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UNDERSTANDING THE URBANISATION SHIFTS IN DEVELOPING COUNTRIES: A GEOSPATIAL INVESTIGATION OF WEST BENGAL, INDIA

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Abstract

Urbanisation is the process of a region gaining people through immigration and natural growth, industrialisation, commercialization, increased work opportunities, and lifestyle changes. This study examines West Bengal's urbanisation trend and pattern between 1951 and 2011, focusing on the last decade. The study uses census data and secondary data sources to analyse the trend and pattern of urbanisation. West Bengal has experienced the fastest rise in Census Towns (CTs) among Indian states, with the number of CTs increasing from 30 to 780 between 1951 and 2011. The proportion of people living in urban areas increased from 23.88% to 31.87%, between 1951-2011 but most CTs grew in the last decade. The urbanisation level in West Bengal has always been higher than in India since independence. The urbanisation pattern was centred on the Kolkata metropolitan area until 2001, but since then, it has shifted towards the periphery district of Kolkata due to the rapid rise of CTs and the growth of small-sized towns. The continuous decline of the primacy index indicates a diffusive pattern of urbanisation in the state. The new CTs require proper urban planning and effective urban governance for better urban services.

Keywords: Urbanisation, West Bengal, Census Town, Rank Size Rule, Surface Trend.

1. Introduction

Urbanisation is reshaping the global economy, transitioning from agriculture to non-agricultural pursuits. Presently, 55% of the world's populace resides in urban regions, yet notable inequalities persist between affluent and impoverished nations (UN-DESA, 2019). Affluent nations have achieved an 80% urbanisation rate, contrasting with developing nations experiencing rapid expansion, surpassing 50% (Das & Kar, 2022). India embarked on its contemporary urbanisation journey post-independence, witnessing a surprising surge as per the 2011 Census, with urban populations outpacing rural ones (Census of India, 2011). Worldwide, urban dwellers have risen from 30% in 1950 to the current 55.3%, poised to escalate to 68.4% by 2050 (UN-DESA, 2019). Although affluent nations are forecasted to hit 79.1% urbanisation by 2020, compared to 51.7% in poorer nations, global disparities endure (UN-DESA, 2019), notwithstanding varying national definitions of urban areas. India reported 377.10 million urban inhabitants, marking a progression from 10.84%

in 1901 to 31.16% in 2011 (Census of India, 2011). West Bengal, as per Guin (2017), sustains a higher urban population percentage than the national average, a trend pre-dating Independence.

In India, the trend of urbanisation has shifted from big cities to small urban centres since 2001-2011 (Jain & Korzhenevych, 2020) in the form of Census Towns (CTs) and the emergence of these CTs during the most recent census era was unprecedented. The Indian government has implemented initiatives like JNNURM, Smart Cities Mission, and AMRUT to promote regional development and decentralization. Small urban centres offer economic opportunities and better living standards, leading to migration from rural areas (Guin and Das, 2015). Major metropolitan areas face challenges like overcrowding, congestion, high living costs, and environmental degradation. Investments in transportation infrastructure have improved connectivity between small towns and rural areas (Chakrabarti&Mukherjee 2022). The rise of information technology and remote work has made smaller urban centres more accessible. Local governance structures and planning mechanisms have also contributed to the growth of these urban centres (Samanta, 2017). Population growth in large metropolitan cities has decreased, but peripheries have seen higher growth due to CTs, emphasizing the importance of interaction between core cities and peripheries (Pradhan, 2013).

India, a major emerging economy in the Global South, is undergoing an urban revolution with massive population growth, but a significant portion still lives in poverty (Jain & Korzhenevych, 2020). This presents an opportunity for economic, social, and ecological transformation. However, researchers argue that Indian urbanisation may be unsustainable due to its dominant urban system, control of large cities, challenges in housing, transport, electricity, water supply, pollution, congestion, and social exclusion (Guin & Das, 2015). Government policies have been lackadaisical in addressing these issues (Samanta, 2017). West Bengal as a state of India saw a significant increase in urban population from 1901 to 2011, rising from 12.19% to 31.87%. The country's urbanisation began with industrialisation post-independence, with a notable surge in small-scale urban centres in the 2011 census. Despite starting as the fourth most urbanized state at independence, by 2011, West Bengal had fallen to fifteenth place (Census of India, 2011). Unlike India's rural population growth of 1.17%, the urban population grew by 2.80% between 2001 and 2011. While India's urbanisation rate increased from 17.29% to 31.20% between 1951 and 2011, West Bengal's rose from 23.88% to 31.87%. Initially, urbanisation in West Bengal was centred on Kolkata, but it has spread to neighbouring districts in recent times (Giri, 1998). This expansion has altered the region's urbanisation pattern from monocentric to a more dispersed one, with rapid growth in census towns, particularly in smaller size categories (Guin, 2017). West Bengal has the highest rate of urbanisation among Indian states, with a significant increase in small towns and populations between 2001 and 2011 (Mukhopadhyay et al., 2020). The region's once-monocentric pattern has shifted, with new urban centres (CTs) emerging in low-populated areas surrounding Kolkata. Initially, concerns were raised about census authorities artificially inflating the increase in CTs, but

research shows this is not a result of activism. With 526 small towns in the 2011 Census, over 60% of newly developed urban centres are further away from major cities (Pradhan, 2013; Guin, 2017).

This article primarily tries to explore the evolution of urbanisation in West Bengal between 1951 and 2011, with a particular focus on the significant growth of Census Towns (CTs) within the state and the driving forces behind this rapid expansion. Furthermore, it examines the proliferation of CTs within the Kolkata Metropolitan Region (KMA). A comparative analysis is conducted on the methodologies used to define urban criteria, comparing those of the Census of India with the UN-DEGURBA method. Drawing upon secondary data, the study concludes that CTs require urban governance structures such as "Nagar Panchayat" or "Town Panchayat" to provide improved urban services. However, there remains a substantial question regarding whether such urban governance is truly necessary for the upgrading of CTs. A primary survey is deemed necessary to arrive at a conclusive decision regarding the requirement for urban governance in these CTs. The transition of urbanisation in West Bengal over five decades, focusing on the surge of Census Towns (CTs) and their significance in the Kolkata Metropolitan Region (KMA) has been addressed here. It also addresses the need for urban governance structures for improved urban services in CTs, suggesting a comparative analysis of urban criteria methodologies. However, it raises a critical question about the necessity of such governance for CTs' development and proposes a primary survey to determine the requirement accurately. The study effectively conveys the main points but could benefit from clearer organization and refinement for better readability. Additionally, the argument about the necessity of urban governance for CTs' development requires further exploration and evidence to strengthen its validity. Many previous studies have been done on the trend of urbanisation of West Bengal during 1951-2011 but very limited studies have been done about the notable shift of urbanisation in the state between 2001-2011 due to the emergence of small-sized urban centres. West Bengal serves as a significant case study for analyzing contemporary urban transition processes and emerging urban structures from 2001 to 2011, given their immediate context (**Fig. 1**). Beyond the primary objective, the study also aims to illuminate the development of cities from Class I to Class VI, population distribution within these urban centres, and the progression of urbanisation in West Bengal from 1951 to 2011. Although the main focus of this study is the state's pattern of urbanisation from 1951 to 2011, there is a special emphasis on the last decade (2001–2011) because West Bengal has experienced the highest growth in CTs during this time, changing the state's urbanisation pattern from monocentric to polycentric. This framework guides the subsequent sections of the research paper. The following segment briefly outlines the study's scope, data sources, and methodology, providing an overview of India's ongoing urban transformation. Following this, a concise historical account of West Bengal's urbanisation from 1951 to 2011 is presented. Subsequently, attention is given to analyzing the geographical and demographic shifts characterizing the state's urban transition between 2001 and 2011. Concluding the paper, the final section summarizes the principal findings, while the preceding section highlights emerging issues and proposed policy approaches.

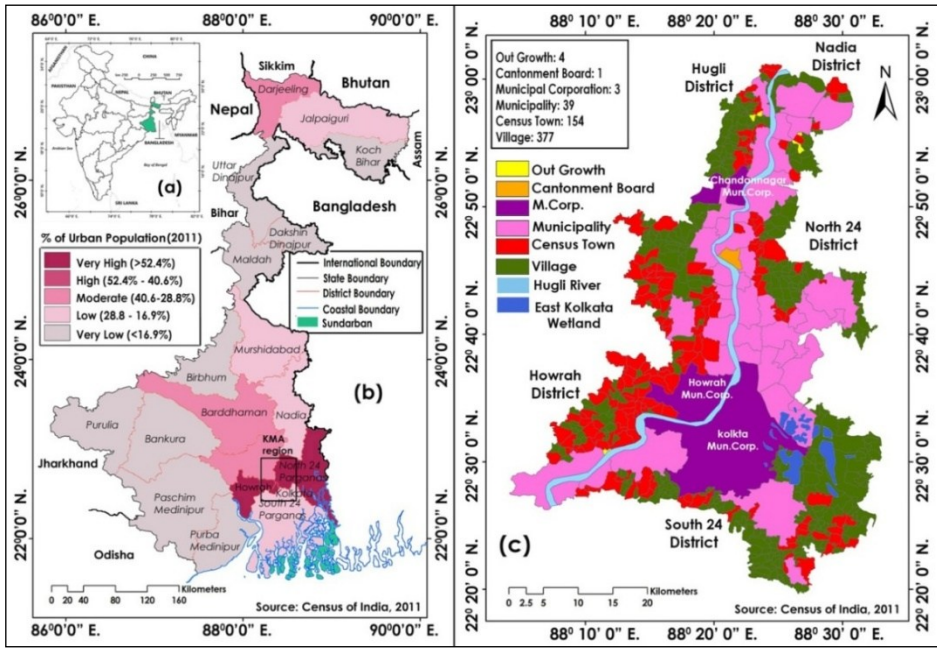


Fig. 1: Location of the study area (a) India, (b) West Bengal and (c) Kolkata Metropolitan Area (KMA) region

2. Background of the study

Almost three times as many people lived in urban areas in India in 2011 than there were in rural areas, where the growth rate was just 12%. With the number of census towns tripling from 1,362 in 2001 to 3,894 in 2011, small towns and census towns accounted for a large amount of this expansion. Around 35 million people moved from agriculture into non-agricultural occupations between 2004–2005 and 2011–2012; this change is linked to the changing employment structure (Guin, 2017). Access to jobs has been made easier in these regions by improved communication and transportation, and small and medium-sized communities have benefited from the cheap labour available to pursue non-agricultural jobs. The majority of these urban peripheries are next to larger cities and rural communities that have begun to exhibit urban traits, including the rise of market towns (Pradhan, 2013). Being close to rural regions has protected them from the risks of major metropolitan centres and allowed them to become hotspots for growth and demand for new goods and services. The level of urbanisation varied from state to state at the country level. The huge growth of small-sized urban centres is the main reason behind the variation of urbanisation level in India and the growth of small-sized urban centres (**Fig. 2a**). Small-sized urban centres make a substantial contribution, but they are frequently overlooked in policy talks and administratively regarded as rural villages, which lowers the importance of developing urban infrastructure (Guin & Das, 2015).

