An Inter-district Analysis of Infrastructural Disparities in Karnataka

Nimisha Jain & Suman Makkar

This study empirically analyzes inter-regional disparities in infrastructural facilities in 30 districts of Karnataka by dividing it into three regions- North, South and Coastal Karnataka. The cross-sectional study is based on Karnataka's secondary data for the year 2019. Infrastructural facilities under the categories- social, financial, economic and composite- have been indexed with the help of modified principal component analysis. The analysis confirms the prevalence of a wide range of inter-regional disparities in infrastructural facilities with that being most severe in the case of financial infrastructure followed by social and economic infrastructure. Correlation analysis shows that the districts with better infrastructural facilities depict higher levels of economic growth. Strategic investment on a priority basis should be implemented to promote the balanced development of the state.

Nimisha Jain (E-mail ID: nimishajain17.nj@gmail.com) is a Research Scholar & ***Suman Makkar*** (makkarsuman@pu.ac.in) is a Professor of Economics, DES MDRC, Panjab University, Chandigarh.

Introduction

The year 2020 witnessed one of the largest global pandemics in the history of mankind which brought the entire world to a halt. Revitalization of infrastructure has been increasingly gaining prominence as a national strategy for re-establishing livelihoods across countries to support the post-pandemic recovery. Strategic investment in infrastructure can build a strong foundation for a resilient and inclusive growth trajectory. In economics, the term 'Infrastructure' refers to the capital equipment used to produce basic facilities and services needed for a country to function efficiently and smoothly. The German economist, A.O. Hirschman in his famous theory of "Unbalanced Growth" referred to infrastructure as a Social Overhead Capital (SOC) (Hirschman, 1958). He asserted that due to differences in resource endowments across regions, it is difficult to invest in all sectors simultaneously. He therefore suggested strategic investment in selected

sectors of the economy to create a chain of disequilibria. As the infrastructure sector has strong forward and backward linkages, strategic investment in it can accelerate growth in all other sectors of the economy. In macro-economic literature, several studies (Bhatia, 1990; Sahoo & Dash, 2012) have found empirical support for a positive impact of infrastructure on economic growth.

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A critical supply-side factor infrastructure can be classified as social, financial and economic in nature. Social infrastructure refers to the facilities leading to human resource development thereby leading to higher economic growth and improved quality of life (Hall & Jones, 1999; De & Ghosh, 2003). Economic infrastructure comprises the services that facilitate economic activities through supply and demand side channels and boost economic growth (Phang, 2003; Shah, 1992). An efficient intermediation between lenders and borrowers ensures the mobilization of savings and its efficient allocation. (Angadi, 2003). A well-established financial infrastructure comes to the stage here. Empirical studies (Gurley & Shaw, 1955; Schumpeter, 1961) have recognized a strong and positive correlation between the level of financial infrastructure and economic growth.

Infrastructure is a crucial area for the government to invest and introduce policies because of its pervasive impact on human welfare and economic development (World Development Report, 1994).

Though the areas were integrated territorially, disparity in terms of development was widely prevalent.

The present study focuses on the infrastructural facilities of Karnataka. As of FY 2019-20, Karnataka occupies the 5th position among the Indian states in terms of Gross Domestic Product (GDP) and 7th position in terms of Net State Domestic Product (NSDP) (Reserve Bank of India, 2022). The state of Karnataka (formerly known as Mysore) was formed in the year 1956 following linguistic reorganization by merging Kannada-speaking parts of Bombay, Hyderabad, and Madras with Mysore. Though the areas were integrated territorially, disparity in terms of development was widely prevalent. The issue of the North and South divide in Karnataka is one of the acute cases of regional imbalances in the country.

Rationale of the Study

Most of the research on infrastructure and development has been done at the national or state level in India (Arunkumar & Upendranadh, 1993). The state cannot be viewed as a homogenous unit when studying such macro issues. It is important to study the scenario on a 'district' level. Research on the prevalent regional infrastructural disparity in Karnataka is sparse.

Objectives of the Study

The present study attempts to empirically analyze inter-regional disparity in infrastructural facilities in 30 districts of Karnataka by dividing the state into three regions- North, South and Central.

