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Determinants of District-level Human Development in Eastern Uttar Pradesh: An Empirical Evidence from Regression Analysis

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Abstract

The human development approach focuses on three essential capabilities: living a long and healthy life, acquiring knowledge and enjoying a decent standard of living. These capabilities enable individuals to participate meaningfully in social, economic and political life. This study relies on secondary data compiled from various government sources to highlight the performance of HDI and its dimension of 28 districts of Eastern Uttar Pradesh. This paper analyses HDI performance along with dimension-wise performances of Eastern Uttar Pradesh. Using regression, the study further explores the determinants of HDI and the findings provide insights into which HDI dimensions contribute the most in improving human development in Eastern Uttar Pradesh. The evidence of the research paper shows that most of the districts of Eastern Uttar Pradesh under low human development category and health dimension plays a better role in Human Development performance in districts of Eastern Uttar Pradesh.

Keywords: Human Development Index (HDI), Health Index (HI), Education Index (EI), Standard of living Index (SI), Regression Coefficients, Eastern Uttar Pradesh

1. Introduction

Human development is a people-centred approach to development that emphasizes expanding human capabilities, freedoms and choices. Unlike traditional development models that equate development with economic growth, human development focuses on improving the overall quality of life. The concept gained global recognition with the first Human Development Report published by the United Nations Development Programme (UNDP) in 1990, drawing significantly from the ideas of Nobel laureate Amartya Sen (Sen A, 1999; UNDP 1990). In a diverse and developing country like India, the human development approach is particularly relevant due to wide regional, social, and economic disparities. In the Indian context, human development goes beyond increasing national income to addressing issues such as poverty, illiteracy, malnutrition, unemployment, gender inequality and unequal access to basic services (UNDP 2023). India has experienced rapid economic growth since economic reforms in 1991; however, this growth has not always translated into equitable improvements in human well-being. This highlights the distinction between economic growth and human development.

Health is a critical dimension of human development in India. Life expectancy has improved over time due to better healthcare facilities, immunization programs and disease control measures. Government initiatives such as the National Health Mission (NHM), Ayushman Bharat – Pradhan Mantri Jan Arogya

Yojana (PM-JAY) and Janani Suraksha Yojana aim to improve access to healthcare, particularly for the poor and rural population. Education plays a vital role in expanding human capabilities. India has made significant progress in improving literacy rates since independence. Programs such as Sarva Shiksha Abhiyan, Right to Education (RTE) Act, 2009, Mid-Day Meal Scheme and Samagra Shiksha Abhiyan have increased school enrolment and reduced dropout rates, particularly at the primary level. The income dimension reflects access to resources necessary for a decent standard of living. India's per capita income has increased over time but income inequality remains a major concern. A large section of the population continues to depend on informal employment with low and unstable incomes. Government schemes such as MGNREGA, Pradhan Mantri Awas Yojana, Public Distribution System (PDS) and Direct Benefit Transfer (DBT) aim to improve living standards and reduce poverty. While poverty levels have declined, multidimensional poverty characterized by deprivation in health, education and living conditions remains significant in many parts of the country.

Human development in India also involves broader dimensions such as gender equality, social inclusion, political participation and environmental sustainability (UNDP 2025, Down to Earth). These dimensions highlight the interconnected nature of development in India. Human development in India is a complex and ongoing process shaped by economic growth, social policies, and institutional effectiveness. While India has made notable progress in health, education, and income, persistent inequalities and regional imbalances remain major challenges. Sustainable human development in India requires inclusive policies, improved governance, increased public investment in social sectors and active participation of citizens(UNDP 2025, Vajiram & Ravi, 2025). Ultimately, the success of development should be judged not by economic indicators alone, but by the extent to which all Indians are able to live healthy, educated and dignified lives.

