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Analyzing Inter-District Disparities in Economic and Social Infrastructure in Haryana and Punjab: A Comparative Study

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Abstract

This study aims to identify advanced and backward districts in Haryana and Punjab by analyzing disparities in selected economic and social infrastructure indicators over the past two decades. Utilizing the Coefficient of Variation (CV) as the primary statistical tool, the research compares the variability of infrastructure development across districts, focusing on metalled road length, number of post offices and educational facilities. Data from various statistical abstracts reveals significant inter-district disparities in both states. In Haryana, advanced districts such as Kaithal and Ambala show consistently high metalled road lengths per population and area, while backward districts like Faridabad and Gurugram exhibit significant declines. The number of post offices per lakh of population also highlights disparities, with some districts showing reductions over time. Educational infrastructure analysis indicates uneven distribution, with advanced districts like Faridabad and Yamunanagar showing substantial increases in school numbers, while backward districts like Sirsa and Hisar exhibit minimal growth. In Punjab, advanced districts like Rupnagar and Ludhiana demonstrate robust road infrastructure and a high number of post offices, whereas districts like Firozpur and Barnala lag behind. Disparities in educational infrastructure are also evident, with advanced districts showing better access to primary and middle schools compared to backward districts like Moga and Amritsar. Despite overall improvements in infrastructure, the study highlights the persistent and widening disparities, emphasizing the need for targeted policies to ensure balanced regional development and equitable access to resources.

Keywords: Educational, Infrastructure, Widening, Disparities, Metalled, Road Length

1 Introduction

Regional disparities in infrastructure development are a significant concern in many developing economies, including India. Haryana and Punjab, two agriculturally and industrially vital states in Northern India, present a unique case for examining these disparities (Ahluwalia 2020). Both states have witnessed rapid development, yet the distribution of economic and social infrastructure remains uneven across districts. Identifying the advanced and backward districts in terms of infrastructure development is crucial for policymakers to design targeted interventions and ensure balanced regional growth. This study focuses on analyzing inter-district disparities in Haryana and Punjab using key indicators of economic and social infrastructure. By employing the Coefficient of Variation (CV) as a measure of relative variability, the study provides a

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comparative analysis of the infrastructure development across districts over the past two decades (Sharma 2023). The selected indicators include metalled road length per lakh of population and per 100 square kilometers of area, the number of post offices per lakh of population and the number of primary and middle schools per 100 square kilometers of area. These indicators were chosen to represent the critical aspects of transportation, communication and education infrastructure, which are essential for the socio-economic development of any region. Infrastructure in Haryana and Punjab plays a crucial role in shaping the economic and social landscape of these states. Haryana, with its strategic location adjacent to the national capital, has developed robust infrastructure, particularly in its urban centers like Gurugram and Faridabad (Gupta 2021). These cities boast modern transportation networks, extensive roadways and efficient public services, attracting significant industrial and commercial investment. Conversely, rural areas in Haryana still struggle with underdeveloped infrastructure, highlighting a need for more equitable distribution of resources. In Punjab, infrastructure development has been historically strong due to its agricultural backbone and significant urban centers like Ludhiana and Amritsar. The state has a well-developed network of roads and irrigation systems supporting its agrarian economy. However, challenges remain in ensuring consistent quality of infrastructure across all districts, with some regions facing deficiencies in healthcare, education and advanced transportation. Both states recognize the importance of enhancing their infrastructure to foster economic growth and improve living standards, with ongoing efforts to bridge the urban-rural divide and promote sustainable development (Verma 2022).

1.1 Indicators Used

To comprehensively analyze the inter-district disparities in infrastructure development in Haryana and Punjab, this study employs a range of economic and social infrastructure indicators. For economic infrastructure, three key indicators are used. The first is the metalled road length per lakh of population, which measures the extent of road infrastructure available per 100,000 people in a district, reflecting accessibility and connectivity. The second is the metalled road length per 100 square kilometers of area, indicating road density and the spread of infrastructure relative to the geographical area. The third indicator is the number of post offices per lakh of population, which reflects the communication infrastructure and accessibility of postal services to the population. For social infrastructure, the study examines two primary indicators. The first is the number of primary schools per 100 square kilometers of area, which measures the availability of primary education facilities relative to the geographical area, indicating access to basic education. The second is the number of middle schools per 100 square kilometers of area, providing insight into the distribution of educational infrastructure for higher primary education. By analyzing these indicators, the study aims to provide a comprehensive understanding of the inter-district disparities in infrastructure development in Haryana and Punjab. This analysis highlights the areas that require focused policy interventions to achieve balanced regional development, ensuring equitable access to essential services and fostering socio-economic growth across all districts.

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2 Objectives of the Study

To identify the advanced and backward districts in Haryana and Punjab in the context of selected indicators.

3 Statistical Tools

To achieve objective, the Coefficient of Variation (CV) was used.

To compare the disparities across the various districts, coefficient of variation will be used. The coefficient of variation (CV) is a statistical measure of the relative variability of data points in a dataset compared to the mean of the dataset. It is expressed as a percentage and is useful for comparing the degree of variation between different datasets, regardless of their units of measurement. By standardizing the measure of dispersion relative to the mean, the CV provides a dimensionless number that facilitates the comparison of variability across different datasets or contexts. For instance, a CV of 10% indicates that the standard deviation is 10% of the mean, reflecting relatively low variability, while a CV of 50% would indicate higher variability. The coefficient of variation is particularly useful in fields such as finance, research and engineering, where understanding and comparing relative risk or variability is crucial.

