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SPATIAL DECISION SUPPORT SYSTEM FOR QUALITY EDUCATION IN UTTAR PRADESH

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Abstract

The decision support system is a query-based system that uses a variety of information for decision making, thus, helping decision-makers. Education plays a vital role in the socio-economic development of any country. For this purpose, the educational system should be well evaluated. The aggregate rate of literacy of the state of Uttar Pradesh (U.P.) has increased during 2001-2011, but disparities in literacy based on gender, urban-rural areas, and sectors have served as deterrents in achieving equitable and quality education. The present study undertakes a multifaceted investigation of the literacy in all the districts of U.P. and its spatial patterns based on census data of 2011 in order to understand the disparity in male and female levels of literacy as well as at the level of rural and urban areas. This paper analyzes the education system in U.P. by utilizing a decision support system for efficient evaluation. The maximum number of districts exhibits lesser Sopher Disparity index (SDI); lesser SDI indicates high Disparity, and vice-versa. There is a wide variation from rural to urban literacy rate. It is also observed that the urban-rural differential indices in the state are relatively higher in the eastern and southern districts compared to the western and central districts.

Key Words: Gender Disparity in Literacy; Decision Support System; Urbanization; Urban-Rural Differential; DSS.

Introduction

Education facilitates the development of humankind and enhances quality learning all through life among people of different genders, age groups, castes, creeds, regions, and religions. In India, a person is called literate if he is more than six years old and able to read, write and understand in any language (Biswas, 2016). Education is one of the crucial three constituents of the Human Development Index and strongly affects the life expectancy and per capita income .The fourth sustainable development goal

established by the United Nations (UN) focuses on equitable quality education. It aims at providing complete free, equitable, and quality education to all individuals up to the secondary level by 2030. To achieve this target, it is required to reduce the different disparities present in literacy such as the male-female differential, rural-urban differentials, etc.

Uttar Pradesh (U.P.) is the fifth largest and most populous state in the country, with a population density of 828 persons per square kilometer, accounting for 16.16 percent of the total population that is still increasing with a higher rate. The literacy rate of the state has increased from 2001 to 2011, but it still lags in the level of literacy. Although the overall literacy rate of U.P. has increased by 5.70 percent and reached 67.68 percent, it is still much below the national average (74.07 percent). It also lags on other parameters like male-female, rural and urban literacy significantly. The overall rate of literacy is 67.68 percent, while the rate of literacy for men is 77.28 percent and for women is 57.18 percent. This implies that more than one-fourth of the state's population is still illiterate (2011). The literacy rate among males living in the rural area is around 76 percent while in urban areas, it is 80 percent, whereas the literacy rate among females living in the rural area is 48.48 percent and 61 percent in urban areas.

The state of Uttar Pradesh exhibits huge spatial distribution and a growing rate of population, thus possess high possibilities for disparities not only throughout the region but also among different population groups. Besides regional disparities, other scopes of disparities like gender disparities, rural-urban disparities, social group inequalities, disparities in the level of education, also have been evident in literacy. The differential transformation occurring in towns and villages is the fundamental cause of urban-rural disparity. Most of the advanced scientific innovations take place in urban areas likewise literacy is not far from this. It dispersed into the countryside based on the intensity of interaction between rural and urban populations which can be enhanced by government initiatives (Shafiqullah, 2011). Social disparities lead to disparities in the utilization of educational facilities. These disparities are uneven across regions. Thus, due to disparity in the level of literacy across regions, there is a need to identify the most vulnerable regions to keep it in the top priority to provide quality education and bridging regional and social disparities. This necessitates a comprehensive understanding of spatial as well as temporal variations in literacy.

