

GIS Based Quantitative Analysis Of Decadal Built-Up Variations In Census Towns Around NCT Delhi

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Abstract

Census Towns around National Capital Territory (NCT) of Delhi have been grappling with the issues of infrastructure and basic amenities as they are under the stress of physical expansion because of saturated development in the National Capital city. Therefore, they have been expanding at an unprecedented rate. Using Geographic Information System (GIS) and the statistical technique, the present paper makes an attempt to assess the degree of physical expansion by calibrating the decadal built-up variations in the census towns. The study finds significant built-up changes in the census towns during last two decades.

Keywords: Census Town, Physical Expansion, GIS, Built-up variations.

1. INTRODUCTION

The number of census towns in India has been steadily increasing over the years, reflecting the ongoing process of urbanization. As of the 2011, there were 3,894 census towns in India. Census towns play a significant role in the urban growth of the country, particularly in areas surrounding large cities like Delhi (**Census of India, 2011**). “In India, the increase of ‘census’ towns in close proximity of ‘statutory’ towns may also be understood as peri-urban growth” (**Aijaz 2019**). Census towns, nestled around the National Capital Territory (NCT) of Delhi, play a crucial role in absorbing its burgeoning population. Yet, these urbanizing pockets often grapple with a stark reality: limited infrastructure and basic amenities (**Census of India 2011**). The Census Towns are those settlement which have a “minimum population of 5000, a density of population at least 400 persons per sq. km. and at least 75% of the male main working population engaged in nonagricultural pursuits” (**Census of India 2011**). Census towns arise in proximity to the large cities because of land use change from agriculture to non-agriculture use as the nearby city grows (**Mitra & Kumar 2015**). The growth of census towns can be attributed to the local transformation of rural settlements into urban (**Pradhan, 2013**). Increasing population density and non-agriculture activities are the drivers for the spatial transformation in the census towns (**Mukhopadhaya et al. 2016**) Intensive physical development for residential purpose has taken place in the census town named Khora situated near Delhi (**Sharma 2014**). Shift from agriculture to non-agriculture land use can be observed in various census towns (**Karmakar 2015**). Therefore, the present paper aims to study the physical transformation i.e. builtup change in census towns around NCT Delhi.

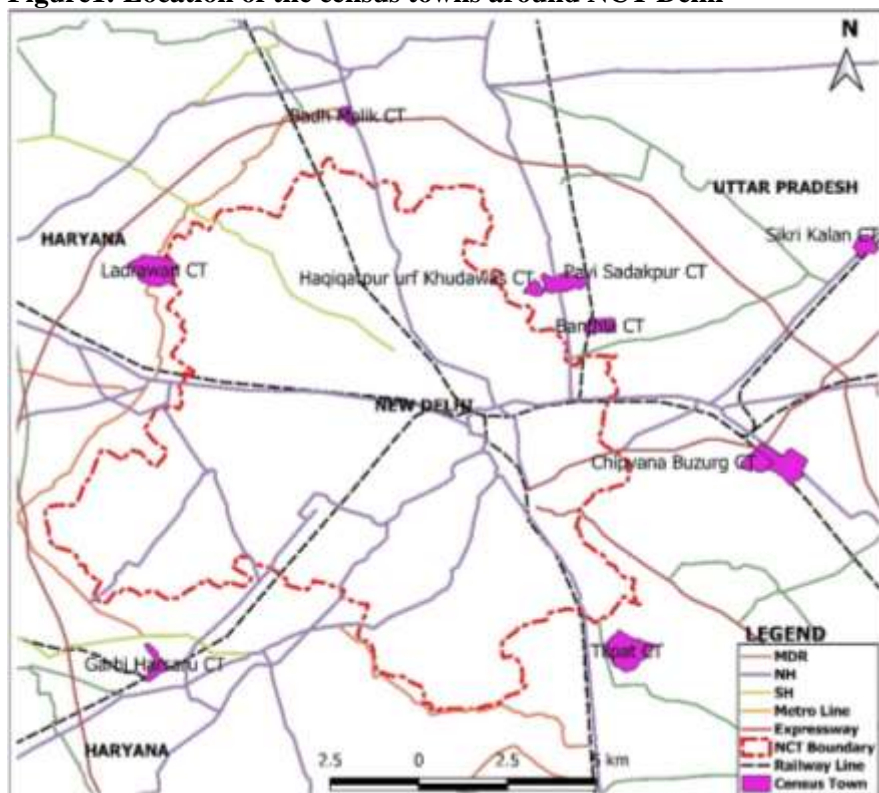
2. STUDY AREA

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The present study makes an attempt to study the ten census towns from the eight blocks adjacent to NCT Delhi. Out of ten census towns, six census towns are located in Uttar Pradesh state whereas the rest four fall into Haryana state.