4 Data Collection

This study will be based on secondary data, gathering essential information on health, education, transportation, financial institutions and other relevant topics from a variety of sources. The data will be collected from comprehensive reports and publications to ensure a robust analysis. Key sources include the Statistical Abstracts of Haryana and Punjab, covering the years from 2006 to 2021 and the Economic Surveys of both states for the same period. Additional data will be obtained from the Central Statistical Organization and the Centre for Monitoring Indian Economy. National Human Development Reports and the Census of India (2001 to 2011) will provide further insights. District-specific information will be sourced from various issues of District Statistical Abstracts. The Planning Commission of India's National Human Development Reports will also be referenced to ensure a well-rounded understanding of the infrastructure disparities across Haryana and Punjab.

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5 Findings

5.1 Inter-District Disparities in Selected Indicators in Haryana

5.1.1 Inter-District Disparities in Selected Indicators of Economic Infrastructure in Haryana

Tables show inter-district disparities in economic infrastructure. Coefficient of Variation represents inter-district disparities.

Table 1: **Metalled Road Length**

	Metalled Road Length per lakh of Population			**Metalled Road Length per 100 sq. km of Area**		
Districts	**2000-01**	**2010-11**	**2020-21**	**2000-01**	**2010-11**	**2020-21**
Ambala	108	111	111	69.44	80.37	79.61
Panchkula	119	108	105	62.36	66.93	65.81
Yamuna Nagar	110	97	98	61.26	66.57	67.48
Kurukshetra	122	122	118	65.88	76.93	74.58
Kaithal	133	168	159	54.16	77.94	73.67
Karnal	86	106	108	43.38	63.61	64.25
Panipat	108	75	70	82.18	70.82	66.64
Sonipat	81	96	99	49.06	66.78	67.53
Rohtak	101	96	102	54.33	58.4	62.29
Jhajjar	100	139	125	48.26	72.46	65.68
Faridabad	55	56	29	56.21	71.47	71.52
Palwal	N.A	80	74	N.A	60.82	57.1
Gurugram	102	47	47	61.32	57.17	56.6
Nuh	N.A	87	84	N.A	50.99	60.85
Rewari	129	113	113	62.2	63.61	63.93
Mahendragarh	116	112	114	50.83	54.34	55.08
Bhiwani	139	149	149	41.54	50.79	50.86
Jind	97	84	87	42.52	41.41	42.97
Hisar	120	126	125	46.47	54.43	54.73
Fatehabad	181	163	159	58.02	60.32	59.1
Sirsa	150	174	142	38.88	52.53	42.9
Charkhi Dadri	NA	NA	78	NA	NA	46.89
Mean	**113.53**	**109.95**	**104.36**	**59.52**	**66.4**	**61.37**
S.D.	**27.24**	**34.53**	**33.24**	**22.16**	**19.59**	**9.88**
C.V.	**24**	**31.4**	**31.85**	**37.23**	**29.5**	**16.09**

Source: Statistical Abstract of Haryana, Various Issues.

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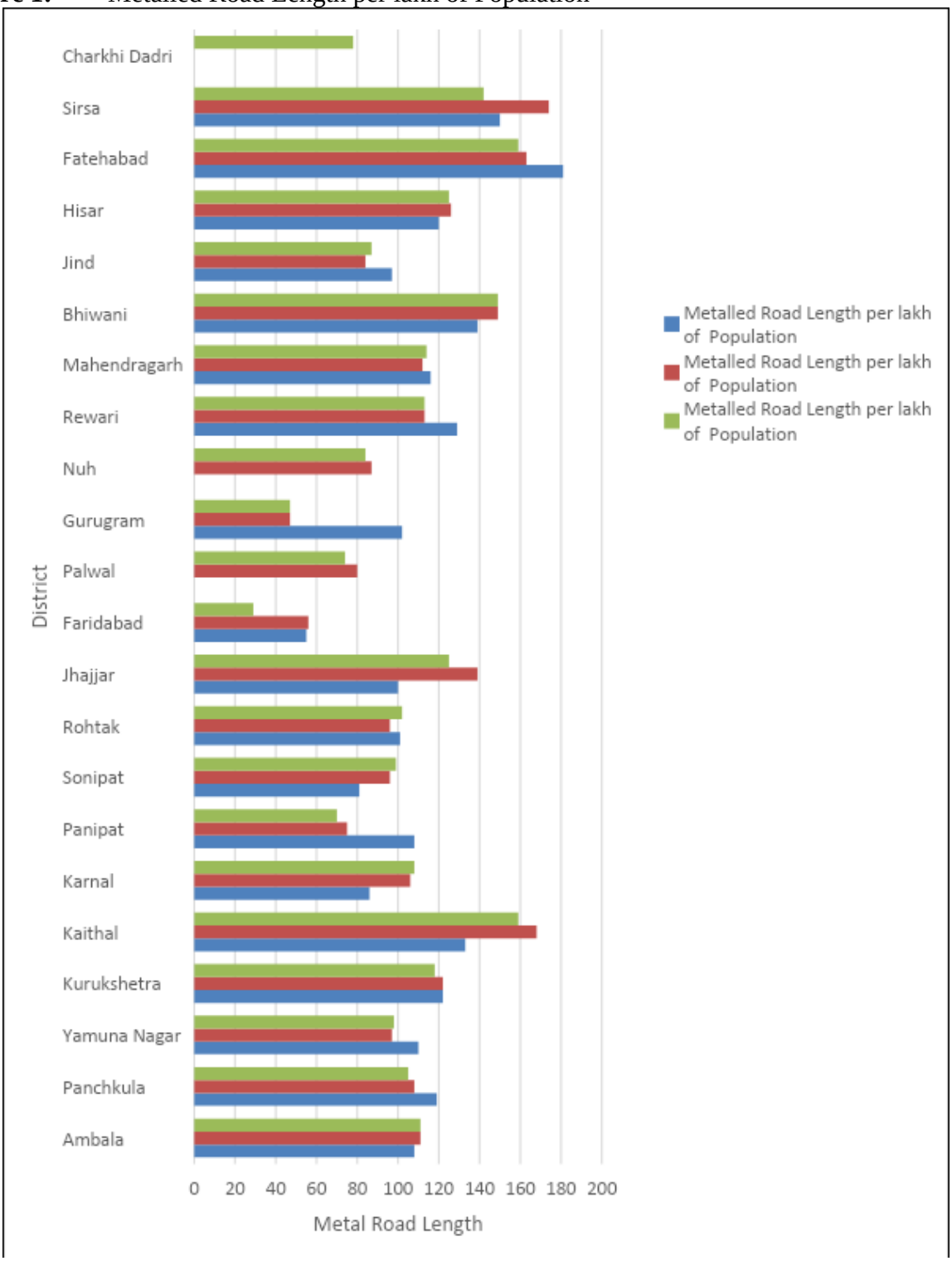
Figure 1: Metalled Road Length per lakh of Population