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With technological advancements currently, massive amount of data can be analyzed in order to be compiled in comprehensive information that can be used for solving critical problems. A decision support system, which is an information system generally found in the form of a computerized program, can be used to support determinations and may help in organizational decision-making activities (Mahmood, 1977; Sopher, 1974; Tripathi, 2011). Several authors have implemented the concept of a decision support system to solve problems related to the education system of India and around the world (Kotsiantis, 2012; Mishra and Singh, 2015; Penn and Collier, 1985; Raju, 1991; Shafiqullah, 2011; Shukla and Mishra, 2014; Siddique, 1977; Sundaram and Vanneman, 2008; Tripathi, 2011). Some of the authors have used this method to highlight the disparity among different groups of society (Chakraborty, 2013; Roy and Mondal, 2015; Sopher, 1980;).

This paper is an attempt to analyze patterns and level of literacy and provides an understanding of the level of literacy not only throughout different regions but also gender-based and rural-urban divide. This is an attempt to map and analyze gender disparity in literacy throughout the districts of U.P. and indicates the future projection of the level of literacy bridging the larger gender gap across districts. Thus the present work examines the variation in the female literacy rates through different districts. The paper also focuses on the spatial aspects of the literacy gap between rural-urban areas and educational level disparity in literacy rate. It facilitates to identify priority areas for decision making regarding equitable quality education.

Study Area

Uttar Pradesh, the heartland of India, lies in the latitude 23° 52' to 30° 28' North and longitude 77° 04' to 84° 38' East (Fig 1). The state is currently divided into 71 districts under 18 divisions, 312 tehsils, and 1.06 lakh villages administratively and electorally among 81 Parliamentary and 403 Assembly constituencies. Structurally, it constitutes the part of the Indo-Gangetic plain that lies between peninsular India in the south and the Himalayan Mountains in the north. The entire state is served by prominent rivers such as the Ganga, Yamuna, Gomati, Ghaghara, and Rapti, which play a significant role in agricultural operations in the state.

As per demographic data, Uttar Pradesh is the most populated state in the country. Area wise, it is the fourth largest state of India. The state exhibits a population density of 828 persons per square kilometer and a population of 199,581,477, accounting for

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16.16 percent of India's total population. As per the census of 2011, among the total state population, the males' population is 4.82 percentage points higher than the female population. In percentage terms, the growth of population throughout 2001-11 was 20.09 percent, which is lower by 5.76 percentage points than the previous decade. As per the 2011 Census, the literacy rate in the state was 69.72 percent, which is still lower than the national average of literacy (74.04 percent). The female literacy rate is also lower at 59.26 percent, and much below the male literacy rate of 79.24 percent. Only 22.8 percent of the population in the state lives in urban areas. U.P. has the largest number of poor people and one of the lowest per capita incomes as compared to the national average, the third-lowest ahead of only Odisha and Bihar. The economic growth of the state has decelerated since 1991, and 17 of its districts fall in the category of the 100 poorest and most backward districts in every respect across India (Fig 1).