2. Literature Review

Several empirical studies have highlighted the importance of human development in explaining variations in income growth and poverty reduction. Shiri et al. (2023)[1] in their research paper titled with "The effect of Human Development Index on obesity prevalence at the global level" examine the relationship between HDI and obesity across 152 countries. Using country-level data from 2000–2019 and applying a Spatial Bayesian Hierarchical model, the study finds a significant positive association between HDI and obesity prevalence. The results indicate that as countries move from low to high HDI, obesity rates increase by about 7.45 percent. The study also reports that urbanization, internet use, alcohol consumption, milk intake, middle-aged population share and depression positively influence obesity prevalence. In contrast, higher consumption of fruits and vegetables and smoking rates show a negative association with obesity. The findings highlight that economic and social development can bring unintended health challenges. The authors emphasize that public health policies must address lifestyle-

[1] Shirvani Shiri M, Emamgholipour S, Heydari H, Fekri N, Karami H. The Effect of Human Development Index on Obesity Prevalence at the Global Level: A Spatial Analysis. Iran J Public Health. 2023 Apr;52(4):829-839. doi: 10.18502/ijph.v52i4.12456. PMID: 37551189; PMCID: PMC10404321.

related risks accompanying higher human development. Shraddha Jain (2020) [2] had published an article in Indian Journal of Human Development that discusses the advancements made in the capability approach using the gender lens and the policy framework intended to address gender inequality. In her article, it had been discussed the case of Kerala state to understand the complex nature of human development. This article talked about the state made strides in education and health, but rising inequalities, gender violence and ecological changes remain major concerns. Sajith and Malathi (2020) [3] had published this article in The Indian Economic Journal that examines the contribution of the income component in the HDI index by recalculating the composite matrix. This article also qualitatively examines the ability of HDI index to measure the human development parameters. Shalini Saksena and Moumita Deb (2017)[4] examined the linkages between EG AND HD in the two decades (1990-2010) after Economic Reform era. In his empirical study, the study has classified into four categories based upon growth and development that is vicious cycle, virtuous cycle, lopsided EG, lopsided HD. The following study had been done for knowing the transition of states and policy implications. Sheetal Mundra and Manju Singh (2017) had published their article in International Journal of Indian Culture and Business Management that examines the impact of the growth (GSDP) on an HDI score for selective states of India and also tries to explore the disparities among different Indian states on selective HDI indicators. The poor performance and disparities of the human indicators across the states highlight the fact that economic benefits arising out of the process of development failed in raising the human development in India and across the states. Ranbir Singh (2012)[5] in the International Journal of Marketing and Technology, examines the interrelationship between Human Development Index (HDI), per capita income, and poverty reduction across 15 major Indian states and selected Asian nations. The study empirically establishes that higher per capita income and improved human development significantly contribute to lowering poverty ratios. Using correlation and regression analysis, the paper highlights a strong and strengthening linkage among HDI, income growth, and poverty reduction over time. The findings indicate that states with better human development outcomes experience a sharper decline in poverty levels. Despite noticeable progress in poverty reduction, the study underscores persistent inter-state disparities in India. The study concludes that enhanced social sector spending and employment generation are crucial for sustainable poverty alleviation through human development.

On the basis of above discussion, it is clear that many research works are done regarding Human Development at national level and sub-national level. But there is no such research work has been done at Eastern Uttar Pradesh.

[2] Jain, S. (2020). Human development, gender and capability approach. *Indian Journal of Human Development*, *14*(2), 320-332.

[3] Sajith, G. G., & Malathi, K. (2020). Applicability of human development index for measuring economic well-being: a study on GDP and HDI indicators from Indian context. *The Indian Economic Journal*, *68*(4), 554-571.

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[5] Singh, R. (2012). Human development index and poverty linkages. *International Journals of Marketing and Technology*, *2*(5), 219-230.

3. Objective

The objectives of the study are:

- ❖ To analyse and ranking the HDI Dimension wise performance (Health, Education & Standard of Living and Income Dimension) of Eastern Uttar Pradesh.
- ❖ To find out the responsive factors for HDI in Eastern Uttar Pradesh.

Hypothesis of the study

H01: There is no significant relationship between Health dimension and HDI.
H02: There is no significant relationship between Education dimension and HDI.
H03: There is no significant relationship between Standard of living dimension and HDI.
Results are interpreted using regression coefficients, R square value and p-values to identify which dimension significantly influence HDI of Eastern Uttar Pradesh.

