punjab geographer

A DOUBLE BLIND PEER REVIEWED JOURNAL OF APG AND ISPER INDIA INDEXED IN SCOPUS

VOLUME 16 ISSN- 0973–3485 OCTOBER 2020

PUNJAB GEOGRAPHER : ISSN- 0973–3485 Volume 16 October 2020

INFRASTRUCTURAL DEVELOPMENT IN BUNDELKHAND REGION: A MICRO-LEVEL ANALYSIS

P. K. Sharma

Abstract

Infrastructure development is one of the driving forces to attain swift economic growth. It plays an important role in the reduction of poverty, improvements in standard of living and leads to sustained development of a region. This study is an attempt to analyse the micro-regional disparities in infrastructural development across 40 blocks of Bundelkhand region of Madhya Pradesh. The study is based on secondary sources of data, obtained from various government agencies for the year, 2011. In order to find out the level of infrastructural development, composite score method has been used by considering 12 variables at the block level. The study reveals widespread micro-regional infrastructural disparity, ranging from highest score of 1.34 for Nowgong block to lowest of -0.95 for Buxwaha block. On the basis of Principal Component Analysis, four dominant factors governing the level of infrastructural development in the region have been identified. These key factors may be addressed on priority basis to enhance the living condition of the people and to reduce micro regional disparities.

Keywords: Infrastructure, Bundelkhand, Development, Disparities, Region, Facilities.

Introduction

In the long path of planned development in India, wide spread regional disparities are still one of the major concerns of the national development policies. Therefore, studies on micro-regional development are now a key issue of research in regional sciences. The development implies progressive change in socio-economic structure of a region and the infrastructure provides the foundation for this transformation (Chand and Puri, 2015). Accordingly, availability of basic infra-structural facilities is an important pre-condition for the overall development of a region (Bagchi, 2017). The better infra-structure provides better living conditions and easy availability of services to the public. The degree of road connectivity has correlation with urbanization and agricultural prod-uctivity in a region leading to overall development and reduction of poverty (Mangat and Gill, 2015). Adequacy of infrastructure helps toward determination of one country's success and another's failure in diversifying production, expanding trade, coping with population growth, reducing poverty or improving environmental

conditions (WDR, 1994). Thus, infrastructure plays a pivotal role in the development of backward region and removal of regional disparities all the way through enhancing the level and nature of economic and social activities in a region.

Regional disparity is a multi-dimensional phenomenon and the outcome of unbalanced regional development varies from region to region depending upon economic, socio-cultural and demographic characteristics (Dinesha, 2015). A sound infrastructural foundation is essential for attainment of the overall socio-economic development of a region. In a modern economy, infrastructure plays a pivotal role in determining the level of development (Sarkar, 1994). The strong positive correlation between the level of infrastructure and the economic development has been a well-established fact in the development economics literature (Sahoo and Saxena, 1999; Chotia and Rao, 2015). There have been enormous differences in individual performance among the states in terms of all the basic indicators of infrastructural development. Further, physical and social infrastructural facilities have proved to be highly significant factors in determining the inter-state level of development (Ghose and Prabir, 2004). The quality of infrastructure networks significantly impacts economic growth and affects inequalities in a variety of ways (Adhyapok and Ahmed, 2012). Economists have identified various factors that have close relationship with regional development and infrastructure is one of the important factors among them (Majumder, 2005). States with better infrastructural facilities are more attractive for domestic and foreign private investment and perform better in terms of economic growth (Ghosh, 2017). Disparities in socio-economic development are attributed to disparities in demographic, social and economic infrastructures (Raj et al., 2019).

Infrastructural development has greater significance in backward region like Bundelkhand due to its inherent deficiencies and imbalances (Purushotam and Paani, 2016). The people in backward regions have lack of economic opportunities. They are deprived of the fruits of development efforts and often carry a deep sense of frustration (Patra, 2010). The Bundelkhand region of Madhya Pradesh is characterized with agriculture based economy and poor infrastructural development. The basic necessities of the society aren't being met (Singh and Shukla, 2010). In this context, the present paper attempts to study the regional disparities in infrastructural development in Bundelkhand region of Madhya Pradesh.

Objectives of the Study

Major objectives of the study are:

- to analyse the disparities in infrastructural development and
- to identify the most significant factors for infrastructural development in the Bundelkhand region.

Study Area

The Bundelkhand region in India traverses across administrative boundaries of 13 districts, out of which seven districts like Jhansi, Jalaun, Lalitpur, Hamirpur, Mahoba, Banda, and Chitrakoot are of Uttar Pradesh, while six districts such as Datia, Tikamgarh, Chhatarpur, Damoh, Panna and Sagar are from Madhya Pradesh. The Bundelkhand region of Madhya Pradesh extending between latitudes of 23° 10' 48″ to 26° 20' 17″ north and longitudes of 78° 26' 31″ to 81° 40' 15″ east is located in the northern part of the state (Fig.1). The study area comprises of 6 districts