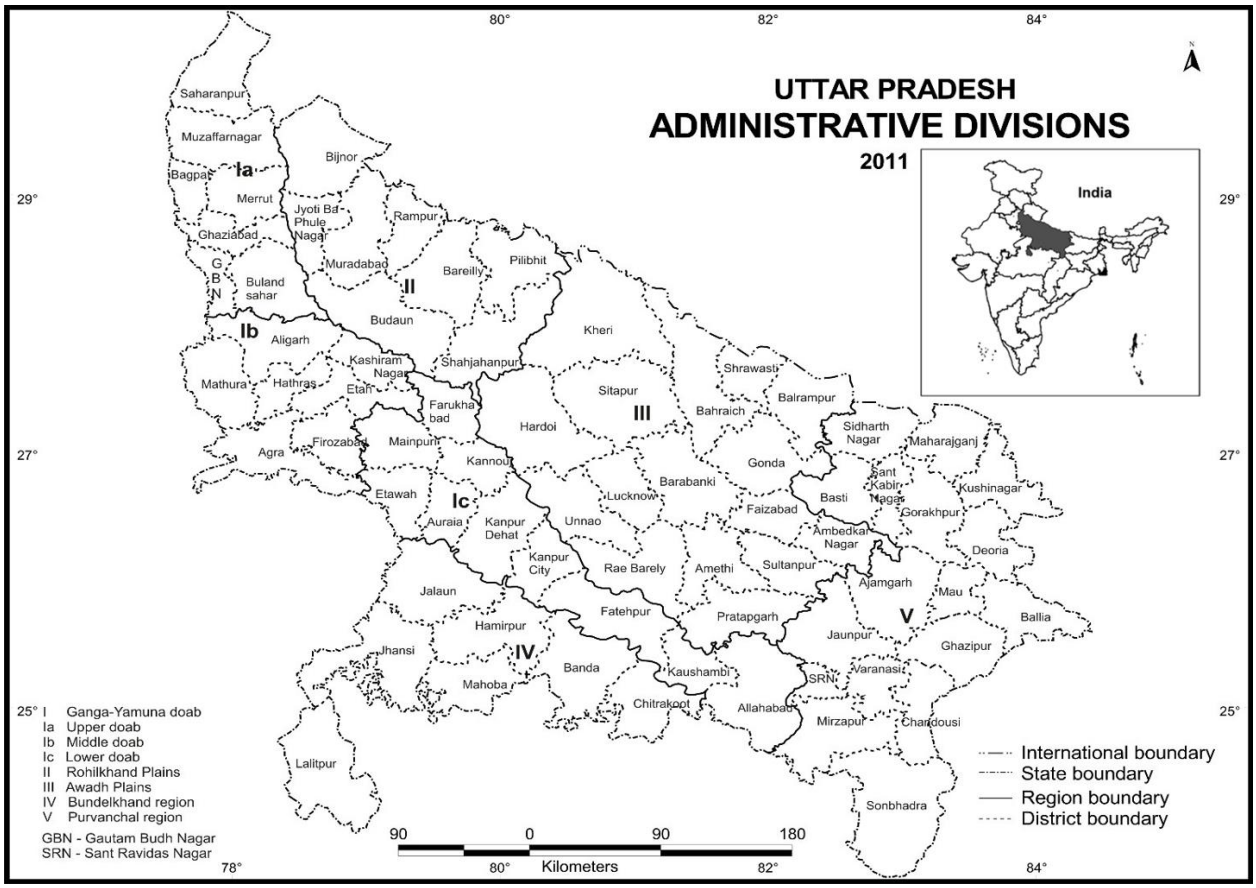

Fig 1. Location map of the study area (Uttar Pradesh), showing different districts.

Data Base and Methodology

This study utilizes the secondary data. The requisite data on literacy rate is collected

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from the census of India 2011 for all the districts of U.P. Additional sources of the secondary data are statistical abstracts of U.P. Several districts of the state has been kept as the unit of study. The literacy rate has been computed for the population older than six years. Sopher's disparity index (SDI) (Sopher, 1974) has been used for the estimation of gender disparity rate. One factor (male literacy) has been detached from the second (female literacy) by using the SDI formula.

$$\textbf{Disparity Index} = \log\left(\frac{X_2}{X_1}\right) + \log\left(\frac{Q - X_1}{Q - X_2}\right)$$

Where,

$X_2 > X_1$ and Q = 100

X_1 = Literacy Rate of Female

X_2 = Literacy Rate of Male

The higher value of the index represents the higher extent of gender disparity.

Rural-Urban Literacy Disparity is also estimated by using Sopher's disparity index.

$$\textbf{Disparity Index} = \log\left(\frac{X_2}{X_1}\right) + \log\left(\frac{Q - X_1}{Q - X_2}\right)$$

Where,

$X_2 > X_1$ and Q = 100

X_1 = Rural Literacy Rate

X_2 = Urban Literacy Rate

The technique of disparity Index is useful in measuring relative disparity between two variables. The SDI value zero indicates perfect equality. Thus, the greater values of SDI denote the higher extent of disparity, and the lower value indicates lower disparity (Biswas, 2016; Raju, 1991).

