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India

A Geostatistical analysis of Gross Domestic Production (GDP) at district level in Uttar Pradesh in 2013.

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Abstract

In this work GDP at district level was analysed at urban areas in Uttar Pradesh. The GDP data was collected from The District Level Database (DLD), tata cornell institute. The pattern of GDP distribution was identified using High/Low Clustering (Getis-Ord General G) statistics. The cluster and outlier were found using Cluster and Outlier Analysis (Anselin Local Morans I) statistics. The result shows the pattern of GDP at district level was found highly clustered because the given z-score of 2.6 confirm, that there is a less than 1% likelihood that this high-clustered pattern could be the result of random chance. The Cluster and Outlier Analysis result identified the five low GDP district and surrounded with Low GDP districts; however, six districts fall in the category of high GDP districts surrounded with high GDP districts. The work is useful for the planners to develop the districts having low GDP and surrounded with low GDP districts.

Key Words: GDP, Per capita income, Urban areas, Standard deviation.

1. Introduction

Gross domestic product (GDP) is a monetary measure of the market value of all the final goods and services produced in a specific time period by countries.[1][2] .According to the International Monetary Fund (IMF), the Indian economy in 2021 was nominally worth $3.04 trillion; it is the fifth-largest economy by market exchange rates, and is around $10.219 trillion, the third-largest by purchasing power parity (PPP).[3][4] With its average annual GDP growth rate of 5.8% over the past two decades, and reaching 6.1% during 2011–2012,[3] India is one of the world's fastest-growing economies.[5] However, the country ranks 139th in the world in nominal GDP per capita and 118th in GDP per capita at PPP.[6] Until 1991, all Indian governments followed protectionist policies that were influenced by socialist economics. Widespread state intervention and regulation largely walled the economy off from the outside world. An acute balance of payments crisis in 1991 forced the nation to liberalise its economy;[7] since then it has moved slowly towards a free-market system [8][9] by emphasising both foreign trade and direct investment inflows.[10]

The economy of Uttar Pradesh is the third largest of all the states in India. Nominal GDP of the state for the year 2022-23 is ₹20.48 trillion (US$260 billion).[11] Uttar Pradesh has an urban population of 4,44,95,063. According to the 2011 census report, 22.76% of Uttar Pradesh's population lives in urban areas. The state has 7 cities with populations exceeding 10 lakh (1 million) each. After partition in 2000 (Uttarakhand state carved out

of it), the new Uttar Pradesh state produces about 92% of the economic output of the old Uttar Pradesh state. According to Planning Commission estimates for the year 2011–12, 29.4% of the state's total population was poor.[12] However, updated findings by NITI Aayog based on NFHS-4 (2015–16), 37.79% of the population was found to be poor.[13] A geographic information system (GIS) is a type of database containing geographic data (that is, descriptions of phenomena for which location is relevant), combined with software tools for managing, analysing, and visualizing those data [14].

Objectives

1. To find the pattern of GDP distribution at district level in Uttar Pradesh.
2. To find the cluster and outlier at district level in Uttar Pradesh.

2. Material and Methods

2.1 Study Area

Uttar Pradesh is divided into 75 districts under these 18 divisions [15] Uttar Pradesh has more metropolitan cities than any other state in India.[16][17] The absolute urban population of the state is 44.4 million, which constitutes 11.8% of the total urban population of India, the second-highest of any state.[18]

