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RESEARCH ARTICLE

DYNAMICS OF DEMOGRAPHIC SURFACE OF HOWRAH DISTRICT IN INDIA: AN EXPERIENCE IN THE 20th CENTURY

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ABSTRACT

The mosaic of demographic surface experiences a continuous change over time, if the area is frequented by constant influx of population from outside. This phenomenon is very well-known in the developing countries wherein rural to urban migration is very prominent. Being a part of developing world India bears such imprints as here the propensity of migration from the remote areas to larger cities or metropolis is an evident phenomenon. After the independence, drastically reduced death rate and slightly reduced birth rate have instigated booming of population. The influx population from the west and East Pakistan added an extra momentum to the population growth due to partition of India in 1947. All these events are continuously modified demographic relief of the state and this is prominent in the province like West Bengal which is densest populated province in India. In West Bengal, the district Howrah bears such imprints as since the beginning of the 20th century it has received an influx population due to rapid pace of industrialisation as well as result of partition. These circumstances have widened the gap of demographic relief. The present investigation has been made to unfold the changing expression of demographic surface of the district and at the same time it will spot lights on the dynamics of demographic relief in inter-block level.

INTRODUCTION

Demographic change over a long period of time profoundly influences physical set up of an area and more even social space within it. Change of absolute population occurs in two ways; first one is internal growth i.e. natural increase of population expressed in terms of difference of birth rate and death rate and second one is migration. A state or a region experiencing high to moderate natural increase coupled with huge migration normally shows high growth of population. It reaches an explosive situation if growth of population is being continued over a fairly long period of time (Guchhait 2005). This explosive situation brings a change in demographic relief if the area is heterogeneous in respect to available resource. Such a wider variation in demographic relief and stupendous growth has been critically accounted for West Bengal (Guchhait 2005), India in which more viable reality can be observed for Howrah district and adjoining districts of Kolkata Metropolis. Present investigation has been dealt with Howrah district of West Bengal which bears such imprints of rapid growth since the beginning of the 20th century as it has received huge influx due to rapid pace of industrialisation and also to some extent due to partition. Above mentioned scenario has propelled the gap of demographic relief, because growth has been localized in some pockets mainly along the north-eastern part of the district. However, over time relatively denser blocks have attained level of space saturation which subsequently exerts repulsive force leading to rapid suburbanisation.

Area under Study

Howrah, most densely populated district of second densely province of India has been considered for intricate spatial demography. The district has been formed by the process of sedimentation by the Hooghly-Bhagirathi river system - the main branch flows along the eastern border of the district. Located in the humid tropical climate entire geographical area is characterized by fertile agricultural land as well as potential storage of groundwater. Geographically the area extends from $22^0$13'32" N latitude to $22^0$48'20"N latitude, $87^0$52'20"E longitude to $88^0$23'15"E longitude. The district is pronounced with industrialization and intense urbanization along the eastern part while rest of the area has an imprint of prosperous agriculture, mainly paddy and jute. In terms of railway transport system, Howrah Municipal Corporation (HMC) is the focal point of the Eastern and the south-eastern railway. G.T. road, the main artery for road transport system is extended from the main city to the western part of the district.

Demographic Perspective: Some Glimpses

Howrah is the densest populated district of West Bengal in India. According to census 2001, it accounts for density of 2913 persons/ km^2 against the West Bengal average of 903 and Indian average of 480. The district is reeling under population pressure as it holds 5.33 % of population of West Bengal occupying only 1.65 % of total area. After Independence (1947), India experienced a declining death rate

