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# An Appraisal Of Block Level Disparity Of Human Development Index In Kharagpur Sub-Division

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## Abstract

One of the key metrics for measuring the progress of society is the Block Human Development Index (BHDI). Here, the relevant blocks demonstrated their performance from 2005–2006 to 2014–2015. By using the Iterative Average Correlation Method (IACM) to assign the correct weights to its underlying dimensions, we have attempted to create the composite Block Human Development Index (BHDI) of the Kharagpur sub-division of West Bengal across the research period. The Health Index (HI), Educational Index (EI), and Standard of Living Index (SLI) dimensions are used to create the BHDI, and IACM was used to determine their relative weights, which are 45.72%, 30.88%, and 23.41%, respectively. GIS tool is employed to determine the geographical variation of BHDI in the Kharagpur sub-division. The highest growth rate is calculated for Dantan-I block (3.78), followed by Narayangar block (3.50) during the study period. The lowest growth rate is calculated for Kharagpur -I block (1.33), followed by Debra block (1.96) in Kharapur sub-division. Results also indicated that the main causes of this variety are income disparity, poor access to healthcare, the school dropout rate, and lack of cultural awareness.

**Keywords**: Human Development Index, Iterative Average Correlation, Spatial disparity, Kharagpur sub-division,

## 1. Introduction

The term "human development" refers to the degree of well-being attained by humans and is used to describe the process of expanding people's options. Along with the fundamental need for food, clothes, housing, and health, the concept of human development takes into account the dignity of each individual (Naubade and Kamat, 2016). The development of human capacities, such as better health, education, and knowledge, as well as how people apply these new qualities, can enhance people's dignity. Since 1990, the Human Development Index has developed into one of the instruments used to gauge development

(Banjade and Gautam, 2022). A long and healthy life, knowledge, and a fair level of living are three essential elements of human progress that the Human Development Index measures in summary form.

The process of modifying the nature of human well-being is a multifaceted component of development. Each geographic area's various socio-economic characteristics undergo a major shift as a result of socio-economic growth. Policies, plans, and programmes for the placement of various conveniences and services are part of socioeconomic development planning (Baig, 2014; Gilani et al., 2020). Due to a lack of data for the relevant variables, it is difficult to calculate the Human Development Index at the block level. However, the facilities are frequently dispersed unevenly, which discourages various stages of development throughout our community. Regional differences in socioeconomic development are a result of an unrestrained and uncontrolled development process (Rao, 1984). Therefore, regional disparities in prosperity are more likely to arise than geographical variations in social, political, demographic, and economic characteristics in any area or state that is filled with shared natural assets like land, water, and minerals.

The planning process for the development of human capabilities to meet challenges and take advantage of opportunities in the age of globalisation places a lot of importance on the block-level human development index (BHDI). It is a complex phenomenon that combines average accomplishment in the key areas of knowledge, a high standard of living, and a long and healthy life. Expanding human options and putting more emphasis on the richness of human lives than the wealth of economies are the key concepts. It serves as a gauge for accomplishments made possible by advances in biological processes, knowledge, and forming enduring habits. It is a spreading phenomenon since it assures numerous other aspects like health and education, which are necessary for a decent level of life, in addition to the increase in the people's income. By using the Iterative Average Correlation Method (IACM) to properly weight its underlying characteristics, we attempted to create the composite Block Human Development Index (BHDI) of the Kharagpur sub-division of West Bengal across the study period.

## 2. Study Area

The ten blocks that make up Kharagpur subdivision are: Dantan-I, Dantan-II, Pingla, Kharagpur-I, Kharagpur-II, Sabang, Mohanpur, Narayangarh, Keshiary, and Debra. The climate in the subdivision is humid sub-tropical, with minimum and maximum temperatures that varied from 7°C in the winter to 45°C in the summer. This district's humidity is fairly high, especially during the monsoon season, and it tends to get worse from January on. Under the monsoon, annual rainfall varies greatly and is concentrated in a few months.

