

Changing urban ecology and transformation of an Indian city: Kolkata from 1971-2011

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Background:

The characteristics of an urban area greatly depend upon the history of its establishment and the age-old changes that it has gone through over the years. Big cities are immensely complicated agglomerations of primary and secondary groups and networks, as well as an array of economic, political, religious, cultural, and many other institutions and structures, most of them organized hierarchically (Gans, 2009). As new groups join new societies, ethnic identity and ethnicities are key variables in determining their position in those new, more so for the first generation than the second, which has taken acculturation, and perhaps eventually assimilated. A network of people of the same access to scarce resources, such as jobs, informal training, short, economic opportunities that migrants need so dearly disadvantaged position owing to their command of the lack of formal training within the educational system their incomplete understanding of the new value system, discrimination by the dominant group or groups (Bruijne and Schalkwijk, 2005). In India, the caste system initially classified people on the basis of the occupational categories which changed to inheritance through birth and ultimately determined social position in society. After independence, under the Indian constitution in 1950, the creation of the constitutional categories of Scheduled Castes (SC) and Scheduled Tribes (ST) were afforded with affirmative action in the form of reservation quotas in government jobs, higher education institutions and legislative seats (Vithayathil and Singh, 2012). Wealthier groups of local societies also try to separate themselves from disadvantaged people as much as possible. This induces a self-reinforcing spiral and continuously strengthens the spatial differences within a town (Farkas, et. al., 2017). Creation of fortified upper and middle-income residential and commercial enclaves excludes the poor and marginalized and private security companies fill the gap here in security and governance.

The Ecological Approach was the most dominant and popular approach in urban sociology from the 1920s to the 1950s. However, it failed to explain the situation in many cases, thus, was later modified to Factorial Ecology. The methodology of Factorial ecology is an outgrowth of social area analysis (Berry and Rees, 1969).

Statement of Research:

Research Question: “How has residential pattern influenced the urban ecology in Kolkata?”

An attempt was made in this paper to understand the changing urban ecology of the city of Kolkata from 1971 to 2011, using the Census of India data at the ward level. This paper aimed to explain the changing structure of a city and population segmentation, distribution, accessibility and availability of basic at the zonal level using indicators of socio-economic, demographic and housing data for small intra-city census tracts (wards). The variance in all the Census information was explained in terms of a few chosen variables which were obtained after combining several other variables.

Data:

The study used decennial Census of India data as published by the Office of Registrar General and Census Commissioner of India for the area under the Kolkata Municipal Corporation for the years 1971-2011. It used ward-wise PCA tables and District Census Handbook data for the years. From 2001, the

census provided slum population distribution. In 2011, the Census also provided a detailed ward level houselisting and household data, which was also included.

The number of wards in Kolkata greatly changed since 1971. There were 100 wards in 1971 and 1981. The number of wards increased to 141 in 1991 to 2011.

Methodology:

Factor Analysis was used for studying the urban ecology of Kolkata for 1971-2011. The analysis was carried out in Stata 13. With the generation of the factor scores, choropleth maps of the study area were prepared for the city for individual years in Arc GIS.

Factor analysis with orthogonal rotation of all factors was used to analyze a data matrix containing measurements on m variables for each n unit of observation (wards). The method aimed to:

- isolate the fundamental patterns of identifying and summarizing the common patterns of variability of the m variables in a smaller number of independent dimensions r that additively reproduced the common variance and
- examine the patterns of scores of each of the n observational units on each of the r dimensions

Factors with Eigen values exceeding unity were considered only to be significant.

The variables for the study were standardized to account the difference in population size among the urban units. These included: annual growth rate, population density, sex ratio, proportion of males and females below 6, percentage of SC population, percentage of ST population, percentage of slum population, literacy rate, work participation rate, and proportion of workers in sub-categories. The slum population was in 2001. The 1971 and 1991 Census of India data provides a 9-fold industrial classification of workers. The 1981, 2001 and 2011 Censuses provided a 4-fold classification of the workers, of which percentage of main workers as cultivators and agricultural labourers were combined because of their very less proportion in the urban areas. Along with the population characteristics the 2011 Census of India provided detailed characteristics of households in the ward level like, number of dwelling rooms, household size, ownership status, number of married couples living in the household, location of drinking water, availability and type of latrine facility within premises, if bathroom facility available within premises, type of drainage, availability of kitchen, and assets possessed by the household.

Findings:

The findings were presented according to the Census year for the city of Kolkata. Choropleth maps showing the Factor score distribution in the city were prepared but was not included in this extended abstract due to lack of space. The factor scores generated at the ward level for the individual factors have been descriptively explained in the following section for each Census year.

Factorial Ecology of Kolkata (Calcutta), 1971:

The factor analysis for 1971 generated an output matrix for 3 factors that described the variables and explained 76.35 per cent of the total variance.

Factor 1 explained a **social groupism and workforce composition gradient**. The large peripheral wards extended towards the east, south and along the western side of the Fort William had high factor scores with more of SC and ST Population who were mainly engaged in the primary sector or as workers in transport and construction. It also showed a better female population. In this time period the city of Kolkata observed a huge influx of migrants and these peripheral wards had many refugee colonies. The core city extending from the northern stretch to the inner regions relatively housed lesser of these population thus the scores of factor 1 was relatively less in these areas.

The factor 2 was a **literacy and work participation gradient** which showed a high factor loading for both. The old core city had high factor 2 scores. However, ward 92 located on the south eastern part of the city estimated the highest score for factor 2. Considering that Kolkata (then Calcutta) to be an urban area there was a very high correlation between the literacy and work participation.

Factorial Ecology of Kolkata (Calcutta), 1981:

The factor output matrix of 1981 generated 2 factors with significant eigen values and explained 80.03 percent of the cumulative variance.