Figure1: Location of the census towns around NCT Delhi



Source: Author

2.1 Demographic characteristics of all the census towns

Table 1: Demographic characteristics in all the census towns (2001-21)

Census Towns	Population 2001	Population 2011	Population 2021 (estimated)	Population Growth 2001-11	Population Growth 2011-21
Sikri Kalan	5637	7037	9100	24.84	29.32
Chhapraula	6820	15154	19700	122.20	30.00
chipyana Buzurg	7682	17400	22600	126.50	29.89
Ladrawan	8008	6905	8900	-13.77	28.89
Tilpat	6369	20514	26600	222.09	29.67
Banthala	9588	5766	7400	-39.86	28.34
Badh Malik	6492	6938	9000	6.87	29.72
Pavi Sadakpur	15584	757	980	-95.14	29.46
Haqiqatpur	4593	15324	19900	233.64	29.86
Garhi Harsaru	5230	7894	10200	50.94	29.21

Source: Census of India website

2001 to 2011

Table 1 shows that during the first decade, Chhapraula experienced a remarkable 122.6% increase in population, indicating substantial growth likely driven by urbanization and economic opportunities. Chipyana Buzurg more than doubled its population, growing by 126.7%, reflecting rapid urban development. Tilpat exhibited significant growth of 221.3%, suggesting urban development and increased economic opportunities. Ladrawan saw a decline in population by 13.6%, possibly influenced by factors like outmigration or changing economic conditions.

2011 to 2021

Table 1 depicts that as per the estimated population of 2021 by census of India, in the second decade, Chhapraula continued its growth, reaching 19700 in 2021, marking a 30% increase and indicating sustained growth. Chipyana Buzurg maintained rapid growth of the population from 17400 to 22600 in 2021 with 29.89 percent increase. Ladrawan's population is estimated to increase from 8008 in 2011 to 8900 in 2021, indicating a 28.89 % decrease over the decade. Except for Banthla and Ladrawan, all the other census towns are expected to have grown at a rate or more than 29 percent between 2011-21.

These trends highlight the diverse demographic changes in the Census Towns, with some like Chipyana Buzurg and Chhapraula experiencing continuous growth, others showing fluctuations, and a few witnessing consistent declines. Urbanization, economic opportunities, and local dynamics likely played significant roles in shaping these patterns.

3. METHODOLOGY & DATA COLLECTION

Demographic data have been downloaded from district census handbooks for the year 2001 & 2011 using the website of census of India and the estimated population of the year 2021 is also taken from Census of India website. Census Town's boundaries data were downloaded from the website of Geoportal for National Capital Region (NCR) Planning Board.