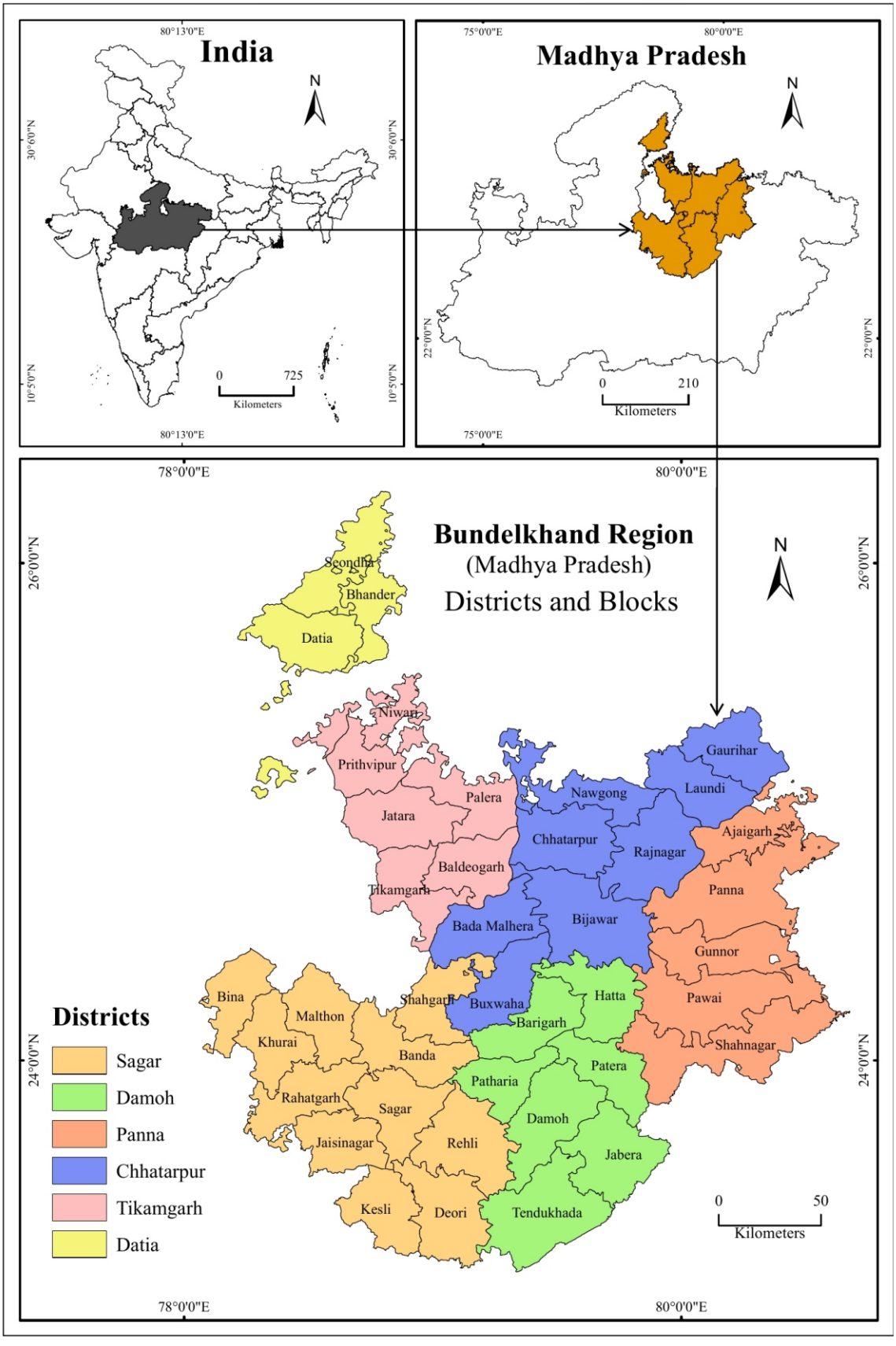
India
Madhya Pradesh
Bundelkhand Region
(Madhya Pradesh)
Districts and Blocks
N
0 725
Kilometers
0 210
Kilometers
0 50
Kilometers
80°13'0"E
30°60'0"N
10°50'0"N
75°0'0"E
80°0'0"E
22°0'0"N
78°0'0"E
26°0'0"N
24°0'0"N
Districts
Sagar
Damoh
Panna
Chhatarpur
Tikamgarh
Datia
Scondha
Bhander
Datia
Niwari
Prithvipur
Palera
Jatara
Baldeogarh
Tikamgarh
Nawgong
Chhatarpur
Bada Malhera
Bijawar
Rajnagar
Laundi
Gaurihar
Ajaigarh
Panna
Gunnor
Pawai
Shahnagar
Hatta
Barigarh
Buxwaha
Shahgarh
Patera
Patharia
Damoh
Jabera
Tendukhada
Bina
Malthon
Khurai
Banda
Rahatgarh
Sagar
Jaisinagar
Rehli
Kesli
Deori

Fig.1

and 40 community development blocks and covers an area of 41330 km² comprising 13.40 per cent of the total area of the state. The landscape is characterized with Deccan lava structure, rugged topography, low rocky outcrops, narrow valleys and plains. The soils are a mixture of black and red-yellow, which is not considered very fertile. The region has a high percentage of barren and uncultivable land.

The total population of the study area has been 86,53,492 persons in 2011 accounting for 11.91 per cent of the total population of the state. About 77.68 per cent of total population is residing in 7157 villages of the study area. The decadal growth rate (2001-2011) of population is 18.47 per cent, compared to the state average of 20.35 per cent. General literacy rate in the study area is 68.11 per cent, while male-female literacy rate is 77.81 per cent and 57.26 per cent, respectively. The study region is predominantly an agriculture region but due to uneven surface and poor soil profile it has only 50.10 per cent of area under agriculture, whereas 80.77 per cent of its rural population is dependent on agriculture. The lack of adequate infrastructure is one of the leading factors to the economic backwardness of the region.