Source: Table 1

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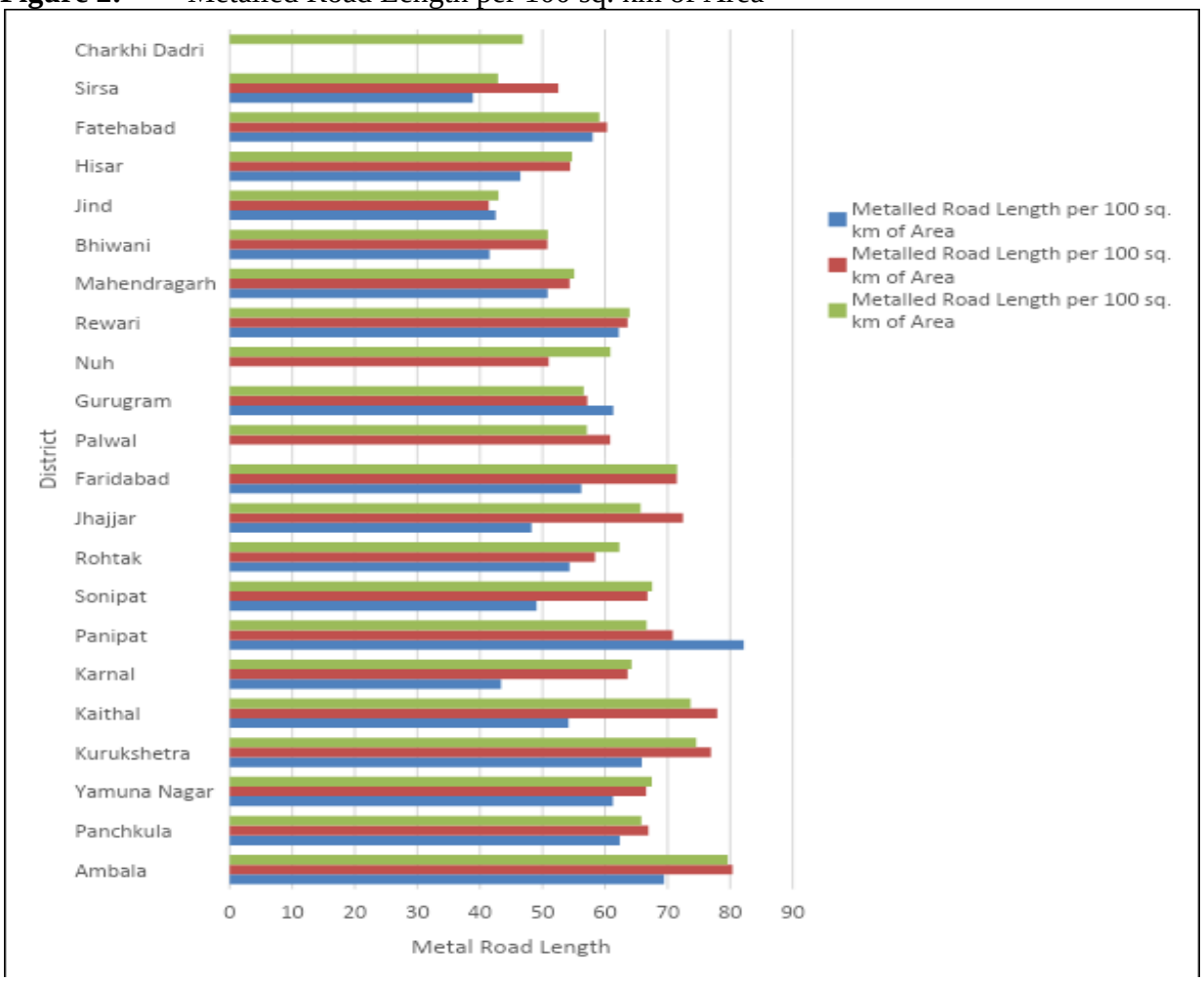
Figure 2: Metalled Road Length per 100 sq. km of Area



