



Mapping Structural Change And Disparities In The Economic Development Of Uttarakhand: A Comprehensive Study

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Citation: Debjani Sarkar, et al. (2024), Mapping Structural Change And Disparities In The Economic Development Of Uttarakhand: A Comprehensive Study, *Educational Administration: Theory and Practice*, 30(6) 4871-4881

Doi: 10.53555/kuey.v30i6.8630

ARTICLE INFO

ABSTRACT

This study analyses economic development and structural changes across Uttarakhand's 13 districts, highlighting disparities between plains and hill regions. Using indicators across agriculture, industry, and services, a composite development index was constructed for 2010-11, 2015-16, and 2020-21. Principal Component Analysis (PCA) reveals significant spatial and sectoral disparities. Plains districts like Haridwar and Udham Singh Nagar, benefiting from infrastructure and economic hubs, rank highest, while hill districts face challenges due to limited resources and terrain. Visualized through choropleth and heat maps, the study emphasizes targeted policies to address inequalities, focusing on healthcare, infrastructure, and connectivity for balanced, inclusive growth.

Keywords: PCA, regional disparity, Uttarakhand, spatial analysis, sectoral changes

JEL Code: O12, I15, I25

Introduction

Uttarakhand, a northern state of India known for its picturesque landscapes and rich cultural heritage, has experienced a dynamic economic evolution since its formation in 2000. The state's economy is marked by pronounced regional disparities, particularly between its hill and plain districts. Geographical constraints, infrastructural deficiencies, and varying levels of investment and policy intervention have shaped these disparities. Understanding the structural changes in Uttarakhand's economy and their impact on inter-district economic development is essential for constructing policies that promote inclusive and sustainable growth. After the separation of the state, GSDP increased from Rs 24,786 cr. to Rs 2, 43,012 cr. (2020-21) at the current price. As per the report of the Economic Census Report of 2005, a shift in the sector-wise share in State Gross Domestic Product (SGDP) has been recorded. From 2001 to 2002, the sectoral contribution of agriculture and allied sectors, manufacturing sector, and service sectors to the growth of the newly formed Uttarakhand was 25.5per cent, 23.0per cent and 51.5per cent respectively. As many developmental policies and programmes were implemented, change in the trend was observed. In 2019-20 the percentage of contribution of agriculture and allied sectors, manufacturing sector, service sectors to the growth was 10per cent, 52per cent and 38per cent respectively¹⁵. Though the state's economy is growing fast, the poverty and migration problem is still a big concern for the government. The problems arise especially in rural areas which comprise around 69.77per cent of the state's total population. Balanced economic development is one of the main objectives of any country, including India. But development was never equal from the very beginning of civilization. A disparity in income level has created a wide gap between people living inside the same geographical area. Even today, the world economy is divided into developed, less developed and underdeveloped countries due to unequal distribution of economic and social factors. A shift in sectoral performance from traditional agriculture to industries and the movement of labour from rural to urban areas are the main drivers of income inequality and economic development¹⁶. As most of the part of the state is covered in hill areas, the level of industrialisation has been uneven and so

agriculture remains the support of the people. Although even in the agricultural sector, there exists a difference in the thought process between the development of agricultural output and its impact on the environment. As a result of unequal development, Uttarakhand is facing problems like unemployment resulting in the migration of the population to the plains. Such migration and other problems are leading the state towards more unequal development among the hills and plains¹⁷. These disparities highlight the pressing need for a comprehensive inter-district analysis to identify the patterns of structural change and their implications on regional development.

Significance of the Study

The findings of this research are critical in informing policy frameworks aimed at reducing regional imbalances and fostering equitable economic progress. As Uttarakhand continues to grapple with developmental challenges, particularly in its hill regions, understanding these structural dynamics can pave the way for targeted interventions. Moreover, the study contributes to the broader discourse on regional economic disparities in emerging economies, offering insights that may be applicable to other regions facing similar challenges. The paper is organized as follows: the next section presents a review of relevant literature, followed by a detailed explanation of the methodology employed. The results and discussion section will analyse the empirical findings, while the concluding sections will outline policy implications and future research directions.

Literature Review

Recent scholarly investigations into structural change and economic development across various contexts have yielded crucial insights into sectoral transformations, disparities, and growth patterns. Ghosh explored the unique services-led growth trajectory in India compared to the manufacturing-driven development in China, employing decomposition methods and labour productivity ratios. The study concluded that labour reallocation in India moved primarily from agriculture into construction and services rather than manufacturing, signifying a distinct and growth-enhancing structural change (Ghosh, 2021). Focusing on the role of financial institutions, Haralayya and Aithal analysed how banking sector activities have influenced per capita GDP in India over the years. Utilizing regression models, they identified that variables like broad money supply and credit availability had positive economic effects, while inflation and high interest rates dampened GDP growth. This analysis underscored the importance of a well-functioning financial sector in facilitating economic development (Haralayya & Aithal, 2022).