Database and Methodology

The present study is based on secondary sources of data collected from District Census Handbooks, Socio-Economic Caste Census, Directorate of Economics and Statistics, Revenue Board of Madhya Pradesh and official websites of the government of Madhya Pradesh for the year 2011. To measure disparities in the level of infrastructural development, 12 indicators such as number of commercial & co-operative banks per 10,000 population (x_1); number of Automatic Teller Machines (ATMs) per 10,000 population (x_2); number of medical institutions per 10,000 population (x_3); per cent of villages having mandis/regular market facilities (x_4); per cent of villages with tap water facilities (x_5); per cent of villages with power supply for agricultural use (x_6); per cent of villages having power supply for domestic uses (x_7); per cent of villages having internet cafes/ common service centre (x_8); per cent of villages connected with pucca/metalled roads (x_9); per cent of villages connected to national highway and state highway (x_{10}); per cent of villages having public transport facilities (x_{11}) and per cent of villages having communication facilities, like telephone and mobile phone (x_{12}) have been taken to quantify the composite scores for each of the 40 blocks.

To find out the block-wise spatial patterns of infrastructural development, the composite index score has been calculated on the basis of standardized values of each variable calculated as:

$$\textbf{Standardized Value (i)} = \frac{\mathbf{X-\bar{x}}}{\mathbf{SD}}$$

where, i is the standardized value of an indicator, X is the value of variable, x is the mean of the variable and SD is the standard deviation of the variable. The composite index scores are computed by dividing the sum of the standardized values of all the indicators by the total number of the variables and presented in Table 1.

To identify the most significant factors for infrastructural development in the study area the method of Principal Component Analysis is applied. As variables with different measurement units and disproportionate range fail to provide an accurate result, therefore factor analysis has been carried out for each variable to get the standardized

Table 1
Bundelkhand Region: Block-wise Values of the Infrastructural Indicators

Districts	Blocks	Infrastructural Indicators												
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	CI
Datia	Datia	0.49	0.04	2.96	6.69	15.62	94.09	94.09	0.79	46.46	14.57	42.52	22.44	**0.62**
	Seondha	0.74	0.00	2.06	13.96	8.56	87.84	87.84	0.90	42.34	9.01	21.17	26.58	**0.19**
	Bhander	0.94	0.00	2.69	10.97	12.90	89.03	89.03	0.00	30.32	7.10	18.06	22.58	**0.06**
Tikamgarh	Niwari	0.35	0.00	3.89	17.27	7.91	85.61	84.89	0.72	63.31	16.55	48.92	22.30	**0.75**
	Tikamgarh	0.49	0.00	1.97	5.17	5.75	91.95	91.38	1.15	58.62	16.67	37.36	18.39	**0.26**
	Palera	0.46	0.00	2.09	10.00	0.67	90.00	89.33	0.67	58.00	12.67	41.33	21.33	**0.23**
	Prithvipur	0.52	0.00	2.94	2.82	0.70	91.55	90.85	0.00	58.45	10.56	53.52	16.90	**0.22**
	Baldeogarh	0.19	0.00	1.96	4.32	1.23	92.59	92.59	1.23	61.73	11.73	53.70	18.52	**0.21**
	Jatara	0.27	0.04	2.57	8.67	6.63	86.73	.71	1.53	48.98	12.24	37.24	15.82	**0.20**
Chhatarpur	Nowgong	0.31	0.00	3.45	17.46	20.63	92.06	92.86	1.59	53.97	37.30	47.62	27.78	**1.34**
	Chhatarpur	0.61	0.09	2.36	11.18	7.89	86.84	90.13	2.63	46.71	13.82	44.08	21.05	**0.80**
	Rajnagar	0.28	0.00	2.82	6.43	7.86	92.86	92.86	2.14	52.86	21.43	53.57	24.29	**0.73**
	Malhera	0.17	0.00	1.63	9.82	11.66	89.57	92.02	1.84	44.17	14.72	34.97	19.02	**0.14**
	Laundi	0.60	0.00	2.29	8.97	5.77	71.15	83.97	0.64	42.31	10.26	37.82	19.23	**-0.06**
	Bijawar	0.42	0.00	1.27	4.76	6.55	69.05	77.98	3.57	36.31	3.57	30.95	14.88	**-0.39**
	Gaurihar	0.34	0.00	2.24	4.64	16.56	45.70	67.55	0.00	35.10	1.99	20.53	17.88	**-0.89**
	Buxwaha	0.25	0.00	1.12	12.98	6.11	48.09	63.36	0.76	27.48	11.45	29.77	9.92	**-0.95**
Sagar	Sagar	0.25	0.05	2.25	0.62	25.31	91.36	91.36	0.62	45.06	24.07	42.59	17.90	**0.47**
	Rahatgarh	0.67	0.00	2.30	0.95	27.96	92.42	92.42	0.95	37.91	18.96	28.91	17.54	**0.31**
	Rehli	0.10	0.05	0.92	0.41	31.02	87.35	86.12	0.41	70.61	2.86	46.12	14.69	**0.06**
	Jaisinagar	0.51	0.00	2.25	0.00	18.79	94.63	93.29	0.67	22.82	10.07	37.58	16.11	**-0.07**
	Khurai	0.22	0.07	1.96	1.07	14.97	90.37	90.37	0.53	29.41	6.95	34.22	12.83	**-0.20**
	Malthon	0.20	0.00	2.29	2.59	9.33	85.49	88.08	2.59	36.27	10.88	29.53	9.84	**-0.22**
	Bina	0.34	0.08	1.52	1.13	9.60	84.75	85.31	0.56	48.59	5.65	38.42	7.34	**-0.24**
	Kesli	0.34	0.00	2.05	2.65	23.28	88.89	88.89	0.53	31.22	7.94	32.28	10.05	**-0.27**
	Banda	0.17	0.00	1.22	0.00	5.03	88.27	89.39	0.00	47.49	7.82	37.43	14.53	**-0.50**
	Shahgarh	0.33	0.00	1.97	4.69	8.59	67.97	74.22	0.00	35.94	16.41	32.81	14.06	**-0.52**
	Deori	0.26	0.00	1.45	1.57	11.37	81.96	81.57	0.78	39.22	12.16	24.71	10.20	**-0.57**
Damoh	Patharia	0.76	0.00	2.21	1.53	16.79	95.42	100	0.00	41.98	6.11	38.93	13.74	**0.10**
	Jabera	0.76	0.00	3.25	2.63	12.63	86.84	91.58	0.00	38.42	8.42	37.37	13.16	**0.05**
	Barigarh	0.57	0.00	2.90	10.00	13.33	75.33	94.00	0.00	45.33	8.67	32.00	11.33	**-0.01**
	Hatta	0.60	0.00	2.05	1.90	8.86	85.44	95.57	0.63	48.73	10.76	37.97	10.13	**-0.06**
	Tendukheda	0.72	0.00	1.73	2.72	22.28	64.67	95.11	0.54	54.35	3.80	42.93	8.15	**-0.08**
	Damoh	0.47	0.00	1.16	2.94	13.45	88.66	95.38	0.42	50.00	9.66	35.71	10.50	**-0.18**
	Patera	0.96	0.00	2.65	3.14	6.29	91.19	96.86	0.63	30.19	3.14	25.79	9.43	**-0.19**
Panna	Gunnor	0.25	0.05	2.18	2.20	17.18	94.71	96.04	1.76	50.66	11.89	30.84	14.10	**0.27**
	Ajaigarh	0.33	0.00	1.95	0,00	6.67	88.33	97.50	1.67	45.83	7.50	31.67	25.00	**0.02**
	Pawai	0.11	0.00	2.07	1.44	24.52	71.63	82.69	1.44	36.54	7.69	34.62	13.94	**-0.33**
	Shahnagar	0.38	0.05	1.73	5.65	5.65	56.52	76.09	1.74	37.83	4.35	35.65	13.91	**-0.43**
	Panna	0.34	0.00	2.05	0.89	8.89	61.78	74.22	1.33	38.67	9.33	32.00	14.22	**-0.57**
Mean ($\bar{x}$)		**0.43**	**0.01**	**2.16**	**5.17**	**12.11**	**82.97**	**88.06**	**0.95**	**44.25**	**11.02**	**36.37**	**16.04**	-
Standard Deviation (SD)		**0.22**	**0.03**	**0.64**	**4.80**	**7.51**	**12.87**	**8.11**	**0.83**	**10.67**	**5.59**	**8.57**	**5.26**	-