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due to promotion of health facilities, especially in the rural areas. This considerable fall in the death rate encouraged population growth which was jerked by the partition in 1947, especially for the boarder provinces of India. As a result huge influx of population over a period of thirty years from the East Pakistan (present Bangladesh) and Punjab (Pakistan part) propelled huge growth of population, especially in the four provinces – West Bengal, Assam, Tripura (close to the boarder of East Pakistan) and Punjab (close to the boarder of West Pakistan). After 1971 due to Independence of East Pakistan, West Bengal once again received huge refugee population, especially in the industrial parts (Kolkata, Howrah, Hooghly and North 24 Parganas districts) of the province. On the contrary, birth rate didn't record any remarkable change up to 1991. This delayed response of reduced birth rate and rapid fall of death rate led to burgeoning population throughout the country. Such a huge growth of population adjoin with poverty, unemployment and refugees influx from East Pakistan initiated rapid rural-urban migration with the outcome of pocket based urban growth, especially around the metropolis and large cities (Khullar 2006). Thus, after a period of thirty to forty years these metropolis and cities reached the level of saturation and subsequent spill over towards the peripheral part of cities (Panigrahi 2005). In sequel to this, saturation at core and suburbanisation at periphery has led to a new spatial dynamics in the form diffusion of population within the district. Howrha Municipal Corporation (HMC), the primate city of the district has experienced all mentioned scenario because, after Independence influx population increased population growth and subsequently it arrives at saturation. This saturation later on instigated suburbanisation process in the peripheral blocks (rural administrative unit in India) of the city leading to rapid growth of census town (urban unit as per criterion of Indian census 1991, but not governed by Municipality). This is not verbal statement but the ground reality as number of census towns have increased from 22 in 1961 to 53 in 2001. It is interesting to note that the district had only 21.79 % of urban population in 1961. Now it has increased to 44.81 % (2001) with a hike of 23.02%, whereas net national average has increased only 9.81 %, from 17.97 % in 1961 to 27.78 % in 2001.

Before going into the inns and outs of population dynamics, it is better to focus on the density distribution first, as it acts as threshold of demographic system. The coefficient of correlation between density distribution in the 1901 (initial point) and 2001 (end point) is + 0.92 which significantly indicates higher growth of high density blocks and lower growth of low density blocks. Keeping this reality in mind the density distribution of 2001 has been represented in figure no. 2 as it is replica of density pattern for all the decades. The whole district has been categorised into three groups; low, medium and high density zones signifying distance decay from urban core to rural periphery.

MATERIALS AND METHODS

In articulating the spatio-temporal change of growth rate of Howrah district block-wise census data has been taken into consideration. To unfold the nature and dynamics of growth rate of the 20th century block-wise data has been framed through different demographic measures in the time span from 1901 to 2001. It is important to mention that data up to 1981 are available under heads of ten block units; whereas 1991 census has enumerated fourteen blocks due to division of Bagnan, Shyampur and Amta. To take uniformity, block division of 1981 Census has been taken into consideration. Another most important consideration is the inclusion of HMC almost as a block unit. On the other hand, Bally and Ulluberia Municipalities are separate census units located respectively in Bally Jagachha and Ulluberia blocks; however these two urban units have been included under the respective blocks. In addition to this, HMC has experienced change in area coverage from one census year to another. Its area increased significantly from 1961 to 1971 and keeps silence thereafter. In order to retain comparability we have settled for ward division of 1971. It necessarily opts for modification of ward-wise population of HMC in 1961. This enumeration is necessary for the calculation of intra-block density relief.

In order to quantify the different aspects of population dynamics, univariate, bi-variate and multivariate techniques have been adopted in different sections. For understanding of spatial process of population growth uni-variate statistic has been used by employing coefficient of Variation (CV). Bi-variate curvilinear regression has been applied to glean out the growth of component in respect to system, wherein system represents whole district and blocks are considered as components. In the penultimate stage of inquiry multivariate statistics have applied in the form of multiple regression to predict the future tendency of demographic surface.

Growth Perspective in the 20TH Century: An Overview

To take a bird's eye view regarding relative growth, system-component technique has been employed in two time span – 1901 to 1951 and 1951 to 2001. System-component growth is an attempt to address population growth of individual blocks in respect to whole district. This entails the adoption of the whole district as a system and each block as a component. The relative growth of components is examined through the power regression in which exponent is the notion of allometry with its value of unity, more than unity and less than unity. The unity (here considers 0.9 to 1.1) denotes isometric growth whereas, allometry more than one (here > 1.1) denotes gaining growth and allometry less than one (here <0.9) as losing growth. The equation used here in the form of $Y= bX^a$, where Y=component, X=system, a=allometric growth, b= threshold value in relative growth perspective.