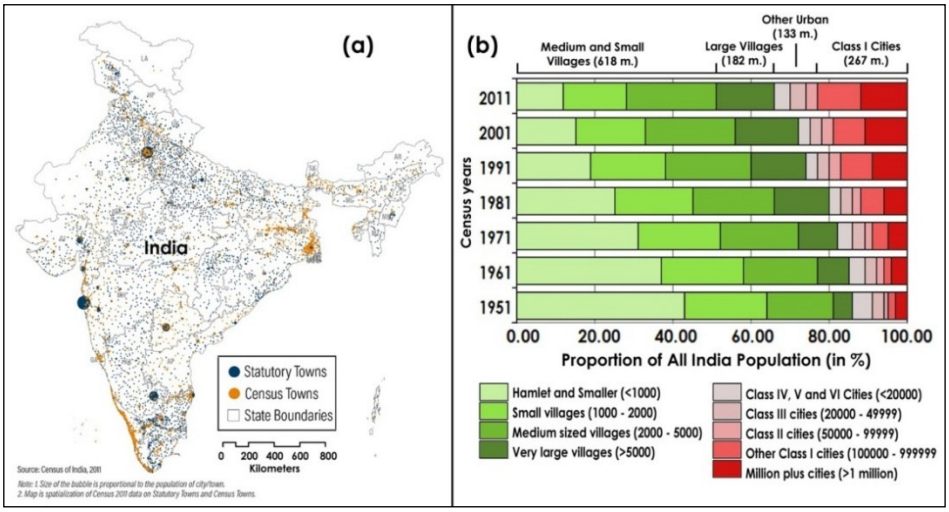
Urbanisation inequality has been evident in India (**Fig. 2b**) since the post-independence era with a top-heavy urban scenario. The data from India's census from 1951 to 2011 shows a consistent decrease in the number of hamlets and smaller settlements, with a slight decline in small villages and a slight increase in medium-sized villages. However, the number of very large villages increased from 5 in 1951 to 16 in 2001 and then decreased to 15 in 2011. Class III cities showed stability, while Class II cities showed minor fluctuations. Class I cities saw a notable increase, while the number of million-plus cities showed steady growth, indicating significant urbanisation and development in larger urban centres. Overall, the data suggests a general trend of urbanisation and growth in larger settlements, with stability observed in smaller settlements and cities during the 2001-2011 Census periods. The dataset in **Table 1** shows the urban population percentages in West Bengal and India from 1951 to 2011. West Bengal had 23.88% of its population in urban areas, while India had 17.29%. Over time, both cities experienced gradual urbanisation, with West Bengal reaching 24.45% in 1961 and India at 17.97%. By 1981, West Bengal's urban population reached 26.47%, while India's reached 23.34%. By 1991, West Bengal's urbanisation rate was 27.48%, while India's was 25.72%. By 2011, West Bengal's urban population reached 31.87%, indicating convergence in urbanisation trends between the states(**Table 1).**

Table 1: Trend of Urban Population Growth of West Bengal during 1951-2011

Year	Percentage of Urban Population	
	West Bengal	India
1951	23.88	17.29
1961	24.45	17.97
1971	24.74	20.22
1981	26.47	23.34
1991	27.48	25.72
2001	27.97	27.78
2011	31.87	31.16

The level of urbanisation in West Bengal varies significantly across districts, ranging from 8.33% in Bankura to 100% in Kolkata, averaging 28.78% (**Table 2**). Kolkata stands out as the primary hub of urban development in West Bengal, encompassing the Kolkata Urban Agglomeration (KUA) spread across five districts. In 1951, KUA housed over three-quarters of the state's urban population, a figure that dwindled to 50% over the span of 50 years, owing to the emergence of industrial complexes such as Asansol-Durgapur, Siliguri, and Haldia port. The 2011 Census also revealed a notable shift in India's urbanisation landscape, with the number of Census Towns (CTs) escalating from 1,362 in 2001 to 3,892 in 2011(Census of India, 2011). Accounting for their contribution to urban expansion, the proportion of CTs residing in urban areas surged from 7.4% in 2001 to 14.4% in 2011(Census of India, 2011). New CTs accounted for over 70% of peripheral expansion in India, significantly altering the spatial organization of major urban agglomerations (UAs) with populations exceeding one million. The evolving dynamics of

CTs over the past decade have significantly influenced the nation's perception of urbanisation, underscoring the importance of comprehending and accommodating municipal system diversity.



Source: Calculated by the authors based on Census of India, 1951 to 2011

Fig. 2:(a) Location of the Statutory Towns (STs) and Census Town (CTs) in India, (b) proportion of Indian population in different units during 1951 – 2011

In 2011, West Bengal, Kerala, Tamil Nadu, Uttar Pradesh, Andhra Pradesh, and Maharashtra, the initial six states, collectively accounted for over 60% of the total influx of new Census Towns (CTs). Kerala and West Bengal notably surpassed other states in both population density and urban expansion between 2001 and 2011, with smaller to medium-sized communities effectively addressing issues of top heaviness. The emergence of new CTs in West Bengal carries significant spatial ramifications, given the prevailing rural-urban disparity and the continuum of settlement patterns within the region's smaller and medium-sized urban centres. Kolkata Urban Agglomeration (UA) housed 59% of the state's urban population, while the western and northern regions exhibited less than one urban centre per 100 individuals. The state is actively promoting the development of local urban centres to counteract the spatially imbalanced and mono-centric trend of urbanisation, deviating from the dominance of the Kolkata UA. In 2011, there was a noteworthy increase in the number of new CTs in the state, coinciding with a reduction in urbanisation inequality, which warrants further investigation. While the proportion of urban dwellers in Kolkata and Asansol experienced a decline from 63.64% in 2001 to 52.71% in 2011, town densities witnessed an upsurge in the western and northern districts.

3. Database and Methodology

The current study's aim has been fulfilled through the utilization of secondary data sources gathered from the Census of India spanning the years 1951 to 2011. The District Census

Handbook (1951-2011) and the Primary Census Abstracts for both India and West Bengal (1991-2011) served as the primary resources for gathering data on urban population, the count of cities categorized from Class I to Class VI, and the respective populations of these cities. National Highways (NH) data were extracted using Google Earth Pro, while the map of West Bengal was obtained from Diva-GIS. The detailed methodology of the study has been represented in a flow chart (**Fig. 3**).

Table 2: District-wise share of urban population to total district population in West Bengal during 1951-2011

Sl.	Districts	1951	1961	1971	1981	1991	2001	2011
1	Bankura	7.17	7.34	7.47	7.63	8.29	7.37	8.33
2	Barddhaman	14.78	18.2	22.78	29.39	35.09	36.94	39.89
3	Birbhum	6.47	6.97	7.03	8.28	8.98	8.57	12.83
5	Dakshin Dinajpur*	12.01	16.7	22.39	27.35	26.68	13.11	14.11
6	Uttar Dinajpur*						12.06	12.05
7	Darjeeling	21.22	23.16	23.05	27.55	30.47	32.34	39.42
8	Haora	32.41	40.48	41.93	45.12	49.58	50.36	63.38
9	Hugli	25.4	25.96	26.47	29.53	31.19	33.47	38.57
10	Jalpaiguri	7.23	9.11	9.6	14.05	16.36	17.84	27.38
11	Koch Bihar	7.51	7.01	6.83	6.91	7.81	9.11	10.27
12	Kolkata	100.0	100.0	100.0	100.0	100.0	100.0	100.0
13	Maldah	3.75	4.16	4.22	4.78	7.07	7.32	13.58
14	Murshidabad	7.86	8.54	8.45	9.36	10.43	12.49	19.72
15	Nadia	18.18	18.41	18.74	21.59	22.63	21.27	27.84
17	North 24 Parganas**	60.34	62.89	69.55	76.26	51.23	54.3	57.27
18	South 24 Parganas**					13.31	15.73	25.58
20	Purba Medinipur***	14.1	14.45	14.46	16.17	19.24	20.18	11.63
21	Paschim Medinipur***							12.22
22	Purulia	6.71	6.81	8.26	9.01	9.44	10.07	12.74
With Kolkata	Mean	21.57	23.13	24.45	27.06	26.34	25.71	28.78
	Standard Deviation	14.63	15.74	17.23	18.89	14.51	14.89	16.67
	Coefficient of Variation	0.68	0.68	0.71	0.71	0.55	0.58	0.58
	C.V In %	67.81	68.02	70.45	69.8	55.03	57.96	57.91
Without Kolkata	Mean	16.34	18.01	19.42	22.2	21.74	21.32	24.82
	Standard Deviation	14.63	15.74	17.23	18.89	14.51	14.89	16.67
	Coefficient of Variation	0.91	0.87	0.89	0.85	0.67	0.71	0.67
	C.V In %	89.51	87.37	88.73	85.09	66.69	69.84	67.14

Source: Census of India, 1951 to 2011

Note.* From 1951-1991 the combined district was known as West Dinajpur, **1951-1981 the combined district was known as 24 Parganas, ***1951-2001 the combined district was known As Medinipur.