Source: Compiled by Author

values of variables. Further, factor loading and weights have been calculated with the help of Principal Component Analysis using the Statistical Package for Social Sciences (SPSS). In the present study, Kaiser-Meyer-Olkin (KMO) and Bartlett's test have been used for testing the adequacy of the result. These tests are being used to find out the most effective variable among the large numbers of variables. The formula for KMO test is as under:

$$\mathbf{KMOj} = \frac{\sum \mathbf{i} \neq \mathbf{j} \mathbf{r}_{ij}^{\ 2}}{\sum \mathbf{i} \neq \mathbf{j} \mathbf{r}_{ij}^{\ 2} + \sum \mathbf{i} \neq \mathbf{ij}^{u}}$$

where, KMO is the Kaiser-Meyer-Olkin test $\mathbf{jr}_{ij}$ is the correlation matrix between variable and $\mathbf{ij}^{u}$ is the partial covariance matrix.

The KMO statistics, which can vary from 0 to 1, indicate the degree to which each variable in a set is predicted without error by the other variable. A higher value indicates that factor analysis may be useful with the data while a value of less than 0.5 indicates

that the factor analysis is likely to be inappropriate. Bartlett's test of sphericity is a statistical test for the presence of correlation among variables, providing the statistical probability that the correlation matrix has a significant correlation among at least some of the variables. A less than 0.05 value of the significance level indicates that factor analysis may be useful with the present data (Hair et al., 2010). The formula for Bartlett's test is:

$$X^2 = (n-1) - (2p-5)/6) \log (R))$$

where, X^2 is the Bartlett's test, n is the number of observations, p is the number of variables and R is the correlation matrix of variables.

Results and Discussion

Based on the score of Composite Index (CI) values, the blocks have been grouped into four categories as; relatively developed, moderately developed, less developed and very less developed (Table 2), reflecting the comparative levels of infrastructural development.

Relatively Developed Region

This category includes blocks which have scored composite index more than 0.60 and includes five blocks, namely Datia (0.62) of Datia district, Niwari (0.75) of Tikamgarh district, Nowgong (1.34), Chhatarpur (0.80) and Rajnagar (0.73) of Chhatarpur district (Table 1). This region accounts for about 6.83 per cent of total area and 12.18 per cent of total population of the study area. These blocks are mainly situated in the northern and north-western parts of the region (Fig. 2). Nowgong block has emerged as highest developed block on account of recording better facilities in terms of power supply for both, domestic and agriculture use, as it is available in more than 92 per cent of the villages. It also has better marketing facilities by recording highest percentage (17.46 per cent) of villages having Mandis and regular market. It has also highly developed other facilities such as medical institutions (3.45 institutions per 10,000 population), highway connectivity (37.30 per cent villages), public transportation (47.62 per cent villages) and communication (27.78 per cent villages) facilities. Chhatarpur block has emerged as the second most developed block by recording index more than the regional average in eleven indicators taken up in this study. The basic reason behind the infrastructural development in this block is its vicinity to the district headquarter and main commercial center of the region. Niwari block has well developed medical facilities by having 3.89 medical institutions per 10,000 populations. It has also above average condition in seven indicators like marketing