Geographically, the north and north-west areas of the Kharagpur Subdivision are a portion of the Chhota Nagpur Plateau at its eastern extremity and are covered in hard laterite stone. In general, the slopes from west, north-west to east, and south-east to south-east decrease the water table. The ground water is restricted in the western portion of the subdivision. 3 to 18 m bgl is the range of the water's depth. Groundwater is present in the eastern region but is limited. Recent alluvium deposits predominately cover the eastern portion of the blocks. The northwestern region, northern, and southwest portions of the subdivision's upland

region may be identified by the existence of laterite soils at the top, which are covered by a thick succession of clay, silt, and sand. The Shilabati, Kangsabati, Subarnarekha, and their tributaries make up the majority of the river system in the Kharagpur sub-division. Since this area is rain-fed, the monsoon season sees the greatest flow of all the rivers. There are 787 people per km2 living in Kharagpur subdivision. In this subdivision, 48.02 percent of the district's total population dwells. A literacy rate of 80.51% was present in the subdivision.

## 3. Materials & Methods

Through the building of BHDI, of Kharagpur sub-division, we have attempted to provide a comprehensive assessment of human development in terms of its character and variance in its 10 blocks during the indicated period of 2005-2006 to 2014-2015, collected from District Information System for Education (DISE) published by Department of MHRD, School Education, Government of India. The health index (HI), education index (EI), and standard of living index (SLI) dimensions are used to construct the BHDI, and their corresponding weights—45.72%, 30.88%, and 23.41%—are calculated by utilising IACM. The corresponding BHDIs for the blocks are then calculated using the aforementioned weights. Child Health Index (CHI) and Adult Health Index (AHI) are used to calculate the composite Health Index (HI). We are therefore testing the use of proxy parameters, such as the proportion of institutional deliveries in total deliveries and the Child Health Index, which measures the level of immunisation among children aged 0 to 5. The percentage of adults who survive to adulthood and the proportion of communities and mouzas with access to clean water are used in the Adult Health Index. The Adult Literacy Index (ALI) and Enrolment Index (ENI) are taken into account by the composite Education Index (EI), and in the case of the Standard of Living Index (SLI), the Male Work Participation Index (MWPI) and Above Poverty Line Index (APLI) are evaluated in the block of the relevant sub-division. To calculate the number of homes satisfying the requirements established for the research years, we employed the rule of projection. The APLI is produced as an index for the number of households over the poverty line. We used the following log quadratic equation to determine the anticipated number of households.

$$LogY = a + b_t + ct^2$$

Y denotes the numeral of residences in a specific block, and t denotes the passing of time. The households in the block for the years 1991, 2001, and 2011 are used to derive the constraints a, b, and c. When the value of LogY for the corresponding value of t is taken as the antilog, one may then estimate the number of households for any additional requisite year. When we had the essential number of APL families, we had subtracted the BPL households from the total number of households. In this article, the definite weights of the primary elements of the BHDI and its dimension indices are calculated using the Average Squared Correlation approach. In order to determine final weights, this procedure is actually applied repeatedly (or iteratively). The Average Correlation approach is also used when the evaluation is carried out in a framework employing collected information to determine the relative weights of all the chosen variables that are distinct. For better comprehension, the computation for average correlation with three and four variables is shown. In fact, we suggest using the average correlation approach to assess the relative position

of each individual exclusive component in explaining a given dependent variable (in this case, the Block Human Development Index). In the article written by Mondal et al., (2017) a thorough methodology for comprehending average correlation is provided, along with information on its importance and necessity.

The weights (or average correlations) and final index must be obtained simultaneously using an iterative method because the final index cannot be measured without knowing the weights, and vice versa. Starting with some arbitrary fixed weights for each individual index, the process begins. These weights are used to create a final index. The third stage involves obtaining the average correlations between each individual index and the final index, which are then utilised as weights to create the new final index. The following step will involve new weights and average correlations, which will result in the creation of a brand-new final index. The process must be continued until the average correlation values do congregate to their earlier levels, after which the ultimate weights and final expansion index must be determined.

