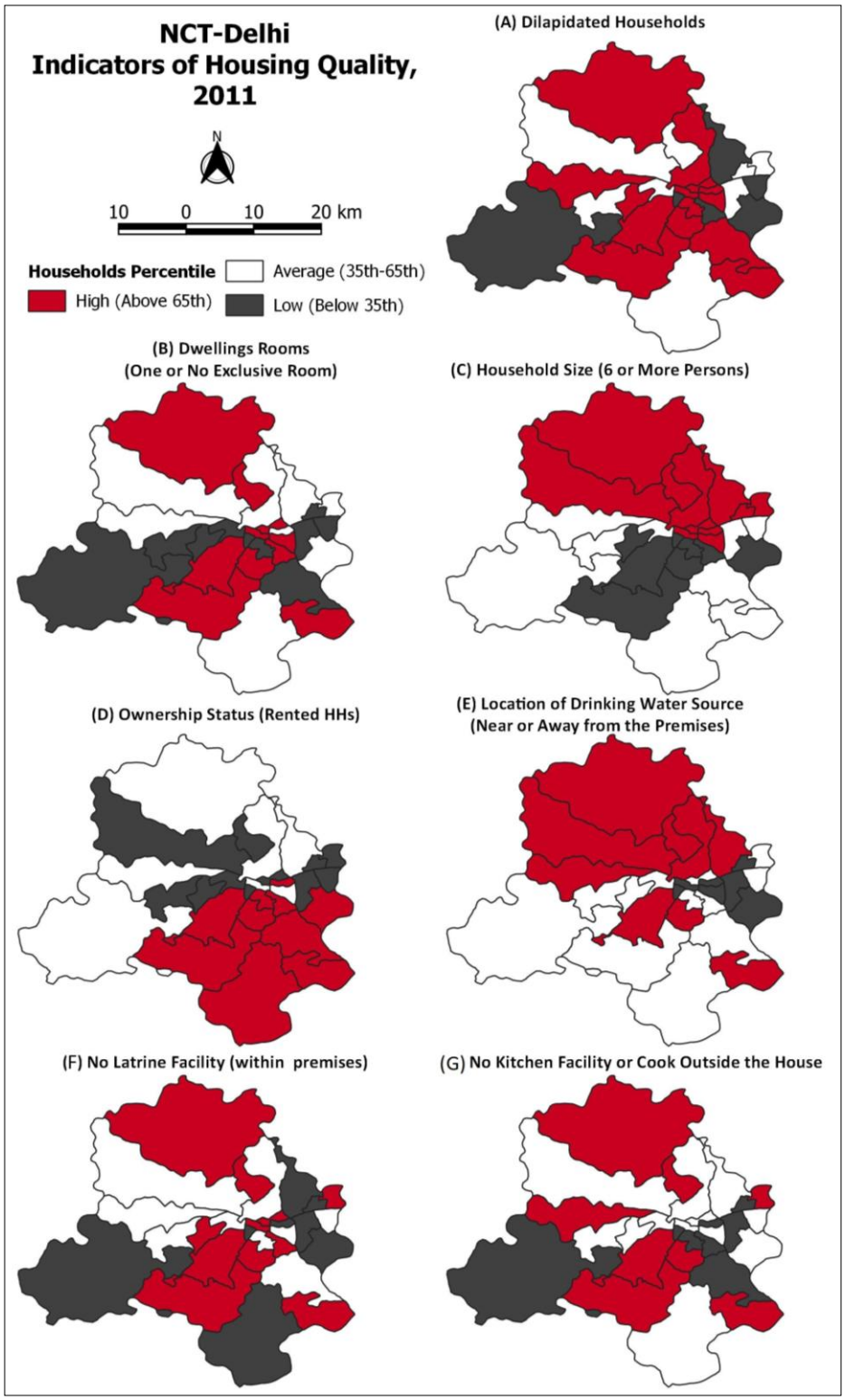


Figure 6: Spatial Variations of Selected Indicators in NCT-Delhi, 2011

4. Ownership Status

Ownership over the house also determines the quality of the house. If it is an owned house, then individual efforts related to maintenance will be more in comparison to the person living in a rented house. In the census, a household is rented if some cash or even in kind is paid or contracted for the household. Overall, the pattern reflects that concentration of the rented house is more in the southern side of the city (Figure 6D). It is a posh area where buying a home is a very costly affair, that is why more people prefer to live on rent due to nearness to their workplace or any other such reasons. The concentration of such HHs ranges from 17% in Karol Bagh to 77% in Parliament Street and peripheral sub-districts show less distribution of such households.