Table 2
Bundelkhand Region: Level of Infrastructural Development, 2011

Composite Index	Level	Blocks
Above 0.60	Relatively Developed	Datia, Niwari, Nowgong, Chhatarpur, Rajnagar
0.00 to 0.60	Moderately Developed	Seondha, Bhander, Prithvipur, Jatara, Palera, Baldeogarh, Tikamgarh, Bada Malhera, Rahatgarh, Sagar, Rehli, Patharia, Jabera, Ajaigarh, Gunnor
-0.60 to 0.00	Less Developed	Laundi, Bijawar, Bina, Khurai, Malthon, Banda, Shahgarh, Jaisinagar, Kesli, Deori, Hatta, Patera, Barigarh, Damoh, Tendukheda, Panna, Pawai, Shahnagar
Below -0.60	Very Less Developed	Gauriharand Buxwaha

Source: Compiled by Author

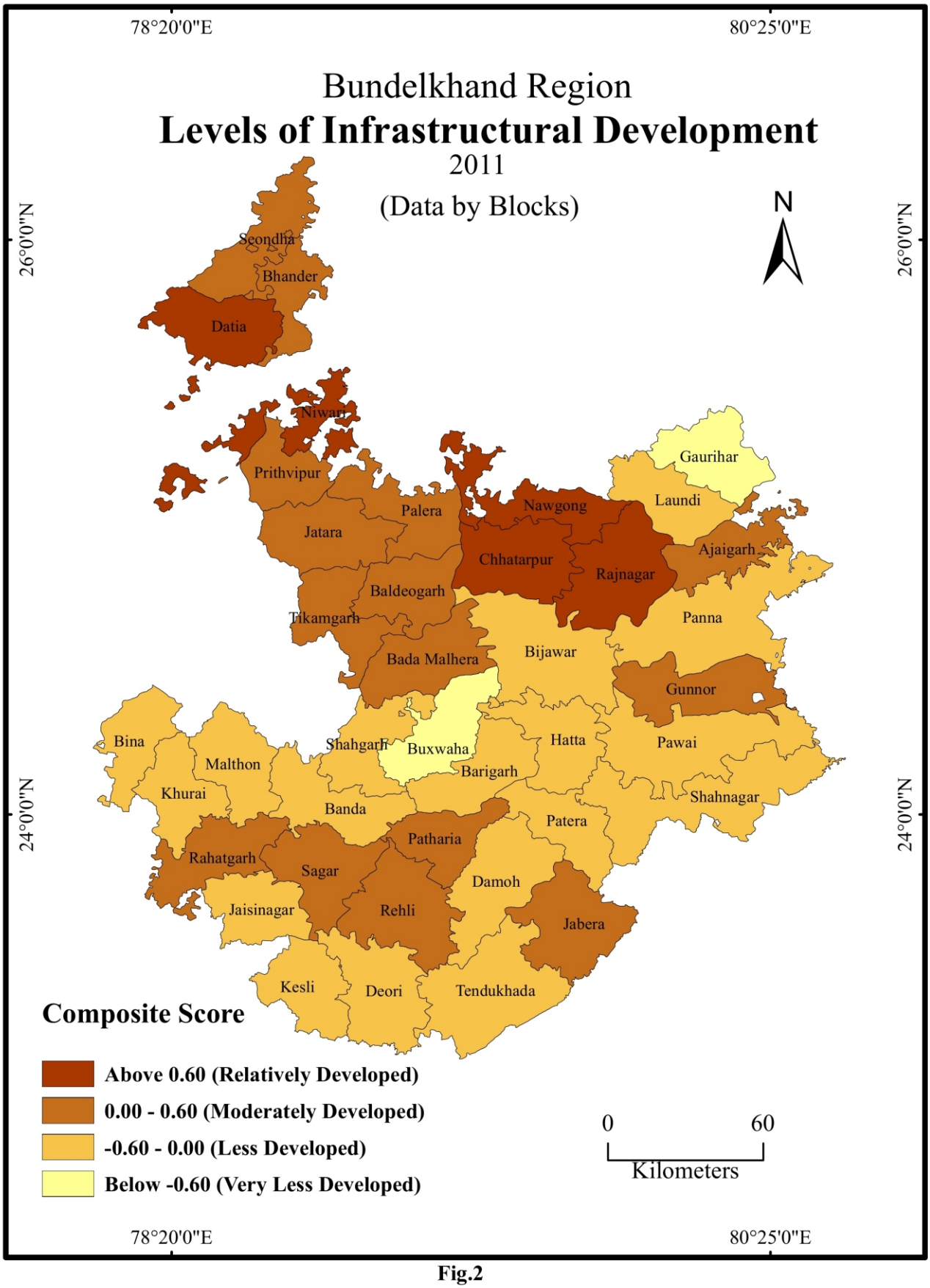
78°20'0"E
80°25'0"E
Bundelkhand Region
Levels of Infrastructural Development
2011
(Data by Blocks)
N
26°0'0"N
24°0'0"N
Seondha
Bhander
Datia
Niwari
Prithvipur
Palera
Jatara
Nawgong
Chhatarpur
Rajnagar
Gaurihar
Laundi
Ajaigarh
Baldeogarh
Tikamgarh
Bada Malhera
Bijawar
Panna
Gunnor
Bina
Malthon
Khurai
Shahgarh
Buxwaha
Barigarh
Hatta
Pawai
Shahnagar
Banda
Patera
Patharia
Rahatgarh
Sagar
Damoh
Jaisinagar
Rehli
Jabera
Kesli
Deori
Tendukhada
Composite Score
Above 0.60 (Relatively Developed)
0.00 - 0.60 (Moderately Developed)
-0.60 - 0.00 (Less Developed)
Below -0.60 (Very Less Developed)
0
60
Kilometers