Source: Table 1

The table 1 shows the metalled road length per lakh of population and per 100 sq. km of area for various districts over three different years: 2000-01, 2010-11 and 2020-21. The data reveals significant disparities in metalled road length across different districts in Haryana. Advanced districts in terms of metalled road length per lakh of population include Kaithal, Fatehabad and Sirsa. Kaithal consistently had high values, with 133 km in 2000-01, increasing significantly to 168 km in 2010-11 and maintaining a high level at 159 km in 2020-21. Fatehabad also showed impressive figures with 181 km in 2000-01, 163 km in 2010-11 and 159 km in 2020-21. Sirsa, despite fluctuations, had 150 km in 2000-01, peaked at 174 km in 2010-11 and settled at 142 km in 2020-21. In terms of metalled road length per 100 sq. km of area, advanced districts include Ambala, Kaithal and Panipat. Ambala consistently had values above the mean, with 69.44 km in 2000-01, 80.37 km in 2010-11 and 79.61 km in 2020-21. Kaithal excelled here as well, with 54.16 km in 2000-01, 77.94 km in 2010-11 and 73.67 km in 2020-21. Panipat, despite fluctuations, had notable values starting from 82.18 km in 2000-01, then slightly decreasing to 70.82 km in 2010-11 and further to 66.64 km in 2020-21.

Conversely, backward districts in terms of metalled road length per lakh of population include Faridabad, Gurugram and Palwal. Faridabad showed a significant decline from 55 km in 2000-01 to 56 km in 2010-11 and drastically fell to 29 km in 2020-21. Gurugram also

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declined, starting at 102 km in 2000-01, dropping to 47 km in 2010-11 and remaining at 47 km in 2020-21. Palwal, with data starting from 2010-11, showed values of 80 km then but declined to 74 km in 2020-21. In terms of area, the backward districts are Sirsa, Jind and Charkhi Dadri. Sirsa, despite earlier strength, had 38.88 km in 2000-01, improved to 52.53 km in 2010-11 but again declined to 42.9 km in 2020-21. Jind started low with 42.52 km in 2000-01, slightly decreased to 41.41 km in 2010-11 and modestly increased to 42.97 km in 2020-21. Charkhi Dadri, with data only for 2020-21, showed a lower value of 46.89 km. The overall trend indicates that while some districts have maintained or improved their road infrastructure over the years, others have experienced declines. Advanced districts like Kaithal and Ambala have consistently high metalled road lengths per population and area, reflecting strong infrastructure development. Conversely, districts like Faridabad and Gurugram have seen significant declines, indicating potential areas for targeted infrastructure improvement. The disparity suggests that strategic investments are necessary to ensure balanced development across all districts in Haryana.

Table 2: **Number of Post Offices**

Districts	**Number of Post Offices Per Lakh of Population**		
	2000-01	**2010-11**	**2020-21**
Ambala	14	12	12
Panchkula	10	9	9
Yamunanagar	13	11	11
Kurukshetra	13	12	12
Kaithal	13	11	11
Karnal	13	12	12
Panipat	10	9	9
Sonipat	14	12	12
Rohtak	12	11	11
Jhajjar	16	14	14
Faridabad	6	5	5
Palwal	N.A	4	4
Gurugram	10	10	10
Nuh	N.A	7	7
Rewari	17	14	14
Mahendragarh	14	13	13
Bhiwani	16	14	14
Jind	14	12	12
Hisar	16	13	13
Fatehabad	14	15	15
Sirsa	14	13	13
Charkhi Dadri	NA	NA	8
Mean	**13.11**	**11.1**	**10.95**
S.D.	**2.64**	**2.91**	**2.92**
C.V.	**20.17**	**26.26**	**26.65**

Source: Statistical Abstract of Haryana, Various Issues.