Data Source & Methodology

This study is mainly an Analytical and Descriptive in nature. The study is based upon the secondary data. The study seeks to compare the HDI Dimension wise performance (Health, Education & Standard of Living Dimension) of 28 districts of Eastern Uttar Pradesh at the one point of time i.e. 2022-23 respectively as per availability of data from respective data sources. The study considers the HDI Dimension wise performance (Education, Health & Standard of Living and Income Dimension) of Eastern Uttar Pradesh on the basis of significant fourteen variables. To analyse the educational performance, five variables have been taken and for health performance, four variables have been taken & rest of five variables for Standard of Living and Income Dimension from National Family Health Survey (NFHS) 5, Districtwise Development Indicators, Economics and Statistics Division, State Planning Institute, Planning Department, Uttar Pradesh.

Box 1: Indicators for different dimensions of Human Development Index (HDI) of Eastern Uttar Pradesh

Parameter	Variable
Health Dimension	Sex Ratio
	Households with any usual member covered under a health insurance/financing scheme (%)
	Children age 6-59 months who are anaemic (<11.0 g/dl) (%)
	All women age 15-49 years who are anaemic (%)
Education Dimension	Children age 5 years who attended pre-primary school during the school year 2019-20 (%)
	No. of School per lakh of population in J.B.S.
	Pupil Teacher ratio at different educational levels in J.B.S.
	Student Enrolment ratio in JBS
	Drop out rate in JBS
Standard of Living Dimension	Population living in households with electricity (%)
	Population living in households with an improved drinking-water source (%)
	Population living in households that use an improved sanitation facility (%)
	Households using clean fuel for cooking (%)

	Per capita net domestic product {at current prices)
Human Development Index (HDI)	**Health Index (HI)** **Education Index (EI)** **Standard of Living Index (SI)**

Methodology for Computation of Indices:

The study aims at computing different dimensional indices for education, health & income performance of 28 districts of Eastern Uttar Pradesh. Assuming equal weight of variables, weighted average of respective dimensios have been calculated for Education Index (EI), Health Index (HI) and Standard of living Index (SI) and then using them to compute the multidimensional HDI index by applying the formula as geometric mean of equally weighted of three-dimension indices. The methodology for preparing the indices is as under:

For positive variables,

$$\textbf{Normalisation Index Value of variable } (NV_{ij}) = \frac{X_{ij} - X_{min}}{X_{max} - X_{min}}$$

where

X_{ij} stands for actual value of ith variable of jth district;

X_{min} stands for minimum value of ith variable of jth district;

X_{max} stands for maximum value of ith variable of jth district.

While **for negative variables,**

$$\textbf{Normalisation Index Value of variable } (NV_{ij}) = 1 - \frac{X_{ij} - X_{min}}{X_{max} - X_{min}}$$

After normalisation of variables, dimension-wise index has been calculated by taking the equally weighted average of normalised index value of variables under dimension i.e.

Weighted average of Dimension-wise Index Value = 1/n $(\sum_{i=1}^{n} NVij)$

where n- number of variables under dimension.

Human Development Index (HDI) Formula

The HDI is calculated as the geometric mean of three-dimension indices: Health Index (HI), Education Index (EI) and Standard of living Index (SI).

$$\textbf{HDI} = [\textbf{ HI* EI* SI}]^{1/3}$$

Indices calculated for the dimension wise performance & HDI index on the basis of above formula lies in between 0 to 1. Districts are then ranked according to Dimension wise as well as HDI indices value. The study further examines through a linear regression model used to estimate the effect of the independent variables (different HDI dimensions) on dependent variables, HDI. The model is specified as;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

where

Y = Human Development Index (HDI)

X_1 = Weighted average of Health Index (HI)

X_2 = Weighted average of Education Index (EI)

X_3 = Weighted average of Standard of Living Index (SI)