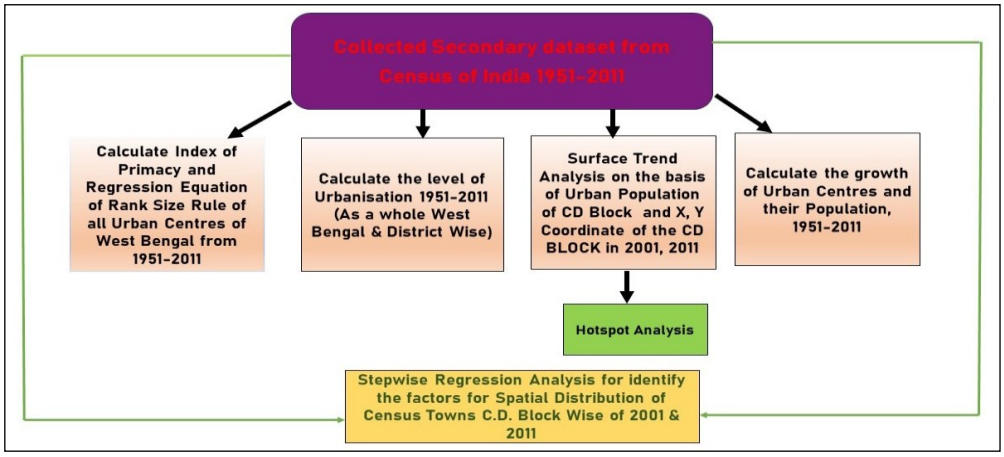


Fig. 3: Methodological workflow of the study

3.1 Rank Size Estimation and Level of Primacy:

The rank-size rule and nature of the primacy index formula are as follows:

$$P_r = \frac{P_i}{r} \quad (1)$$

Where P_r denotes the Population of the r^{th} rank size city, P_i indicates a population of the largest city, r is the rank of the city.

$$PI = \frac{P_1}{P_2} \quad (2)$$

PI is the nature of the Primacy Index P_1 is the population of the largest city, P_2 is the population of the 2nd largest city.

The analysis encompasses the growth of the urban population, the evolution from Class I to Class VI cities, and the population dynamics of these urban centres from 1951 to 2011, aiming to elucidate the spatiotemporal trends of urbanisation in West Bengal. To delineate the distribution inequality within the urban population, the Primacy Index and Rank Size Rule (Zipf, 1941) have been computed for all urban centres in West Bengal over the aforementioned period. Urban primacy, denoting the disproportionate dominance of one city over others in terms of population, economic activity, or cultural influence, is assessed through a quantitative measure known as the "index of urban primacy." Although there is no universally accepted metric for urban primacy, various methods exist to gauge it. Comparing the population or economic output of the largest city, typically the capital, with that of the next largest city or the combined populations or outputs of multiple other cities is a commonly utilized approach. A high primacy ratio indicates urban primacy, signifying the dominance of one city within the urban landscape.

3.2 Simultaneous Fraction Procedure (Cramer's Rule):

Using the Simultaneous Fraction Procedure (Cramer's Rule), the surface trend of urbanisation in West Bengal from 2001 to 2011 was plotted. For the simultaneous fraction method, the district's urban population and district coordinates were utilized. For this calculation the following steps are followed:

$$an\ (a1) + b\sum XY(b1) + c\sum Y(c1) = Z\ (d1) \quad (3)$$

$$a\sum X(a2) + b\sum X^2(b2) + c\sum XY(c2) = XZ\ (d2) \quad (4)$$

$$a\sum Y\ (a3) + b\sum XY\ (b3) + c\sum Y^2\ (c3) = \sum YZ\ (d3) \quad (5)$$

where, n is a number of observations, X and Y are the district coordinates and Z is the urban population.

Then, calculate multiple linear equations.s

$$(Zc) = [x + (y*X) + (z*Y)] \quad (6)$$

Where Zc is, the computed value of the surface trend and x, y, z denote determinant of matrix A, B, X respectively.

Finally, calculate the residual value of the surface trend:

$$(Z - Zc) \quad (7)$$

Where, Z is the observed value and Zc is computed value.

To prepare the map of the surface trend of urbanisation Inverse Distance Weightage(IDW) a standard interpolation tool has been used.IDW is a technique of interpolation which fits the continuous models of spatial variations (Patra et al., 2018). In this study, it is used to interpolate surface trends of urbanisation data. This method derives the value of some new locations by using the data of some known locations. It is measured through the following equation:

$$\hat{X}_P = \sum_{i=1}^{N} w_i X_i \quad (8)$$

$$w_i = \frac{d_i^{-\alpha}}{\sum_{i=1}^{N} d_i^{-\alpha}} \quad (9)$$

Where,$\hat{X}_P$ represents the unknown data on the surface trend of urbanisation, $X_i$is data of known points, N for the number of observations, w_i Indicate the weight of each concerned data point, d_i denotes the distance between known and unknown points and α Indicates the power.

3.3 Spatial Autocorrelation Analysis

For assessing the degree of spatial clustering of the surface trend of urbanisation in spatial autocorrelation Moran's I used. By using Moran's I we identify how an observation is similar and distant. (Haldar et al., 2023). It can be measured through the following equation:

$$I_i = \frac{Z_i - \bar{Z}}{\sigma^2} \sum_{j=1, j \neq i}^{n} \left[W_{ij} \left(Z_j - \bar{Z} \right) \right] \quad (10)$$

Where, $Z_i$is the value of the Z variable of the alternative; $\bar{Z}$is the mean value of variable Z; $Z_j$indicates the Z variable value of other locations where $\neq i$;σ the variance of variable Z and W_{ij}denotes the weighted value among the locations i and j.

Values of Moran's I are between -1 to +1, where near to +1 value indicates spatial clustering which means similar values are more probably to be found to each other and near to -1 value indicates spatial dispersion (Haldar et al., 2023). Hotspot analysis is used to identify groupings within spatial data. Based on high and low values of a given data this grouping represents hot spot and cold spot respectively. **(**Haldar et al., 2023).Getis-ord G* statistics have been applied to identify hot spots and cold spots. Through hotspot analysis, we validate the spatial data that the patterns that are noticed are statistically significant or not. (Haldar et al., 2023). In this study, the hotspot analysis was used to locate the surface trend of urbanisation in West Bengal. The hotspot analysis is measured through the following equation:

$$G_i^* = \frac{\sum_{j=1}^{n} W_{ij} x_j - \bar{x} \sum_{j=1}^{n} W_{ij}}{s \left\{ \left[n \sum_{j=1}^{n} W_{ij}^2 - \left(\sum_{j=1}^{n} W_{ij} \right)^2 \right] / (n-1) \right\}^{0.5}} \quad (11)$$

Where,W_{ij} denotes the spatial weighted matrix between observations i and j, $x_j$indicates the value of selected attributes of observation$j$, n is the total number of observations in the dataset,$\bar{x}$ Denotes sample means that. $\bar{x} = \frac{\sum_{j=1}^{n} X_j}{n}$and S indicates Standard error, $S = \sqrt{\frac{\sum_{j=1}^{n} x_j^2}{n} - (\bar{x})^2}$

3.4 Stepwise Regression

For find out the factors which control the spatial distribution of Census town block-wise stepwise regression has been done (Guin & Das, 2015). The equation followed in this regression is as follows:

$$Y = \alpha + \beta_1 x_1 + u \ldots \text{(Step 1)}$$
$$Y = \alpha + \beta_1 x_1 + \beta_2 x_2 + u \ldots \text{(Step 2)}$$
$$Y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_n x_n + u \ldots \text{(Step 3)} \quad (12)$$

Where Y represent the dependent variable, $\alpha$is intercept, β is the slope, x is the independent variable and the error term of the regression is denoted by u.

4. Results

4.1 Analysis of urban growth patterns in West Bengal

4.1.1 Growth of Urban Population during 1951-2011

Since independence, in each decadal census, West Bengal has consistently exhibited a higher level of urbanisation compared to the national average, although the disparity in urbanisation levels between the two entities has been gradually narrowing over time. In 1951, the proportion of the urban population in West Bengal stood at 23.88%, surpassing the urban population share of the entire country, which was recorded at 17.29% (see **Table 1**). **Table 1** further indicates a progressive increase in the urban population share of West Bengal throughout the study period, with no instances of decline from the preceding decade. Even though West Bengal has always had a higher rate of urbanisation than the rest of the nation, this difference has gradually closed as a result of the industrial belt along the Hugli River, which is the primary driver of the state's urbanisation, stagnating decade after decade. As a result, rural-to-urban migration within the state has also gradually decreased. The distribution of urban population or the degree of urbanisation across the state exhibits significant disparities. In 1951, this ranged from 3.75% in Maldah to 100% in Kolkata, with an average rate of 21.57%. By 2011, the range expanded from 8.33% in Bankura to 100% in Kolkata, with an average rate of 28.78% (see **Table 2**).

Table 2 vividly illustrates that throughout all census periods between 1951 and 2011, Kolkata maintained a 100% urbanisation level due to the absence of rural administrative units. While the urbanisation levels in the outer districts of Kolkata are lower than in Kolkata itself, most districts have seen a continuous increase in urbanisation from 1951 to 2011. For instance, District Howrah increased from 32.41% in 1951 to 63.68%, and even the less urbanized district of Maldah increased from 3.75% in 1951 to 13.58% in 2011. The consistent growth of urbanisation in these districts outside Kolkata suggests a continuous influx of urban population. However, some districts have exhibited steady or slow increases over the decades. While the share of the urban population in the peripheral districts of Kolkata is not experiencing substantial growth, districts farther from the state capital are witnessing higher growth rates in urban population compared to those near Kolkata. Additionally, this table provides insights into the urban landscape of West Bengal with and without Kolkata. The average urbanisation rate, including Kolkata, increased from 21.57% in 1951 to 28.78% in 2011. Excluding Kolkata, the average urbanisation rate of the state decreased from 21.57% to 16.34% in 1951 and 28.78% to 24.82% in 2011.