To perceive relative growth rate calculated allometric values have been tabulated under different time points mention earlier (table 2). It is observed that (fig. 3a and 3b) in the initial period (first half) the gaining growth has been recorded in the blocks of Bally jagachha and HMC, the urban core of the district. However, the blocks with relatively low population density associated with rurban character are standing with extremely loosing growth rate. In the later half relative growth rate of the components are drastically changed in comparison to earlier, especially due to significant increase of allometric value in the adjacent blocks of the urban core. It indicates spatial diffusion of population towards the east-central part of the district. Interestingly, in 1951-2001 Bally jagachha and HMC recorded significant fall in allometric value, whereas other all blocks have increased (except

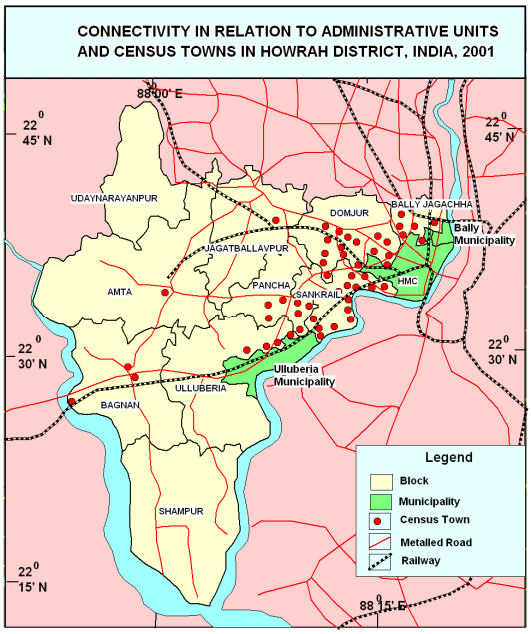


Fig. 1. Spatial connectivity of Howrah district

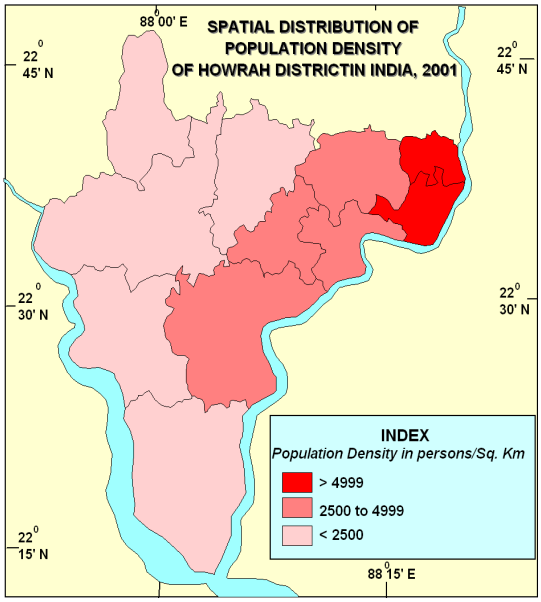


Fig. 2. Core to periphery paradigms of population distribution

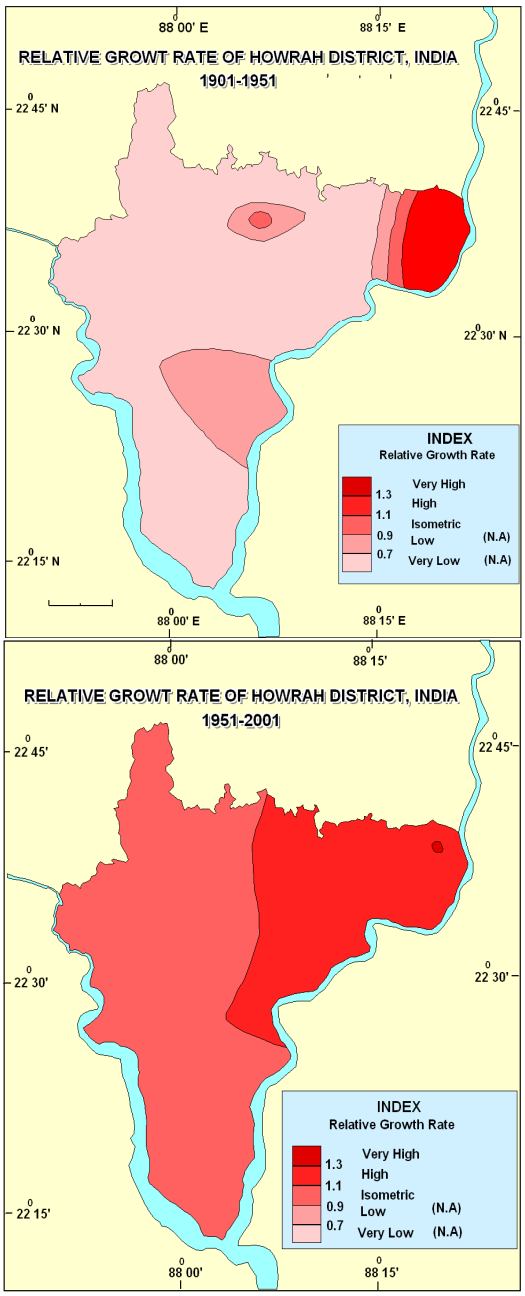


Fig. 3a and 3b. Changing expression of growth relatives in the 20th century

Jagatballavpur) their allometric value. This is an indication of spatio-temporal diffusion of population from core to periphery. The most striking aspect of this change is that range of components growth rate has decreased to a significant extends from 1901-51 to 1951-2001, prompting more homogeneous growth of the blocks.

Spatial Expression of Demographic Surface

Inter Block Level

This part is, perhaps the pivot area of whole inquiry wherein a change in demographic surface has been highlighted in details. Spatiality of population growth can be expressed into two major processes – nucleation and diffusion. Nucleation indicates concentration of population within a geographical