Fig. 1 Regions of Karnataka

Source: Created by Authors

Coastal Karnataka. Fig. 1 shows the three regions of Karnataka. The study is based on 30 districts of Karnataka (before Vijayanagar district was carved out of Bellary district on 2 October 2021). Consequently, the following objectives have been devised:

(i) To prepare district-level infrastructural indices.

(ii) To empirically analyze regional disparities in social, financial, economic, and composite infrastructural facilities across 30 districts of Karnataka with the aid of infrastructural indices.

(iii) To examine the relationship between infrastructural facilities and district outcomes.

Data Sources

The present study is based on secondary data. It studies the district-wise infrastructural facilities available in Karnataka, as on 30th March 2019. Based on the assumption that the establishment of infrastructural facilities in t-time period will lead to the economic growth of that region in t+1 time period, data for Per Capita Net District Domestic Product (NDDP) has been taken for the year 2021-22 (ignoring the pandemic year). The data has been collected from Karnataka at a Glance (2021-22), Department of Economics and Statistics, Government of Karnataka.

Methodology

Different regions have different infrastructural facilities. While a region may be in deficit of one or more infrastructural facilities, it may possess an adequate supply of others (Majumder, 2002). Consequently, infrastructure has been divided into 3 categories:

I. Social Infrastructure- further subdivided into health and education infrastructure.

II. Financial Infrastructure

III. Economic Infrastructure

Table 1 shows the selected variables for analysis under each category of infrastructure. The study attempts to develop the following infrastructure indices using the Modified Principal Component Analysis (Modified PCA) method – HLTINF (representing Health Infrastructure), EDUINF (representing Education Infrastructure), SII (representing Social Infrastructure), FII (representing Financial Infrastructure), EII (representing Economic Infrastructure)– each depicting a specific aspect of infrastructure and finally a Composite Infrastructure Index (INF). Since the variables measuring infrastructure in this study are widely dispersed over space and there is marked inequality among districts regarding the availability of infrastructural facilities, the modified PCA is used to construct composite indices for each of the groups of variables by finding out such a 'Weight' vector that maximizes the sum of squared projection of the transformed data matrix (Amitabh Kundu et al, 1980). The rationale for using PCA is that it facilitates reaching an aggregate representation from various individual indicators.

Table 1 Selected Variables and Weights Derived From PCA

Categories of Infrastructure	Facilities considered	Variables taken	Abbreviation of variables	Weights
Social	Health	1. Hospitals per 1000 sq km area	HSP	0.398
		2. Doctors per 10000 population	DOC	0.414
		3. Hospital Beds per 10000 population	HPB	0.186
	Education	4. Primary schools per 1000 sq km area	PS	0.311
		5. High schools per 1000 sq km area	HS	0.341
		6. Colleges per 1000 sq km area	CLG	0.327
Financial	Banking	7. Bank Branches per 1000 sq. km area	BB	0.499
		8. ATM per 1000 sq. km area	ATM	0.499
Economic	Communi-	9. Mobile Phones per 10000 population	MP	0.131
	cation &	10. Motor Vehicles per 10000 population	MV	0.444
	Transport	11. Road Length per 1000 sq. km area	RL	0.423
		Health Infrastructure Index	HLTINF	0.499
		Education Infrastructure Index	EDUINF	0.499
		Social Infrastructure Index	SII	0.381
		Financial Infrastructure Index	FII	0.374
		Economic Infrastructure Index	EII	0.243

Note: PCA: Principal Component Analysis. Weights count only the square of first principal factor (unrotated factor loadings); Stata 14 has been used for PCA.
Source: Authors' own calculations

The modified PCA method overcomes the drawback of the simple PCA method by standardizing variables and allowing them to retain their individual variances at the same time. Each infrastructure index is a linear combination of unit-free values of individual variables such that:

$$\text{Infrastructure Index}_i = \Sigma W_k X_{ki} \quad \text{.....(1)}$$

where Index_i = index of the i_{th} district, W_k = weight of the k^{th} factor and X_{ki} = unit-free value of the k^{th} factor for the i^{th} district.