Disparities in regional development have also been examined extensively. Preethi et al. applied the Weighted Mean Development Index (WMDI) to analyse socio-economic disparities among Kerala's districts. The study highlighted significant variations, with Ernakulam and Thiruvananthapuram ranking highly, while districts like Kasargode lagged (Preethi et al., 2022). In contrast, Padder et al. used polynomial regression functions to investigate structural transformation across Indian states, noting that middle- and lower-income states often diverged from the high-income states' growth paths, reflecting significant intra-state heterogeneity in development (Padder et al., 2022). Basole provided a cross-country comparative perspective on India's structural transformation, employing cross-country panel regression models to examine the efficiency of employment generation. The findings indicated that India's rate of labour movement out of agriculture was slower than in other developing countries, emphasizing the need for policies that generate more formal sector employment (Basole, 2022). Das et al. used clustering techniques like Wroclaw Taxonomy and K-means to assess regional disparities in India, identifying significant inter-state differences, with southern and western states outperforming northern and eastern regions. They emphasized the importance of targeted interventions for equitable growth (Das et al., 2022). Angelov introduced the "Square Theory of Economic Development," which focuses on five critical dimensions—resources, infrastructure, investment climate, human capital, and innovation—stressing the need for integrated policies to stimulate sustainable growth (Angelov, 2023). The analysis of Uttarakhand's economic landscape by Kutwal emphasized urbanization trends using spatial analysis and the Economic Development Index (EDI). This research revealed disparities among districts, pointing to the need for policies that address specific developmental lags (Kutwal, 2023). Patel et al. constructed composite indices to measure social, economic, and environmental disparities across Indian states, employing principal component analysis to propose interventions for underdeveloped areas, particularly in healthcare and education (Patel et al., 2023). In addition, Deb and Mukherjee focused on regional deprivation among Scheduled Tribes in eastern India, employing the Wroclaw Taxonomic method to quantify deprivation levels. The study found Odisha had the highest deprivation, while Jharkhand showed relatively better conditions, recommending enhanced regional and tribal development programs to address these gaps effectively (Deb and Mukherjee, 2024). Collectively, these studies emphasize the complexity of regional and sectoral economic transformations, the need for nuanced policy responses, and the importance of addressing disparities to achieve balanced and sustainable development.

Research Objectives

This study aims to:

1. Analyse the district wise sectoral development trends in Uttarakhand's economy.
2. Explore the regional inequalities across Uttarakhand's districts.

By employing a multi-sectoral approach, this research seeks to unveil the complexities of Uttarakhand's economic landscape and provide evidence-based recommendations for policymakers. It delves into various sectors, including agriculture, industry, services, banking, education, health, transportation, and communication, to construct a comprehensive understanding of economic transformations and their spatial dimensions.

Database and Methodology

Database

This study utilizes a comprehensive dataset to explore structural change and economic development across districts in Uttarakhand. Data sources include various government publications, census data of 2001 and 2011, and official district-wise statistical releases that provide insights into the economic performance of each district.

Indicators

Based on the objective of the study altogether sixty-two indicators are taken for three broad categories (Agriculture, Industries and service sectors) to do an in-depth study of the economic development of the state.

Table 1: List of Indicators

SECTOR	GROUP
Primary	Agriculture(AG)
Secondary	Industries(IN)
Tertiary	Banking(BS), Power(PS), Transportation and Communication(TC), Education(ES), Health(HS)

Methodology

To analyse level of economic development and structural changes across districts, this study employs a Factor Analysis (PCA method) and rank has been assigned to the thirteen districts of the state according to Composite Index value for categorising them as highly developed, moderately developed and low developed. Districts with high CI value has been assigned with high rank. Choropleth maps to show level of development and heat map to show structural shift for spatial representation have complemented the interpretation. In Choropleth mapping, each district is shaded according to its cluster assignment, showing the distribution of economic development levels. Three time periods has been adopted for the analysis 2010-11, 2015-16, and 2020-21.

The methodology involves the following steps:

1. Data Pre-processing and Normalization:

The **Z-score standardization** (also known as Z-score normalization or standard score) transforms the values of a variable into a common scale where the mean becomes 0 and the standard deviation becomes 1. The mathematical expression for the Z-score of a value X_i is:

$$Z_i = \frac{X_i - \mu}{\sigma}$$

Where:

- Z_i is the Z-score of the i -th value.
- X_i is the original value of the i -th observation.
- μ is the mean of the dataset.
- σ is the standard deviation of the dataset.

Missing values are addressed through interpolation methods or sourced from the latest available district-level estimates where direct data is unavailable.

2. Analysis of different levels of economic development: PCA was employed to develop a composite development index that combines multiple indicators into a single measure of overall development for each district (Filmer and Pritchett 2001).

Let us denote the component matrix as X , where X_{ij} represents the value of the j -th indicator for the i -th district. For m districts and n indicators, the matrix X is structured as:

$$X = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix}$$

Where:

- X_{ij} is the value of the j -th indicator for the i -th district.
- m is the total number of districts.

- n is the total number of indicators.