5. Location of Drinking Water Source

For a good house, the availability of drinking water sources is very important. Its location within the premise makes it easy availability for the same and hence good housing quality and if it is outside the premise or away from the premise reflects poor housing quality. For the current case, the location of water source near or away from the premises has been considered to highlight the percentage of households with poor housing quality in Delhi. The pattern reflects the districts of North, North-West, and some sub-districts in West and South have more concentration of such households (Figure 6E). It ranges from 2% (Karol Bagh in the Central district) to 36% (Narela in North-West District). The northwestern and western parts of Delhi have rural character, the infrastructure related to water facilities is still poor, and people go to nearby common tap to collect water. The central and eastern parts are comparatively developed sub-districts with proper water pipelines due to which they have a small percentage of such households.

6. Latrine Facility

Among the sanitation facility, the availability of the latrine facility is of utmost importance from a mega city point of view where the population lives in large numbers. The percentage of households not having a latrine facility within the premise is taken as the indicator to represent the poor housing quality. The distribution of households with high percentage of such HHs is found to be near south-central Delhi and north-west Delhi (Figure 6F). The percentage of such households ranges from 1.7% in Karol Bagh to 31% in Chanakya Puri (Table 3). Narela is located in the North-West Delhi district also shows a higher percentage of such households due to its rural background, small dwelling rooms and, thus, uses common latrine facility.

7. Kitchen Facility

Besides sanitation facilities, kitchen availability within the house makes it a good and livable house. However, still, there is large number of households in the capital that cooks the food outside the house or inside the room but no such dedicated space for the kitchen. The Figure 6G shows a mixed pattern with reference to no kitchen availability or cooking outside the premises. The percentage of such households varies from 8.8% in Karol Bagh to 38 % in the Narela sub-district.