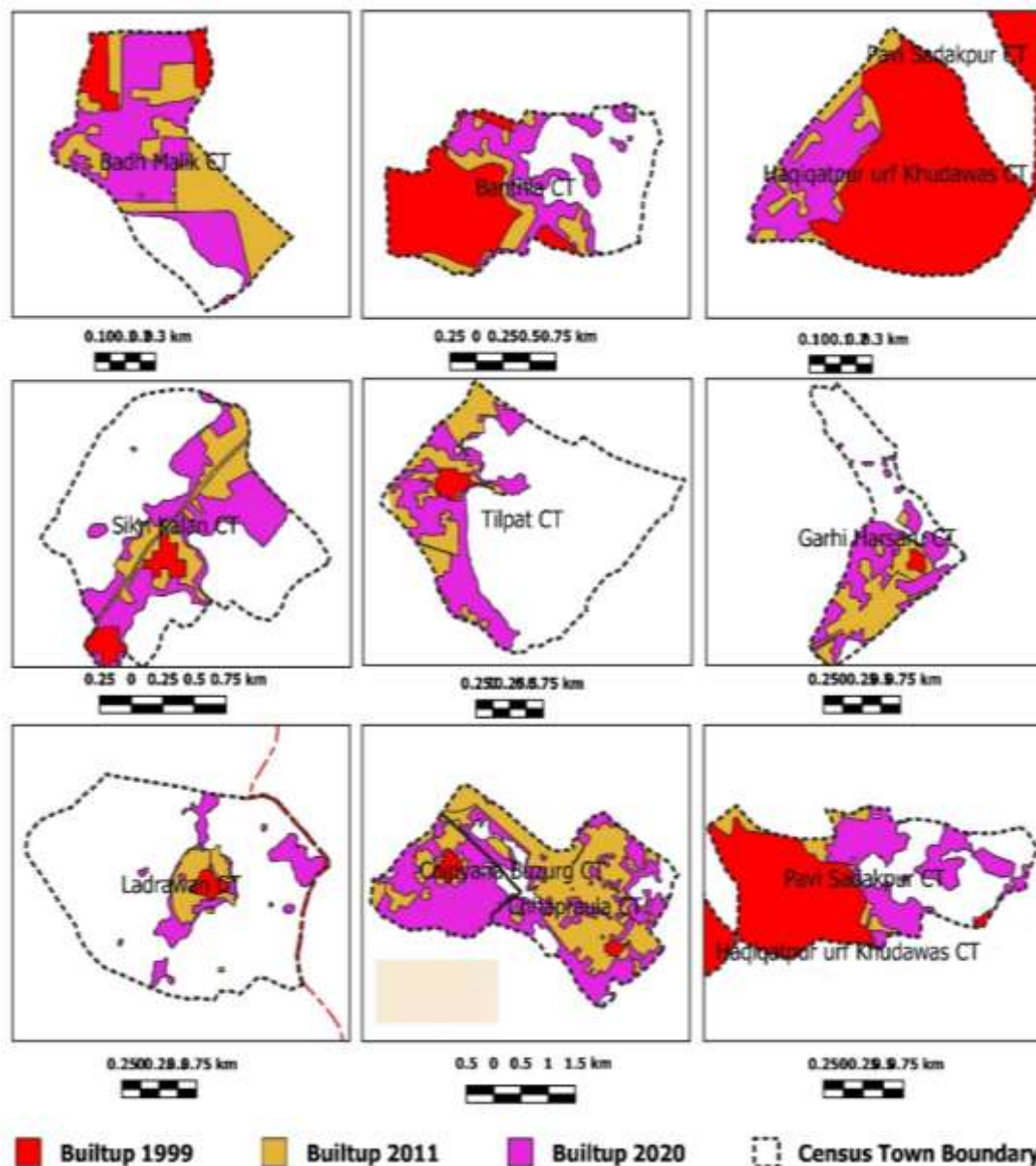
Using QGIS software(an open source software) builtup data was extracted and calculated using the available data from different sources for example built-up data for the year 1999 was extracted from NCR Planning Board Geoportal website. Land use Landcover map 1999 available on the website was downloaded and georeferenced using QGIS software and then it was digitized and thereafter, the final calculations were made for all the census towns. Similarly, 2011-12 data was downloaded from BHUVAN website and Sentinel Imagery Data 2020, ESRI was used for the extraction of builtup data for the year 2020.

Scatter Diagram and correlation technique has been used as the statistical technique for statistical analysis of the relationship between builtup growth in different census towns and their respective population growth during 2001 to 2021.

4. RESULTS

Over the three decades represented in the data (1999, 2011, and 2020), there is a discernible trend in the expansion of built-up areas across various census towns.