unit, whereas diffusion addresses sprawling effect of population growth. The second one is ultimate reality after long experience of nucleation episode of population growth. Thus, it can be stated that diffusion comes after nucleation. In exception to this, sometimes a region or a state may lead to nucleation after passing through diffusion process (Guchhait 2005). This particular behaviour reflects the presence of newly evolved geographical area which may be identified as secondary poles of population concentration. This is nothing but the rejuvenation of demographic relief through which the expression of demographic surface gets a new dynamics.

Coefficient of variation (CV) is the best simple measure to perceive the demographic relief. So likely, CV tool has been employed to point up the inter-block demographic variation, wherein increase in CV indicates nucleation process and vice-versa. Here, two types of CV have used – CV of population size and CV of population density. Considering block-wise population data base since 1901 size and density CV are presented in table 3 and systematically represented in Fig. 4a

Table 1. Distribution of Population Density in 2001

Population density (Person/ Km^2) 2001census	Functional identity of the blocks	Name of the blocks
Low (< 2500)	Rural	Amta, Udaynarayanpur, Shampur, Jagatballavpur, Bagnan
Medium (2500 – 4999)	Rurban	Ulluberia, Pancha, Domjur, Sankrail
High (>5000)	Semi urban and urban	Bally Jagachha and HMC

Source: Calculated from Census 2001

Table 2. Temporal Change of Block-wise Relative Growth Rates

Block	1901-51	1951-2001	Change in relative growth rate
Bally	1.809	1.331	-0.478
Howrah	1.589	0.804	-0.785
Sankrail	0.531	1.15	0.619
Pancha	0.525	1.134	0.609
Jagatballavpur	1.146	1.101	-0.045
Domejur	0.547	1.203	0.656
Uluberia	1.027	1.107	0.08
Shampur	0.793	0.993	0.2
Bagnan	0.856	1.048	0.192
Amta	0.546	0.918	0.372
Udaynarayanpur	0.556	1.006	0.45