Fig.2

(17.27 per cent villages), power supply for agriculture (85.61 per cent villages), pucca road (63.31 per cent villages), highway connectivity (16.55 per cent villages), public transport (48.92 per cent villages) and communication facilities. Therefore, it also falls in areas of relatively developed region. Rajnagar block is also well developed on account of nine indicators by recording their values more than the mean values of these indicators. In Datia block, more than 94 per cent of villages have electricity facilities for domestic and agricultural use. It has also higher values in ten indicators of infra-structural development taken up in this study. These 5 blocks accounting for the 12.50 per cent of total blocks of the study area, are having 25 per cent of ATMs and 17.91 per cent of medical institutions of the study region. These blocks on the whole contain 28.54 per cent of market facilitated villages, 20.73 per cent villages having internet cafes/Common Service Centre (CSC), 18.37 per cent of communication facilitated villages and 16.28 per cent of public transport served villages, out of total 7157 villages, of the study region. As a result, these blocks have emerged as relatively developed areas of the study region.

Moderately Developed Region

This category includes 15 blocks, with a range of composite index falling between 0.00 and 0.60. These blocks are Sagar (0.47), Rahatgarh (0.31) and Rehli (0.06) blocks of Sagar district; Tikamgarh (0.26), Palera (0.23), Prithvipur (0.22), Baldeogarh (0.21) and Jatara (0.20), blocks of Tikamgarh district; Seondha (0.19) and Bhander (0.06) blocks of Datia district; Bada Malhera (0.14) block of Chhatarpur district; Patharia (0.10) and Jabera (0.05) blocks of Damoh district and Gunnor (0.27) and Ajaigarh (0.05) blocks of Panna district (Table 1). This region spreads over 15.86 per cent of total area and contains 31.62 per cent of total population of the study region. Except Ajaigarh, Gunnar and Jabera blocks, all other blocks are mostly situated in the northern and south-western parts of the study region (Fig. 2). These parts of the study area have appropriate geo-graphical conditions for infrastructural development with regular surface structure, sufficient ground water for irrigation and plenty of fertile soil. Bhandar, Patharia, Jabera, Seondha, Rahatgarh and Prithvipur blocks have recorded high to very high index in banking facilities as well as in medical institutions per 10,000 population. Seondha, Bhander, Palera and Jatara blocks are well placed in marketing facilities. About 14 per cent of total villages of Seondha block have mandis and regular market services, which provide better opportunities to the agricultural sector of the region. Rehli, Tikamgarh, Prithvipur, Palera and Gunnor blocks have high index in road connectivity. Among these Rehli has ranked first in this indicator with 156 villages (70.61 per cent) connected with pucca or metalled road. The block also has the highest percentage (31.02) of villages having portable water supply followed by Rahatgarh (27.96) and Sagar (25.31) blocks. Similarly, Patharia, Ajaigarh and Gunnor blocks are moving towards 100 per cent coverage of electric connections. Among these, Patharia block has scored first rank in power supply for both, domestic and agriculture use by covering 95.42 per cent and 100 per cent of the villages, respectively. It is happening due to the government initiatives meant for 100 per cent rural electrification. Baldeogarh block with more than one-half of villages (53.70 per cent) have attained first position in the study region in public transportation facility.

Similarly, villages of Sagar, Rahatgarh and Tikamgarh blocks are well connected with national highways. Likewise, Gunnor, Rahatgarh and Palera blocks have witnessed higher index in six indicators. Baldeogarh block has ranked first in transportation facilities with more than one-half of villages (53.70 per cent) having public transportation facility. Although all these blocks have recorded appreciable development in various sectors, yet due to their poor performance in other areas, these have remained low in infrastructural development than the blocks of relatively developed region. On the whole, these moderately developed blocks have an adequate level in terms of availability of banking, medical, electricity, potable water and means of transportation.

Less Developed Region

The majority of blocks (18) are marked under this category, which has a composite score ranging between -0.60 to 0.00. These blocks are Barigarh (-0.01), Hatta (-0.06), Tendukheda (-0.08), Damoh (-0.18) and Patera (-0.19) of Damoh district; Laundi (-0.06) and Bijawar (-0.39) blocks of Chhatarpur district; Jaisinagar (-0.07), Khurai (-0.20), Malthon (-0.22), Bina (-0.24), Kesli (-0.27), Banda (-0.50), Shahgarh (-0.52), and Deori (-0.57) blocks of Sagar district and Pawai (-0.33), Shahnagar (-0.43) and Panna (-0.57) blocks of Panna district (Table 1). Less developed region covers the largest area (78.80 per cent) and contains the highest share (52.99 per cent) of the population of the study region. This region is characterized with dense forest cover, higher ratio of barren land, low fertile red-yellowish soil and deep groundwater table, which limits the agricultural and other development activities. Mining of minerals and stone quarrying has emerged as a major non-farm activity. Khurai, Malthon, Banda and Pawai blocks have recorded less than 0.25 banking institutes per 10,000 population. The shortage of ATMs is a big concern in most of the blocks where majority of the people are living in rural areas. Barely 1 per cent of the rural villages have access to an ATM. Shahgarh, Khurai, Tendukheda, Shahnagar, Bina, Deori, Bijawar, Banda and Damoh blocks are lagging in medical institutions per 10,000 population. The lowest value in marketing and communication facilities are recorded by Banda and Bina blocks, respectively. The road connectivity is pitiable in the villages of Bijawar, Malthon, Shahgarh, Kesli, Patera, Khurai and Jaisinagar blocks. The blocks of this region have recorded low to very low status in most of the indicators but better performance in some criterions such as banking, power supply for domestic and agricultural use, that take them away from the category of very less developed region. The poor infrastructure setup of these areas shows the sheer negligence of the rural areas.