β_0 = Intercept

β_1, β_2, β_3 = Coefficients for X_1, X_2, X_3

Analysis and Discussion of the study

The analysis and discussion of the study are in the following manners**:**

Section A: Rankings of districts in terms of Dimension-wise and HDI value

The table 1 represents a comparative analysis of districts based on Health Index, Education Index, Standard of living Index and overall Human Development Index (HDI). It highlights significant inter-district disparities. Among the top performers, Amethi (0.6847) ranks first, followed by Kushinagar (0.6350), Prayagraj (0.6176) and Pratapgarh (0.5699), indicating better healthcare access and outcomes. While, Ballia (0.1413) ranks lowest, followed by Balrampur (0.1763), Bahraich (0.1777) and Ghazipur (0.2598), reflecting serious health infrastructure and service gaps. With education dimension, Sultanpur (0.7288) leads in education, followed by Sonbhadra (0.6517), Shrawasti (0.6484) and Amethi (0.5456), suggesting higher literacy and educational attainment. The bottom performers are Ghazipur (0.2930), Jaunpur (0.3327), Mahrajganj (0.3615) and Ambedkar Nagar (0.3656), indicating weak educational outcomes. Similarly, Varanasi (0.8957) ranks highest, followed by Gorakhpur (0.7889), Deoria (0.6954) and Mahrajganj (0.6734), reflecting better income levels and living conditions. The lowest ranks are held by Bahraich (0.3026), Balrampur (0.3773), Shrawasti (0.3906) and Kaushambi (0.3981) showing poor economic conditions and limited access to basic amenities.

In overall HDI, Sultanpur (0.5888) ranks first, followed by Amethi (0.5764), Deoria (0.5583) and Kushinagar (0.5423), due to balanced performance across all three dimensions. At the lower end, Bahraich (0.3069) ranks last, followed by Ballia (0.3197), Balrampur (0.3261) and Ghazipur (0.3385) indicating multidimensional deprivation. The study finds that Amethi remain best performer among three dimension-wise indices value and HDI value while Balrampur, Ghazipur and Bahraich poor performer among three dimension-wise indices value and HDI value of 28 districts of Eastern Uttar Pradesh. According to UNDP HDI categorisation of districts, Sultanpur - 0.5888, Amethi - 0.5764 and Deoria -0.5583, 3 out of 28 districts have been categorised under medium human development of range between 0.550 to 0.699 while

rest of 25 districts are categorised under low human development of range below 0.550 (see annexure 2). The study finds out wide regional disparities in human development. Districts performing poorly in HDI also show weak outcomes in health, education and standard of living. This underscores the need for targeted policy interventions to reduce inequalities and promote inclusive development.

Table 1: Top and bottom four districts of Eastern Uttar Pradesh in terms of Dimension-wise and HDI value

Top 4 districts			**Bottom 4 districts**		
Rank	**Districts**	**Health Index**	**Rank**	**Districts**	**Health Index**
1	Amethi	0.6847	1	Ballia	0.1413
2	Kushinagar	0.6350	2	Balrampur	0.1763
3	Prayagraj	0.6176	3	Bahraich	0.1777
4	Pratapgarh	0.5699	4	Ghazipur	0.2598
Rank	**Districts**	**Education Index**	**Rank**	**Districts**	**Education Index**
1	Sultanpur	0.7288	1	Ghazipur	0.2930
2	Sonbhadra	0.6517	2	Jaunpur	0.3327
3	Shrawasti	0.6484	3	Mahrajganj	0.3615
4	Amethi	0.5456	4	Ambedkar Nagar	0.3656
Rank	**Districts**	**Standard of living Index**	**Rank**	**Districts**	**Standard of living Index**
1	Varanasi	0.8957	1	Bahraich	0.3026
2	Gorakhpur	0.7889	2	Balrampur	0.3773
3	Deoria	0.6954	3	Shrawasti	0.3906
4	Mahrajganj	0.6734	4	Kaushambi	0.3981
Rank	**Districts**	**HDI Value**	**Rank**	**Districts**	**HDI Value**
1	Sultanpur	0.5888	1	Bahraich	0.3069
2	Amethi	0.5764	2	Ballia	0.3197
3	Deoria	0.5583	3	Balrampur	0.3261
4	Kushinagar	0.5423	4	Ghazipur	0.3385

Source: Compiled by author based on available data, NFHS 5 (2019-21) and Districtwise Development Indicators, 2024 (see annexure 1)

Section B: Responsive factor for Human Development Index

The table 2 and 3 represents Pearson correlation analysis and regression model summary together, provide a comprehensive understanding of the relationship between HDI and its components such as Health Index (HI), Education Index (EI) and Standard of Living Index (SI). The very high multiple correlation coefficient (R = 0.994) in the regression model is consistent with the strong positive Pearson correlation between HDI and Health Index (r = 0.877) and the moderate positive correlation between HDI and Standard of Living Index (r = 0.509). These strong associations contribute significantly to the model's ability to explain variations in HDI. The R Square value of 0.989 indicates that 98.9% of the variation in

HDI is explained by the three indices together. This high explanatory power reflects the combined influence observed in the correlation matrix, particularly the dominant role of health, supported by standard of living. Although the Education Index shows a weak positive correlation with HDI (r = 0.140), its inclusion in the regression model still contributes to the overall explanatory strength when combined with health and living standards. This suggests that education may have an indirect or long-term effect on HDI rather than a strong immediate linear impact.