The Getis-Ord Gi* measurement is determined for every block in a dataset by the Hot Spot measurement tool. This technique locates hot spots of high HDI values (hotspot) and low HDI (cold spots) values that are statistically significant spatial clusters. A geographic grouping of characteristics with either high or low HDI values may be seen in the generated z-scores and p-values. This tool functions by examining each block in the context of its neighbours (Scott and Warmerdam, 2005). Z-scores and p-values, two statistical significance indicators, demonstrate whether or not to reject the null hypothesis block by block. The Getis-Ord Gi* statistic can be calculated as:

$$G_i^* = \frac{\sum_{j=1}^{n} W_{i,j}x_j - \bar{X}\sum_{j=1}^{n} W_{i,j}}{S\sqrt{\frac{[n\sum_{j=1}^{n} w_{i,j}^2 - (\sum_{j=1}^{n} w_{i,j})^2]}{n-1}}}$$

Where, $x_j$ is the HDI value for block *j*, $W_{i,j}$ is the spatial weight between blocks *i* and *j*, n is equal to the total number of blocks and:

$$\bar{X} = \frac{\sum_{j=1}^{n} x_j}{n}$$

$$S = \sqrt{\frac{\sum_{j=1}^{n} X_j^2}{n} - (\bar{X})^2}$$

The $G^*_i$ statistic is a z-score so no further calculations are required

A block with a high z-score and less p-value is likely to have high values spatially clustered together. A relatively low negative z-score and a modest p-value point to a geographical concentration of low scores. As the z-score increases (or decreases), the grouping becomes stronger. There is no discernible regional grouping when the z-score is near to 0.

# 4. Results

One of the key metrics for measuring the progress of society is the Block Human Development Index (BHDI). Therefore, the relevant blocks demonstrated their efficiency from 2005–2006 to 2014–2015. Debra Block won the top spot from 2014–2015 on account of its developed standards of life, health, and education. One of the key measures of a society's development is the Block Human Development Index (BHDI). In this instance, the concerned blocks displayed their performance from 2005–2006 to 2014–2015. Due to its developed status in terms of population standard of life, health, and education, Debra Block held the top ranking from 2014–2015. The BHDI value was 0.60 in 2005-2006, 0.61 in 2006-2007, and it increased to 0.74 in 2014-2015 with a growth rate of 2.60% (Table 1).

In the case of Sabang, it held the second position from 2005–2006 to 2011–2012, with BHDI values of 0.68 in 2005–2006, 0.70 in 2006–07, 0.71 in 2007–2008, 0.73 in 2008–2009, 0.77 in 2009–2011, and 0.83 in 2011–2012; it then rose from that position to the first position for the following year before reverting to the second position with a value of 0.76 in 2014–2015. One of the top-performing blocks was Mohanpur, which held the third position throughout the entire study period with values of 0.66 in 2005–2006, 0.67 in 2006–2007, 0.70 in 2007–2008, 0.73 in 2008–2009, and 0.77 in 2009–2011. However, it improved its standing and kept the third position in 2012–2014 with a value of 0.78, and in 2014–2015 it reached 0.79 with a growth rate of 2.17% (Figure 1).

*Table 1: Calculation of BHDI, by using IACM, for 10 blocks of Kharagpur sub-division for the period 2005-06 to 2014-15 and their respective Growth Rates*

| Block | 2005-2006 | 2006-2007 | 2007-2008 | 2008-2009 | 2009-2010 | 2010-2011 | 2011-2012 | 2012-2013 | 2013-2014 | 2014-2015 | Average | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Debra | 0.74 | 0.75 | 0.78 | 0.78 | 0.83 | 0.85 | 0.85 | 0.84 | 0.87 | 0.88 | 0.82 | 1.0E-05 |
| Pingla | 0.63 | 0.64 | 0.67 | 0.68 | 0.71 | 0.74 | 0.75 | 0.76 | 0.78 | 0.79 | 0.72 | 3.6E-07 |
| Keshiary | 0.51 | 0.54 | 0.55 | 0.56 | 0.56 | 0.59 | 0.61 | 0.63 | 0.64 | 0.66 | 0.59 | 1.6E-07 |
| Dantan-I | 0.53 | 0.54 | 0.55 | 0.56 | 0.61 | 0.66 | 0.67 | 0.67 | 0.71 | 0.72 | 0.62 | 3.1E-06 |
| Dantan-II | 0.54 | 0.55 | 0.58 | 0.59 | 0.64 | 0.68 | 0.68 | 0.67 | 0.70 | 0.71 | 0.63 | 1.2E-05 |
| Narayangarh | 0.53 | 0.54 | 0.56 | 0.56 | 0.64 | 0.67 | 0.68 | 0.68 | 0.69 | 0.70 | 0.63 | 2.8E-05 |
| Mohanpur | 0.66 | 0.67 | 0.70 | 0.70 | 0.73 | 0.77 | 0.77 | 0.78 | 0.78 | 0.79 | 0.74 | 5.2E-06 |
| Sabong | 0.68 | 0.70 | 0.71 | 0.73 | 0.77 | 0.82 | 0.83 | 0.84 | 0.86 | 0.87 | 0.78 | 1.3E-06 |
| Kharagpur-I | 0.52 | 0.49 | 0.48 | 0.46 | 0.51 | 0.52 | 0.53 | 0.53 | 0.55 | 0.55 | 0.51 | 3.0E-02 |
| Kharagpur-II | 0.63 | 0.64 | 0.66 | 0.65 | 0.70 | 0.71 | 0.72 | 0.72 | 0.74 | 0.76 | 0.69 | 1.7E-06 |