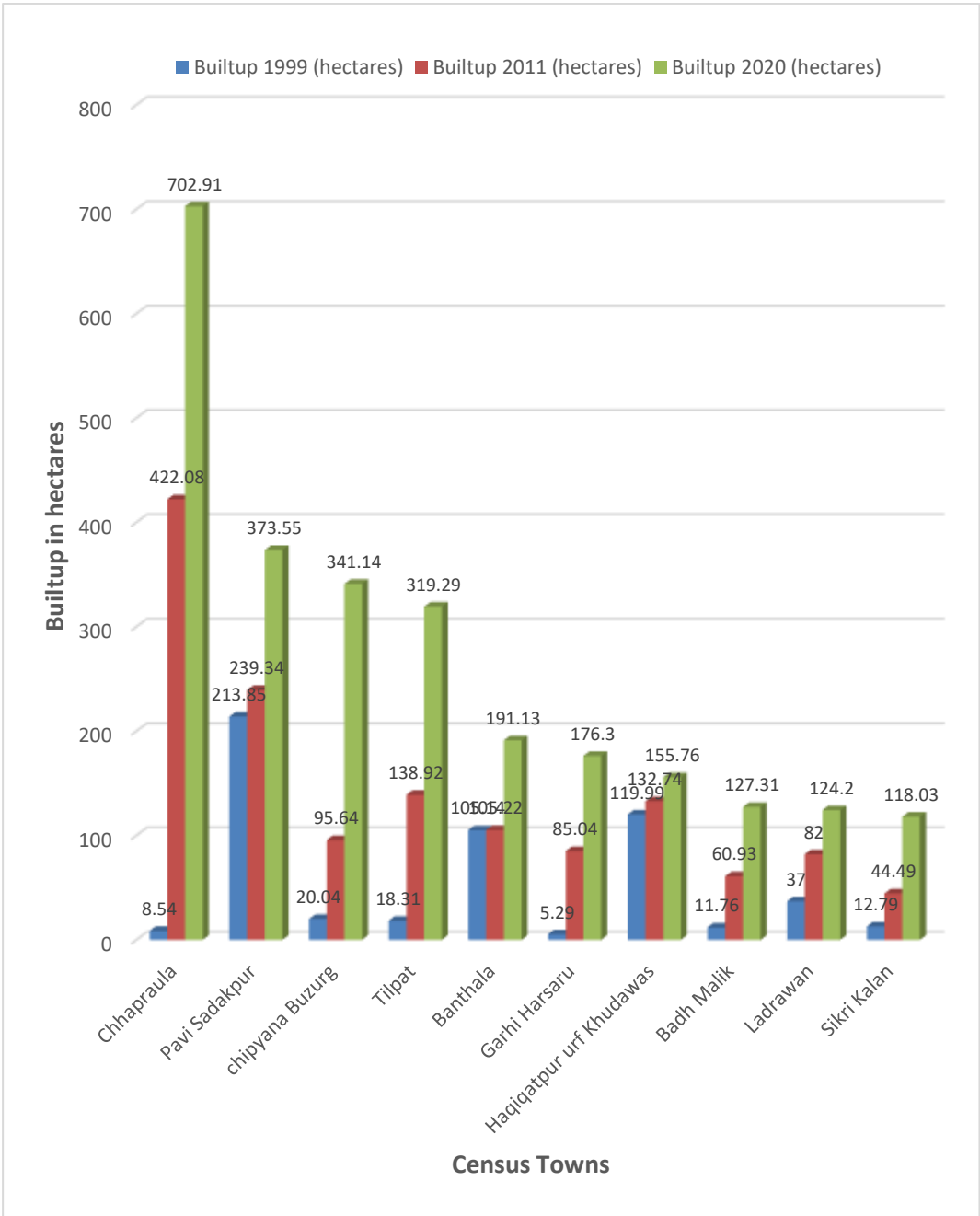
Figure 2: Builtup Growth in Census Towns (1999-2020)