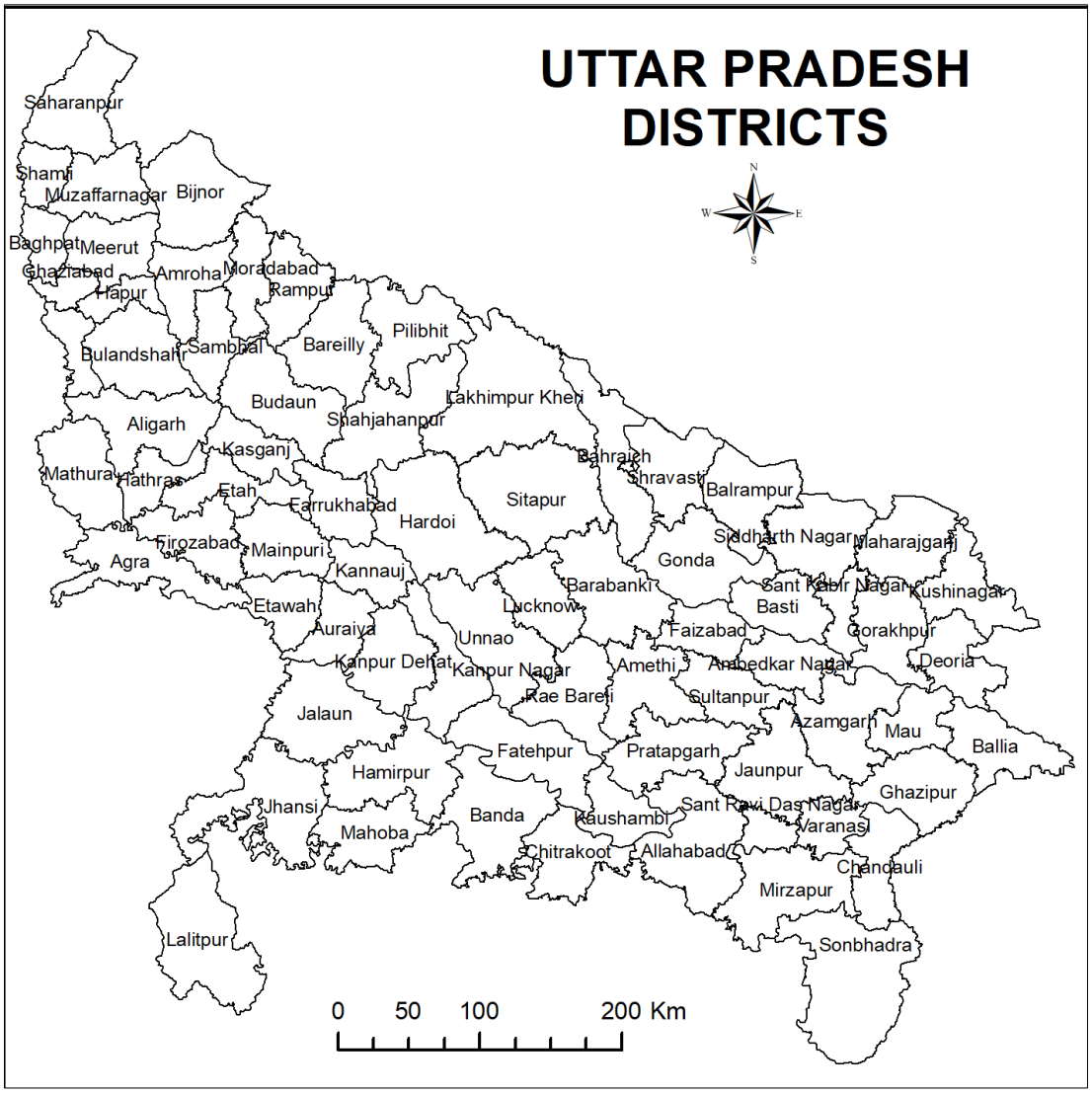

Figure 01 Study Area Map

2.2 **Work Flow**

The workflow is given in Fig. 02.

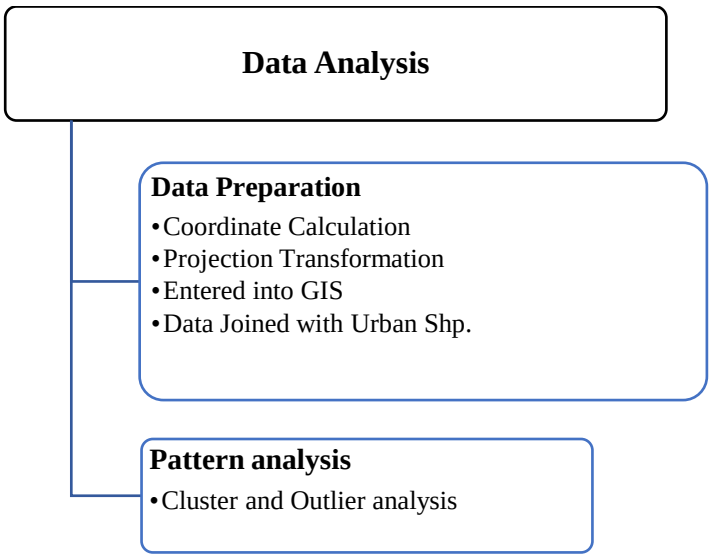

Figure 2 Work Flow

2.3 **Data Used**

The District Level Database (DLD) developed by TCI was used in this study. This data is for Indian economic sectors provides a comprehensive for research hypotheses, identification of relevant districts / regions for technology dissemination, promoting rural pro-poor programs / development initiatives and identification of relevant representative districts for micro level assessment. It acts as a link between country-level macro data and household-level micro data. The consistent recording and detail at district level makes it a powerful research response tool for priority setting and in tracking inter-district and intra-district economic changes.