Sector-wise comparison of literacy in the district of Uttar Pradesh in the year 2011 is identified by the following formula

Total literacy normalcy (P/S/G/H) = Literacy (P/S/G/H) / total literate population

Where P = Primary, S = Secondary, G = Graduation, H = Higher Education

As per the map Index and the mathematically calculated values from the above equation, we can draw the following interpretation:

a. The value varies between 0 to 1.

b. A value closer to 0, means the worst Education condition with respect to the total literate population.
c. A value closer to 1, means good Education condition with respect to the total literate population.

A lower value will indicate a lower literacy rate than normal.

General pattern and spatial variation in Literacy Disparity and Educational Disparity have been mapped by choropleth method using Arc GIS 9.3 software.

Results and Discussion

Analysis of Gender Disparities in Literacy Rate

The literacy rate in U.P. has improved since independence from 12.02 percent in 1951 to 69.72 percent in 2011. The literacy rate for males shows more improvement from 19.17 percent in 1951 to 79.24 percent in 2011 (about 60 percentage points), whereas for females, it has improved to 55 percentage points (from 4.07 percent to 59.26 percent). During the same period, literacy rate for urban areas rose from 29 percent in 1951 to 65.45 percent in 2011. In ruralites, the literacy rate was only 8 percent in 1951, which has increased to 54.9 percent in 2011. The literacy rate among males living in rural areas in Uttar Pradesh was around 76 percent while in urban areas it is 88 percent, whereas the literacy rate among females living in rural areas was 48 percent and 61 percent belonging to urban areas.

The gender gap has fallen from 30.45 percentage points (in 1991) to 26.6 percentage points (in 2001) and further to 19.98 percent (in 2011). The gender gap in literacy in urban areas is lower compared to the rural areas. It was 22 percentage points (in 2011) in rural areas and 10 percentage points in urban areas. There is dissimilarity in literacy rate through districts. Among the districts in the state, Gautam Budh Nagar, Ghaziabad, Kanpur Nagar, Etawah, Auraria, Lucknow, Mainpuri, Kanpur Dehat, Varanasi, and Jhansi recorded high literacy rate, whereas Shrawasti, Bahraich, Balrampur, Badaun, and Rampur recorded the lowest literacy rates. However, the literacy rate of 2011 has been improved over the literacy rate of 2001. As literacy rate greater than 75 percent has been increased to 12 districts in 2011 from none of the districts in 2001. But still, there is a disparity in literacy among the male and female population as identified by Sopher's Disparity index.