4.1.2 Growth of Urban centres of West Bengal during 1951-2011

As per the Census of India, all urban centres in the country are categorized into six groups based on their population size, with Class I, II, III, IV, V, and VI having population sizes of more than 100,000, 50,000-99,999, 20,000-49,999, 10,000-19,999, 5,000-9,999, and below 5,000 respectively. These urban centres are further divided into three main categories: large, medium, and small. Large urban centres comprise only Class I cities, while Class II and III cities fall under medium-sized urban centres, and the remaining classes constitute small urban centres. In 1951, the proportion of large urban centres was 5.83%, housing more than half of the urban population (see **Table 3**). This share of large

urban centres continuously increased from 1951 to 2001 and their population had a minor decrease between 1951-1971 but again from 1971-2001 it continuously increased in every decade, but, in the last decade, the share of large urban centres and the urban population of that large urban centre proportion declined, due to small urban centres saw significant growth, with their population more than doubling in the same period (2001-2011) (**Table 3**). This substantial expansion of small urban centres and their population indicates a shift in the urbanisation pattern in West Bengal from metropolitan cities to smaller urban areas. Medium size urban centres (class II and class III) slightly increased between 1951 to 1961 also their population increased within this period. But from 1961 to 2011 share of those urban centres continuously decreased, though between 1961 and 1971 the medium-sized urban centres decreased their population increased during this period but after 1971 to 2011 their population decreased meanwhile small urban centres emerged within this period also small urban centres population has increased.

Table 3: Share of Urban population and urban centres in West Bengal during 1951-2011

Size of Urban Centres and Population (in %)		1951	1961	1971	1981	1991	2001	2011
Large (Class I)	Urban Centres	5.83	6.49	6.73	8.25	11.52	15.69	6.81
	Urban Population	57.47	55.13	54.91	55.63	63.97	74.11	61.95
Medium (Class II & III)	Urban Centres	35.83	36.22	35.87	31.62	25.13	22.87	12.97
	Urban Population	30.09	32.45	33.22	31.4	23.78	16.52	16.89
Small (Class IV-VI)	Urban Centres	58.33	57.3	57.4	60.14	63.35	61.44	80.22
	Urban Population	12.44	12.41	11.87	12.97	12.25	9.38	21.16

Source: Census of India, 1951 to 2011

Between 1951 and 2001, West Bengal experienced a fluctuating urban growth pattern, with an initial increase in small urban centres and a population decline due to various factors. Post-Independence industrial expansion, administrative reclassification, decentralized urbanisation, and rural-urban migration were key drivers. However, by the 1970s, industrial growth stagnated due to political instability, labour strikes, and outdated infrastructure (Bhattacharya, 2006). Kolkata-centric urbanisation concentrated economic activities, leading to outmigration from smaller towns. Poor infrastructure and connectivity in small urban centres also contributed to population decline. Economic reforms in the 1990s facilitated faster urbanisation, but small towns were left out due to limited integration (Banerjee & Roy, 1993). Agricultural dependence and land scarcity also affected the economic viability of these towns. Urban outmigration from smaller urban centres led to a reduction in population growth.

4.1.3 Rank Size Distribution and Nature of Primacy

From 1951 to 2011, the application of the rank-size rule to all urban centres in West Bengal illustrated an imbalanced urban development trend. Kolkata, as the sole

metropolitan city in West Bengal, consistently maintained a significantly higher population than expected from 1951 to 2011. Analysis of the regression table (**Table 4**) reveals that throughout the entire study period, the correlation between the theoretical rank of urban centres and their population, as hypothesized by Zipf, accounted for less than 10% of the variance, indicating a lack of perfect correlation between rank and population size of urban centres. The other two parameters intercept and slope, hold significance. The intercept signifies the population of the largest city concerning rank Over the study period from 1951 to 2011, the intercept value continuously decreased, indicating a consistent decline in the population of the largest urban centres, with this population diffusing to smaller-sized urban Census Towns (CTs) (see **Table 4**). According to Zipf's (1949) rank-size theory, the slope value represents the force of diversification and unification within urban populations. While the algebraic sign of the slope is disregarded, an increasing slope indicates the unification of the urban population into one or two urban centres, whereas a decreasing slope suggests the diversification of the urban population from one core urban centre to smaller-sized urban centres.

Table 4: Regression results for Rank-Size distribution and index of primacy for the urban centres in West Bengal during 1951-2011

Census Years	Intercept (a)	Slope (b)	R^2	Index of Primacy	Census Years	Intercept (a)	Slope (b)	R^2	Index of Primacy
1951	164725	1857.5	0.08	5.88	1991	154306	550.8	0.07	4.62
1961	142150	1029.2	0.07	5.71	2001	193160	708.3	0.09	4.54
1971	152602	923.4	0.08	4.27	2011	101363	152.1	0.06	4.18
1981	153017	708.3	0.09	4.44					

Source: Census of India, 1951 to 2011

The gradual decrease in the slope suggests a diversification of the urban population from one primary urban centre to various smaller-sized urban centres, attributed to the substantial growth of these smaller urban areas. Understanding the growth and development of any urban region is often assessed through the growth of its Primate City, gauged by its primacy index. This index is calculated by dividing the population of the largest urban centre by that of the second largest, serving as a measure of primacy. **Table 4** also reveals a continuous decline in the magnitude of the primacy index from 1951 to 2011, indicating a narrowing gap between the populations of the largest and second-largest urban centres. Despite the decline in the primacy index from 5.88 in 1951 to 4.18 in 2011, the urban system remains highly imbalanced within the state.

4.1.4 Emergence of urban centres during 2001-2011

As per the Census of India, all statutory towns, Census Towns (CTs), Notified Areas, and Cantonment Boards are considered urban centres. The number of urban

centres in West Bengal increased from 376 to 910 between 2001 and 2011. During this period, over 50% of the total urban centres were identified as CTs. When categorized by district, Class I to Class VI cities are further classified into three groups: large urban centres (Class I), medium-sized urban centres (Class II & III), and small-sized urban centres (Class IV to VI).

In Kolkata, the urban population share remained consistently at 100% for both years, with the entire urban population concentrated within the single large urban centre of Kolkata itself. In 2001, the number of small and medium-sized urban centres did not significantly impact the increase in urban centres. However, between 2001 and 2011, there was a significant change due to the substantial growth of CTs, predominantly falling under small-sized urban centres. During this period, the share of small-sized urban centres and their population experienced tremendous growth, particularly in the peripheral districts of Kolkata, such as Howrah, Hugli, North 24 Parganas, South 24 Parganas, and Nadia (see **Fig. 4a**). Even in the westernmost districts of Purulia, Bankura, and Barddhaman, there was an increase in the share of small-sized urban centres during this period (see **Fig. 4a**). Similarly, the northernmost districts of Darjeeling, Jalpaiguri, and Coochbehar witnessed a significant rise in small-sized urban centres and their population.

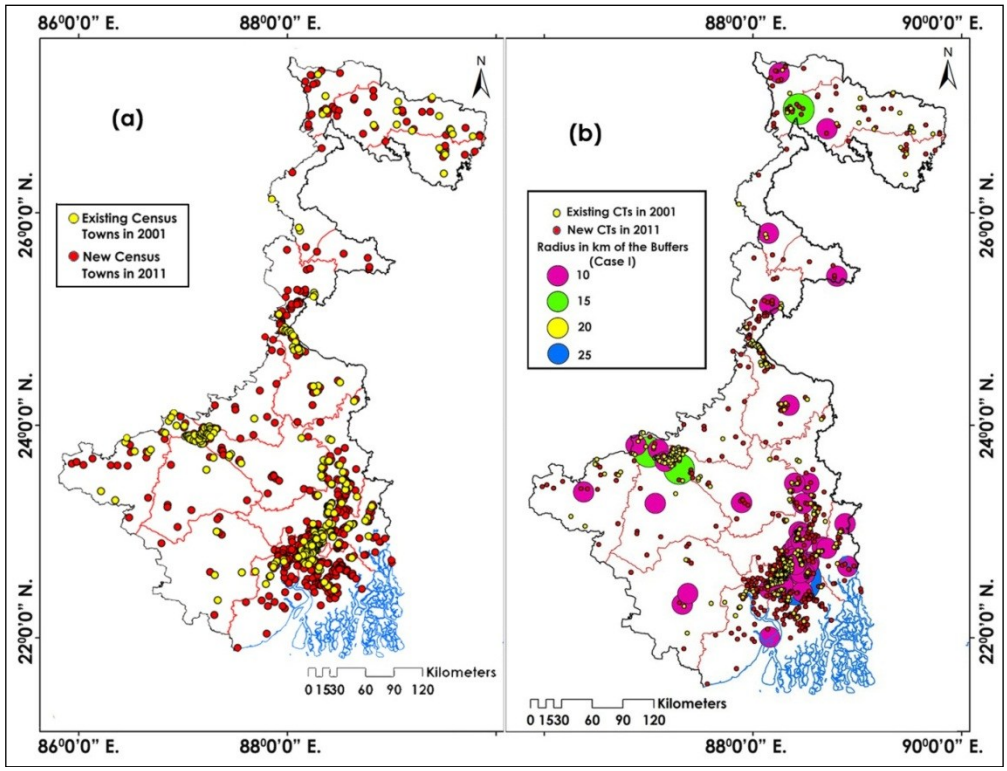


Fig. 4:(a) Emergence of Census Towns (CTs) during 2001-2011 in West Bengal and (b) Concentration and dispersion nature of CTs

4.2 District-level growth of CTs

A comprehensive analysis of census data spanning from 1951 to 2011 indicates that there were no significant spatial changes in the growth of Census Towns (CTs) between 1951 and 2001. However, in the last decade, from 2001 to 2011, CTs experienced tremendous growth, particularly in the Kolkata Metropolitan Area (KMA). Collectively, the five districts comprising the KMA (North 24 Parganas, South 24 Parganas, Nadia, Howrah, and Hugli) accounted for over 50% of the new CTs in 2011 (see **Table 5**). Additionally, apart from these five districts, the northern and westernmost districts witnessed a substantial number of new CTs in 2011 (see **Table 5**).