The low or moderate inter-correlations among independent variables such as the weak correlation between Health and Education (r = –0.081) and the moderate negative correlation between Education and Standard of Living (r = –0.475) indicate limited multicollinearity. This regression summary supports the stability and reliability of the regression coefficients and explains why the Adjusted R Square (0.987) remains close to R Square. The highly significant F-statistic (F = 688.791, p < 0.001) aligns with the strong correlations observed between HDI and its key components. Additionally, the Durbin–Watson value of 2.151 confirms the absence of autocorrelation, strengthening confidence in both the correlation and regression findings. In conclusion, the correlation analysis identifies the strength and direction of relationships, while the regression model confirms their combined explanatory power. Both analyses consistently show that Health Index is the most influential determinant of HDI, followed by Standard of Living, with Education Index playing a supportive but weaker role. Together, they validate the robustness of the HDI model and highlight the need for integrated development policies.

Table 2: Pearson correlation matrix of different dimensions of HDI and HDI

lations					
		HDI	**Health Index**	**Education Index**	**Standard of Living Index**
Pearson Correlation	**HDI**				
	Health Index (HI)				
	Education Index (EI)				
	Standard of Living Index (SI)				

Source: Compiled by author based on available data, NFHS 5 (2019-21) and Districtwise Development Indicators, 2024

Table 3: Model summary matrix of different dimensions of HDI and HDI

l Summary[b]										
		Square	**Adjusted R Square**	**Std. Error of the Estimate**	**ge Statistics**					**Durbin-Watson**
					R Square Change	**Change**	**1**	**2**	**Sig. F Change**	
	4[a]			5		)1				
a. Predictors: (Constant), Health Index, Education Index, Standard of Living Index										
b. Dependent Variable: HDI										

Source: Compiled by author based on available data, NFHS 5 (2019-21) and Districtwise Development Indicators, 2024

Table 4 represents the results of the multiple linear regression analysis examining the impact of the Health Index (HI), Education Index (EI) and Standard of Living Index (SI) on the Human Development Index (HDI). The regression coefficients indicate that all three explanatory variables exert a positive and statistically significant influence on HDI at the 1% level. $\mathbf{Y_{HDI} = -0.013 + 0.403X_1 + 0.324X_2 + 0.283X_3}$ is a linear regression model of Human Development Index (HDI) of Eastern Uttar Pradesh

The Health Index shows the strongest effect, with an unstandardized coefficient (B) of 0.403 ($t = 33.67$, $p < 0.001$). This implies that, holding other factors constant, a one-unit increase in the Health Index leads to a 0.403 unit increase in HDI. The standardized coefficient ($\beta = 0.771$) further confirms that health is the most influential determinant of HDI among the variables considered. The Education Index also demonstrates a significant positive relationship with HDI, with a coefficient value of 0.324 ($t = 17.536$, $p < 0.001$). This suggests that improvements in educational attainment contribute substantially to human development outcomes. However, the standardized beta value ($\beta = 0.437$) indicates that its relative impact is weaker than that of health and standard of living. Similarly, the Standard of Living Index has a positive and statistically significant effect on HDI ($B = 0.283$, $t = 19.079$, $p < 0.001$). The standardized coefficient ($\beta = 0.494$) shows that standard of living exerts a stronger influence on HDI than education, though it remains less influential than health. The constant term is negative and statistically insignificant ($B = -0.013$, $p = 0.392$), suggesting that in the absence of the explanatory variables, HDI does not differ significantly from zero. This result has limited substantive relevance given the composite nature of HDI.