Source: Author

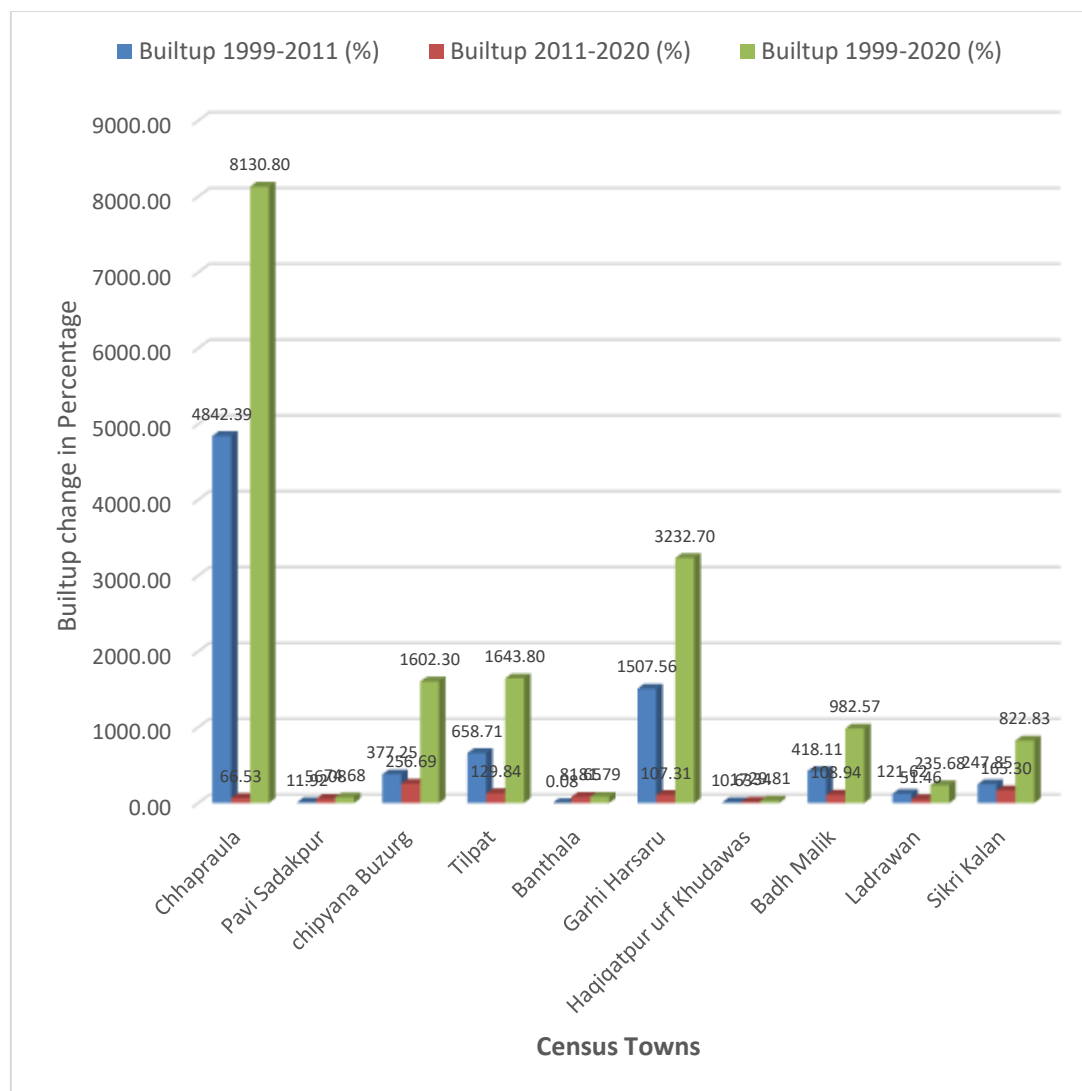
Figure 3 shows that in 1999, the census towns exhibited relatively modest built-up areas, with Chhapraula having 8.54 hectares, Pavi Sadakpur at 213.85 hectares, and Chippyana Buzurg at 20.04 hectares, among others. By 2011, there was a significant surge in built-up areas, indicating accelerated urban growth. Chhapraula, for instance, expanded to 422.08 hectares, and Pavi Sadakpur increased to 239.34 hectares. The trend continued into 2020, with Chhapraula reaching 702.91 hectares, showcasing a continued pattern of urbanization and larger built-up spaces. This data underscores the dynamic nature of urban development in these census towns, with the considerable expansion of built-up areas reflecting a broader trend of increasing urbanization over the years. The sharp rise in built-up areas from 1999 to 2020 suggests sustained development and population growth in these regions.