Table 5: District-wise distribution of census towns (CTs) in West Bengal during 2001-2011

Districts	CTs in 2001		CTs in 2011		Change in number	Change in share
	Actual	Share	Actual	Share		
Bankura	2	0.79	9	1.15	7	0.36
Barddhaman	55	21.83	85	10.90	30	-10.93
Birbhum	1	0.40	14	1.79	13	1.40
Darjeeling	4	1.59	24	3.08	20	1.49
Howrah	50	19.84	135	17.31	85	-2.53
Hooghly	28	11.11	64	8.21	36	-2.91
Jalpaiguri	13	5.16	35	4.49	22	-0.67
Koch Bihar	4	1.59	12	1.54	8	-0.05
Maldah	3	1.19	27	3.46	24	2.27
Murshidabad	22	8.73	65	8.33	43	-0.40
N. Dinajpur	3	1.19	5	0.64	2	-0.55
Nadia	15	5.95	55	7.05	40	1.10
North 24 Parganas	20	7.94	78	10.00	58	2.06
Paschim Medinipur*	9	3.57	11	1.41	2	-2.16
Purba Medinipur*			20	2.56	20	2.56
Purulia	9	3.57	25	3.21	16	-0.37
S. Dinajpur	0	0.00	5	0.64	5	0.64
South 24 Parganas	14	5.56	111	14.23	97	8.68
Total	252	100.00	780	100.00		

Source: Census of India, 2001 to 2011

Note. *in 2001, the combined district known as Medinipur

A significant number of new CTs emerged in Murshidabad district. In Jalpaiguri, the newly emerged CTs were scattered throughout the district, with the economy predominantly reliant on tea plantations, leading to an increase in CTs. Interestingly, in Malda district, the newly emerged CTs were primarily concentrated in the southern portion where large urban

centres are absent. The substantial influx of CTs in Barddhaman district can be attributed to its agricultural and industrial development. Similarly, the westernmost districts of Birbhum, Purulia, and Bankura also experienced a significant increase in new CTs, albeit to a lesser extent compared to the northern districts.

4.3 Concentration and dispersion nature of CTs

As noted by Bala (1982), newly emerging Census Towns (CTs) can be broadly categorized into two types: those concentrated around large urban centres and those dispersed and located away from such centres. A detailed analysis of previous literature, including studies by Dasgupta (1987) and Kundu (1992) indicates that in both India and West Bengal, the majority of new CTs were concentrated around metropolitan cities or large urban centres until the 2001 census. It has been observed that a village may transform into a CT if it plays a significant socio-economic role within its surrounding villages, even without proximity to metropolitan cities (Rondinelli, 1983). However, in the most recent census, Pradhan (2013) applied a buffer approach around Class I cities (those with a population of more than 100,000) to analyse the concentration and dispersion nature of newly emerged CTs in 2011 in India. The results revealed a contrary trend from previous censuses: only about one-third (31.06%) of the newly emerged CTs were concentrated around Class I cities, with the remainder located far from large urban centres. This study also employed a similar method to (Chakrabarty et al., 2015) to understand the nature of newly emerged CTs in West Bengal in 2011. Initially, three buffers were drawn around individual urban centres based on their population size (see **Table 6**). CTs within these buffers were termed "Suburban New CTs," while those outsides were labelled "Subaltern New CTs".

Table 6: Buffer-wise distribution of urban centres

Size Class of Urban Centres	The radius of the Buffer (in Km)		
	Case I (Base)	Case II (+25%)*	Case III (-25%)**
1 lakh -5 lakhs	10.00	12.50	7.50
5 lakh-10 lakhs	15.00	18.75	11.25
10 lakh -40 lakh	20.00	25.00	15.00
More than 40 lakhs	25.00	31.25	18.75

Note. * Radius is 25% larger than base (Case I), ** Radius is 25% smaller than base (Case I) as proposed by Pradhan (2013)

Source: Calculated by the authors based on the Census of India, 2011

The results presented in **Table 7** indicate the total number of new CTs within the buffer of each particular district, along with the percentage of new CTs within the buffer area of each district. Across all districts combined, 31.06% of newly emerged CTs are located around Class I cities. Consequently, more than two-thirds of new CTs are situated outside the buffer area of Class I cities. This suggests that the old pattern of monocentric urbanisation has gradually diminished. Additionally, when the buffer radius is increased by 25%, the share of new CTs rises to 35.23%, whereas a 25% decrease in radius reduces it

to 27.84% (**Table 7**). However, the distribution of new CTs around the proximity of Class I cities varies from district to district. Highly urbanized districts like North 24 Parganas, Howrah, Hugli, and Barddhaman exhibit a higher concentration of new CTs around Class I cities. Conversely, in less urbanized districts such as Nadia, South 24 Parganas, Malda, and Murshidabad, the share of new CTs around large urban centres is minimal (**Fig. 4b**). This indicates that non-urban areas of highly urbanized districts, which are proximate to Class I cities, are rapidly transforming into CTs, while areas in districts with lower urbanisation levels, located far from large urban centres, are also undergoing CT transformation.

Table 7: Buffer-wise distribution of Census Towns

District	The radius of the Buffer (in Km)		
	Case I (Base)	Case II (+25%)*	Case III (-25%)**
Bankura	0 (0.00)	0(0.00)	0 (0.00)
Barddhaman	12 (40.00)	15 (50.00)	10 (33.33)
Birbhum*	--	--	--
Darjeeling	6 (30.00)	7 (35.00)	6 (30.00)
Howrah	28 (32.94)	32 (37.65)	21 (24.71)
Hooghly	25 (69.44)	32 (88.89)	21(58.33)
Jalpaiguri	5 (22.73)	9 (40.91)	1 (4.55)
Koch Bihar*	--	--	--
Maldah	3 (12.50)	4 (16.67)	5 (20.83)
Murshidabad	3 (6.98)	1 (2.33)	5 (6.98)
North Dinajpur	0 (0.00)	0 (0.00)	0 (0.00)
Nadia	7 (17.50)	14 (35.00)	13 (32.50)
North 24 pgs	52 (89.66)	56 (96.55)	50 (86.21)
Paschim Medinipur	0 (0.00)	1 (14.29)	1 (14.29)
Purba Medinipur	1 (6.25)	0 (0.00)	0 (0.00)
Purulia	2 (12.50)	2 (12.50)	2 (12.50)
South Dinajpur	1 (20.00)	2 (40.00)	2 (40.00)
South 24 pgs	19 (19.59)	11 (11.34)	12 (12.37)
West Bengal	164 (31.06)	186 (35.23)	147 (27.84)

Source: Census of India, 2011

Note. * Birbhum and Koch Bihar have no Class I Cities as Classification of Pradhan (2013)

4.4 Surface trends of urban growth

The surface trend of urban growth at the level of CD blocks was assessed using the simultaneous fraction approach, commonly known as Carmer's Law, along with three key factors: the urban population of each specific CD block and their corresponding X and Y coordinates. This examination delved into a comprehensive analysis of the urban growth trends between 2001 and 2011, focusing on both district and CD block levels. At the CD block level in 2001, the application of Carmer's Rule highlighted Domjur, Sankrail, and Bally

Jagachha blocks within the Haora district as exhibiting notably high levels of urbanisation, while Gosaba block in South Twenty-four Parganas displayed the lowest urbanisation rate. By 2011, the trend persisted with several blocks in the Haora district, including Domjur, Sankrail, Panchla, and Bally-Jagachha, maintaining high levels of urbanisation. Meanwhile, the Gosaba block retained its position with the lowest urbanisation rate.

The analysis of CD block-level data from 2001 to 2011 indicated a notable shift in urban concentration (**Fig. 5a** and **5b**). In 2001, urbanisation was centred on Kolkata and a few nearby blocks; by 2011, it increased to several nearby districts, including Purulia, Barddhaman, Birbhum, Darjeeling, and Jalpaiguri. This expansion was influenced by neighbouring states, particularly Jharkhand, which played a significant role in fostering urban growth in the westernmost districts. Additionally, factors such as the Siliguri urban agglomeration and the presence of tea cultivation contributed to urban growth in northern regions. Conversely, blocks situated near the Bay of Bengal in the southernmost areas exhibited consistently low to very low levels of urbanisation in both 2001 and 2011. This trend was attributed to limited non-agricultural activities in the region, resulting in migration away from these areas. The findings underscored the dynamic nature of urban growth, influenced by a combination of geographical, economic, and social factors. Understanding these trends is crucial for informed urban planning and resource allocation to support sustainable development in diverse regions.

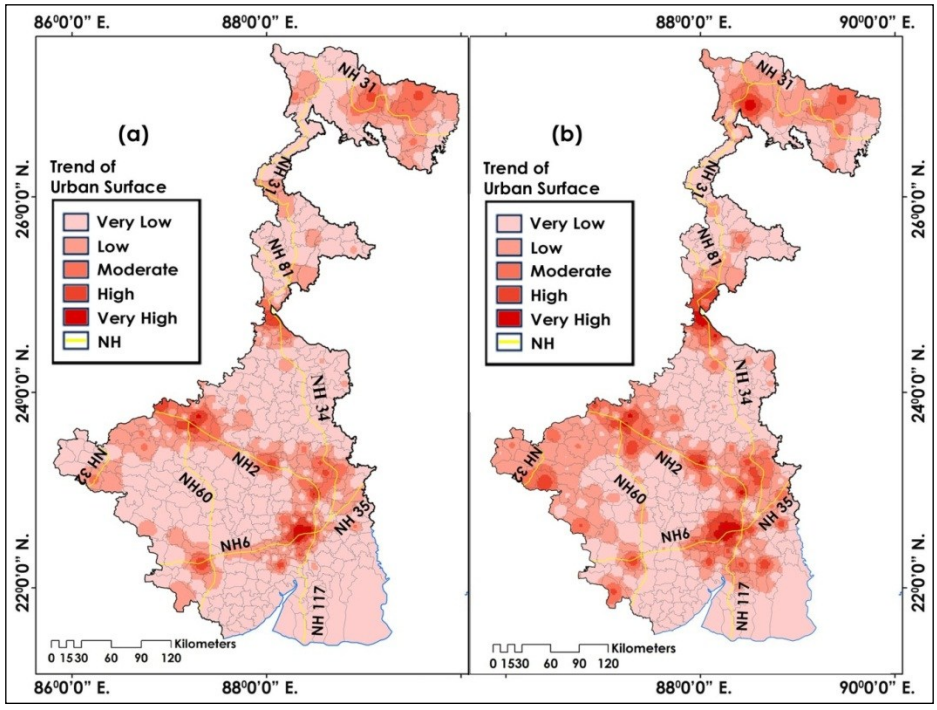


Fig. 5: Depicting the surface trend of Census Towns (CTs) as implications of urban growth at CD Block level for (a) 2001 and (b) 201