Kharagpur-I, Keshiary, and Dantan-I were the worst-performing blocks; Kharagpur-I achieved the 10th rank for all years with values of 0.49 in 2005-06, 0.48 in 2006-07, 0.46 in 2007-08, 0.53 in 2010-12, and 0.55 in 2013-15, with the exception of 2004-05 (0.52, 9th position). Dantan-I earned 8th position in 2005-06 with the value 0.53, 0.61 in 2010-11 and finally 0.72 in 2014-15 with the second highest growth rate 3.78%.

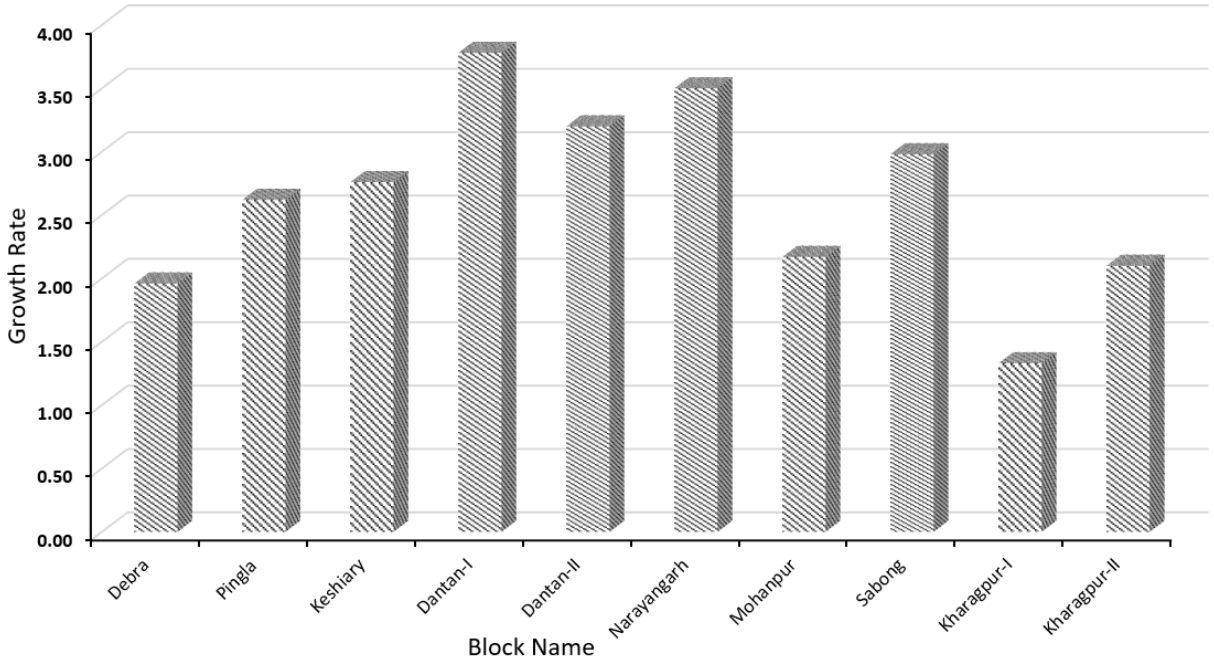


*Figure 1: Block-wise growth rate of human development indicators in Kharagpur sub-division*