Figure 3: Builtup changes in census towns in hectares (1999-20)



Source: Author

Figure 4: Builtup changes in census towns in percentage (1999-20)



Source: Author

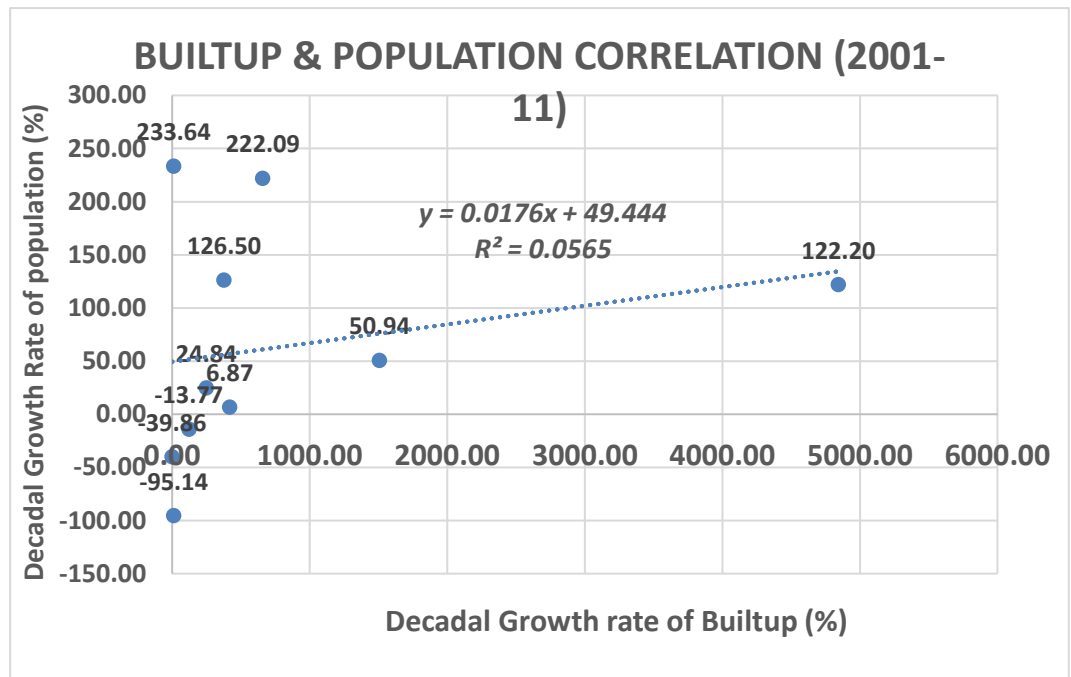
Figure 4 presents the percentage change in built-up areas for various census towns over the three distinct periods: 1999-2011, 2011-2020, and 1999-2020.

- The built-up area in Chhapraula surged dramatically by 4842.39% from 1999 to 2011, and it continued to grow by 66.53% from 2011 to 2020. The overall increase from 1999 to 2020 is an astounding 8130.80%, showcasing rapid urbanization and significant development.
- Pavi Sadakpur experienced a noteworthy increase of 11.92% in built-up area from 1999 to 2011, followed by a substantial growth of 56.08% from 2011 to 2020. The cumulative increase over the entire period is 74.68%.
- Chipyana Buzurg witnessed an extraordinary growth of 377.25% in built-up area from 1999 to 2011, and a further 256.69% increase from 2011 to 2020. The cumulative growth for the entire period is an impressive 1602.30%.
- Tilpat experienced a remarkable 658.71% increase in built-up area from 1999 to 2011, followed by a 129.84% increase from 2011 to 2020. The overall growth from 1999 to 2020 is 1643.80%.