An index (or score) is derived for each of the infrastructure categories with the help of eq. (1). The weights are derived from principal component analysis. The infrastructural indices are used to rank districts of Karnataka to understand regional disparity across the state. The correlation coefficient is calculated for infrastructural facilities and district outcomes to understand the impact of infrastructural development on the economic growth of districts.

The present study has used the Kaiser rule for the selection of principal components. Table 1 depicts concerned weights derived from PCA (using Stata 14).

Regional Disparity in Social Infrastructure

The two major components analyzed under social infrastructure are health and education.

Health Infrastructure Index

HLTINF= 0.398 HSP + 0.414 DOC + 0.186 HPB

Education Infrastructure Index

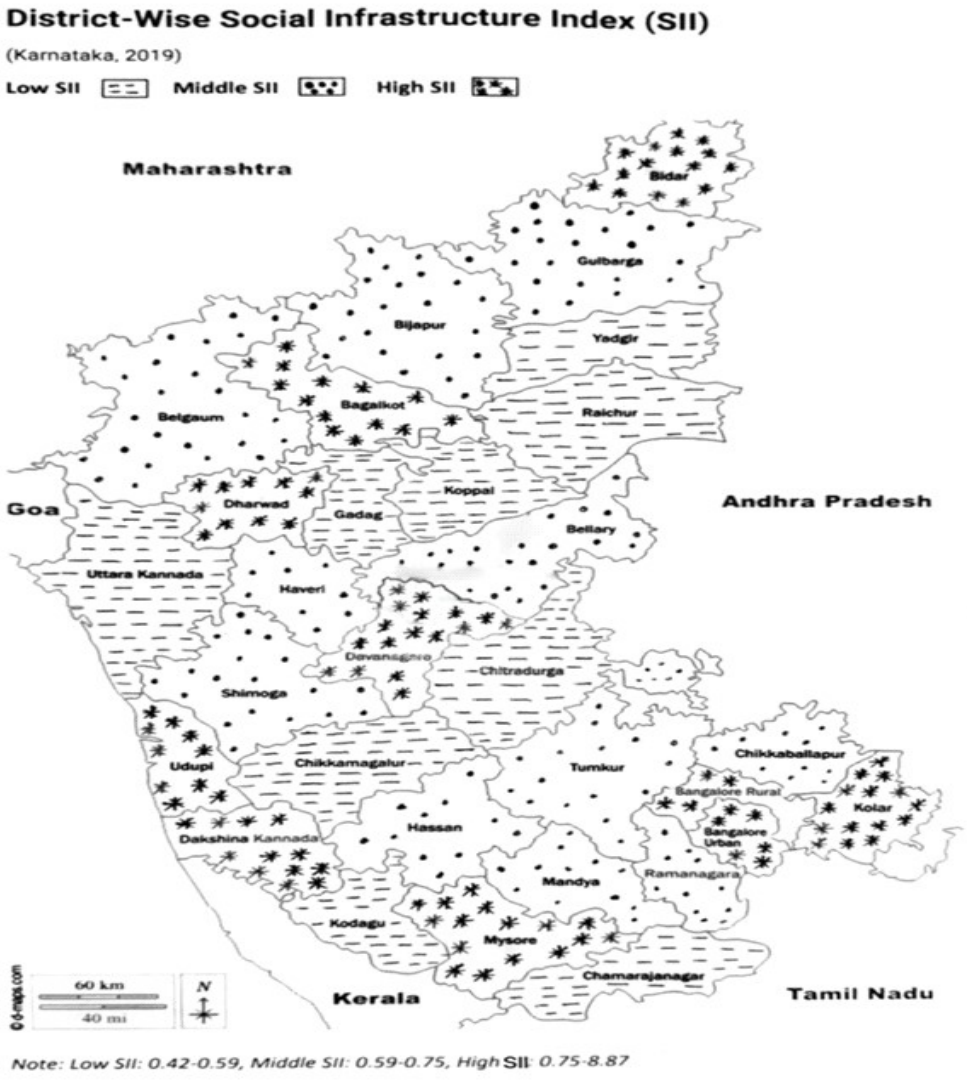
EDUINF= 0.311 PS+ 0.341 VHS+ 0.327 CLG

Social Infrastructure Index (SII)