Weighted Composite Index: The Weighted Component Scores methodology ensures that the information captured by the most important components has a larger impact on the final Composite Index, enhancing the interpretability of the reduced-dimension representation.

a. Variance Explained by Principal Components:

Let the total variance in the dataset be explained by k principal components $PC_1, PC_2, \dots, PC_k$. The proportion of variance explained by each component is denoted as $v_1, v_2, \dots, v_k$, where:

$$v_i = \frac{\text{Variance of } PC_i}{\text{Total Variance}} \text{ such that } \sum_{i=1}^k v_i = 1$$

b. Component Scores:

Each principal component PC_i has an associated component score, denoted by FAC_i , for each observation. These scores represent the projection of the original data onto the corresponding principal component.

c. Weighting of Principal Components:

The idea is to assign weights to the component scores based on the proportion of variance explained by each PC. Therefore, the weight for PC_i is directly proportional to v_i , the variance it explains.

d. Formula for the Composite Index:

The Composite Index is calculated as the weighted sum of the component scores. If we use $w_i = v_i$ as the weight for each component, the Composite Index C can be expressed as:

$$C = \sum_{i=1}^k v_i \times FAC_i$$

3. Analysis of Economic Structural Shifts: The study further examines sectoral shifts by tracking changes in each district's economic structure across the three periods (2011, 2016, and 2021). The rank method based on sectoral growth rates (agriculture, industry, and services) is used to fulfil this objective.

Interpretation of Findings:

1. Analysis of different levels of economic development

The Table 2 provides a detailed ranking of thirteen districts in Uttarakhand based on various socio-economic indicators such as Agriculture, Industry, Banking Services, Power Sector, Transport & Communication, Educational Services, and Health Services. The districts are ranked in each category, and the total is computed by summing the ranks across all indicators. The Overall Ranking is based on the total, with a lower total score indicating higher overall development. Rank difference method has been used to fulfil the purpose.

Udham Singh Nagar ranks first overall, with a total score of twenty-four. This district excels across most sectors, securing top ranks in Agriculture, Industry, Banking Services, and Power Sector. The district's diverse and well-developed infrastructure is reflected in its consistently high performance, although it ranks lowest in Health Services. Districts such as Udham Singh Nagar, Haridwar, and Dehradun consistently performed well in other sectors, while demonstrated mixed or declining trends health sector. The primary issue stems from unfavourable outcome indicators, which are influenced by the geographic and demographic characteristics of these districts. Additionally, their health infrastructure, when adjusted for population, performs poorly. One of the reason for such poor performance could be that the indicator used in the health sector does not include private facilities.

Dehradun and Nainital share the second position with a total score of thirty each. Dehradun, the state capital, performs particularly well in Power Sector and Transport & Communication, which is expected given its status as an administrative and economic hub. However, its relatively low rank in Health Services suggests that there may be disparities in healthcare access. This could be due to the increase in population density during the study period. Nainital, a popular tourist destination, excels in Education Services and Health Services, reflecting its emphasis on social services. Both districts' balanced performance across various sectors secures their high overall rankings. Haridwar, ranked fourth with a score of thirty-seven, shows strength in Industry and Banking Services, positioning it as a vital industrial hub. However, it lags in Health Services, indicating the need for improvements in healthcare infrastructure. Almora, ranked fifth with a total score of forty-seven, performs exceptionally well in Agriculture and Transport & Communication, but struggles in Industry and Educational Services. This suggests that while the district has a strong agricultural base and good connectivity, it faces challenges in industrial growth and education. Tehri Garhwal and Pauri Garhwal ranked sixth and seventh respectively show mixed performance. Tehri Garhwal excels in Power Sector and Transport & Communication, while Pauri Garhwal performs well in Agriculture and Power Sector. Both districts, however, rank poorly in Health Services, indicating that healthcare development remains a pressing concern.

The bottom-ranking districts include Chamoli, Pithoragarh, and Uttarkashi, with Chamoli having the lowest overall score of seventy-two. These districts face significant challenges across multiple sectors. Chamoli ranks poorly in Industry, Power Sector, and Health Services, highlighting a lack of infrastructure development. Similarly, Pithoragarh and Uttarkashi rank low in Industry, Power Sector, and Health Services, which could be attributed to their remote locations and limited access to resources. Bageshwar and Champawat ranked ninth and tenth, respectively struggle in key sectors such as Power Sector and Health Services, reflecting developmental gaps that need to be addressed.

The analysis of district rankings reveals significant regional disparities in development across Uttarakhand. Udham Singh Nagar, Dehradun, and Nainital emerge as the most developed districts, owing to their strong infrastructure and diverse economic base. On the other hand, districts like Chamoli, Pithoragarh, and Uttarkashi face severe developmental challenges, particularly in industrial growth and healthcare services. Addressing these disparities through targeted interventions, especially in the less developed districts, could promote more balanced regional development across the state.