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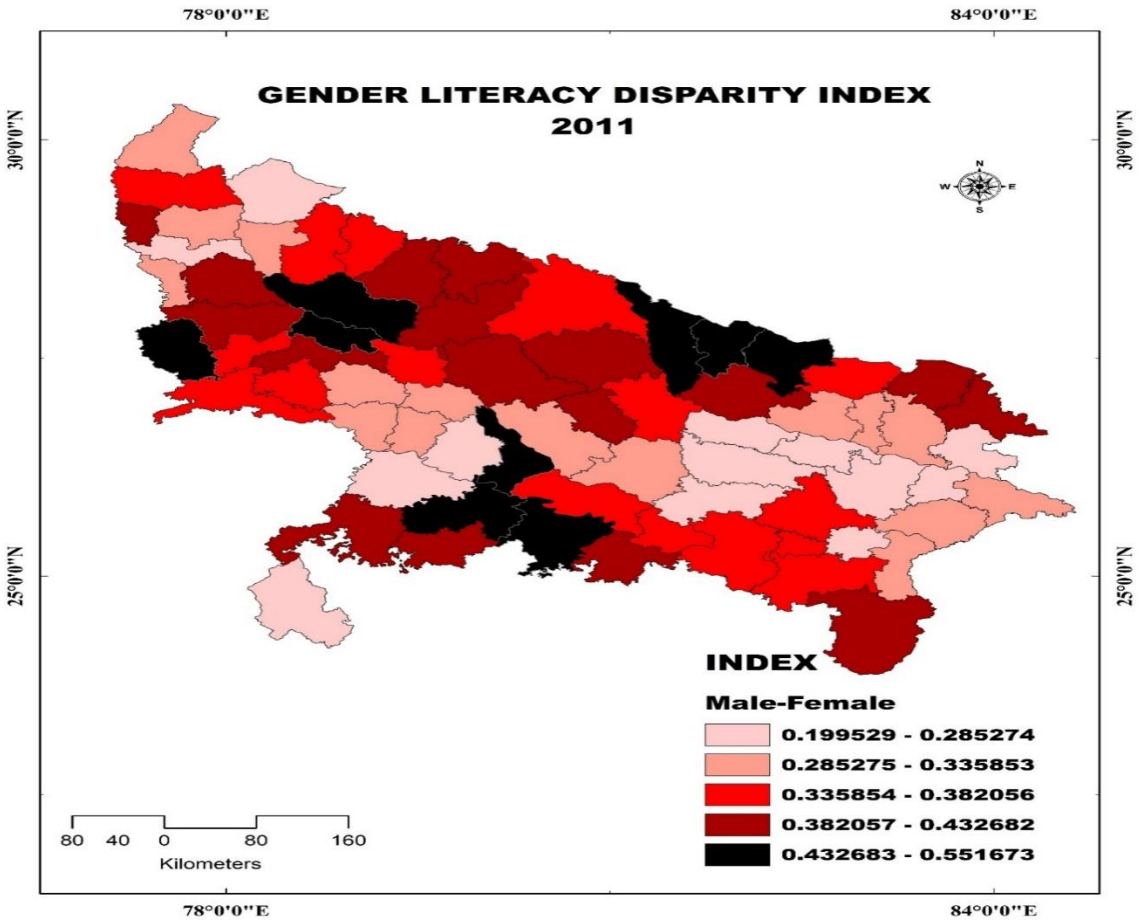

Fig 2. A pattern of gender literacy disparity index of Uttar Pradesh based on Census data 2011.

There exists a wide variation in a male-female pattern based on the disparity index. In 2011, a very low disparity of male-female literacy is found in Ghaziabad, Kanpur City, Lalitpur, Varanasi, Deoria, Mau, Azamgarh, Pratap Nagar, Sultanpur, Ambedkar Nagar, and Faizabad districts. In 2011 low disparity of male-female literacy was found in Gorakhpur, Basti, Sant Kabir Nagar, Saharanpur, Jyotiba Phule Nagar, Meerut, Gautam Budh Nagar, Ballia, Gazipur, Chandausi, Auraria, Etawah districts. There are 16 districts under the category of medium disparity index. These districts are Mirzapur, Jaunpur, Muzaffar Nagar, Rampur, Kheri, Sultanpur, Farrukhabad, Agra, Firozabad, Allahabad, and Mirzapur districts. Whereas Bulandshahar, Aligarh, Shahjahanpur,

Hardoi, Sitapur, Unnao, Sonbhadra, Chitrakoot, Jhansi, and Mahoba districts are found under the category of high disparity index. The district like Bahraich, Shrawasti, Sitapur, Badaun, Banda, Hamirpur, Raibareli, and Lalitpur districts reveal a very high literacy gap between male-female. The high male-female disparity in literacy is characteristic of the region marked by the large proportion of the population in agriculture and low degree of urbanization. The male-female disparity index of the Northern and Eastern districts are relatively medium and high compared to the western and southern districts (Fig 2).