4.5 Hotspot Analysis

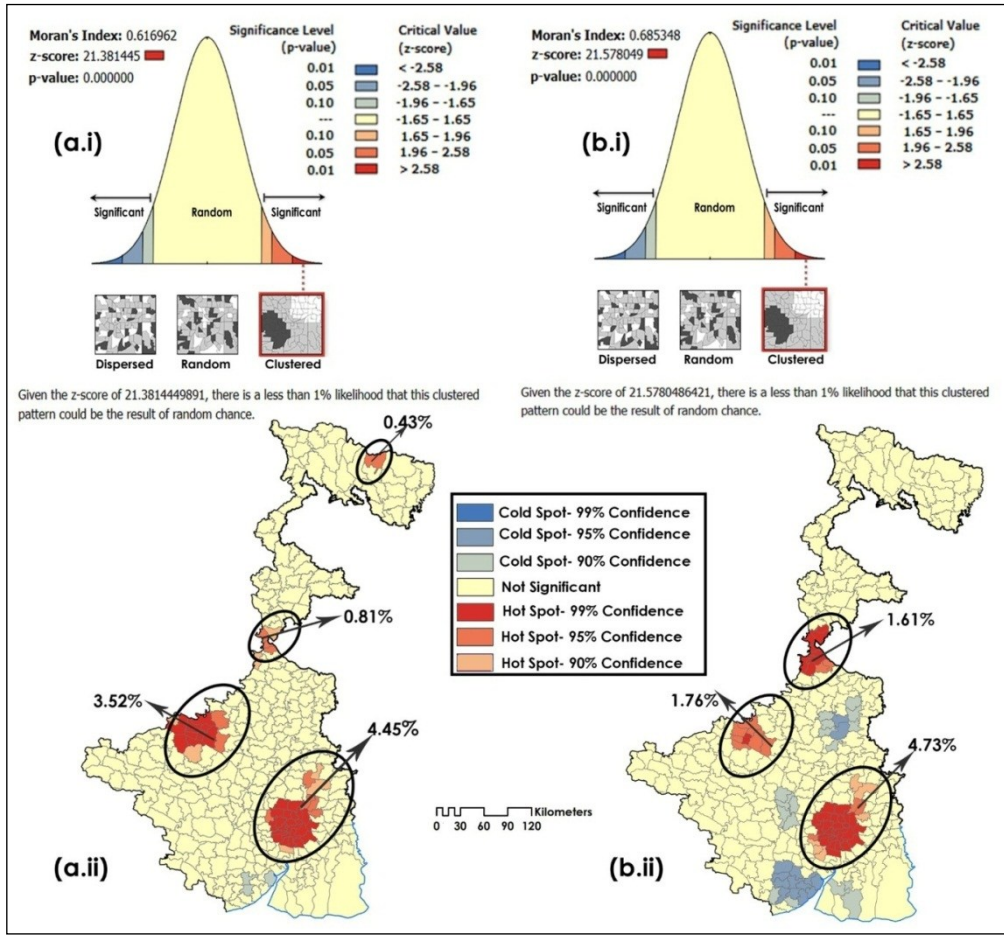


Fig. 6:(a.i) and **(b.i)** show the spatial autocorrelation for 2001 and 2011, respectively and **(a.ii)** and **(b.ii)** show the surface trend of urban growth for 2001 and 2011 respectively at the CD Block level in West Bengal

The spatial distribution of urbanisation across block levels in West Bengal is examined in hotspot analysis. Before conducting hotspot analysis, the presence of spatial autocorrelation among neighbouring observations in the datasets was evaluated. Moran's I statistic was employed as a measure to assess this spatial autocorrelation (Haldar et al., 2023). The results of Moran's I values at the CD Block level for both 2001 and 2011 revealed a tendency towards positive clustering. Specifically, in 2001, Moran's I value was calculated to be 0.61, indicating that 61% of the surface trend data for CD Blocks demonstrated positive clustering, with a Z value of 21.38 and a significant P value of 0.000. By 2011, this Moran's I value increased to 68%, with corresponding Z and P values of 21.57 and 0.000, respectively (see **Fig. 6a.i** and **6a.ii**). This spatial autocorrelation analysis offers valuable insights into the spatial patterns of urban growth (Haldar et al., 2023). In

2001, 32 blocks were identified as hotspot regions with a confidence level of 99%. The majority of these hotspots were concentrated within the Kolkata metropolitan area, with the remaining hotspots situated in the western part of the Barddhaman district. Similarly, in 2011, 42 blocks were designated as hotspot regions with a confidence level of 99%. Similar to 2001, the focal points of hotspot regions were primarily within the Kolkata metropolitan area but also extended towards the surrounding districts of Kolkata and Barddhaman (refer to **Fig. 6b.i and 6b.ii**). Furthermore, in 2011, blocks within the Murshidabad district were also identified as hotspot regions. This categorization of hotspot areas for urbanisation trends was attributed to the proliferation of non-agricultural activities and the presence of major highways such as NH-2 in Barddhaman district and NH-34 in Murshidabad district. Overall, the analysis provides valuable insights into the spatial patterns of urbanisation in West Bengal, highlighting areas of significant growth and the factors contributing to these trends.

4.6 Urban transition in Kolkata Metropolitan Area (KMA) during 2001-2011

Similar to West Bengal, the Kolkata Metropolitan Area (KMA) region has witnessed significant growth in Census Towns (CTs) over the past decade. While the number of Municipal corporations has remained constant, there has been a notable decrease in the absolute population and the proportion of male non-agricultural workers from 2001 to 2011. In contrast, **Table 8** shows that while the overall number of CTs, their population, and their percentage of the primary male non-agricultural population all increased over that time, the population density fell. This points to a demographic change in the KMA region, with people moving from large cities to smaller CTs and growing secondary and tertiary economic activity in these smaller regions. The number of villages in the area has remarkably decreased over this time, along with the population, population density, and percentage of male non-primary workers in the villages.

Table 8: Nature of urban characteristics in Kolkata Metropolitan Area (KMA) during 2001-2011

Type of administrative units	2001					2011					
	Number of units	Area (sq.km)	Population Size	Population Density	Share of male non-primary workers	Number of units	Area (sq km)	Population Size	Population Density	Share of male non-primary workers	Population growth rate
Municipal Corporation	3	285	5750265	20176	93.88	3	285	5740636	20142	93.48	-0.17
Municipality	38	631.99	6695461	10594	92.16	39	656.83	7327623	11156	90.36	9.44
Census Town	80	185.1	1028217	5554	88.4	154	342.71	1829098	5337	89.40	77.89
Cantonment Board	1	3.68	22041	5989	90.42	1	3.68	17380	4723	89.4	-21.15
Out Growth	12	29.93	65462	2187	84.54	4	16.33	22909	1402	90.58	-65.00
Village	462	715.71	1275432	1782	63.81	377	546.851	947122	1731	62.69	-25.74

Source: Calculated by the authors based on the Census of India, 2001 and 2011

Figures 8a and **8b** further illustrate that many villages exhibited urban characteristics as early as 2001 and 2011. Consequently, many villages have transformed

into CTs by adopting urban attributes. This transformation is attributed to changes in economic activities, with a considerable number of villages transitioning from the primary sector to the secondary and tertiary sectors. The Kolkata Metropolitan Area (KMA) region has undergone notable demographic and economic shifts over the past decade, with a particular focus on the proliferation of Census Towns (CTs) and the urbanisation of previously rural areas. The surge in CT numbers within the KMA signifies a trend towards urbanisation and demographic redistribution away from major metropolitan hubs. This shift is underscored by the decline in both the total population and the proportion of male non-agricultural workers within Municipal corporations, juxtaposed with the rise seen in CTs. This trend suggests a reconfiguration of population and economic activities towards smaller urban centres. Additionally, the expansion of secondary and tertiary economic activities in CTs indicates a broadening of the economic base beyond primary sectors, potentially fostering enhanced employment prospects and economic development in these locales. Conversely, the decrease in the number of villages, coupled with declines in population and workforce participation rates, signals a pattern of rural depopulation and economic restructuring. The transition of many villages with urban characteristics into CTs highlights a formalization of their urban status, driven by shifts in economic activities and population dynamics. This transformation is attributed to the evolving economic landscape, with agriculture-based sectors giving way to secondary and tertiary industries, reflecting broader economic restructuring processes. In sum, the KMA region exhibits a nuanced interplay of demographic shifts, economic transformations, and urbanisation dynamics, emphasizing the necessity for comprehensive urban planning and policy interventions to address emerging challenges and capitalize on opportunities presented by these changes.