SII= 0.499 HLTINF + 0.499 EDUINF

Fig. 2 highlights the districts of Karnataka falling under three categories of SII. Table 2 shows district-wise rank-

Fig. 2 District-Wise Social Infrastructure Index (SII)



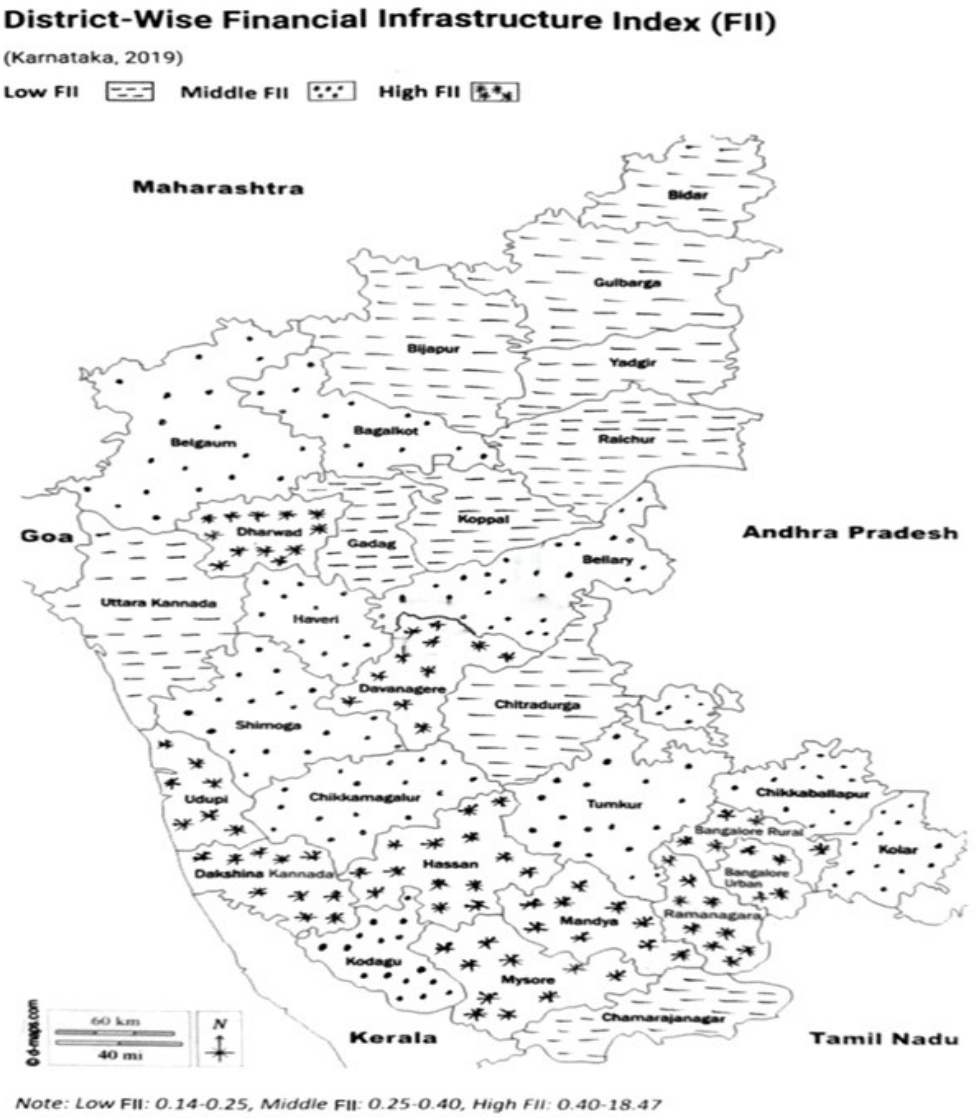
Source: Created by Authors

ing and indices of social infrastructure. The ratio of the most developed district (Bengaluru-Urban) and worst performer district (Yadgir) of the social infrastructure index is as high as 27.82:1.