Analysis of Rural-Urban Differential in Literacy rate

For a country like India, where the soul of the country lives in the rural areas and still the rural population is much higher than the urban population, the rural-urban disparity in literacy is a great matter of concern. Since all states and regions have a different pace of urbanization, which ultimately affects the rural-urban divide. The gap between the literacy rate of rural and urban areas has been decreasing continuously since 1951. It has decreased from 17 percentage points (in 2001) to 9 percentage points (in 2011). In 1951, the literacy rate for urban areas was 29 percent, which rose to 50.5 percent (in 1971), and then increase further to 75.14 percent (in 2011). Furthermore, in 1951 the literacy rate of rural areas was only 8 percent, which increased to 21.3 percent in 1971 and further improved to 65.46 percent in 2011. The differential index in literacy for rural and urban areas in Uttar Pradesh has been decreasing continuously from 1.94 percent point (in 1951) to 0.31 percent point (in 2001) and 0.25 percent point (in 2011). But still, the state possesses a wide variation in the literacy rate of rural-urban areas among its different districts. (Fig 3).

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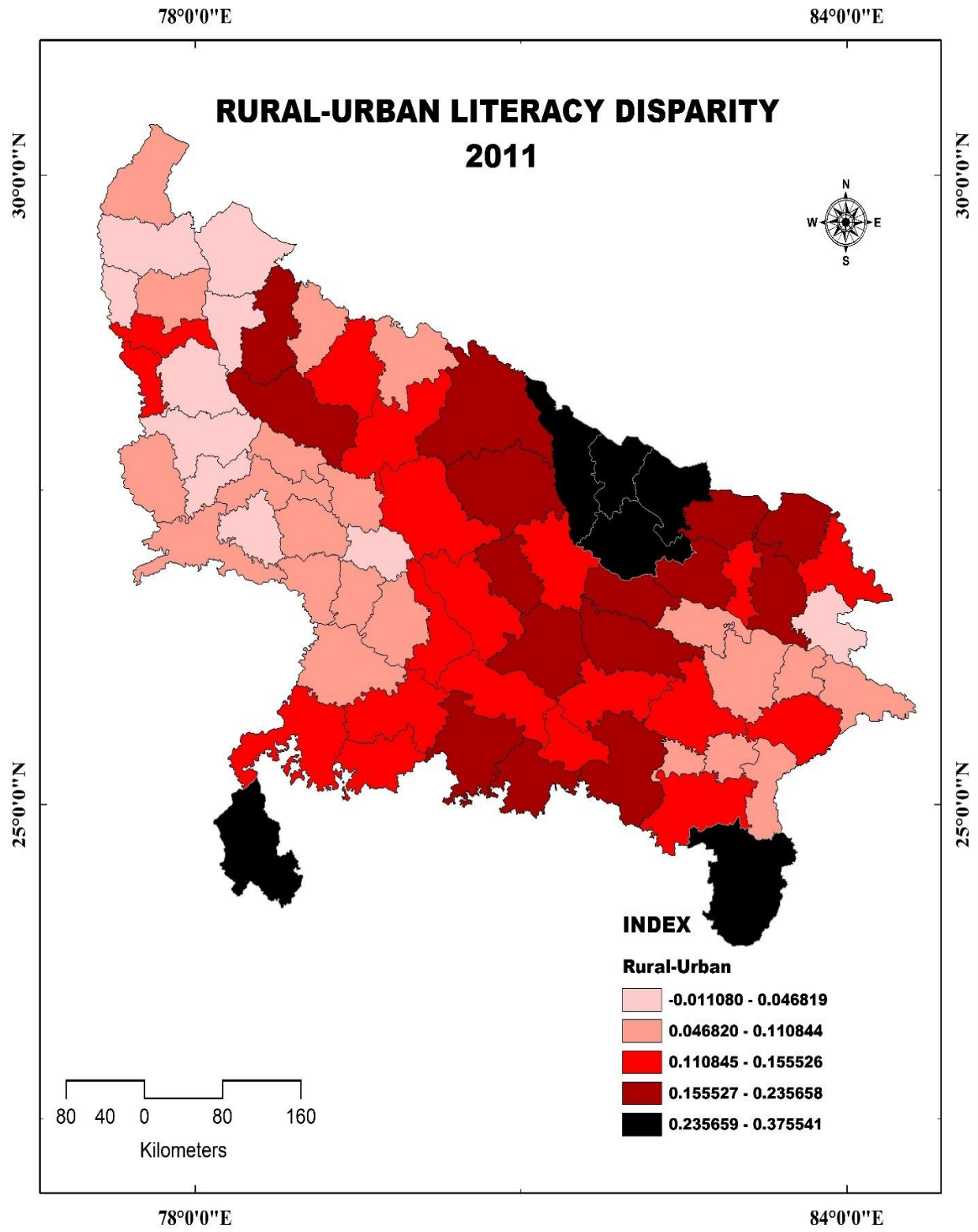