Table 2: Ranking of Districts 2010-2011

District	A G	CI Val ue	I N	CI Val ue	B S	CI Val ue	P S	CI Val ue	T C	CI Val ue	E S	CI Val ue	H S	CI Val ue	Tot al	O R [#]
Almora	2	235.81	13	127.72	10	153.02	8	148.92	3	232.85	10	162.94	1	269.74	47	5
Bageshwar	9	178.00	7	158.82	6	188.40	11	142.47	9	162.68	8	165.07	7	178.32	57	9
Chamoli	12	149.81	12	133.68	9	155.78	7	149.41	13	132.00	11	144.51	8	163.63	72	13
Champawat	10	162.09	4	169.15	4	192.57	13	135.60	12	137.77	5	191.02	11	132.75	59	10
Dehradun	8	192.43	3	219.39	3	201.73	2	255.26	1	318.66	3	226.84	10	159.06	30	2.5
Haridwar	3	226.54	1	351.75	2	289.16	10	147.98	7	193.43	2	313.49	12	112.03	37	4
Nainital	4	213.47	10	144.81	5	189.26	3	242.71	2	250.09	4	212.85	2	218.66	30	2.5
Pauri Garhwal	6	202.16	5	163.46	13	133.31	4	173.92	4	221.86	12	130.68	9	159.82	53	7
Pithoragarh	11	158.93	11	141.18	7	171.84	1	139.73	10	154.75	9	163.49	5	192.57	65	12
Rudrapur	5	206.00	6	162.95	11	151.88	9	148.78	8	179.19	1	120.77	3	203.54	55	8
Tehri Garhwal	7	199.96	9	148.73	8	156.79	5	173.07	6	211.35	7	166.91	6	186.38	48	6
Udham Singh Nagar	1	315.21	2	300.63	1	337.99	1	338.36	5	218.00	1	351.55	13	95.54	24	1
Uttarkashi	13	146.04	8	149.18	12	139.30	6	152.61	11	143.92	6	182.86	4	202.24	60	11

Source: Authors own calculation

#Overall Ranking

Table 3 shows that Udham Singh Nagar emerges as the most developed district, with an overall score of twenty-five. It consistently ranks first in Agriculture, Industry, and Banking Services, and performs strongly in Power Sector and Education Services. However, its low ranking in Health Services (thirteenth place) highlights a need for improvement in healthcare infrastructure. Despite this, the district's dominance in economic and public sectors secures its top position. Tehri Garhwal ranks second with a total score of thirty-eight, performing exceptionally well in Power Sector and Transport & Communication, where it ranks first. It also ranks high in Agriculture and Health Services, reflecting balanced development across both social and economic sectors. Nainital comes in third with a total score of forty. The district excels in Industry and Banking Services, indicating a robust economic structure. Nainital's high rank in Power Sector and Education Services further highlights its strength in social infrastructure, making it one of the most well rounded districts.

Haridwar, ranked fourth with a score of forty-one, leads in Industry and Power Sector, showing its importance as an industrial and administrative hub. However, its lower rank in Health Services (twelfth place) indicates significant healthcare challenges. Similarly, Dehradun, ranked fifth with a score of forty-three, shows strong

performance in sectors like Banking Services and Power Sector, but its lower rank in Health Services (eleventh place) also suggests a need for healthcare improvements.

Almora, with a score of forty-five, ranks sixth and performs consistently across most sectors, particularly in Agriculture and Transport & Communication. However, its relatively lower ranks in Banking Services and Power Sector suggest areas where development could be bolstered.

Chamoli, with a total score of seventy-one, ranks last (thirteenth overall), indicating significant underdevelopment across most sectors. The district struggles particularly in Industry, Banking Services, and Power Sector reflecting a lack of infrastructure and economic growth. Uttarkashi and Rudraprayag, ranked twelfth and joint tenth with scores of sixty-four and fifty-nine, respectively, face similar developmental challenges. Uttarkashi ranks poorly in Transport & Communication and Industry, suggesting remoteness and weak industrial growth. Rudraprayag, despite ranking second in Health Services, struggles significantly in Power Sector and Banking Services, pointing to uneven development. Pithoragarh also displays a mix of strengths and weaknesses, performing better in Agriculture and Banking Services, but lagging in Power Sector and Transport & Communication.

The Table 3 illustrates stark disparities in regional development across Uttarakhand. Udham Singh Nagar, Tehri Garhwal, and Nainital emerge as the most developed districts, with strong

Table 3: Ranking of Districts 2015-16

District	A G	CI Valu e	I N	CI Valu e	B S	CI Valu e	P S	CI Valu e	T C	CI Valu e	E S	CI Valu e	H S	CI Valu e	Tot al	O R#
Almora	2	248. 76	1 0	140. 95	11	160. 17	1 0	95.0 8	2	289. 71	6	159. 71	4	248. 59	45	6
Bageshw ar	7	214. 41	7	147. 30	5	190. 62	6	104. 38	1 2	149. 51	7	151. 91	5	232. 07	49	8
Chamoli	8	204. 55	1 3	124. 21	1 0	162. 40	1 2	92.7 5	9	162. 98	1 2	129. 05	7	207. 65	71	13
Champa wat	9	200. 22	8	145. 53	9	166. 43	7	103. 71	6	179. 96	8	145. 55	1 0	180. 65	57	9
Dehradu n	12	138. 71	4	203. 56	3	213. 67	5	119. 02	4	254. 92	4	204. 71	11	145. 75	43	5
Haridwa r	13	114. 83	1	355. 70	2	293. 69	1	400. 22	1 0	154. 69	2	306. 90	1 2	136. 57	41	4
Nainital	11	147. 05	3	206. 13	4	202. 70	3	174. 41	7	179. 60	3	205. 86	9	182. 21	40	3
Pauri Garhwal	5	224. 24	5	177. 67	1 3	148. 11	4	151.1 0	3	263. 23	1 3	122. 67	3	270. 88	46	7
Pithorag arh	4	227. 66	1 2	129. 58	7	181. 86	9	96.3 9	11	149. 75	1 0	133. 88	6	224. 83	59	10 .5
Rudrapr ayag	6	220. 09	9	142. 46	1 2	149. 46	1 3	85.2 9	8	177.1 1	9	136. 12	2	270. 95	59	10 .5
Tehri Garhwal	3	244. 29	6	160. 29	8	167. 90	8	97.0 4	1	299. 36	11	132. 16	1	292. 49	38	2
Udham Singh Nagar	1	320. 93	2	227. 69	1	354. 38	2	186. 37	5	209. 95	1	353. 79	13	119. 33	25	1
Uttarkas hi	1 0	187. 50	1 1	130. 59	6	190. 25	1 1	93.6 9	1 3	111.7 3	5	172. 21	8	203. 72	64	12