Regional Disparity in Financial Infrastructure

FII= 0.499 BB+0.499 ATM

Fig. 3 District-Wise Financial Infrastructure Index (FII)



Source: Created by Authors

Fig. 3 highlights districts of Karnataka falling under three categories of FII. Table 2 shows the district-wise ranking and indices of financial infrastructure. The ratio of the most developed district (Bengaluru-Urban) and worst performer district (Yadgir) of infrastructure index is as high as 123.9:1.

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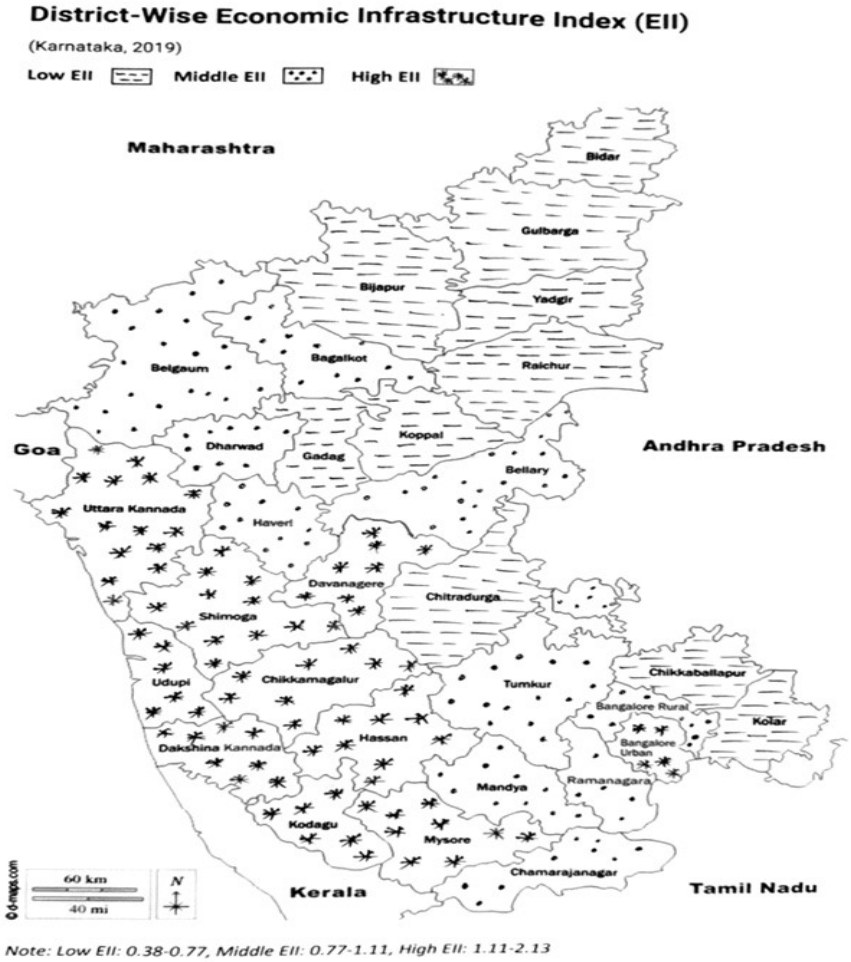
Regional Disparity in Economic Infrastructure

EII= 0.131 MP + 0.444 MV + 0.423 RL

Fig. 4 District-Wise Economic Infrastructure Index (EII)



Source: Created by Authors

Fig. 4 highlights districts of Karnataka falling under three categories of EII. Table 2 shows district-wise ranking and indices of economic infrastructure. The ratio of the most developed district (Bengaluru-Urban) and worst performer district (Chitradurga) concerning economic infrastructure index is as high as 5.49:1.

Regional Disparity in Composite Infrastructure

INF= 0.381 SII + 0.374 FII + 0.243 EII

Fig. 5 District-Wise Composite Infrastructure Index (INF)