Fig 3. A pattern of rural-urban literacy disparity of Uttar Pradesh based on Census

data 2011.

The 6 districts Lalitpur, Sonbhadra, Bahraich, Balrampur, Sarawasti, and Gonda fall under a very high disparity index. The reason for these high disparity indexes is inadequate educational facilities, a low level of per capita income, and a primarily traditional agro-based economy. The districts recording high disparity index in 2011, are Kheri, Sitapur, Maharajgang, Gorakhpur, Siddharth Nagar, Basti in eastern U.P.

Twenty districts are found in the region of the medium disparity index. These districts forming continuous region in the central part of the state include Kushi Nagar, Sant Kabir Nagar, Ghazipur, Mirzapur, Jaunpur, Pratapgarh, Ambedkar Nagar, Bareilly, Hardoi, Barabanki, Jhansi, Hamirpur, and Mohaba. About 19 districts of the state exhibit low rural-urban differential literacy indices. These districts are Azamgarh, Ballia, Mau, Ambedkar Nagar, Chandausi, in the eastern part of the state, and Jalaun, Kanpur City, Auraria, Etawah, Mainpuri, Farrukhabad, Kashiram Nagar, Etah, Agra, Mathura, Varanasi, Hathras, Rampur, and Pilibhit in the southwestern part of the state. Only about 10 percent of the area exhibits a very low differential index and has one distinctive region in the western part of U.P. These districts are Baghpat, Muzaffar Nagar, Meerut, Aligarh, Jyotiba Phule Nagar, Gautam Budh Nagar, and Firozabad.

Analysis of Sector Wise Educational Disparity

Based on sector-wise educational disparity, there are variations across the district. District with low population in the primary level of education are Moradabad, Rampur, Shahjahanpur, Budaun, Etawah, Siddharth Nagar, Shravasti, and Barabanki. Districts with extremely low population in secondary level are Bijnor, Rampur, Moradabad, Pilibhit, Shahjahanpur, Budaun, Siddharth Nagar, Balrampur, Shravasti. Districts with low population in graduation level are Bijnor, Shamli, Rampur, Badaun, Siddharth Nagar, and Shravasti. Districts with low populations in higher education levels are Bijnor, Moradabad, Rampur, Badaun, Balrampur, and Shravasti. (Fig 4).