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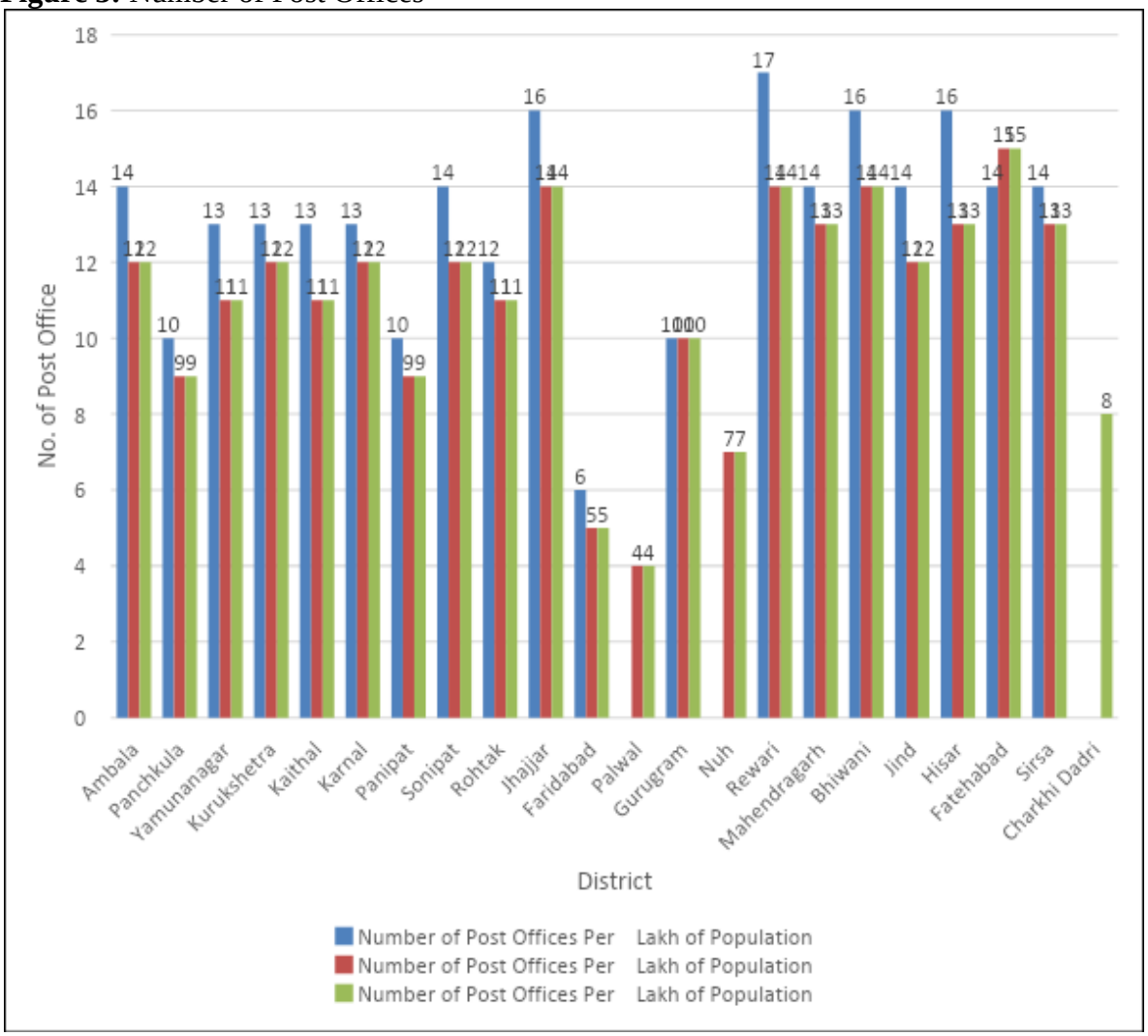
Figure 3: Number of Post Offices



Source: Table 2

The analysis of the data on inter-district disparities in economic infrastructure, specifically focusing on the number of post offices per lakh of population and the percentage of net area irrigated to the net area sown, reveals several key trends over the two-decade span from 2000-01 to 2020-21. In terms of the number of post offices per lakh of population, most districts have experienced a decline or remained stable over the years. For instance, Ambala, Kurukshetra, Kaithal, Karnal and Sonipat saw a reduction in the number of post offices from 14 or 13 in 2000-01 to 12 in 2020-21. Similarly, Yamunanagar, Panipat and Rohtak decreased from 13 or 12 to 11 over the same period. This trend indicates a reduction in postal infrastructure, possibly due to urbanization and increased reliance on digital communication. However, some districts like Faridabad and Palwal consistently had fewer post offices per lakh of population, indicating a persistent disparity in postal infrastructure. Regarding the percentage of net area irrigated to net area sown, most districts have shown an increase or maintained high levels of irrigation over the years. Districts like Kurukshetra, Kaithal, Karnal, Panipat, Sonipat, Jind and Rewari achieved or maintained 100% irrigation by 2020-21, reflecting substantial investments in irrigation infrastructure. On the other hand, districts like

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Panchkula, Gurugram and Nuh, which had lower irrigation percentages in 2000-01, saw significant improvements, with percentages rising to 82.61%, 100% and 77.27%, respectively, by 2020-21.

This improvement indicates focused efforts to enhance agricultural productivity through better irrigation facilities. The mean values for the number of post offices per lakh of population decreased from 13.11 in 2000-01 to 10.95 in 2020-21, while the mean percentage of net area irrigated to net area sown increased from 83.91% to 94.66% in the same period. The standard deviation (S.D.) and coefficient of variation (C.V.) for the number of post offices increased slightly, suggesting growing disparities in postal infrastructure. In contrast, the S.D. and C.V. for the percentage of net area irrigated decreased significantly, indicating reduced disparities in irrigation coverage across districts. In summary, the data demonstrates a trend towards reduced postal infrastructure availability while showing significant improvements and reduced disparities in irrigation infrastructure across the districts. This suggests a shift in focus towards enhancing agricultural productivity through better irrigation, while the postal infrastructure has not seen similar levels of investment or expansion.

5.1.2 Inter-district Disparities in Selected Indicators of Social Infrastructure

Indicators of social infrastructure include those from the educational as well as the health care sectors. The number of primary, middle and high schools per 100 square kilometers of land, as well as the student-teacher ratio in primary, middle and high schools, are the indicators that have been picked for the education infrastructure. The number of hospitals, community health centres, primary health care centres, sub-centers, dispensaries and beds per one lakh of people have been chosen as the indicators for health infrastructure. The differences in educational infrastructure from district to district are presented. The differences in health infrastructure between the districts are displayed.