Very Less Developed Region

The very less developed region accounts for only 2.51 per cent of total area and 3.21 per cent of total population residing in 244 villages comprising 3.41 per cent of total villages of the study region. Buxwaha (-0.95) and Gaurihar (-0.89) blocks of Chhatarpur district are included in this region by recording a composite index of less than -0.60 (Table 1). Buxwaha block is located in the central part while Gaurihar block is in the north-western part of the study region (Fig. 2). Except marketing facility; Buxwaha block recorded very low values in all the eleven indicators used in this study. The block stands at bottom in power supply for domestic use,

where 36.64 per cent of villages are still without any access to electricity. Similarly, Gaurihar block has moderate conditions in potable water supply and communication facilities but it has also performed very poorly in remaining ten indicators. The block scored the lowest rank in power supply for agricultural use, highway connectivity and accessibility of public transport services. With 3.41 per cent of the total villages of the study region, these blocks are sharing less than one per cent of villages having public transport and medical facilities. Thus, infrastructural facilities like banking, public transportation, road connectivity, power supply and medical facilities are insufficient to meet the needs of local people. Therefore, these blocks are at the lowest level of infrastructural development. Apart from human factor, a number of geographical constraints like unfavorable topography, poor quality of soil, inadequate water resource, adverse agricultural conditions and poor economic base have also hindered the progress of these blocks.

Identification of Significant Indicators

The factor analysis via Principal Component Analysis has been used to identify the most significant variables affecting the status of infrastructural development. Factor analysis has been carried out to make comprehensive evaluation of 12 indicators of infrastructural development for 40 blocks of the study region. For testing the adequacy of the results of infrastructural development Kaiser-Meyer-Olkin (KMO) and Bartlett's test have been used to find out the most effective indicators among the selected ones. The KMO test of sampling adequacy indicates usefulness of the factor analysis on the first place, hereby, suggesting with a value of 0.573 that the factor analysis for this data set is preferable while the significance value of the Bartlett's Test shows another side of preferability.

Additionally, the communalities of the 12 indicators used in this study have been shown in Table 3. Leaving aside x_2, the extraction communalities are greater than 0.5 or close to 0.5 almost all the way from x_1 to x_{12} representing the amount of variance in each variable accounted by the components where highest variance is extracted for x_7 at a value of 0.931. On the other hand, least variance has been extracted for x_2 with a value of 0.388. These variances have been explained in Table 3. The eigen values and the percentage of the variance which essentially is the ratio

Table 3
Bundelkhand Region: Total Variance Explained of Infrastructural Indicators

Indicators	Communalities (X_1 to X_{12})		Initial Eigen-Values			Extraction Sums of Squared Loadings			Rotated sums of Squared Loadings		
	Initial	Extraction	Total	Variance (per cent)	Cumulative (per cent)	Total	Variance (per cent)	Cumulative (per cent)	Total	Variance (per cent)	Cumulative (per cent)
X_1	1.000	0.710	3.074	25.620	25.620	3.074	25.620	25.620	2.646	22.050	22.050
X_2	1.000	0.388	2.068	17.237	42.857	2.068	17.237	42.857	2.162	18.017	40.066
X_3	1.000	0.779	1.739	14.492	57.349	1.739	14.492	57.349	1.689	14.074	54.141
X_4	1.000	0.761	1.090	9.080	66.429	1.090	9.080	66.429	1.475	12.289	66.429
X_5	1.000	0.705	0.952	7.936	74.365	-	-	-	-	-	-
X_6	1.000	0.875	0.865	7.210	81.575	-	-	-	-	-	-
X_7	1.000	0.931	0.679	5.660	87.235	-	-	-	-	-	-
X_8	1.000	0.461	0.516	4.300	91.535	-	-	-	-	-	-
X_9	1.000	0.469	0.417	3.471	95.006	-	-	-	-	-	-
X_{10}	1.000	0.599	0.277	2.304	97.310	-	-	-	-	-	-
X_{11}	1.000	0.604	0.220	1.830	99.141	-	-	-	-	-	-
X_{12}	1.000	0.689	0.103	0.859	100.00	-	-	-	-	-	-

Source: Compiled by Author

Table 4
Bundelkhand Region: Rotated Component Matrix of Infrastructural Indicators

Indicators	Component			
	1	2	3	4
X_1	0.090	0.267	-0.740	0.289
X_2	-0.164	0.091	0.594	0.009
X_3	0.759	0.197	-0.145	0.378
X_4	**0.777**	-0.219	-0.211	-0.254
X_5	-0.052	0.051	0.096	**0.831**
X_6	0.152	0.919	0.083	0.032
X_7	0.040	**0.954**	-0.077	0.119
X_8	0.122	-0.024	0.295	-0.599
X_9	0.279	0.404	0.442	-0.183
X_{10}	0.715	0.175	0.231	-0.056
X_{11}	0.455	0.102	**0.604**	0.147
X_{12}	0.770	0.186	-0.014	-0.249