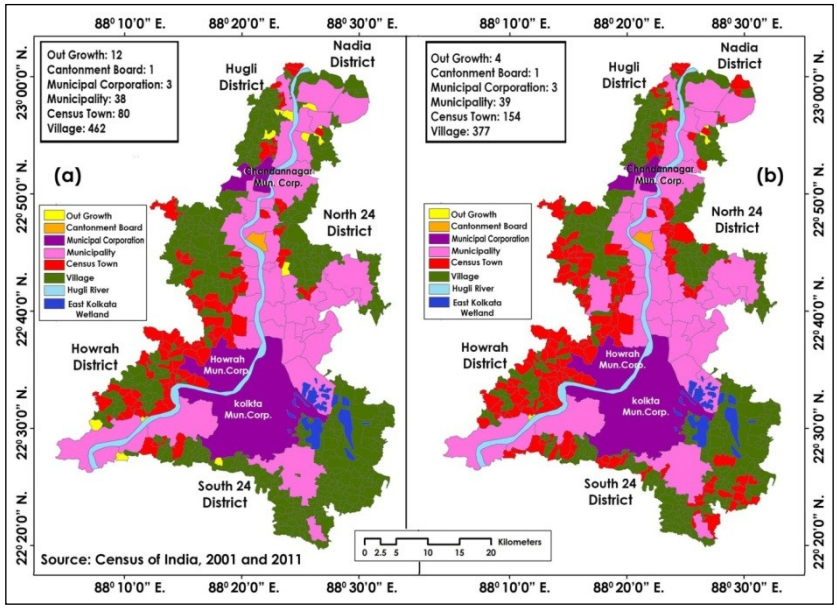


Fig. 7: Urban transition in Kolkata Metropolitan Area (KMA) (a) as per Census of India during (a) 2001 and (b) 2011

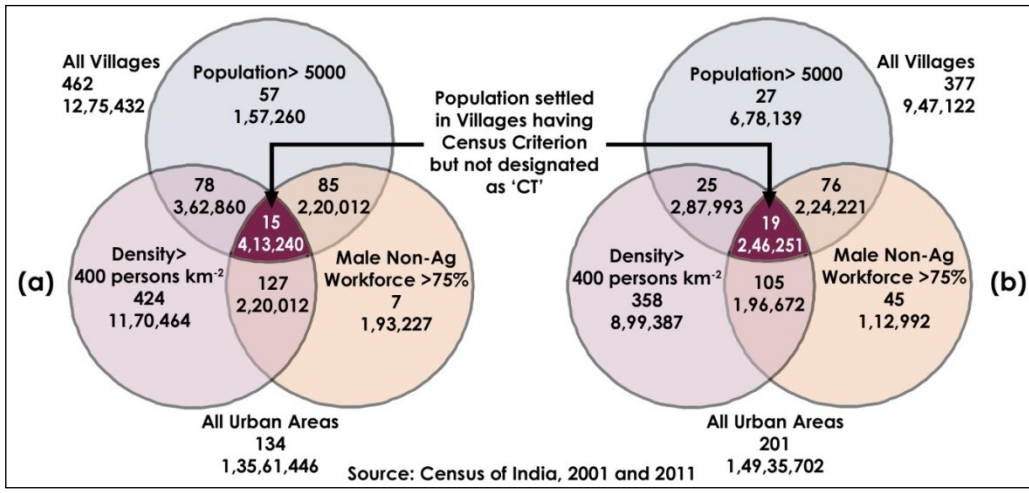


Fig. 8: Change in settlement structure, Kolkata Metropolitan Area in (a) 2001 and (b) 2011

In particular, the number of units, population size, population density, and the proportion of male non-primary workers to total workers are highlighted in **Table 8**, which presents statistics on several types of administrative units for the years 2001 and 2011. A variety of administrative unit types are listed in the table, including Villages, Census Towns, Municipal Corporations, Municipalities, and Cantonment Boards. Between 2001 and 2011, the Municipal Corporation and Census Towns' Populations increased, and the rest of the administrative units' populations decreased. Census towns and municipalities have a positive population growth rate. Among these two administrative census towns, the highest population growth rate is 77.89%, and the rest of the administrative units have a negative Population growth rate. In comparison to other administrative entities, Municipal Corporations and Municipalities have larger population densities in both years, which suggests higher degrees of urbanisation and denser settlement patterns. According to the statistics, between 2001 and 2011, the proportion of male non-primary workers declined in the majority of administrative units except Census Town and Outgrowth. This can point to a move toward primary industries like agriculture, or it might point to economic shifts and automation that reduce the number of non-primary occupations. The population size, density, and percentage of male non-primary workers vary significantly throughout the various categories of administrative divisions. For example, compared to Census Towns, Municipal Corporations and Municipalities often have larger populations and densities. Over the ten years from 2001 to 2011, the table shows how the demographic changed across various administrative unit types, with particular attention paid to changes in the workforce's composition, urbanisation, and population growth trends.

According to the UN-DEGURBA approach, urban and rural areas are further subdivided into seven subclasses for the KMA region (**Table 9**) based on total population size and population density (Persons/km^2). This analysis outlines the complexity of defining urban and rural areas globally, showcasing different approaches used in India and other

countries while highlighting a notable international effort to develop a standardized methodology. This study concludes that, by the Census of India, which includes Statutory Towns, they fall under the category of Urban Center in UN-DEGURBA; Indian CTs are Dense Urban Center in UN-DEGURBA in both of the years of comparison between the UN-DEGURBA method of urban and rural area delineation of KMA region in 2001 and 2011 (**Fig. 9a** and **9b**). Numerous villages fall within the Peri-Urban Center category, while others are in the Rural Cluster zone, Low-Density Rural Center, and both. Therefore, it is evident that the distinction between an urban and rural administrative entity varies depending on the approach and the criteria used.

Table 9: UN-DEGURBA Method of Classification

Population Density	Population Size			No Minimum Population Size Criterion
	>50,000	50000-5000	5000-500	
>1500	Urban Centre	Dense Urban Centre	Rural Cluster	
300-1500		Semi-Dense Urban Centre		Suburban or Peri-Urban Centre
300-50				Low-Density Rural Centre
<50				Very Low-Density Rural Centre

Source: Adopted from Sudeshna et al. (2023)

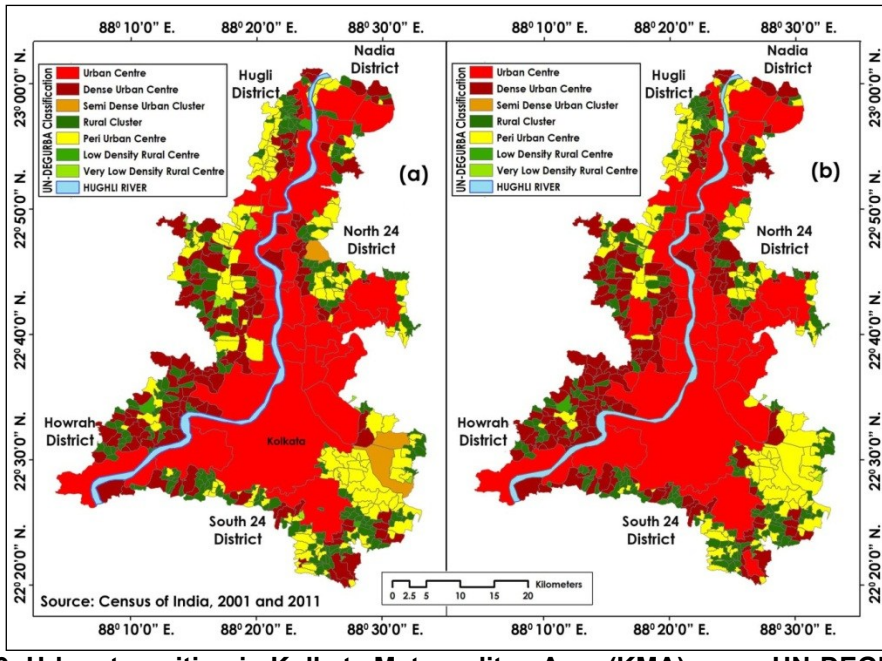


Fig. 9: Urban transition in Kolkata Metropolitan Area (KMA)as per UN-DEGURBA classification during (a) 2001 and (b) 2011

4.7 Factors Controlling the Spatial Distribution of Census Town CD Block Wise

Based on our previous analysis, it has been established that over the past decade, there has been a continuous increase in the number of small urban centres, primarily categorized as Census Towns (CTs). To discern the factors influencing the growth of CTs, stepwise regression analyses were conducted to examine the spatial distribution of census towns at the CD block level for the years 2001 and 2011. In this regression model, the number of CTs within each block was considered the dependent variable (Y), while independent variables included Total Population (TOT_P), Percentage of Main Worker Males (MAINWORK_M), Percentage of Main Household Worker Males (MAIN_HH_M), Percentage of Main Other Male Workers (MAIN_OT_M), Population Density (Pop_Den), Percentage of Cultivable Area (CL_Area), Percentage of Female Non-Agricultural Population (F_Non_Agr), Availability of National Highways (NH), State Highways (SH), Railways (RL), and Important Metalled Roads (IMR).

Table 10: Results of Stepwise Regression Analysis for Spatial Distribution of Census Towns, CD Block Level for 2001 and 2011

Year	Variables	Standardized Coefficients	Collinearity Statistics		R	R^2	Adjusted R^2	F	Sig.
		Beta	Tolerance	VIF					
2001	(Constant)	0.51	1	1	0.612	0.375	0.369	67.31	0.00
	MAIN_OT_M	0.506	0.994	1.006					
	MAIN_HH_M	0.283	0.993	1.007					
	MAINWORK_M	0.168	0.993	1.007					
2011	(Constant)	0.603	1	1	0.794	0.631	0.626	143.557	0.00
	MAIN_OT_M	0.554	0.983	1.018					
	MAIN_HH_M	0.414	0.966	1.035					
	MAINWORK_M	0.154	0.847	1.181					

Source: Calculated by the authors based on the Census of India, 2001 and 2011

The stepwise regression analysis for the CD blocks in 2001 revealed that out of the 10 independent variables, only three other male workers, main male household workers, and main male workers, essentially representing the male non-agricultural population, influenced the distribution of CTs. This model accounted for only 37.5% of the variance at a 99% significance level (see **Table 10**). However, in 2011, while the same three independent variables remained significant as in 2001, one new independent variable, total population, also demonstrated statistical significance in CT distribution. Overall, in 2011, this model explained 63.1% of the variance at a 99% significance level (see **Table 10**). This suggests that the variables significant in 2001 remained prominent in 2011, as evidenced by the substantial increase in variance explained from 37.5% to 63.1%. Hence, the findings indicate a positive correlation between the share of the male main non-agricultural population and the proliferation of CTs. The diversification of economic activities and the presence of a male non-agricultural population are pivotal factors contributing to the growth of CTs. Moreover, the development of non-agricultural activities and industrialisation emerges as significant factors driving the growth of CTs in West Bengal.