Source: Authors own calculation

Overall Ranking

infrastructure and economic growth. In contrast, Chamoli, Uttarkashi, and Rudraprayag lag significantly behind, with poor performance across key sectors such as industry, banking, and Power Sector. The rankings reflect the need for targeted policy interventions to address regional imbalances, especially in healthcare, Power Sector, and industrial development in the less developed districts.

Table 4: Ranking of Districts 2020-21

District	A G	CI Valu e	I N	CI Valu e	B S	CI Valu e	P S	CI Valu e	T C	CI Valu e	E S	CI Valu e	H S	CI Valu e	Tot al	O R#
Almora	6	173. 92	9	189. 49	1 0	150. 50	7	136. 04	1	311. 31	1 0	164. 27	3	261. 13	46	6

Bageshwar	8	170.72	8	195.23	7	171.55	13	105.87	9	168.87	9	164.29	8	236.11	62	10.5
Chamoli	13	129.38	13	130.08	12	140.46	12	106.97	7	194.67	6	187.73	1	293.09	64	13
Champawat	5	175.15	4	225.72	9	157.07	11	124.39	8	185.71	5	188.38	9	214.68	51	7
Dehradun	4	187.48	2	253.35	3	213.72	2	285.08	3	252.43	1	327.46	11	149.95	26	1
Haridwar	2	233.24	1	351.82	2	321.58	3	236.23	1	163.14	3	289.43	12	131.98	33	3
Nainital	3	208.00	10	169.23	5	197.56	4	168.95	5	217.08	4	267.48	10	170.98	41	4
Pauri Garhwal	11	147.92	7	205.06	13	114.06	10	128.69	2	271.27	11	153.81	7	249.02	61	9
Pithoragarh	10	149.36	11	162.25	8	168.30	9	133.32	12	129.44	8	183.21	5	251.01	63	12
Rudrapur	9	160.45	5	225.44	11	148.55	5	154.64	11	159.40	13	128.73	2	269.11	56	8
Tehri Garhwal	7	173.22	3	227.07	6	186.56	6	144.68	4	249.22	12	140.71	4	260.07	42	5
Udham Singh Nagar	1	337.37	6	211.69	1	347.18	1	326.80	6	195.68	2	326.73	13	127.47	30	2
Uttarkashi	12	129.41	12	140.22	4	203.72	8	134.96	13	114.76	7	187.67	6	249.23	62	10.5

Source: Authors own calculation

Overall Ranking

From the above Table 4, it was observed that Dehradun ranks first overall with a total score of twenty-six, highlighting a balanced and highly developed profile. It ranks in the top three in Industry, Banking Services, Power Sector, and Educational Services. However, it ranks relatively low in Health Services (eleventh), indicating that healthcare is an area where improvement may be needed. Nevertheless, its strength in multiple critical sectors, especially in education and Power Sector, secures Dehradun's top position as the most developed district. Udham Singh Nagar, ranked second with a total score of thirty, excels in Agriculture, Banking Services, and Power Sector, where it ranks first across these categories. However, its performance is hindered by its last-place rank in Health Services. This district reflects strong economic and infrastructural development but lags significantly in healthcare, indicating a clear area for policy intervention.

Haridwar, ranked third with a total score of thirty-three, shows strength in Industry, Banking Services, and Power Sector, indicating its position as a key industrial and financial hub. Like Udham Singh Nagar, Haridwar struggles in the Health Services sector, where it ranks twelfth, highlighting a developmental imbalance that policymakers should address. Nainital ranks fourth with a total score of forty-one, excelling in Agriculture, Power Sector, and Educational Services. However, its lower ranks in Industry and Health Services indicate that while Nainital is strong in infrastructure and Power Sector, its economic and healthcare systems need further development. Tehri Garhwal, ranked fifth with a score of forty-two, performs well in Banking Services and Power Sector, but is held back by its low rank in Educational Services (twelfth). Similarly, Almora, ranked sixth with a total score of forty-six, demonstrates a solid performance in Transport & Communication but faces challenges in Banking Services and Educational Services.

Pauri Garhwal, Rudrapur, and Champawat are ranked lower, with Pauri Garhwal showing particularly poor performance in Banking Service and Educational Services. These districts demonstrate imbalances, where strengths in certain areas such as Transport & Communication or Health Services are counteracted by underperformance in economic sectors like industry or banking.