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Table 3: **Number of Primary and Middle Schools**

Districts	**Number of Primary Schools Per 100 sq. km. of Area**			**Number of Middle Schools Per 100 sq. km. of Area**			
	2000-01	**2010-11**	**2020-21**		**2000-01**	**2010-11**	**2020-21**
Ambala	36	46	34		4	14	15
Panchkula	30	39	35		5	11	15
Yamunanagar	31	52	36		3	14	19
Kurukshetra	37	41	36		6	14	18
Kaithal	20	26	18		3	5	9
Karnal	24	32	23		4	9	12
Panipat	24	36	25		5	7	26
Sonipat	31	39	24		7	7	13
Rohtak	21	27	15		4	6	7
Jhajjar	30	34	19		5	6	9
Faridabad	49	113	41		8	39	92
Palwal	N.A	41	30		N.A	13	30
Gurugram	31	36	33		5	10	26
Nuh	N.A	42	27		N.A	21	20
Rewari	32	39	29		5	8	10
Mahendragarh	40	34	26		6	8	10
Bhiwani	19	23	15		3	5	7
Jind	23	25	17		5	5	8
Hisar	13	20	15		3	3	8
Fatehabad	14	19	18		3	4	7
Sirsa	13	17	13		3	3	6
Charkhi Dadri	NA	NA	16		NA	NA	6
Mean	**27**	**37**	**24.77**		**4.58**	**10.1**	**16.95**
S.D.	**9.55**	**19.67**	**8.5**		**1.46**	**8.02**	**18.19**
C.V.	**35**	**52.99**	**34.3**		**31.99**	**79.49**	**107.29**

Source: Statistical Abstract of Haryana, Various Issues

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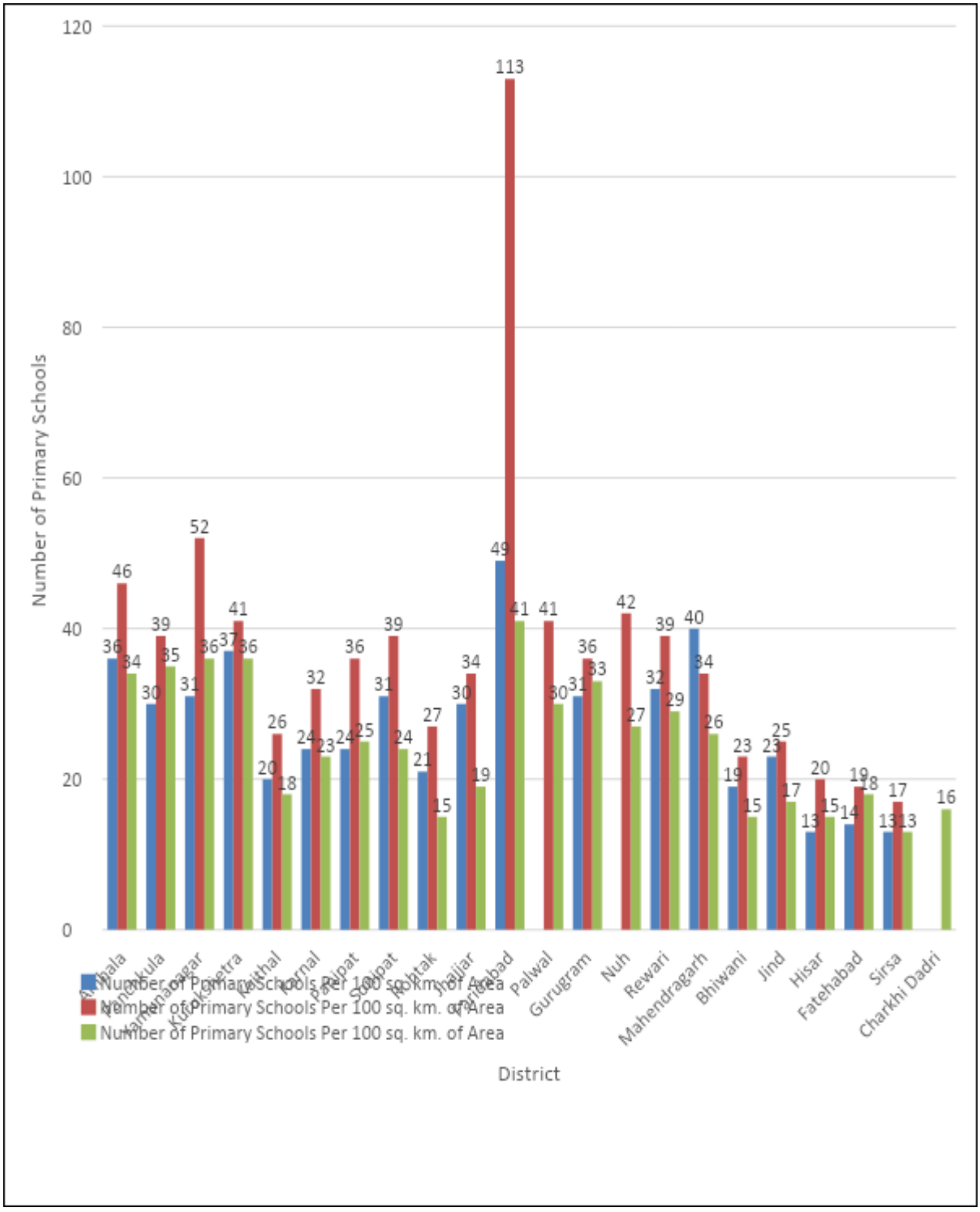
Figure 4: Number of Primary Schools