Source: Calculated from Census 1961, 1971, 1981, 1991, 2001

Table 3. Temporal Change of Size and Density Relief

	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991	2001
Size CV	47.82	49.95	52.30	55.20	71.78	78.96	76.07	79.96	66.19	68.045	63.14
Density CV	103.33	103.76	107.12	111.28	133.59	139.39	134.56	140.34	123.41	123.39	116.02

Source: Calculated from Census 1961, 1971, 1981, 1991, 2001

Table 4. Intra-block Variation of Population Density

Block	Initial Disorderness (1961)	Present Disorderness (2001)	Diffusion Rate	Population Density (2001)	Change in relative growth rate
Bally Jagachha	189.82	96.97	92.84	9893.884	-0.478
Howrah	171.54	66.52	105.48	19472.98	-0.785
Sankrail	102.29	72.98	29.30	4884.553	0.619
Pancha	51.30	44.82	6.48	3010.643	0.609
Jagatballavpur	52.69	48.59	4.09	1757.809	-0.045
Domejur	69.47	82.72	-13.25	3204.056	0.656
Uluberia	114.86	59.76	55.09	2716.484	0.08
Shampur	41.57	39.80	1.77	1619.053	0.2
Bagnan	48.93	43.08	5.85	2169.171	0.192
Amta	62.67	57.74	4.92	1521.28	0.372
Udaynarayanpur	52.26	33.95	18.30	1569.465	0.45

Source: Calculated from Census 1961, 1971, 1981, 1991, 2001

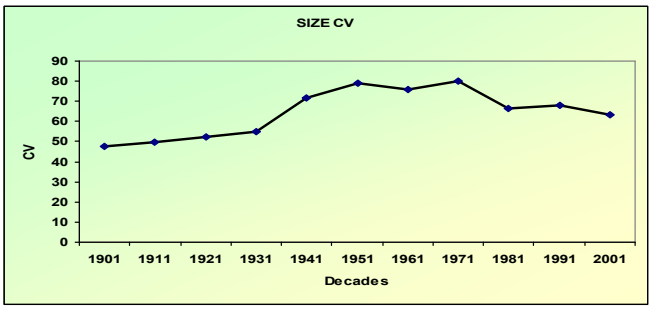
Table 5 Multiple Regression for Diffusion Rate

BLOCK	Diffusion rate (y)	Initial Disorderness (x_1)	Population Density (x_2)	Change in relative growth rate(x_3)
Bally jagachha	92.84	189.82	32.59283	-47.8
Howrah	105.48	171.54	100	-78.5
Sankrail	29.30	102.29	18.99744	61.9
Pancha	6.48	51.30	11.88843	60.9
Jagatballavpur	4.09	52.69	7.469028	-4.5
Domejur	-13.25	69.47	11.87942	65.6
Uluberia	55.09	114.86	11.02037	8
Shampur	1.77	41.57	7.120537	20
Bagnan	5.85	48.93	9.107769	19.2
Amta	4.92	62.67	7.356038	37.2
Udaynarayanpur	18.30	52.26	7.029658	45

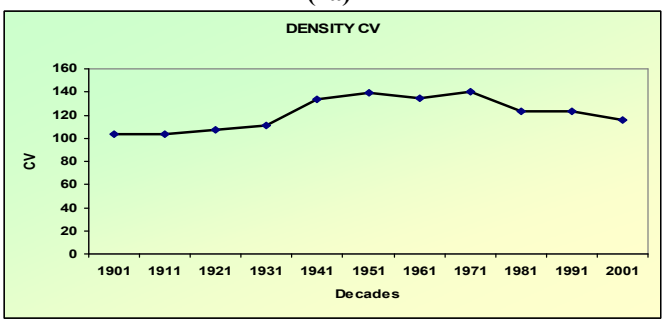
Source: Calculated from Census 1961, 1971, 1981, 1991, 2001

Table 6. Model Summery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
.967(a)	0.934	0.906	12.039	0.934



(4a)



(4b)