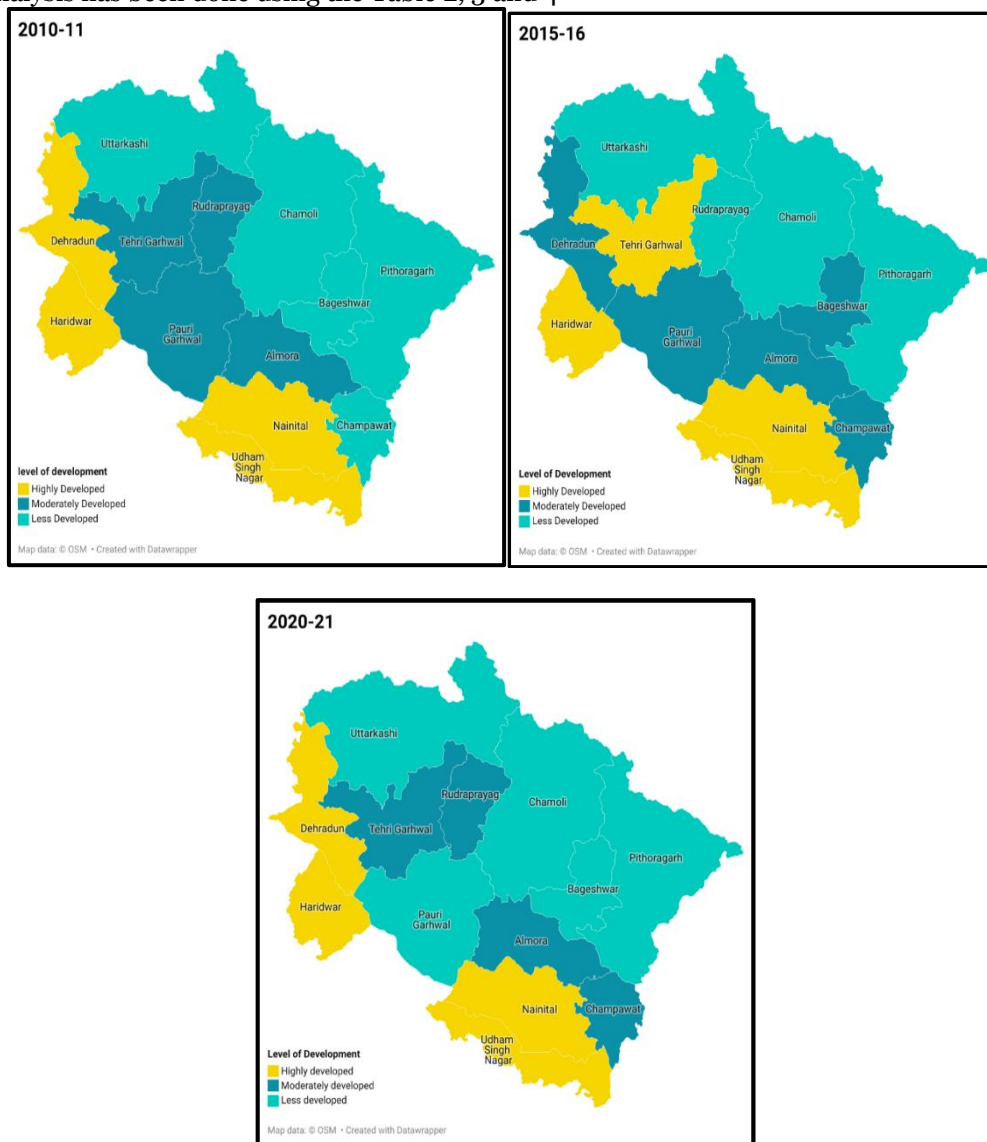
At the bottom of the rankings are Chamoli (thirteenth with a score of sixty-four) and Pithoragarh (twelfth with a score of sixty-three), both of which struggle across multiple sectors. Chamoli ranks last in Agriculture, Industry, and Banking Services, indicating severe infrastructural and economic deficiencies. Pithoragarh also shows underdevelopment in key areas such as Industry and Power Sector, reflecting its status as one of the least developed districts in the state.

The analysis highlights significant disparities in regional development across Uttarakhand's districts. Dehradun, Udham Singh Nagar, and Haridwar lead the rankings, thanks to their strong economic and infrastructural performance, while districts like Chamoli and Pithoragarh lag behind, facing challenges in multiple sectors. The lower-performing districts tend to struggle with industrial development and Power Sector, suggesting that these

areas require targeted policy interventions to foster growth that is more balanced across the state. Additionally, healthcare emerges as a critical issue in many districts, even among top performers, emphasizing the need for improvements in health infrastructure state wide.

Map 1: Choropleth map Displaying Level of Development among Districts

The spatial analysis has been done using the Table 2, 3 and 4



2. Analysis of Economic Structural Shifts:

Structural Change of Uttarakhand Economy: A District -wise Analysis

The sector-wise and year-wise analysis of district rankings in Uttarakhand from 2010 to 2021 offers a detailed view of the economic performance across various sectors, highlighting significant trends and structural shifts.