Source: Table 3

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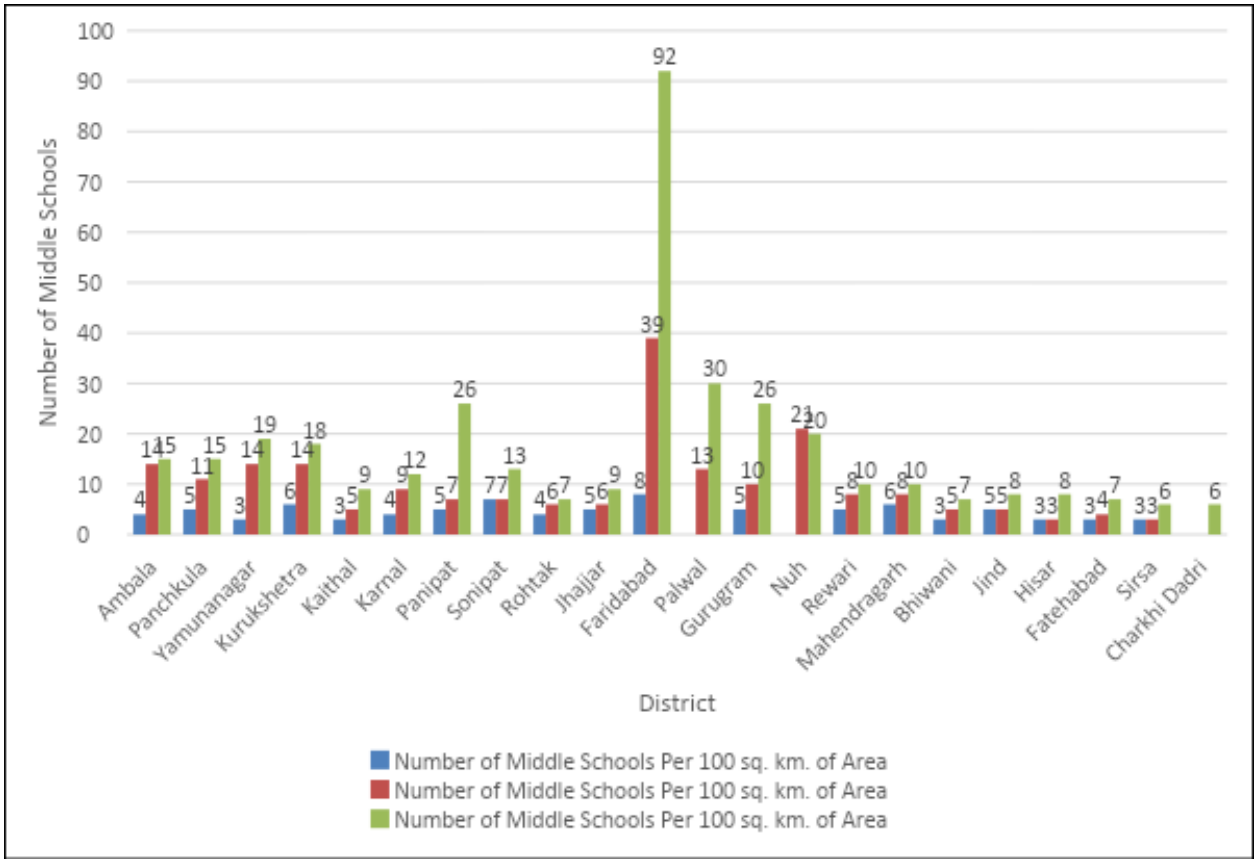
Figure 5: Number of Middle Schools



Source: Table 3

Inter-district disparities in educational infrastructure in Haryana are evident when examining the number of primary and middle schools per 100 square kilometers across various districts from 2000 to 2021. In terms of primary schools, districts like Faridabad, Ambala and Yamunanagar show significant numbers, with Faridabad peaking at 113 schools per 100 sq. km. in 2010-11 but then dropping to 41 by 2020-21. Conversely, districts such as Sirsa and Hisar remain on the lower end, with figures around 13 to 15 schools per 100 sq. km. Middle schools display similar variability, with Faridabad again showing a sharp increase from 8 to 92 schools per 100 sq. km. between 2000 and 2021, while districts like Rohtak and Sirsa exhibit minimal growth. The data reveals a standard deviation (S.D.) and coefficient of variation (C.V.) that underscore these disparities, particularly in middle school numbers where the C.V. rises from 31.99 in 2000-01 to 107.29 in 2020-21. Such disparities highlight the uneven distribution of educational resources, impacting overall educational development in the state.