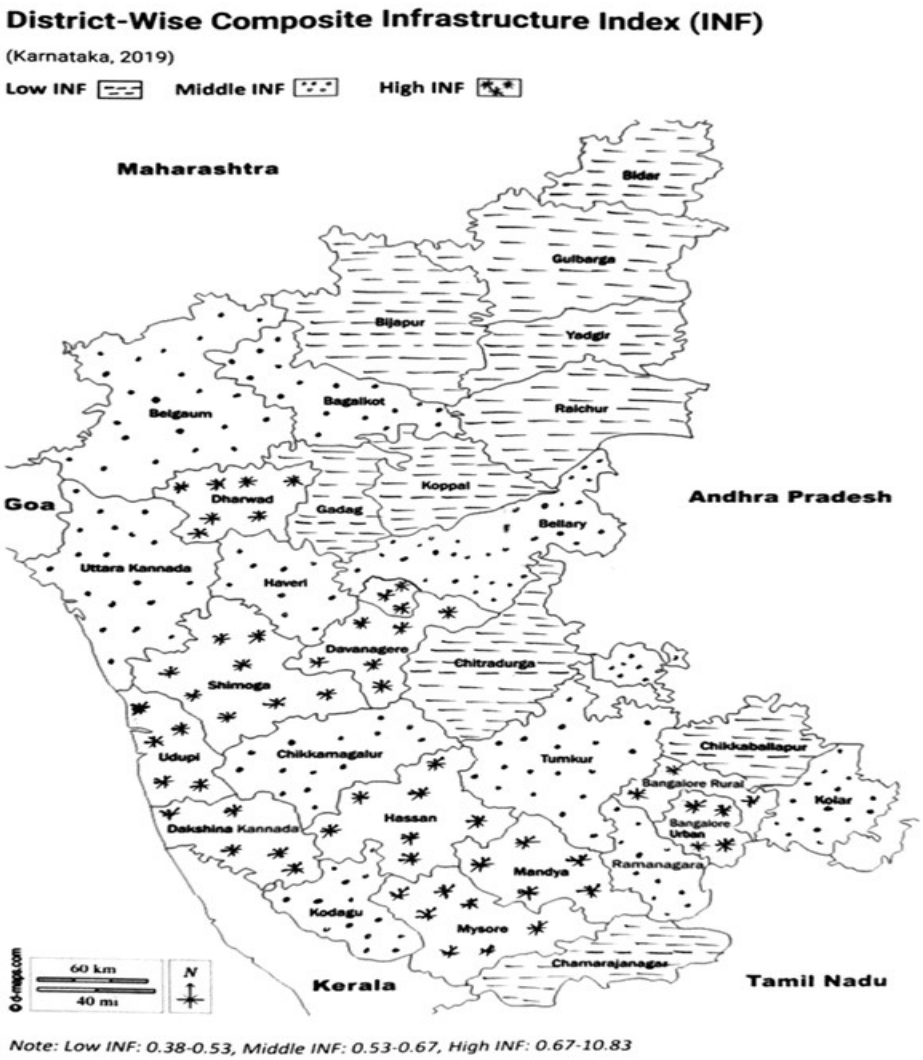


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Fig. 5 highlights the districts of Karnataka falling under three categories of INF. Table 2 shows district-wise ranking and indices of composite infrastructure. The ratio of the most developed district (Bengaluru-Urban) and worst performer district (Yadgir) concerning the overall infrastructure index is as high as 33.63:1.

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Table 2 District-Wise Indices and Ranking