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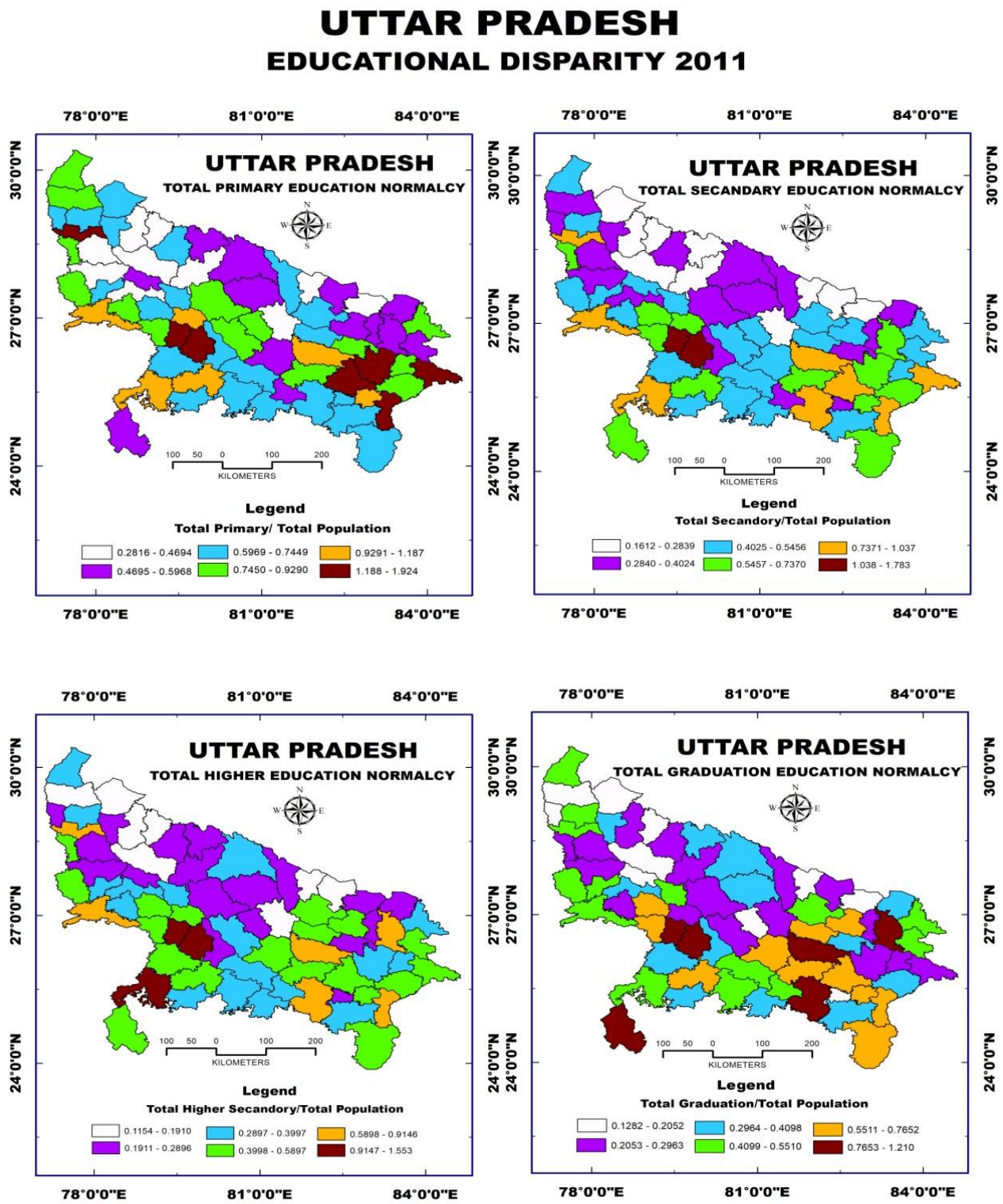

Fig 4. A pattern of sector-wise educational disparity among different districts of Uttar

Pradesh based on Census data 2011.

Conclusion

The paper analyzes the progress of literacy in the state of Uttar Pradesh considering its male-female differential, rural-urban differential, and sector-wise disparity. The state has documented considerable growth in literacy from 2001 to 2011. The gender and urban-rural gap across the districts are reducing. However, the gender-based disparity is higher than locality-based disparity and some districts exhibit high male and female literacy differential. Seven districts are having a high rural-urban gap. The rural-urban differential indices in the eastern and southern districts are relatively higher than the central and western districts. A prominent region of high male literacy disparity is found in the southeastern part of the state whereas high female literacy disparity is found in the north-central part of the state. In the western side districts locating in proximity to the national capital, the differential index was found low due to the presence of a well-developed urban industrial region, well-diversified economy, better employment opportunities, higher rate of rural mobility, and business share of non-agricultural people. The districts having a high male-female disparity index, high rural-urban differential index and districts with low populations in various educational sectors should be given top priority to achieve equitable and quality education.

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