The factor 1 explained a **social groupism and primary workforce gradient**. The peripheral wards in the east, south and along the western bank of river Hooghly in the city had a higher score for this factor. There was a very strong correlation of the factor with proportion of cultivators and agricultural labourers. The trend showed that the SC and ST population might have been residentially segregated in the city towards the outskirts. The older part of the city towards the north and inner core area relatively scored less for this factor showing that relatively the proportion of SC, ST population as well as the proportions of people involved in farming were lower in these wards.

The factor 2 scores were high for the northern and southern wards of the city.

Factorial Ecology of Kolkata (Calcutta), 1991:

Factor analysis for the selected variables in the year 1991 generated 5 factors of significant eigen values and explained almost 82.63 percent of the total variance.

The Factor 1 was the gradient for **social groupism and work force gradient**. As the previous years, the factor score was higher for wards mostly lying in the eastern and southern periphery of the city, with a few wards in the western periphery of the city also. These wards were marked with higher proportion of female child below 6 years, higher proportion of SC and ST population, higher proportion of workers in farming and in livestock. The rest of the city did not show much regular pattern of decrease in the factor scores however.

The Factor 2 was a **gradient of literacy and work participation**. Unlike the earlier years it showed a strong correlation between proportion of workers in other fields, literacy rate, work participation rate and proportion of workers in trade and commerce. The inner-city wards had greater scores for Factor 2. With higher literacy rate, there was more work participation rate and a greater number of workers in the tertiary sector (others). There was also a high proportion of people involved in trade. On the other hand, the Factor 2 scores were lower in the peripheral wards of the southern and eastern part of the city.

The Factor 3 and Factor 4 explained a **gradient of workforce composition and sex ratio**. The Factor 3 scores were higher for the southern and eastern peripheral wards whereas that for the city centre and northern part of the city (old city) had relatively lower Factor 3 scores. The Factor 4 scores were higher in a central middle zone that stretches in the wards lying from the extreme western part to the eastern part without extending to the southern part of the city.

Factorial Ecology of Kolkata, 2001:

Factor analysis for the selected variables generated 3 significant factors and explained 92.02 percent of the cumulative variance.

The Factor 1 was a **gradient of worker composition**. The scores were higher for wards located in the western and northern part of the city. The scores fall gradually for the wards towards the south of the city starting from the central part itself for Factor 1.

The Factor 2 was **socio-economic gradient**. The scores were higher for some of the peripheral wards in the western and eastern parts of the city as well as the upper central wards of the city having a high proportion of slum population, higher population density and larger population engaged in farming.

The Factor 3 was **axiality of literacy gradient**. The scores were higher in the southern and eastern peripheral wards of the city. The central to northern wards record relatively lower scores for this factor in 2001.

The Factor 4 was a **social groupism and worker composition gradient**. The scores for Factor 4 was higher in the eastern, southern and western peripheral wards of the city. These had relatively higher proportion of population belonging to SC and ST population with relatively lesser proportion of workers engaged in the 'other' work category (tertiary sector). The scores were lower for the northern part of the city

Factorial Ecology of Kolkata, 2011:

Factor analysis for the year was performed on the selected variables that generated 6 significant factors that explained 91 percent of the cumulative variance.

The Factor 1 was a **gradient of housing and owned assets**. The wards in the southern, eastern and western periphery of the city have higher scores. This referred to the areas which initially saw a lot of migrants settling some 40 years before. The scores remain lower in the wards located in the central to northern part of the city.

The Factor 2 was a **socio-economic gradient**. The municipal wards in the southern and western parts of the city have higher sex ratio, more children below 6 years of age (both sexes), higher proportion of slum population, more workers manufacturing in household industries and more population using Kerosene as fuel for cooking. The scores were relatively lower for the extreme northern areas and the inner central wards.

The Factor 3 was **axiality of social groupism and housing gradient**. The eastern, southern and the central wards of the city had more semi-permanent houses, more of kutchha house walls (made of mud, bamboo, polythene, wood, stone etc.), more proportion of the minority population of SC and ST, more of dilapidated houses, higher annual growth rate than general population, with no latrine and more work participation. The scores lower out towards the northern and north eastern wards of the city.

The Factor 4 was a **gradient of familism and work-force composition**. The upper central and northern wards of the city have highest scores for this factor. These were the oldest parts of the city. Most of the households had no couples i.e. bachelors working in the tertiary sectors. The scores were lowest for the wards in the western periphery of the city.

The Factor 5 was a **gradient of familism and housing**. The scores were highest for wards located in the older part of the city i.e. upper central portion of the city. The scores decreased southwards.

The Factor 6 was a ***workforce composition gradient***. The wards in the peripheral west and lower central parts of the city had higher proportion of people engaged in farming, thus, having greater share of marginal workers (workers working less than 6 months a year). The scores were less in the peripheral northern wards of the city.

Discussion and Conclusion:

The urban ecology of Kolkata over the years has changed. The central and northern parts of the city were the older parts of Kolkata. The changing urban ecology from 1971-2011 showed a change in the type of workforce composition. People initially engaged in primary activities like agriculture which shifted to manufacturing or tertiary activities (others). Also, there was significant improvement in literacy and after 2001 the southern and eastern parts of the city have higher literacy rates than the inner core city. But, it was evident from the analysis that residential segregation prevailed in Kolkata more in terms of economic quintile (slums) than of social classification as on the basis of caste (SC and ST). The southern, western and eastern parts of the city have higher proportion of SC and ST that affects many aspects. According to the factorial ecology of 2011, better housing conditions prevail in the northern part of the city, but assets owned and housing conditions are better in the southern and eastern parts. Occupation, education, social status, type of household and family composition, household conditions and assets owned are found to be responsible for the urban ecological classification of the city.

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