Fig. 4a and 4b. Inter-block demographic relief from 1901 to 2001

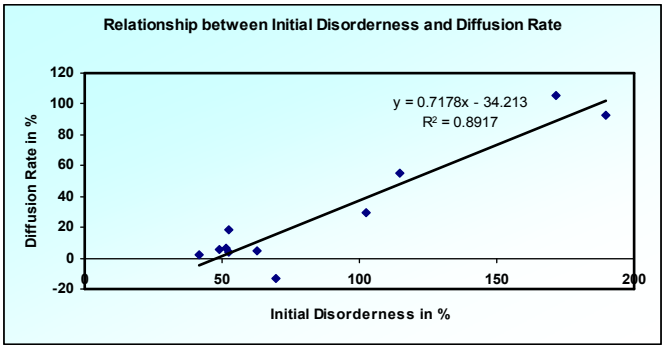


Fig. 5. A strong association of initial disorderness and diffusion rate

development. This growth was localised only in HMC and Bally Municipal areas. Hence, an increasing trend of CV value has been found. This result has also been reflected in the previous discussion that within the period of 1901-1951 relative growth rate was higher (>1.1) only in the north-eastern corner of the district (Fig. 3a) – an outcome of lop sided of industrialization and urbanisation. After independence, momentary population growth continues leading to saturation of two highly urbanised blocks (Table 2).

The most noticeable thing is that, in the period of 1951-2001 higher relative growth rates (> 1.1) show a tendency of diffusion over the space and it has been extended up to the east-central part of the district (Fig. 3b). This is nothing but the suburbanisation process which leads extension of urbanisation away from urban core. In addition to this, significant achievement in health services in rural areas plays a sound effect on falling of death rate over the last three decades and encouraged rise in population density in rural blocks. Hence, a slight diffusing trend has been found after 1970s. Besides this, partition effect due to Independence turns out demographic surface towards homogeneity due to unbridled filling of rural areas (close to urban units) by refugees from Bangladesh.

Intra Block Level

The preceding section harps on demographic relief at district level; however, the intra block variation of population density is yet to explain. Keeping this point in mind, mouza level data of each block has been treated in two different time points - 1961 and 2001. The decade 1961 is landmark of partition episode as well as beginning of national industrialisation; whereas decade 2001 addresses present situation. *Mouza* (smallest census unit of rural area) level data of each block has been transformed into CV value for the said time points and subtracting 2001 from 1961thereafter (table 4). The urban units within the blocks (Bally jagachha and Ulluberia) have been treated as a single spatial unit for computing CV, whereas ward wise (smallest census unit of urban area) population data of HMC (population density) has been used for intra-variation population density. The positive differences are addressed as diffusion and converse is nucleation. From table 4, it is clear that except Domejur, all the blocks are showing diffusion in terms of intra-block variation. It is clear from table 4 that significant change of CV has been found in those blocks where CV was very high

Table 7. Estimation of Change of Relative Growth Rate from 1951-2001 period to 2001-2051 period

Block	Projected Population					Model r square	Allometric Value		Change in Allometric Value
	2011	2021	2031	2041	2051		2001-2051	1951-2001	
Bally jagachha	481786	578238	684162	799558	924426	0.974	1.052	1.331	-0.279
Howrah	1190438	1345407	1510306	1685135	1869894	0.982	0.811	0.804	0.007
Sankrail	345593	409054	479051	555584	638653	0.988	1.047	1.15	-0.103
Pancha	257017	303090	353819	409204	469245	0.998	1.042	1.134	-0.092
Jagatballavpur	266319	309716	356953	408030	462947	0.994	0.955	1.101	-0.146
Domejur	365724	432775	506664	587391	674956	0.992	1.033	1.203	-0.17
Uluberia	641534	749135	866592	993905	1131074	0.99	0.969	1.107	-0.138
Shampur	418379	485330	558421	637652	723023	0.995	0.947	0.993	-0.046
Bagnan	399002	465312	537784	616418	701214	0.997	0.97	1.048	-0.078
Amta	462728	532748	609282	692330	781892	0.991	0.919	0.918	0.001
Udaynarayanpur	208076	241177	277404	316757	359236	0.989	0.969	1.006	-0.037