The Kharagpur sub-division performed normally in the BHDI in terms of growth rate (i.e., 2.16), with the exception of the municipal areas, and this is again because the baseline value was not so low. It has been noted that there is a large fluctuation in BHDI for certain of the blocks. As an illustration, it should be noted that Mohanpur shown strong performance in the year 2004–05, earning the third rank, which it held during 2014–15. Similar results were found for the block of Mohanpur, Pingla, and Kharagpur-II, which during the course of the study period, held firm and static positions of third, fourth, and fifth in the overall ranking.

**Cluster Analysis**

Figure 2 shows the geographical distribution of blocks based on the HDI value in Kharagpur sub-division in 2004-2005. The cluster of high HDI blocks were mainly observed in the north-east (Debra and Pingla block) of the study area, containing higher and significant positive z-score. The cluster of low HDI blocks (Kesiary and Narayangarh blocks) were detected in the central and west of the Kharagpur sub-division, containing smaller and significant negative z-score with. The z-score value of Kharagpur-I, Kharagpur-II, Sabang, Dantan-II and Mohanpur showed z-score close to zero directs no apparent geographical clustering. Figure 3 illustrates the spatial distribution of HDI values in Kharagpur sub-division during the period between 2014 and 2015. The positive and significant z-score value is recorded for Pingla block, situated in the east of the Kharagpur sub-division. The negative and significant z-score value is recorded for Kharagpur-I and Keshiary block.