Primary Sector: Agricultural Sector (2010-2021)

In the **agricultural sector**, Udhampur Singh Nagar consistently held the top rank throughout the decade, establishing itself as the agricultural powerhouse of Uttarakhand. In 2010-11, Almora and Haridwar followed in second and third places, respectively. However, Chamoli and Uttarkashi ranked lowest, signalling their weaker agricultural productivity.

By 2015-16, Udhampur Singh Nagar maintained its position at the top, while Nainital experienced a significant drop to eleventh, and Haridwar fell even further to thirteenth. Despite these declines, districts such as Tehri Garhwal showed notable improvement, climbing to third place, demonstrating a positive shift in agricultural activities.

In 2020-21, Udhampur Singh Nagar continued to dominate, indicating its agricultural stability. Haridwar rebounded impressively to second place, and Dehradun showed substantial progress, moving from twelfth in 2015-16 to fourth in 2020-21. However, Chamoli dropped further to thirteenth, reflecting a continued decline in agricultural performance.

Structural Change (2010-2021): Throughout the decade, Udham Singh Nagar remained a consistent leader in agriculture. Meanwhile, Haridwar and Chamoli experienced significant fluctuations, with Chamoli consistently declining. Dehradun and Champawat showed improvements in recent years, suggesting a shift towards enhanced agricultural productivity in these regions.

Secondary Sector: Industrial Sector (2010-2021)

In the **industrial sector**, Haridwar consistently led, maintaining its top rank from 2010-11 through 2020-21. In 2010-11, Udham Singh Nagar and Dehradun followed in second and third places, respectively, while Almora and Chamoli ranked at the bottom, indicating limited industrial activity.

In 2015-16, Haridwar continued its leadership, with Dehradun and Nainital improving their rankings, reflecting growth in their industrial sectors. Udham Singh Nagar held its second position, while districts such as Chamoli remained at the lower end of the rankings.

By 2020-21, Haridwar retained its top position, and Dehradun moved up to second place, highlighting its industrial growth. Tehri Garhwal also showed significant improvement, climbing to third. On the other hand, Udham Singh Nagar dropped to 6th, signalling a decline in industrial activity and Chamoli continued to rank last.

Structural Change (2010-2021): Haridwar's dominance in the industrial sector remained unchallenged throughout the decade, while Udham Singh Nagar saw fluctuations, particularly a decline by 2020-21. Emerging industrial hubs such as Tehri Garhwal and Rudraprayag showed promising growth, suggesting their increasing industrial potential.

Tertiary Sector: Banking, Power, Transportation and Communication, Education, and Health (2010-2021)

In the **banking sector**, Udham Singh Nagar consistently ranked first from 2010-11 to 2020-21, followed by Haridwar and Dehradun. Pauri Garhwal and Almora consistently remained at the lower end, indicating limited banking infrastructure and access.

In the **power sector**, Udham Singh Nagar and Dehradun performed strongly in 2010-11, with Haridwar ranking low at 10th. By 2015-16, Haridwar improved significantly, taking the top position, while Dehradun fell to fifth. However, Udham Singh Nagar regained the first spot in 2020-21, with Haridwar dropping to third. Chamoli and Champawat showed limited improvements in the power sector over the years.

In the **transportation and communication sector**, Dehradun and Nainital led in 2010-11, followed closely by Almora, while Chamoli and Champawat ranked low. By 2015-16, Tehri Garhwal emerged as the leader, and Almora improved to second place. In 2020-21, Almora took the top spot, followed by Pauri Garhwal and Dehradun, indicating their well-developed transportation and communication infrastructure. Chamoli and Rudraprayag continued to struggle, reflecting weaker infrastructure development.

In the **education sector**, Udham Singh Nagar consistently ranked first in 2010-11 and 2015-16, followed by Haridwar and Dehradun. By 2020-21, Dehradun had overtaken Udham Singh Nagar, becoming the leader in educational infrastructure. Districts like Pauri Garhwal and Rudraprayag remained at the bottom throughout the period, indicating persistent challenges in educational development.

The **health sector** saw Almora ranked first in 2010-11, followed by Nainital and Rudraprayag. However, by 2015-16, Tehri Garhwal moved to the top position, with Almora falling to fourth. In 2020-21, Chamoli showed remarkable improvement, ranking first in healthcare services. Meanwhile, Haridwar and Udham Singh Nagar consistently ranked low, reflecting weaker healthcare infrastructure throughout the decade.

Overall Structural Shift (2010-2021): The data indicates a transition from reliance on the primary (agriculture) and secondary (industrial) sectors towards a more service sector. The analysis of district-wise sectoral development, structural changes, growth patterns, and regional inequalities in Uttarakhand reveals considerable disparities across the districts. The agricultural sector, for instance, shows that Udham Singh Nagar is highly developed, benefitting from superior infrastructure, irrigation, and favorable climate, while districts like Almora have faced setbacks, highlighting regional inequalities in agricultural productivity and infrastructure. In the industrial sector, growth is predominantly concentrated in Haridwar, Udham Singh Nagar, and Dehradun, where geographic advantages, industrial estates, and government policies have fostered development. Meanwhile, mountainous districts struggle to build an industrial base, deepening economic disparities.