5. Discussions

Since independence, the rate of urbanisation in West Bengal has consistently exceeded that of the country as a whole. The proliferation of small urban centres has been a key factor driving this ongoing urbanisation trend in the state. Guin (2017) previously argued that the rapid growth of Census Towns (CTs), primarily spurred by the emergence of small settlements, has been the principal contributor to high urbanisation rates in both the nation and the state. Additionally, the presence of numerous small industries, particularly the jute industry, the establishment of railway towns due to railway expansion, and the growth of cantonment towns have significantly influenced the surge of urbanisation in West Bengal (Samanta, 2017). Another noteworthy aspect of urbanisation in the state is the uneven distribution of urbanisation, particularly evident in the Kolkata district. This unevenness stems from historical factors, notably the influx of residents into Kolkata from the eastern region of Bengal in 1971, resulting in a concentrated urban population in and around the Kolkata district (Dasgupta, 1987). However, starting from the 1980s, there has been a notable shift in urbanisation patterns.

With the rural economy transitioning towards secondary and tertiary sectors, the rural market expanded, leading to an increase in the number of small towns. Consequently, urbanisation began to spread from the core Kolkata metropolitan region to its periphery (Giri, 1998). One intriguing observation throughout the study period is that while the level of urbanisation in the Kolkata district has consistently remained at 100%, there has been a discernible shift in the distribution of urban population within the district. The share of the urban population has declined within the Kolkata district itself and has concurrently increased in peripheral districts such as Howrah, North Twenty-four Parganas, and Hugli. This shift can be attributed to the emergence and growth of small towns in these peripheral areas (Das & Kar, 2022). Several elements, including the development of minor urban centres, industrialisation, past migratory patterns, and economic transformations, are highlighted in the research on the dynamics of urbanisation in West Bengal. It also sheds insight into how urban growth has changed over time in the area by highlighting the geographical distribution of urbanisation inside the Kolkata district and its outskirts.

While urbanisation levels vary across districts, the inter-district differences are primarily attributed to variations in natural resources, socio-economic development, industrialisation, transportation infrastructure, and other geographical factors (Bhowmick and Sivaramakrishnan, 2021). The proportion of the urban population and the distribution of urban centres, ranging from large to small, in West Bengal remained relatively stable from 1951 to 2001. However, in the last decade, both the urban population share and the number of urban centres have experienced significant expansion, driven by the growth of non-primary activities in smaller urban areas (Guin & Das, 2015). Additionally, the rapid development of transportation networks and the increase in job opportunities in non-agricultural sectors, coupled with lower living costs, have attracted a considerable influx of people from rural areas to these smaller urban centres, as opposed to larger cities (Das & Kar, 2022). Historically, West Bengal was dominated by the primate city of Kolkata.

Although Kolkata maintained its primacy in 2011, the primacy index between Kolkata and the second-largest urban centre, Haora, has steadily declined over the study period. This trend suggests diversification of the urban population away from a single core urban centre towards smaller urban centres (Das & Kar, 2022). There has been a focus on the many variables influencing urbanisation, such as natural resources, industry, socioeconomic development, and transportation infrastructure. It also talks about the mechanics of urban expansion, and how economic possibilities and cheaper living expenses are causing a trend towards smaller metropolitan regions. The factors influencing urban migration are also highlighted in the book, including better employment and transit options. Decentralization of urban population and resources is suggested by the decreasing primacy index between Haora and Kolkata.

An in-depth examination of census data spanning from 1951 to 2011 reveals a notable trend: while there were no significant changes in the growth of Census Towns (CTs) between 1951 and 2001, the last decade witnessed a tremendous surge in their numbers. The distribution pattern of newly emerged CTs in 2011 indicates dispersion away from major urban centres, suggesting a transition from rural to urban settlements occurring in situ (Denis et al., 2017). Several factors contribute to this substantial growth in CTs, with the Census of India's urban classification playing a crucial role. Additionally, many villages have transformed CTs, as documented by Guin and Das (2015). Various regional industries have also contributed significantly to the proliferation of CTs. For instance, the expansion of the tea industry in the Darjeeling and Jalpaiguri districts, the influence of silk industries in Murshidabad, and the bidi industry in Maldah have all fuelled the growth of CTs in their respective regions (Guin and Das, 2015). Furthermore, the presence of statutory towns and the growth of non-agricultural activities have been cited as factors driving CT growth in Murshidabad district (Roy &Samanta, 2018). Similarly, the industrial and coal mining developments in Barddhaman district have spurred the growth of CTs in that area (Samanta, 2017). Overall, the past decade has witnessed a decline in primary and secondary activities alongside a notable increase (9-11%) in tertiary activities. The development of small service centres and markets of smaller sizes has also contributed to the growth of CTs in West Bengal (Roy & Samanta, 2018).

Census Towns are growing in a very different way than they were ten years ago. A notable uptick in growth has been seen in the past ten years. This suggests that the region's urbanisation processes and settlement patterns are changing dynamically. The expansion of CTs is attributed to several causes, such as shifting census definitions, rural-to-urban migration patterns, and regional economic activity. A mix of social, economic, and policy issues determines the dynamics of urbanisation, as the text demonstrates. The development of CTs in certain areas is mostly driven by regional industry and economic activity. The given examples—the tea industries in Darjeeling and Jalpaiguri, for instance—emphasize how localized urbanisation processes are and how crucial regional economic dynamics are. There is a change in the economic landscape, with a rise in tertiary activity and a fall in primary and secondary industries. This change in the spatial distribution of urban settlements is a reflection of larger economic changes taking place in West Bengal.

Overall, this research highlights the interaction between demographic, economic, and policy variables influencing urbanisation trends in the region and provides insights into the complex nature of CT growth in West Bengal.

The significant surge in Census Towns (CTs) over the past decade has seen more than 50% of this growth concentrated in the Kolkata Metropolitan Area (KMA). This concentration primarily stems from the burgeoning development of the manufacturing and service sectors within and around the KMA, as highlighted by Chakraborty et al. (2015). Moreover, the expansion of non-agricultural activities from Kolkata metropolitan to its peripheral districts, coupled with a notably higher natural population growth rate in these smaller urban centres compared to metropolitan cities, has played a pivotal role in driving the growth of CTs in this region, as noted by Das and Kar (2022). Additionally, the presence of highways has contributed positively to the proliferation of CTs. State and national highways, in particular, have facilitated the transformation of numerous large villages into CTs in West Bengal, as underscored by Chakrabarti and Mukherjee (2022). Notably, while the Hugli River was historically the primary influencer of urbanisation in Kolkata until 2001, the advent of improved road connectivity has emerged as another crucial factor catalyzing the growth of CTs in these regions, as observed by Bhowmick and Sivaramakrishnan (2021). The main factor driving CT concentration is the growth of the manufacturing and service industries in and around the KMA. This implies that patterns of urban expansion are greatly influenced by economic issues. The expansion of CTs in the area is driven by the population growth rate of the smaller urban areas. This emphasizes how crucial demographic patterns are to the process of urbanisation (Haldar et al., 2023).

In essence, a holistic examination of the forces propelling the expansion and clustering of Census Towns (CTs) within the Kolkata Metropolitan Area (KMA) underscores the intricate interplay among economic, demographic, and infrastructural facets in urban evolution. Notably, the outcomes of stepwise regression analysis concerning CT distribution reaffirm a significant factor: the presence of male non-agricultural workers substantially contributes to the proliferation of CTs. Furthermore, the transformation of numerous large villages into CTs is attributed to the shift of economic activities from the primary sector to the secondary and tertiary sectors within these locales. This demonstrates how fundamental changes in the economy have an impact on how urban landscapes are shaped. All things considered, this provides insights into the complex and diverse nature of urbanisation processes, clarifying the intricate relationships between economic, demographic, and infrastructure factors that propel the expansion and change of urban settlements such as CTs in the KMA and throughout West Bengal. (Guin and Das, 2015).

6. Conclusion and Policy Perspectives

This research investigates the temporal evolution of urbanisation in West Bengal spanning from 1951 to 2011, with a focus on the emerging trends of rapid urbanisation observed in the state during the last decade. The analysis reveals that between 1951 and 2001, the urbanisation dynamics in West Bengal were primarily characterized by the

dominance of the metropolitan city of Kolkata. However, in the past decade, this monocentric urbanisation pattern has transitioned towards a polycentric model, driven by significant growth in the number of small-sized cities, particularly Census Towns (CTs), in comparison to larger urban centres. This shift towards a polycentric pattern has been observed not only within the vicinity of Kolkata but also in the peripheral districts as well as in the western and northern regions of the state. The continuous decline in the primacy index further indicates the diffusion of urbanisation across the state.

Additionally, the study finds that only 31.06% of the newly emerged CTs are located near class I cities, with the majority being situated farther away and referred to as "Subaltern CTs." However, there exists a significant intra-district variation, where CTs in highly urbanized districts tend to be closer to class I cities compared to those in less urbanized districts. The results of stepwise regression analysis suggest that the increasing male non-agricultural population is a key factor driving the significant growth observed in CTs.

Furthermore, amidst the era of neo-liberalization, where economies in highly urbanized states like Tamil Nadu, Maharashtra, and Gujarat are flourishing, West Bengal's economy has faced decline. This is attributed to the concentration of new investments primarily in major cities, leaving the newly emerged CTs, particularly those in underdeveloped regions of the state, without significant benefits from such investments. Moreover, the newly emerged CTs are predominantly governed by rural panchayats, resulting in a lack of basic urban services and amenities. Therefore, in line with the emerging diffusive pattern of urbanisation, there is a pressing need for diffusive economic activities and proper urban planning facilitated by urban governance. Following the example of other states like Andhra Pradesh, Gujarat, Madhya Pradesh, Uttar Pradesh, and Tamil Nadu, West Bengal must consider establishing "Nagar Panchayats" by the 74th Constitutional Amendment Act of 1992 to ensure better provision of urban services in small towns and CTs.

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