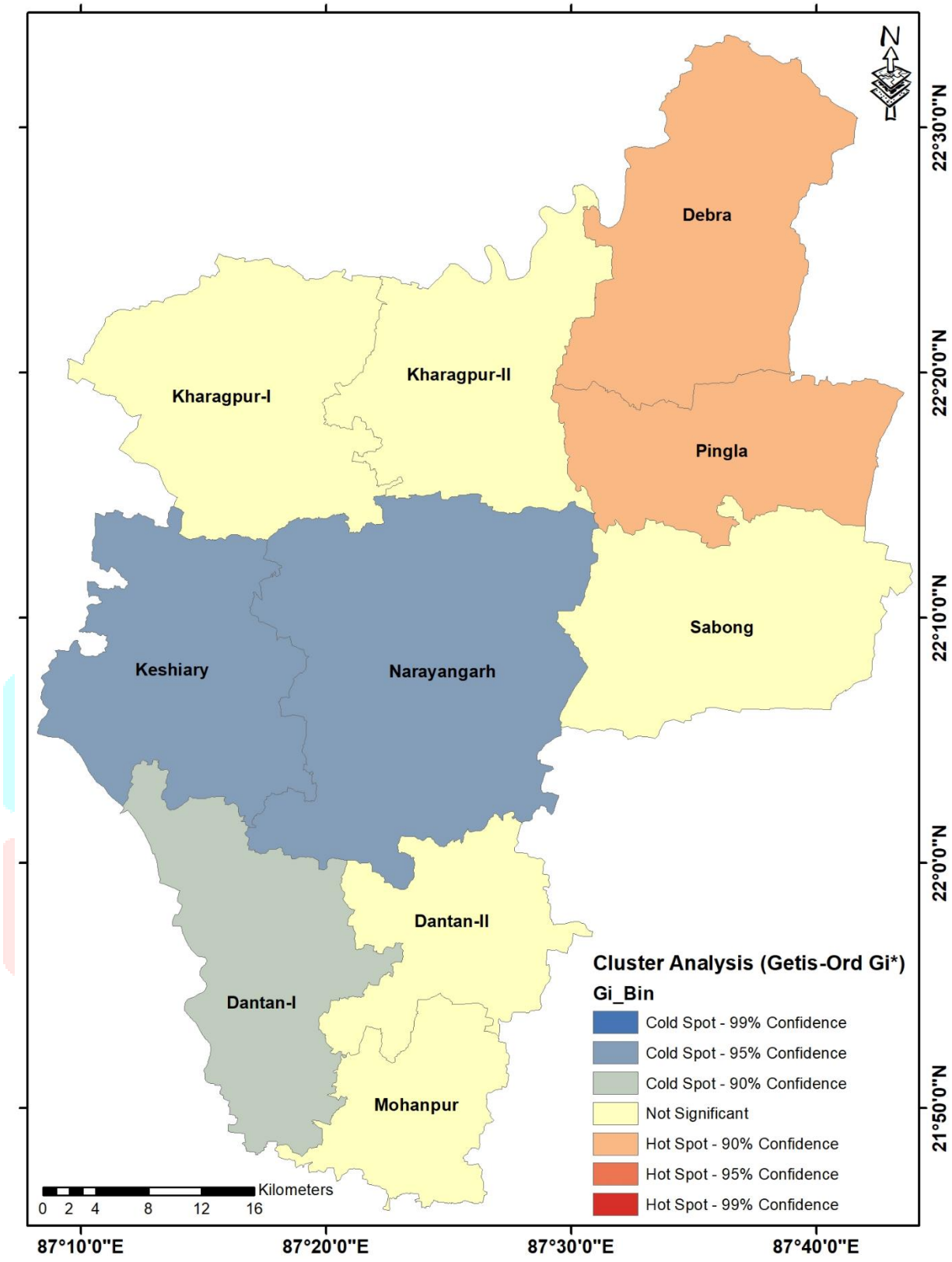


*Figure 2: Cluster of HDI of Kharagpur sub-division in 2004-2005*

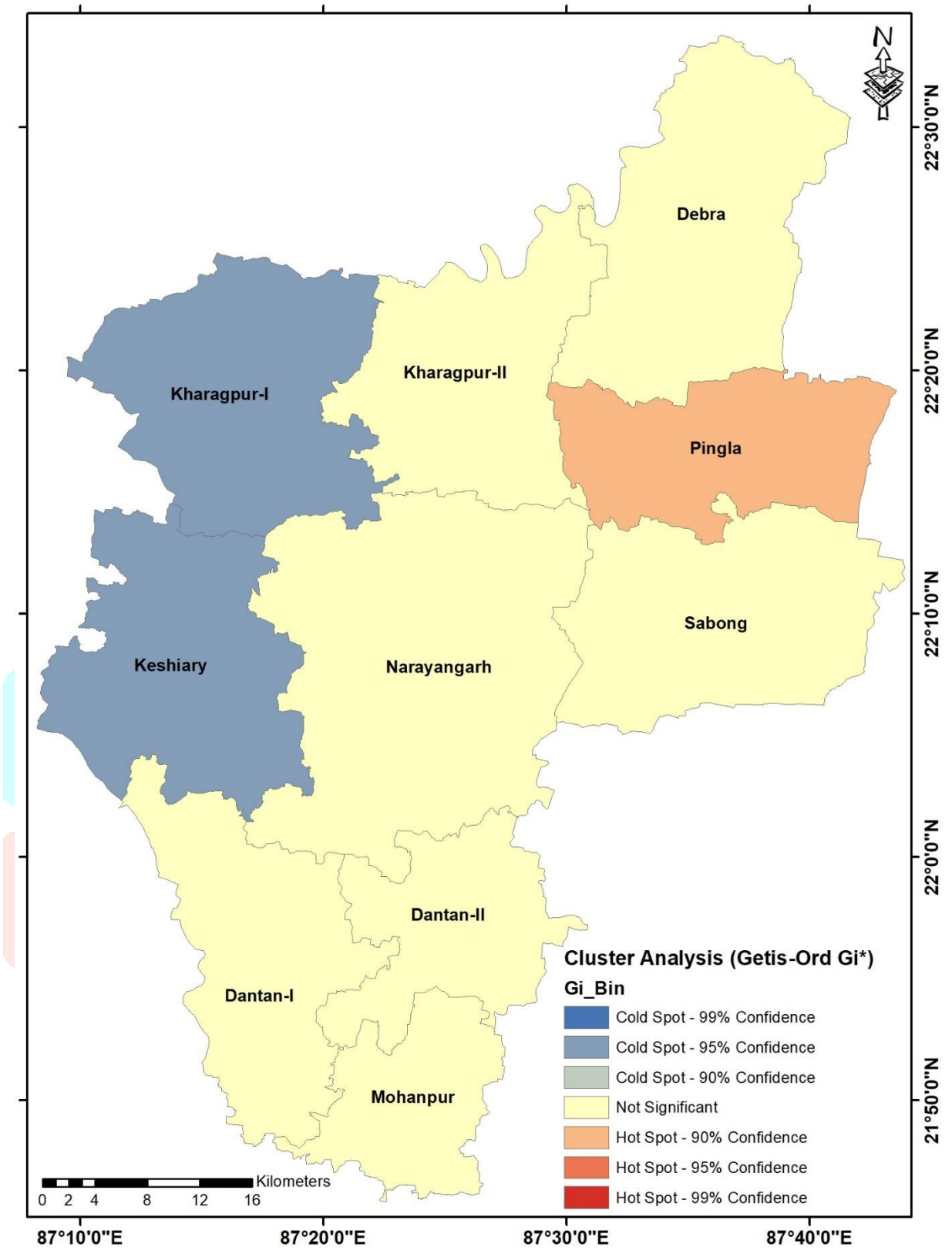


*Figure 3: Cluster of HDI of Kharagpur sub-division in 2014-2015*

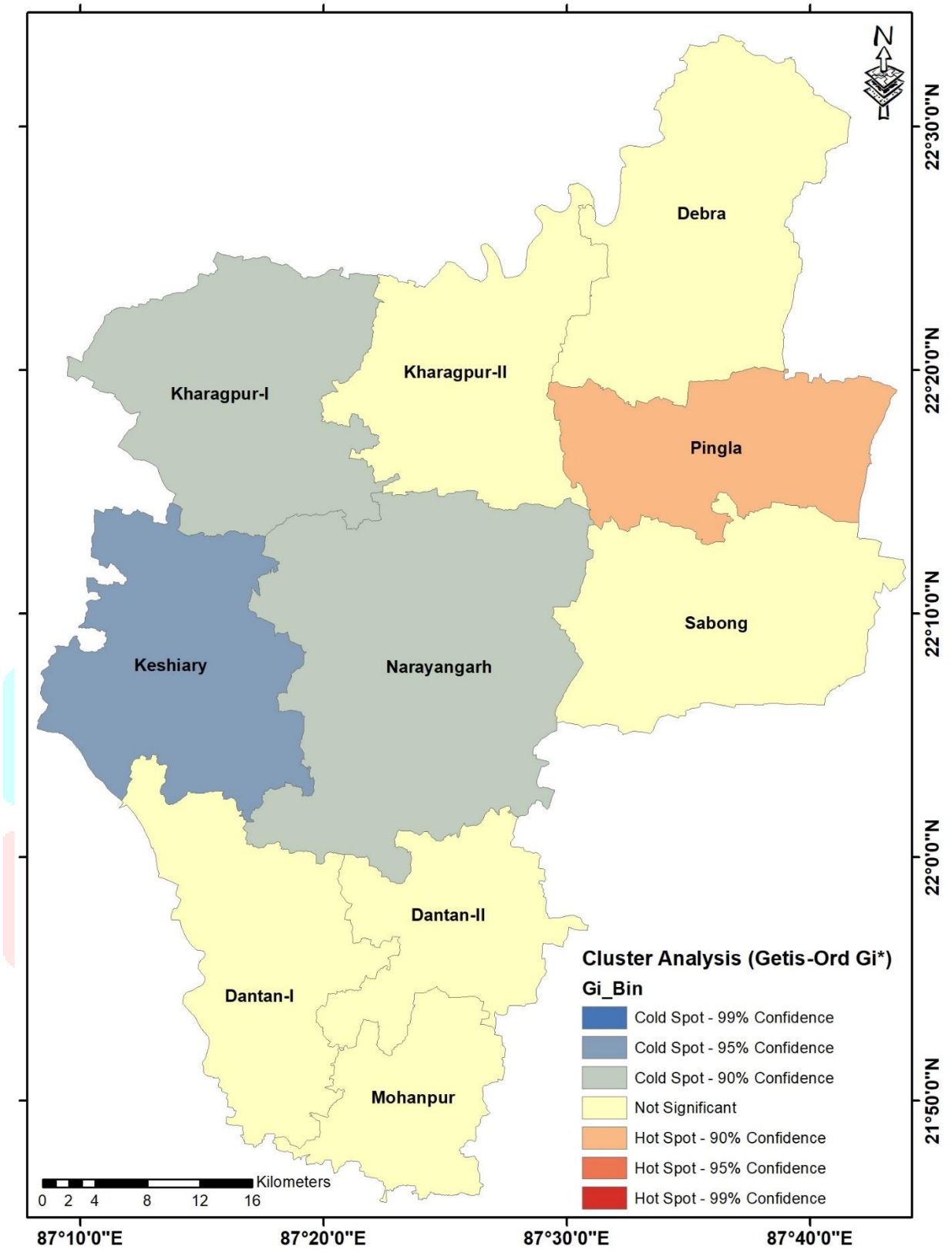


*Figure 4: Cluster of HDI of Kharagpur sub-division in 2004-2015*

Figure 4 portrays the spatial distribution of mean HDI value of Kharagpur sub-division during the period between 2004 and 2015. Results showed significant and positive z-score value is calculated for Pingla block, indicated more intense the clustering. The significant and negative z-score value is calculated for Keshiary, Kharagpur-I and Narayangarh block in the Kharagpur sub-division, indicated a spatial clustering of low HDI values. Dantan-I, Dantan-II, Mohanpur, Sabang, Kharagpur-II and Debra calculated z-score near zero specified no apparent geographical clustering.

## 5. Discussion

According to the discussion above, it can be concluded that the Debra block consistently held the top spot over the study period and was closely followed by the Mohanpur block. The Pingla block's trend line exhibits several minor ups and downs, but it ends with an upward tendency. For a specific year, the BHDI values of some blocks increase, while those of other blocks decrease. Overall, it can be claimed that although if the performance of the aforementioned blocks is subpar in terms of BHDI values, there is still hope because these blocks are working hard to advance from their low level of human development, as is seen in the way that Figure 1 is used to illustrate this.