Source: Compiled by Author

expressed as percentage of all the indicators. The first component has the percentage of variance of about 25.62 per cent followed by second, third, and fourth components with percentage of variance of 17.24 per cent, 14.49 per cent and 9.08 per cent, respectively. The initial four components have a cumulative percentage of 66.43 per cent suggesting that these four components explain about 66.43 per cent of the variability in the original. In order to figure out the important indicators of the infra-structural development in Bundelkhand region, the rotated component matrix of the data has been presented in Table 4. The first component is most highly correlated (r=0.777) with x_4 (percentage of villages having mandis/regular market). The second component is most highly correlated (r=0.954) with x_7 (percentage of villages of having power supply for domestic uses). The third component is most highly correlated (r=0.604) with x_{11} (percentage of villages having transport facilities). The fourth component is most highly correlated (r=0.831) with x_5 (percentage of villages where tap water facilities are available). The above-mentioned correlations of these four variables, x_4, x_7, x_{11} and x_5 have been extracted to show the most dominant effect on the results of the comp-osite index analysis. With a manageable loss of 33.57 per cent, the indicators of x_4 and x_{11} have a linear correlation of 0, therefore these have emerged as the principal indicators of infrastructural development in this study. These analytical observations indicate that factor analysis is appropriate for the data used in the present study.

Conclusions

The preceding analysis reveals that there are widespread micro-regional disparities in the levels of infrastructural development in the study region. The study reveals that about 50 per cent blocks (81.31 per cent area and 56.20 per cent of the population) fall in the category of back-wardness by recording low or very low level of infrastructural development. On the other hand, only 20 per cent blocks (6.83 per cent area and 12.18 per cent of the population) fall in the category of relatively developed areas. The maximum variation of 49.72 per cent has been noticed in case of villages having power supply for agricultural use followed by 47.79 per cent in pucca road connected villages. On the other hand, minimum variations of 17.46 per cent

and 20.44 per cent have been witnessed in case of percentage of villages having mandis/regular market and percentage of villages having communication facilities. Comparative data analysis shows that except power supply for domestic and agricultural use, the development in remaining ten indicators is very poor. On the basis of Principal Component Analysis (Kaiser-Meyer-Olkin (KMO) and Bartlett's test), four dominant variables such as marketing (x_4) electricity (x_7) transportation (x_{11}) and potable water (x_5) have been identified. Therefore, for the sustainable infrastructural development, it is necessary to enhance the road connectivity and public transport facility to provide mobility and connectivity. There should be establishment of regular market facilities to fulfill domestic and agricultural needs at minimum distance. Proper medical facilities and easily accessible drinking water are essential to ensure better health conditions in these backward areas. Banking facility, uninterrupted communication and continuous supply of electricity at minimum cost are other areas that require improvement. However, Buxwaha and Gaurihar blocks falling at the bottom should be given top priority in policy initiatives.

Acknowledgements

The author is grateful to the Indian Council of Social Science Research (ICSSR) for providing financial assistance for this research under Major Research Project scheme.

References

Adhypok, P.K. and Ahmed, R. 2012. Disparity of infrastructure in Assam: an inter-district study. *Indian Journal of Regional Science,* 45 (2): 118-129.

Bagchi, C. 2017. Development of basic infrastructure: an analysis of 24 Parganas district in West Bengal, India. *Bulletin of Geography, Socio-economic series,* 36: 33-60.

Chand, M. and Puri, V.K. 2015. *Regional Planning in India.* Allied Publishers, New Delhi: 79.

Chotia, V. and Rao, N.V.M. 2015. Examining the inter-linkages between regional infrastructural disparities, economic growth and poverty: a case of Indian states. *Economic Analysis,* 60 (205): 53-71.

Dinesha, P.T. 2015. Regional disparities in Karnataka: an overview. *Research Express,* 2 (11): 52-57.

Ghose, B. and Prabir, D. 2004. How do different categories of infrastructure affect development? Evidence from Indian states. *Economic and Political Weekly,* 39 (42): 4645-4657.

Ghosh, M. 2017. Infrastructure and regional development in rural India. *Margin-The Journal of Applied Economic Research,* Sage Publications, 11: 256-289.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. 2010. *Multivariate Data Analysis.* Pearson University Press. New Jersey: 280-285.

Majumder, R. 2005. Infrastructure and regional development: interlinkages in India. *Indian Economic Review,* 40 (2): 167-184.

Mangat, H.S. and Gill, L.S. 2015. Haryana-levels of road transportation. *Punjab Geographer,* 11: 87-102.

Patra, A. K. 2010. Inter- regional disparities in infrastructure services: a study of Orissa. *Indian Journal of Regional Science,* 41 (1): 49-57.

Purushotam, P. and Paani, B.S. 2016. Strengthening rural livelihood in Bundelkhand.

Journal of Rural Development, 35 (1): 1-16.

Raj, N., Thakur, B.R. and Chand, P. 2019. Levels of regional disparities in socio-economic development in Himachal Pradesh and Uttarakhand states. *Punjab Geographer,* 15: 64-78.

Sahoo, S. and Saxena, K.K. 1999. Infrastructure and economic development: some empirical evidence. *The Indian Economic Journal,* 47 (2): 27-34.

Sarkar, P.C. 1994. Regional imbalances in Indian economy over plan periods. *Economic and Political Weekly,* 29 (11): 26-31.

Singh, S. P. and Shukla, A. 2010. Socio-economic outlook of the Bundelkhand: Problems and prospects. *The Indian Journal of Political Science,* 71 (3): 947-967.

World Development Report (WDR). 1994. *Infrastructure for Development.* Oxford University Press, New York: 23-27.

P. K. Sharma, Assistant Professor,
Email: pawansharmageo@gmail.com
Department of General & Applied Geography,
Dr. H. S. Gour Central University,
Sagar (M.P.).

punjab geographer