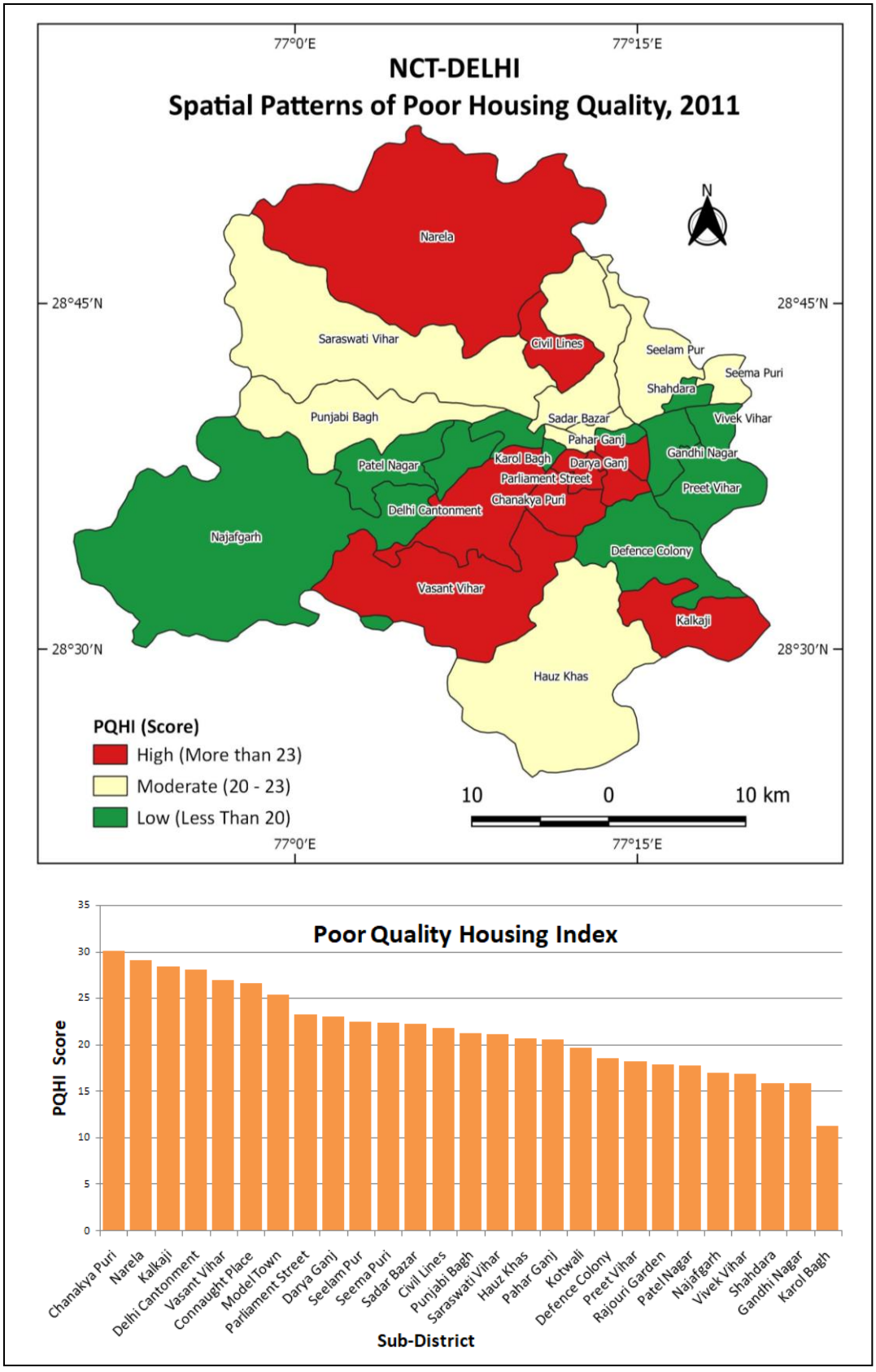
3.3 Spatial Patterns of Poor Housing Quality Index (PHQI)

Based on the average score method, the poor housing quality index was calculated and the whole of Delhi is divided into three categories known as High, Moderate and Low levels of PQHI Scores.

Out of the total 27 sub-districts, 10 sub-districts show a very high percentage of poor housing. All 3 sub-districts of the New Delhi district (Parliament Street, Connaught Place and Chanakya Puri) show very high poor housing quality due to above selected indicators. Two sub-districts of the North-West district (i.e. Narela and Model Town) and two sub-districts of the South-West district (Delhi Cantonment and Vasant Vihar) are also in the same category. Further, one sub-district of each Central (Darya Ganj sub-district) and South district (Kalkaji sub-district) fall within this category.

Under the moderate poor housing quality category, a total of 9 sub-districts exist. Out of which 2 sub-districts of North district (Sadar Bazar and Civil Lines) and 2 sub-districts of North-East district (Seelampur and Seema Puri) are in this category. On the other hand, one sub-district of West (Punjabi Bagh sub-district), South (Hauz Khas sub-district), Central (Pahar Ganj sub-district) and North-West (Saraswati Vihar sub-district) districts is found to be moderate poor housing in Delhi.

A low percentage of houses with poor quality housing exists in 10 sub-districts of Delhi. All three sub-districts of East Delhi district (Vivek Vihar, Preet Vihar, and Gandhi Nagar sub-districts) and two sub-districts of West Delhi (Rajouri Garden and Patel Nagar sub-districts) belong to this category. One sub-district from all districts except North-West is under this category. Kotwali (North), Defence Colony (South), Najafgarh (South-West), Karol Bagh (Central) and Shahdara sub-district (North-East) are under this category.