Source: Calculated from Census 1961, 1971, 1981, 1991, 2001

and 4b respectively. The graphs show slow increasing trend up to 1931 for both size and density of population. Afterwards, it exhibits marked increasing trend up to 1971 – indicating nucleated growth in some pockets of the district. Over the last three decades declining trend of CV values for both size and density have been recorded, which confirms spatial diffusion of population within the district. The reason behind this is not difficult to understand. Before independence of India, eastern part of the district experienced industrial as well as urban

Table 8. Estimation of Diffusion Rate in 2051

BLOCK	Disorderness in 2001	Disorderness in 2051 (estimated)	Diffusion Rate from 2001 to 2051(estimated)	1961		2001		2051	
				Population Density (y)	Disorderness (x)	Population Density (y)	Disorderness (x)	Population Density(y)	Disorderness (x)
Bally jagachha	96.97	55.10	41.87	2562.53	189.82	9893.88	96.97	21498.28	55.10
Howrah	66.52	32.71	33.81	9041.36	171.00	19472.98	66.52	36140.20	32.71
Sankrail	72.98	47.80	25.19	1668.64	102.29	4884.55	72.98	10722.85	47.80
Pancha	44.82	35.88	8.94	1040.69	51.30	3010.64	44.82	6606.29	35.88
Jagatballavpur	48.59	38.71	9.89	616.57	52.69	1757.81	48.59	3613.38	38.71
Domejur	82.72	53.82	28.90	1009.97	69.47	3204.06	82.72	6944.04	53.82
Uluberia	59.77	43.26	16.51	945.11	114.86	2716.48	59.77	5626.11	43.26
Shampur	39.81	34.64	5.16	632.71	41.58	1619.05	39.81	3310.30	34.64
Bagnan	43.09	35.75	7.34	799.89	48.94	2169.17	43.09	4506.52	35.75
Amta	57.75	43.31	14.44	636.61	62.68	1521.28	57.75	3054.44	43.31
Udaynarayanpur	33.96	31.89	2.07	613.95	52.26	1569.47	33.96	3277.54	31.89

Source: Calculated from Census 1961, 1971, 1981, 1991, 2001

initially (three digits) and insignificant change where it was low in 1961. More conclusively, urban areas with higher CV (simply disorderness) have embarked high change or homogenization due to saturation as well as spill over and rural blocks with low disorderness is weak in homogenization as it is already homogenized in terms of density distribution. Thus, a linear trend is found between disorderness and degree of diffusion. To establish this relationship, linear regression between degree of diffusion and initial disorderness is employed in fig. 5. Here the relationship is discernable because of coefficient of determination is high. The slope of the regression is 71.50% (0.715), making a positive influence of disorderness on degree of diffusion.

To address role of other determinants in controlling degree of diffusion, population density and change of relative growth (table 5) have been included along with initial disorderness. It is axiomatic that if population density is increased at a higher rate, it arrives at saturation level. Therefore, spatial units exhibit higher degree of diffusion by filling up sparsely populated areas. By this process, relative growth rate of population density will gradually decrease due to space saturation. Thus, it is pertinent to derive a model of population diffusion based on the role of consecutive interrelated factors of diffusion. First, maximum disorderness enhances the scope of population growth. Secondly, this trend boosts the population density steadily and thus diffusion continues. The increasing trend of population density in long terms attends the level of saturation. Hence, space saturation negates relative growth rate and subsequently population diffuse slowly in the low density areas. At the level of saturation, declined growth relatives once again put the diffusion in a continuous track. To articulate the impact of interrelated factors, degree of diffusion is considered as dependent variable (y) irrespective of these three independent variables - initial disorderness (x_1), initial population density (x_2) and relative growth rate (x_3). Here, the values of y and x_1 have been calculated in terms of percentage, whereas the values of x_2 and x_3 have been measured in different units. So, x_2 value is standardized under percentage by assigning highest as 100%. The same standardisation is repeated by multiplying 100 with the values of x^3. Following this calculation tabulated data (table 4) have been employed multiple regression to detect relative rate of the variables on diffusion rate. The resultant regression model is as follows:

$$y = -16.961 + 0.522x_1 + 0.160x_2 - 0.204x_3 \text{ ---------- (1)}$$

The model summery (table 6) exhibits a strong value of R square (0.934) and adjusted R square (0.906) which confirms reliability of the model to predict the changes in demographic surface. The R square value explains 93.40% of variation by the explanatory variables. Among these variables, initial disordeness (x_1) is principal determinants as coefficient of regression is highest (0.522). Second important factor in this model is relative change of growth rate (0.204) which exhibits negative association to the existing system and shows a moderate influence on degree of diffusion. The role of population density is very insignificant due to skewed pattern of density distribution of the blocks. Only top two high density blocks exhibit a higher rate of diffusion, whereas moderate and low density blocks exert weak rate of diffusion (except Domjur). So, initial disorderness performs the fundamental determination in gearing the degree of diffusion. Such modelling is more important for prediction of future tendency, especially for demographic analysis. So, to predict the future trend, estimated population for the coming five decades have been derived by second degree polynomial regression on the basis of trend form 1901 to 2001. The higher value of R square indicates goodness of fit of the equations by which estimated value has been derived (table 7) from the decades 2011 to 2051. Later on system-component technique (taking population density) has been adopted to find out the relative growth rate for 2001-2051 period. The residuals (Subtracting these from the value of 1951-2001 period) have been used as change of relative growth rate (Table 7).

To perceive future trend, block-wise value of initial disorderness (CV of 2001), initial population density (2001) and relative change in growth rate (period 2001-2051) have been employed in the model (eq^n – 1). The calculated value indicates degree of density diffusion from 2001 to 2051. Now these values are subtracted from CV of 2001. These resultant values indicate future disorderness of demographic surface (table 8). The calculated values ensure independency of disorderness irrespective of population density as range of

disorderness ranges is low (within 55.10 % to 31.88 %). In general, disorderness of population will be high in high density blocks due to nucleation of population within a particular geographical limit (Tiwari 1999). However, time plays a crucial role in modifying the association of population density and disorderness. To justify it linear regression have been employed in the three time points – 1951, 2001, 2051; wherein disorderness has been treated as a function of population density. Here three equations for the three time points are as follows:

1951: $y = 60.86 + 0.014x$ $R^2 = 0.496$ ---------- (2)
2001: $y = 50.77 + 0.001x$ $R^2 = 0.228$ ---------- (3)
2051: $y = 40.71 + 0.00005x$ $R^2 = 0.003$ ---------- (4)

The three equations clearly show a propensity of declining intercept value of the system signifying a process towards uniform demographic surface. On the other hand, the slope of the equations exhibit falling trend indicating least dependence of disorderness on population density. The same reality is once again prompted by R^2 values which record gradual falling from 1951 to 2051 (equation 2,3,4). Finally, it may be concluded that the demographic surface of the district is tending towards uniformity and population density gradually will loose its control from density variation, just like the spread of liquid lava uniformly in all direction.

Conclusion

Throughout the whole inquiry, demographic process of Howrah district has been closely scrutinized from different outlook and methods like – system-component growth for understanding of relative growth perspective, CV calculation in addressing density relief, adoption of multiple regression and formulation of modelling of demographic surface. The most common findings of this inquiry are that nodal point of demographic surface i.e HMC and Bally Municipality are almost saturated. As a result, diffusion of population is the outcome in the peripheral region. Here, core area turns out toward homogeneity; peripheral blocks have an intension towards heterogeneity and once again reflecting homogeneous character for the outer rural blocks. This simultaneity of heterogeneity and homogeneity is the clear indication of cyclic nature of demographic process spreading out from core towards peripheral region. At the penultimate stage of this inquiry attention has been given for the prediction of demographic surface. The inquiry reveals gradual development of demographic surface towards uniformity in relation to intra-block density variation.

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