- Banthala saw a minor increase of 0.08% in built-up area from 1999 to 2011, but there was a significant growth of 81.65% from 2011 to 2020. The overall increase from 1999 to 2020 is 81.79%.
- Garhi Harsaru witnessed an astounding growth of 1507.56% in built-up area from 1999 to 2011, followed by a substantial 107.31% increase from 2011 to 2020. The cumulative growth for the entire period is an impressive 3232.70%.
- Haqiqatpur experienced a 10.63% increase in built-up area from 1999 to 2011, followed by a more modest growth of 17.34% from 2011 to 2020. The overall increase from 1999 to 2020 is 29.81%.
- Badh Malik saw a substantial growth of 418.11% in built-up area from 1999 to 2011, followed by a noteworthy 108.94% increase from 2011 to 2020. The cumulative increase for the entire period is 982.57%.
- Ladrawan witnessed a notable increase of 121.62% in built-up area from 1999 to 2011, followed by a 51.46% increase from 2011 to 2020. The cumulative growth for the entire period is 235.68%.
- Sikri Kalan experienced a remarkable growth of 247.85% in built-up area from 1999 to 2011, followed by a substantial 165.30% increase from 2011 to 2020. The overall growth from 1999 to 2020 is 822.83%. This data underscores the varying rates of urbanization and development across different census towns, providing insights into the dynamics of growth in built-up areas over the specified time periods.

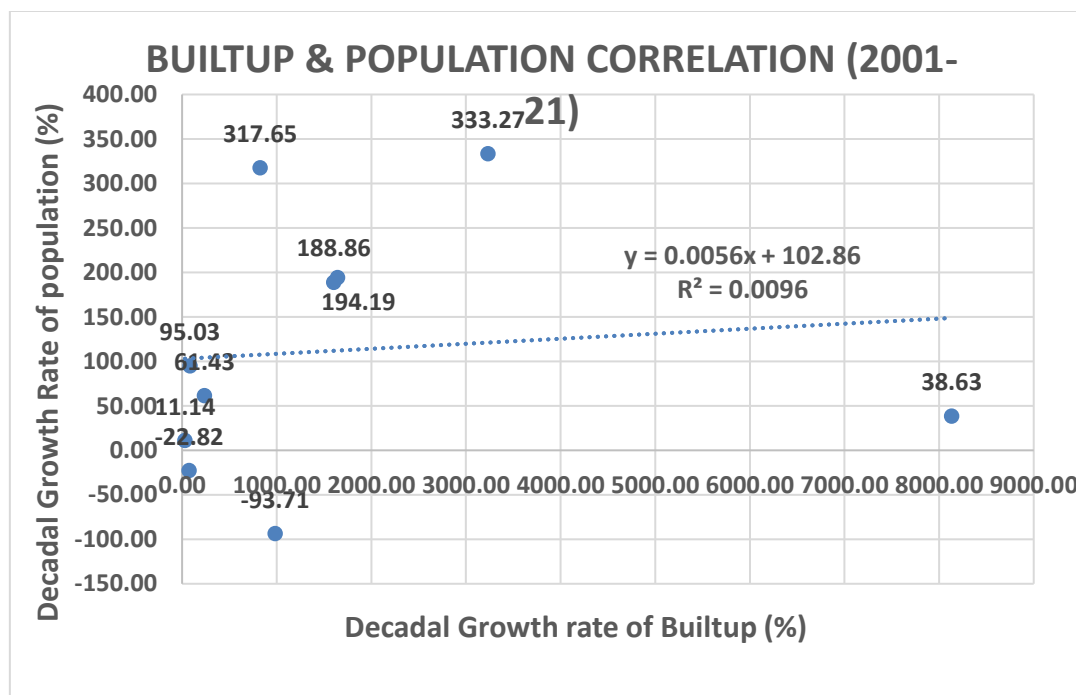
Correlation between builtup growth and population growth

Figure 5: Builtup growth and population growth correlation (2001-11)



Source: Author

Figure 6: Builtup growth and population growth Correlation (2001-21)



Source: Author

Figure 5 and Figure 6 show that the correlation between decadal growth of population and builtup in census towns is quite low between 2001 to 2021 which indicates that population growth is not a major factor in the growth of builtup area in these towns. Therefore, further studies should be conducted to find out the major cause behind the variations in growth rate of builtup in these census towns.

5. CONCLUSION

To sum up, the study finds that some of the census towns like Chhapraula, Chipiyana Buzurg & Sikri Kalan have experienced huge growth in their builtup areas whereas Haqiqatpur and Banthla have witnessed lowest builtup growth during 1999 to 2021. The study also shows that correlation between decadal growth of population and builtup in census towns is quite insignificant and can not be termed as a major factor causing the physical growth of these towns. Therefore, further studies should be conducted to find out the major cause behind the variations in growth rate of builtup in these census towns.

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