2.4 Data Processing

Cluster and Outlier analysis was used in this work, given a set of features (Input Feature Class) and an analysis field (Input Field), the Cluster and Outlier Analysis tool identifies spatial clusters of features with high or low values. The tool also identifies spatial outliers. To do this, the tool calculates a local Moran's I value, a z-score, a pseudo p-value, and a code representing the cluster type for each statistically significant feature. The z-scores and pseudo p-values represent the statistical significance of the computed index values.

The Local Moran's I statistic of spatial association is given as:

$$I_i = \frac{x_i - \bar{X}}{S_i^2} \sum_{j=1, j \neq i}^{n} w_{i,j}(x_j - \bar{X}) \quad (1)$$

where x_i is an attribute for feature i, $\bar{X}$ is the mean of the corresponding attribute, $w_{i,j}$ is the spatial weight between feature i and j, and:

$$S_i^2 = \frac{\sum_{j=1, j \neq i}^{n} (x_j - \bar{X})^2}{n - 1} \quad (2)$$

with n equating to the total number of features.

The z_{I_i}-score for the statistics are computed as:

$$z_{I_i} = \frac{I_i - \mathrm{E}[I_i]}{\sqrt{\mathrm{V}[I_i]}} \quad (3)$$

where:

$$\mathrm{E}[I_i] = -\frac{\sum_{j=1, j \neq i}^{n} w_{ij}}{n - 1} \quad (4)$$

$$\mathrm{V}[I_i] = \mathrm{E}[I_i^2] - \mathrm{E}[I_i]^2 \quad (5)$$

3. Results and Discussion

3.1 GDP at district level

The GDP at district level is shown in the figure 2 as follows:

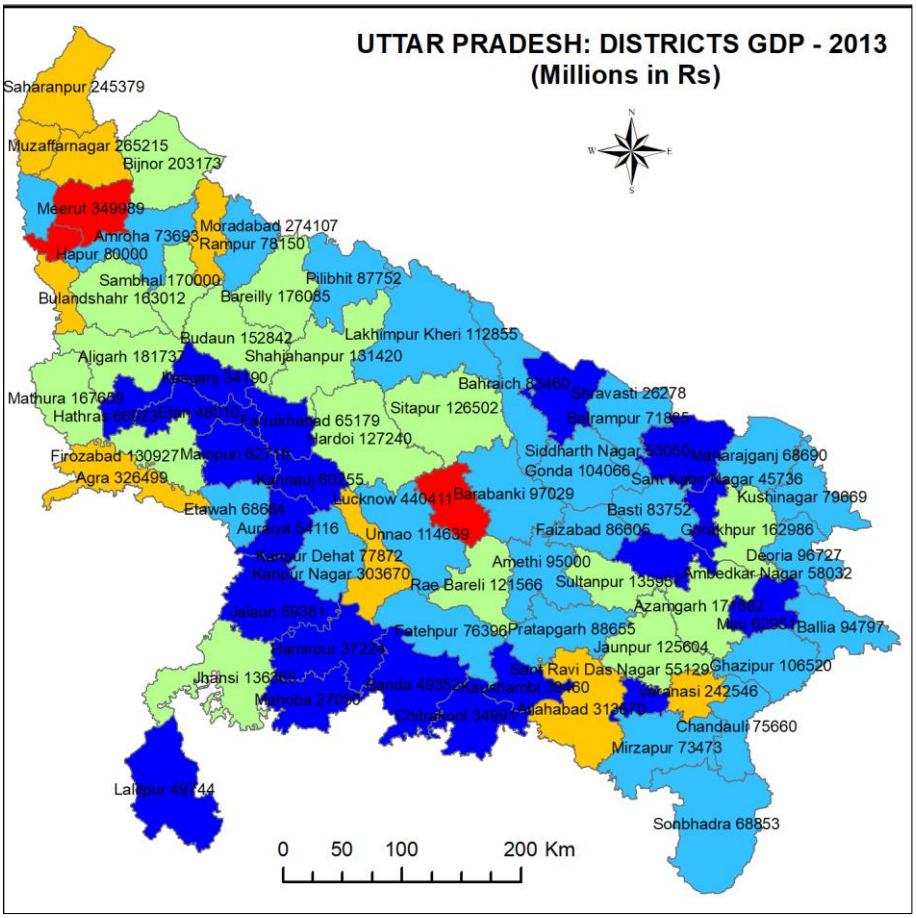

Figure 3 GDP at district level

3.2 GDP Pattern

Given the z-score of 2.61612268914, there is a less than 1% likelihood that this high-clustered pattern could be the result of random chance. The results of GDP pattern at district level are given in the following table 01.