NCT-DELHI
Spatial Patterns of Poor Housing Quality, 2011
77°0′E
77°15′E
28°45′N
28°30′N
N
Narela
Saraswati Vihar
Civil Lines
Seelam Pur
Seema Puri
Shahdara
Punjabi Bagh
Sadar Bazar
Vivek Vihar
Pahar Ganj
Gandhi Nagar
Patel Nagar
Karol Bagh
Darya Ganj
Parliament Street
Preet Vihar
Chanakya Puri
Delhi Cantonment
Najafgarh
Defence Colony
Vasant Vihar
Kalkaji
Hauz Khas
PQHI (Score)
High (More than 23)
Moderate (20 - 23)
Low (Less Than 20)
10
0
10 km

Poor Quality Housing Index
PQHI Score
35
30
25
20
15
10
5
0
Chanakya Puri
Narela
Kalkaji
Delhi Cantonment
Vasant Vihar
Connaught Place
Model Town
Parliament Street
Darya Ganj
Seelam Pur
Seema Puri
Sadar Bazar
Civil Lines
Punjabi Bagh
Saraswati Vihar
Hauz Khas
Pahar Ganj
Kotwali
Defence Colony
Preet Vihar
Rajouri Garden
Patel Nagar
Najafgarh
Vivek Vihar
Shahdara
Gandhi Nagar
Karol Bagh
Sub-District

3.4 Correlation Matrix of Selected Indicators

All seven indicators are related to each other; however, the degree of correlation vary. Looking at Table 4, it is interesting to note that dilapidated HHs are positively related to the indicators like dwelling rooms (r= 0.518), no latrines (r= 0.537) and no kitchen facilities (r= 0.508). It indicates that where the percentage of dilapidated HHs is high, the percentage of all these indicators is also high. Further, the number of dwelling room indicators is also positively related to the latrine (r= 0.683) and kitchen facilities (r= 0.586). Household size is negatively correlated with rented households (r=-0.484), which indicates that large family households live less on rented accommodation while smaller families live more on rented accommodation. This correlation matrix proves that where there are water source location is outside and away from the premise exist, there are fewer kitchens (r=0.697) and no latrine facility (r=0.554) exist among the households. Overall, this matrix analyses the relation among the indicators as well as with the PHQI.

Table 4: Correlation Matrix

Selected Indicators		Dilapidated HHs	Dwellings Rooms	HHs Size	Rented HHs	Water Source Location	No Latrine Facility	No Kitchen Facility	PHQI
Dilapidated HHs	Pearson Correlation	1							
	Sig. (2-tailed)								
	N	27							
Dwellings Rooms	Pearson Correlation	**.518****	1						
	Sig. (2-tailed)	.006							
	N	27	27						
HHs Size	Pearson Correlation	.049	-.045	1					
	Sig. (2-tailed)	.806	.822						
	N	27	27	27					
Rented HHs	Pearson Correlation	.123	.143	**-.484***	1				
	Sig. (2-tailed)	.542	.477	.010					
	N	27	27	27	27				
Water Source Location	Pearson Correlation	.267	.357	.022	-.005	1			
	Sig. (2-tailed)	.179	.068	.914	.980				
	N	27	27	27	27	27			
No Latrine Facility	Pearson Correlation	**.537****	**.683****	-.353	.245	**.554****	1		
	Sig. (2-tailed)	.004	.000	.071	.219	.003			
	N	27	27	27	27	27	27		
No Kitchen Facility	Pearson Correlation	**.508****	**.586****	-.061	-.059	**.697****	**.762****	1	
	Sig. (2-tailed)	.007	.001	.761	.769	.000	.000		
	N	27	27	27	27	27	27	27	
PHQI	Pearson Correlation	**.580****	**.769****	-.141	.436*	**.701****	**.847****	**.780****	1
	Sig. (2-tailed)	.002	.000	.483	.023	.000	.000	.000	
	N	27	27	27	27	27	27	27	27

Source: Calculated by Author using SPSS.