The banking sector, similarly, is focused in the more developed districts, particularly Udham Singh Nagar and Haridwar, reflecting a gap in financial inclusion that hinders economic opportunities in rural and less-developed areas. Power access has improved, especially in the developed districts, yet differences in meeting the energy needs of both industrial and agricultural sectors persist, signaling a need for a more equitable energy distribution to support balanced growth. Transportation and communication infrastructure also remain uneven, with remote districts lagging in connectivity and market access, which further contributes to regional inequalities.

In the social infrastructure domain, while districts like Dehradun have made strides in education and Almora in healthcare, many other districts show limited progress, reflecting uneven development. These disparities are evident in the availability of healthcare professionals, educational facilities, and vocational training opportunities,

particularly in under-resourced areas. The economic transition in the state is marked by a structural shift towards service sectors in developed districts like Dehradun, Udham Singh Nagar, and Tehri Garhwal. However, some regions remain heavily reliant on agriculture, underscoring the need for a diversified economic strategy. The analysis underscores the persistent regional inequalities in Uttarakhand, with developed districts benefitting from stronger infrastructure, policy support, and market access, while remote and hilly regions face significant development challenges.

Heat map Showing Sectoral Shift among Districts during Study Period (2010-2021)

The heat map visually represents the sectoral shifts among districts in Uttarakhand between 2011 and 2021 across seven key sectors: Agriculture, Industry, Banking Sector, Power Sector, Transport & Communication, Education Sector, and Health Sector. Ranking method has been implemented to get the result. The color gradient, ranging from dark blue (improvement) to light blue (decline), illustrates the changes in rank for each district in each sector.

Map 2: Visual Display of Structural Change of Uttarakhand Economy from 2011-2021

District	AG	IN	BS	PS	TC	ES	HS
Almora	-4	4	0	1	2	0	-2
Bageshwar	1	-1	-1	-2	0	-1	-1
Chamoli	-1	-1	-3	-5	6	5	7
Champawat	5	0	-5	2	4	0	2
Dehradun	4	1	0	0	-2	2	-1
Haridwar	1	0	0	7	-3	-1	0
Nainital	1	0	0	-1	-3	0	-8
Pauri Garhwal	-5	-2	0	-6	2	1	2
Pithoragarh	1	0	-1	3	-2	1	0
Rudraprayag	-4	1	0	4	-3	0	1
Tehri Garhwal	0	6	2	-1	2	-5	2
Udham Singh Nagar	0	-4	0	0	-1	-1	0
Uttarkashi	1	-4	8	-2	-2	-1	-2

Legends



Created with Datawrapper

Source: Authors own calculation

Heat map has been created using the CI analysis (Map 1) to demonstrate the sectoral shift among districts from the period 2010-11 to 2020-21. The heat map highlights stark sectoral disparities across Uttarakhand's districts over the decade. Districts like Chamoli and Tehri Garhwal have shown significant sectoral shifts, both positively and negatively. Conversely, districts like Almora and Udham Singh Nagar face declines, especially in key areas like agriculture and education. These shifts suggest targeted development efforts are needed to balance the disparities across sectors and districts.

Conclusion

The analysis of district wise sectoral development and structural changes, in Uttarakhand reveals considerable disparities across the districts. The agricultural sector, for instance, shows that Udham Singh Nagar is highly developed, benefitting from superior infrastructure, irrigation, and favorable climate, while districts like Almora have faced setbacks, highlighting regional inequalities in agricultural productivity and infrastructure. In the industrial sector, growth is predominantly concentrated in Haridwar, Udham Singh Nagar, and Dehradun, where geographic advantages, industrial estates, and government policies have fostered development. Meanwhile, mountainous districts struggle to build an industrial base, deepening economic disparities.

The banking sector, similarly, is focused in the more developed districts, particularly Udham Singh Nagar and Haridwar, reflecting a gap in financial inclusion that hinders economic opportunities in rural and less-developed areas. Power access has improved, especially in the developed districts, yet differences in meeting the energy needs of both industrial and agricultural sectors persist, signaling a need for a more equitable energy distribution to support balanced growth. Transportation and communication infrastructure also remain uneven, with remote districts lagging in connectivity and market access, which further contributes to regional inequalities.

In the social infrastructure domain, while districts like Dehradun have made strides in education and Almora in healthcare, many other districts show limited progress, reflecting uneven development. These disparities are evident in the availability of healthcare professionals, educational facilities, and vocational training opportunities, particularly in under-resourced areas. The economic transition in the state is marked by a structural shift towards service sectors in developed districts like Dehradun, Udham Singh Nagar, and Tehri Garhwal; however, some regions remain heavily reliant on agriculture, underscoring the need for a diversified economic strategy.

Overall, the analysis underscores the persistent regional inequalities in Uttarakhand, with developed districts benefitting from stronger infrastructure, policy support, and market access, while remote and hilly regions face significant development challenges. These findings indicate the importance of implementing targeted policies that promote infrastructure development, enhance financial inclusion, and support industrial growth in lagging districts, fostering a more inclusive growth pattern across the state.

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