Table 01: General G Summary	
Observed General G:	0.000002
Expected General G:	0.000002
Variance:	0.000000
z-score:	2.616123
p-value:	0.008893

Following is the figure shows the pattern:

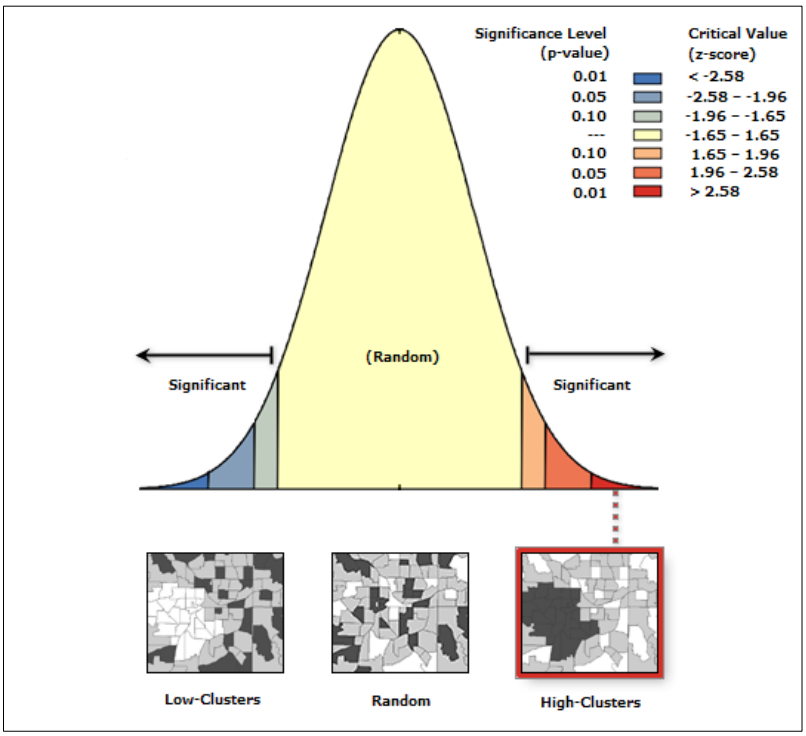

Figure 4 High-Low Clustering

3.2 Cluster and Outlier analysis

The Cluster and Outlier of GDP at district level are shown in the following figure:

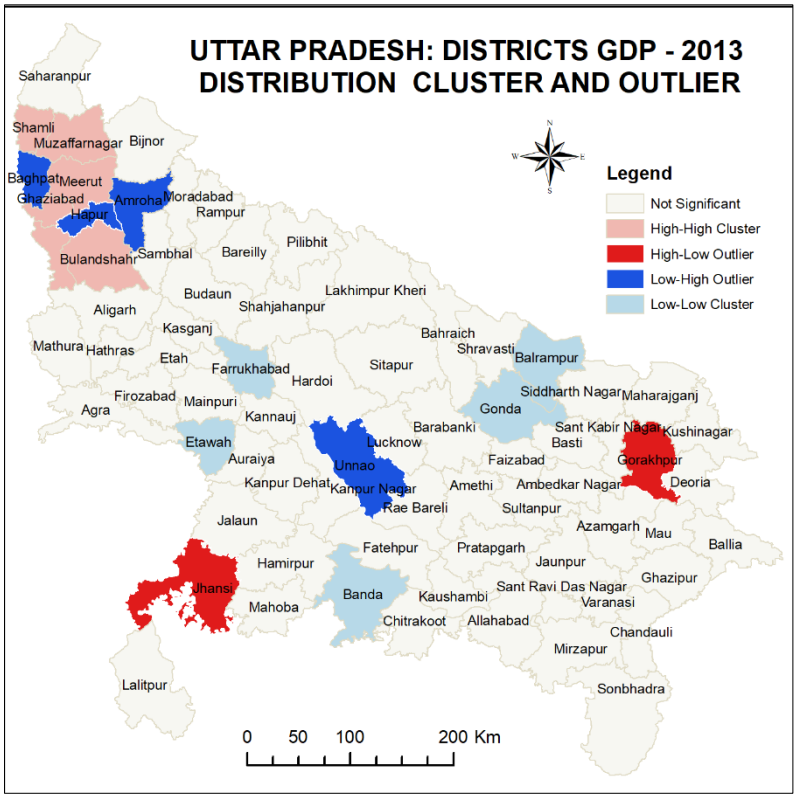

Figure 5 Per capita Income classes

Conclusion

In this work per GDP at district of Shahjahanpur was studied. In the result it was found that High GDP districts are clustered in the western side of Uttar Pradesh while low GDP districts are concentrated in the eastern side. This is the reason; the pattern of the district was found highly clustered. This work will open the way for further research on GDP spatial distribution.

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