4. FINDINGS, CONCLUSIONS AND POLICY MEASURES

The present study analysed the urban expansion and levels of poor housing quality in Delhi. It is quite evident from the analysis that most part of Delhi are now urbanized with 97.5% population is now living in urban built-up areas. During 2001-11, 34.6 lakh of urban dwellers have been added to the total population and will be more when recent census will come out. Maximum parts are now showing continuously built-up areas, particularly in central, eastern and southern side that are very much related to highway corridors and development of satellites towns like Gurugram, Faridabad, Noida etc. On the other hand, still some patches in the north, north-west and south-west direction show relatively less built up area. The indicators selected for analysing the levels of poor housing quality proved to be very useful in understanding the level of housing quality in Delhi. The level of poor housing quality has spatial variations depending upon factors like population density, household's density, household size, overcrowding, livable conditions, civic amenities, historical, lower income level, poor financing to house repairing etc. Thus, the present attempt has been made to understand the poor housing quality in the city so that the housing policy should be made appropriately looking at the magnitude of the problem. However, many policies are in existence with reference to providing adequate housing in Delhi. For example, Jawaharlal Nehru National Urban Renewal Mission in 2005 (JNNURM), Basic Services for the Urban Poor (BSUP), Integrated Housing and Slum Development Programme (IHSDP), Pradhan Mantri Awas Yojana in 2015 (PMAY), Rajiv Awas Yojana (RAY) etc have contributed in providing basic amenities and upgrading the slum areas or providing housing facilities. Overall, they contribute in providing either new housing or basic amenities. But none of the them look into the issue of dilapidated housing in the city. For example, Chandni Chowk and Darya Ganj are most congested alongwith highly dilapidated old structure housing. The prime location of these areas demands more repairing cost and narrow street are major hurdles in doing any work. Thus, government with their strong will must look into all such issue to provide good housing quality for the urban dwellers of Delhi.

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REFERENCES

- Abhay RK and Sharma M (2022) Housing shortage in a mega city: a spatio-temporal analysis of NCT-Delhi, 2001–2011. GeoJournal. https://doi.org/10.1007/s10708-022-10597-5

- Anonymous (2022) https://ctb.ku.edu/en/table-of-contents/implement/physical-social-environment/housing-quality/main
- Bengston DN, Fletcher JO and Nelson KC (2004) Public policies for managing urban growth and protecting open space: policy instruments and lessons learned in the United States. Landscape and Urban Planning, 69(2–3): 271-286.
- Census of India (2011) Population Census 2011. Table HL-14: Percentage of households to total households by amenities and assets, NCT of Delhi, Office of the Registrar General & Census Commissioner, Delhi, India.
- Krishna K and Sen A (2021) Socio-Economic Development in Highway Corridor Zones of Bihar: Case Study of Kuchai Kot-Muzaffarpur Section. In: B. Thakur, R.R. Thakur, S. Chattopadhyay and R.K. Abhay (eds) Resource Management, Sustainable Development and Governance: Indian and International Perspectives, Switzerland AG: Springer Nature, 583-587
- Kuchay NA, Sultan Bhat M and Shafi N (2016) Population growth, urban expansion and housing scenario in Srinagar City, J&K, India. Journal of Geography and Regional Planning. 9(1) 1-11. DOI: 10.5897/JGRP2015.0506
- Misra RP (1998) Urban in India Challenges and Opportunities. ICSSR North Eastern Regional Centre, Shillong.
- NASA (2018) Urban growth of New Delhi. Earth Observatory. Available online: https://earthobservatory.nasa.gov/images/92813/urban-growth-of-new-delhi
- Okewole IA & Aribigbola A (2006) Innovations and sustainability: Housing policy conception and implementation in Nigeria. In I. A. Okewole (Ed.) The built environment: innovation policy and sustainable development. Covenant University Ota. 414–420.
- Rajaei SA, Mansourian H (2017) Urban Growth and Housing Quality in Iran. Social Indicators Research. 131: 587–605. https://doi.org/10.1007/s11205-016-1260-2
- Ramachandran R (1989) Urbanization and Urban Systems in India, New Delhi: Oxford University Press.
- Sarkar R (2019) Urbanization in India before and after the economic reforms: What does the census data reveal?. Journal of Asian and African Studies. 54(8): 1213-26.
- Sivam A (2003) Housing supply in Delhi. Cities 20(2): 135-141.
- Zhou Z, Ma Y, Du W, et al. Housing Conditions and Adolescents' Socioemotional Well-being: An Empirical Examination from China. Applied Research Quality Life 17, 2721–2741 (2022). https://doi.org/10.1007/s11482-021-09998-4