Table 4: Linear regression analysis matrix of different dimensions of HDI and HDI

Coefficients[a]							
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**95.0% Confidence Interval for B**	
	B	**Std. Error**	**Beta**			**Lower Bound**	**Upper Bound**
(Constant)	-0.013	0.014		-0.871	0.392	-0.042	0.017
Health Index (HI)	0.403	0.012	0.771	33.67	0	0.378	0.428
Education Index (EI)	0.324	0.018	0.437	17.536	0	0.286	0.362
Standard of Living Index (SI)	0.283	0.015	0.494	19.079	0	0.253	0.314
a. Dependent Variable: HDI							

Source: Compiled by author based on available data, NFHS 5 (2019-21) and Districtwise Development Indicators, 2024

4. Conclusions

The study presents that the dimension-wise and HDI performance of 28 districts of Eastern Uttar Pradesh at one point of time 2022-23 and finds out the responsive determinants of HDI of Eastern Uttar Pradesh. The study finds that Amethi remain best performer among three dimension-wise indices value and HDI value while Balrampur, Ghazipur and Bahraich poor performer among three dimension-wise indices value and HDI value of 28 districts of Eastern Uttar Pradesh. According to UNDP HDI categorisation of districts, 3 districts (Sultanpur - 0.5888, Amethi - 0.5764 and Deoria -0.5583), out of 28 districts have been

categorised under medium human development of range between 0.550 to 0.699 while rest of 25 districts are categorised under low human development of range below 0.550 (see annexure 2). The findings of the correlation and regression analyses identifies the Health Index is the key determinants influencing human development index (HDI), followed by Standard of living Index as second most significant contributor. In contrast, role of Education Dimension is not showing responsible for district's HDI of Eastern Uttar Pradesh. Health facilities should be provided in those districts which has low HDI value especially Bahraich, Ballia, Balrampur and Ghazipur.

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Annexure

Annexure 1: Dimension-wise and Human Development Index (HDI) of 28 districts of Eastern Uttar Pradesh

S.No.	Districts	Health Index (HI)	Education Index (EI)	Standard of living Index (SI)	HDI
1	Pratapgarh	0.5699	0.5057	0.4094	0.4905
2	Kaushambi	0.3545	0.4156	0.3981	0.3885
3	Prayagraj	0.6176	0.4238	0.5788	0.5331
4	Faizabad	0.4338	0.4462	0.6062	0.4896
5	Ambedkar Nagar	0.5417	0.3656	0.5360	0.4735
6	Sultanpur	0.5174	0.7288	0.5415	0.5888
7	Amethi	0.6847	0.5456	0.5126	0.5764
8	Bahraich	0.1777	0.5376	0.3026	0.3069
9	Shrawasti	0.4019	0.6484	0.3906	0.4669
10	Balrampur	0.1763	0.5212	0.3773	0.3261
11	Gonda	0.3701	0.5286	0.4843	0.4558
12	Siddharth Nagar	0.2840	0.5348	0.4442	0.4071
13	Basti	0.5691	0.3782	0.6654	0.5232
14	Sant Kabir Nagar	0.5334	0.3799	0.6310	0.5038
15	Mahrajganj	0.5086	0.3615	0.6734	0.4984
16	Gorakhpur	0.3418	0.4507	0.7889	0.4953
17	Kushinagar	0.6350	0.3949	0.6363	0.5423
18	Deoria	0.5616	0.4456	0.6954	0.5583
19	Azamgarh	0.3391	0.5076	0.5984	0.4687
20	Mau	0.3778	0.3828	0.6601	0.4570
21	Ballia	0.1413	0.4297	0.5383	0.3197
22	Jaunpur	0.4940	0.3327	0.6164	0.4662
23	Ghazipur	0.2598	0.2930	0.5096	0.3385
24	Chandauli	0.4613	0.4704	0.5312	0.4867
25	Varanasi	0.3584	0.4027	0.8957	0.5056
26	Bhadohi	0.5388	0.4248	0.5404	0.4982
27	Mirzapur	0.4327	0.4369	0.5813	0.4790

28	Sonbhadra	0.4262	0.6517	0.4305	0.4927

Source: Compiled by author based on available data, NFHS 5 (2019-21) and Districtwise Development Indicators, 2024

Annexure 2: Categorisation of districts on the basis of UNDP Human Development achievements

Very high human development	0.800 and above
High human development	0.700–0.799
Medium human development	0.550–0.699
Low human development	Below 0.550

Source: HDR 2023, UNDP