Districts	SII Value	SII rank	FII value	FII rank	EII Value	EII rank	INF value	INF rank
Bagalkot	0.78	9	0.27	19	0.83	18	0.606	16
Bellary	0.71	14	0.37	12	0.8	19	0.608	15
Belgaum	0.6	18	0.34	13	1.06	13	0.622	14
Bangalore Rural	0.92	7	0.79	5	1.1	11	0.921	6
Bangalore	8.87	1	18.47	1	2.13	1	10.83	1
Bidar	0.78	10	0.24	21	0.48	28	0.508	22
Chamrajnagar	0.34	29	0.16	29	0.77	20	0.381	28
Chikkaballapura	0.6	19	0.31	16	0.68	22	0.517	21
Chikamagalur	0.45	27	0.29	17	1.12	10	0.557	20
Chitradurga	0.54	23	0.17	27	0.38	30	0.365	29
Dakshina Kannada	1.91	2	1.22	2	1.6	3	1.58	2
Davanagere	0.99	6	0.42	9	1.19	8	0.831	7
Dharwad	1.2	3	0.73	6	0.89	17	0.951	5
Gadag	0.54	24	0.22	23	0.67	25	0.455	25
Hassan	0.67	15	0.41	10	1.16	9	0.697	10
Haveri	0.6	20	0.27	20	1	14	0.578	19
Gulbarga	0.73	12	0.19	25	0.61	26	0.501	23
Kodagu	0.49	26	0.34	14	1.34	7	0.643	12
Kolar	0.82	8	0.4	11	0.76	21	0.652	11
Koppal	0.5	25	0.16	28	0.68	24	0.423	26
Mandya	0.71	13	0.46	8	1.07	12	0.707	9
Mysuru	1.1	5	0.82	4	1.34	6	1.057	4
Raichur	0.56	22	0.2	24	0.41	29	0.395	27
Ramanagara	0.59	21	0.46	7	0.94	16	0.628	13
Shimoga	0.73	11	0.33	15	1.49	4	0.768	8
Tumkur	0.63	17	0.27	18	0.97	15	0.585	18
Udupi	1.1	4	1.02	3	1.67	2	1.212	3
Uttara Kannada	0.42	28	0.22	22	1.45	5	0.6	17
Bijapur	0.64	16	0.17	26	0.68	23	0.48	24
Yadgir	0.31	30	0.14	30	0.59	27	0.322	30

Source: Authors' own calculations

District Outcomes

Per-capita income depicts the standard of living of the citizens and therefore can be used as a proxy measure to analyze the economic growth of a region (Siddalingaswami & Raghavendra, 2010). Per capita net state domestic product

(PCNSDP) of Karnataka was Rs. 90,269 in 2011-12, which increased to Rs. 1,55,869 in 2019-20, a rise of more than 72%. But per capita income has not been evenly distributed across districts of Karnataka.

Table 3 shows the correlation coefficient between Overall Infrastructure Index (INF) of 2019-20 and per capita NDDP of 2020-21 to be 0.793, suggesting that districts with higher level of infrastructural development had higher per capita income.

Table 3 Correlation between Overall Infrastructure Index (INF) and per capita NDDP (pcNDDP)

	pcNDDP	INF
pcNDDP	1.0000	
INF	0.7930	1.0000

Source: Authors own calculations

Findings & Conclusion

The present cross-sectional district analysis based on Karnataka's secondary data for the year 2019 throws light on the social, financial, and economic infrastructural disparities in its 30 districts. The above empirical analysis confirms the prevalence of a wide range of inter-regional disparity in infrastructural facilities in the state which is prominently visible across North-South-Coastal regions of the state. Table 2 shows the district-wise ranking in all infrastructural indices.

The disparity is most severe in the case of financial infrastructure and least in the case of economic infrastructure. North Karnataka depicts relatively a better situation in the case of social infrastructure as compared to its situation in economic and financial Infrastructures.

Analysis of the composite infrastructure index shows that seven districts of South Karnataka, two districts of Coastal Karnataka and only one district of North Karnataka fall in the range of the top ten districts of INF. This shows that despite North Karnataka's three districts falling in the top ten of SII, only one district is found in the top ten of INF. Therefore, it points to the need for overall improvement in infrastructural facilities in North Karnataka. The study also observes that out of 30, there are only five districts (Bangalore, Dakshin Kannada, Udupi, Mysore and Devanagere) that depict higher infrastructural development in all the categories.

The results also show that districts with better levels of infrastructural facilities depict higher levels of economic growth. Therefore, strategic investment must be made in districts with lower levels of infrastructural availability. Plans on a priority basis may be implemented for the four districts of North Karnataka- Gadag, Koppal, Raichur and Yadgir- depicting lower levels of infrastructural development in all the categories of infrastructure. Addressing concerns of regional imbalance is of utmost importance for the state of Karnataka to promote

unity and harmony among its citizens. Improving the quality along with quantity of infrastructure should be the focus of state policy. Investment in infrastructural facilities will lead to balanced regional development. It will promote a skilled workforce with more employment opportunities which will increase production and consumption while ensuring a greater connectivity across the region. Public-private partnerships can be sought to achieve the goal. Efforts in this direction will lead to a faster and smoother post-pandemic recovery.

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