Additionally, we have attempted to use "cluster analysis" for the two time periods of 2004–2005 and 2014–2015 to display every aspect of BHDI along with its underlying components for the relevant blocks. The demographic structure includes factors like the literacy rate, sex ratio, population age distribution, family size, and population growth rate. Consequently, we take into account family size as one of the reliable indicators of a region's demographic makeup. If there are fewer earners in a household, an increase in family size typically results in a decrease in per capita income. Poor investment, low consumption, and low spending on health, education, and living standards are the results (Saha et al., 2018). Schedule Tribes (ST) have historically been found to be economically backward, usually extremely poor, concentrated in low-skill vocations, and mostly rural. People from scheduled tribes are likely to have less physical and human capital than people from unscheduled tribes, and they also tend to receive poorer returns on these assets (Dinda and Ghosh 2015). Due to their lesser wealth endowment, it is predicted that ST individuals will have poorer educational attainment than those in the other categories.

With the use of the Iterative Average Correlation Method (IACM), we were able to effectively calculate an acceptable composite Index of Block Human Development Index (BHDI) for the blocks of the Kharagpur sub-division in West Bengal during the years of 2004–2005 and 2014–2015. The blocks with the lowest overall performance in terms of human development, together with health, education, and standard of living, are Dantan-I and Kharagpur-II. Sabong and Debra are at the top of the list. Our research shows that throughout time, the majority of the blocks in the Kharagpur sub-division have improved in terms of human development achievement. The general behaviours of the chosen variables appear to be somewhat affected because the area has a sizable SC/ST population (Ashraf et al., 2013). It has long been held that big family sizes are typically chosen by illiterate people due to their widespread ignorance, which has a detrimental effect on their ability to develop as human beings. Nevertheless, the findings of this investigation that relate block level HDI make sense. However, we were unable to choose a few additional factors to explain the underlying dimensions of the BHDI due to insufficient data, and we believe that this can be regarded as a limitation of the study. Future major parameters may very well pick up the issue and take into account more independent factors affecting the BHDI dimensions, which would also make the study's scope and depth greater.

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**Conflict of Interest**
No conflict of interest

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