The data reveals considerable disparities in the distribution and growth of educational infrastructure across different districts in Haryana. Advanced districts like Faridabad, Yamunanagar and Kurukshetra have shown substantial increases in both primary and middle

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schools per 100 sq. km of area, indicating robust educational infrastructure development. Faridabad demonstrated significant growth, with 49 primary schools in 2000-01, a remarkable increase to 113 in 2010-11, though it declined to 41 in 2020-21, still remaining above the mean. It also led in middle schools, increasing from 8 in 2000-01 to 39 in 2010-11 and reaching 92 in 2020-21. Yamunanagar maintained consistently high values, with 31 primary schools in 2000-01, peaking at 52 in 2010-11 and maintaining 36 in 2020-21, while its middle schools grew from 3 in 2000-01 to 14 in 2010-11 and 19 in 2020-21. Kurukshetra showed strong figures with 37 primary schools in 2000-01, 41 in 2010-11 and 36 in 2020-21 and consistent improvement in middle schools from 6 in 2000-01 to 14 in 2010-11 and 18 in 2020-21. On the other hand, backward districts such as Sirsa, Hisar and Bhiwani have shown limited growth, remaining below the mean and indicating a need for targeted educational infrastructure development. Sirsa had low values, with 13 primary schools in 2000-01, declining to 17 in 2010-11 and further to 13 in 2020-21 and minimal growth in middle schools from 3 in 2000-01, 3 in 2010-11 and 6 in 2020-21. Hisar showed limited growth with 13 primary schools in 2000-01, 20 in 2010-11 and 15 in 2020-21 and its middle schools increased slightly from 3 in 2000-01 and 2010-11 to 8 in 2020-21. Bhiwani had minimal improvement with 19 primary schools in 2000-01, 23 in 2010-11 and 15 in 2020-21 and its middle schools grew from 3 in 2000-01 to 5 in 2010-11 and 7 in 2020-21. Overall, while there has been a general increase in the number of schools over the years, the disparity suggests that strategic efforts are necessary to ensure more balanced educational infrastructure development across all districts in Haryana. This would help in providing equitable access to education and improving overall educational outcomes in the state.

5.2 Inter-District Disparities in Selected Indicators in Punjab

5.2.1 Inter-District Disparities in Selected Indicators of Economic Infrastructure

Tables show inter-district disparities in economic infrastructure. Coefficient of Variation represents inter-district disparities.

Table 4: **Metalled Road Length**

Districts	Metalled Road Length per lakh of Population		
	2000- 01	**2010- 11**	**2020-21**
Gurdaspur	159	185	315
Pathankot	NA	259	276
Amritsar	198	213	213
Tarn Taran	NA	270	285
Kapurthala	265	291	315
Jalandhar	244	264	224
S.B.S. Nagar	NA	400	397
Hoshiarpur	322	347	373
Rupnagar	359	376	403
S.A.S. Nagar	NA	236	279
Ludhiana	271	286	269
Firozpur	160	173	306
Fazilka	NA	282	304
Faridkot	289	310	294
Shri Muktsar Sahib	430	452	424

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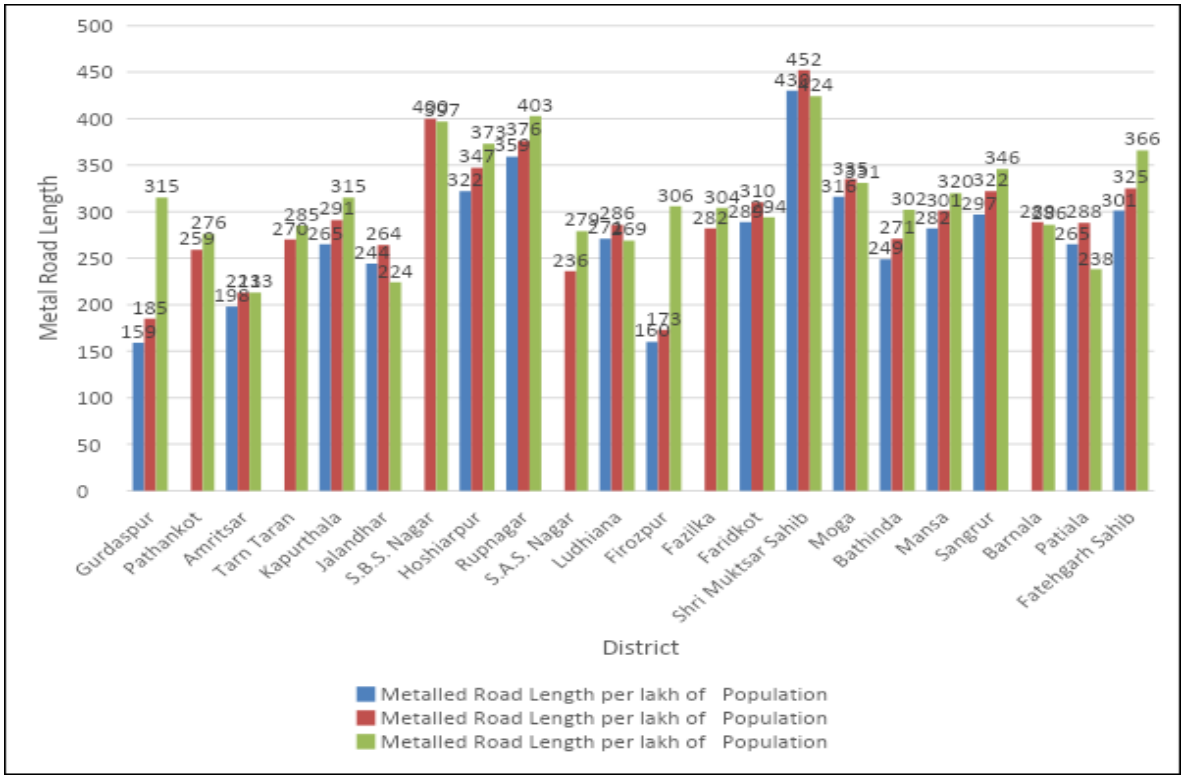
Moga	316	335	331
Bathinda	249	271	302
Mansa	282	301	320
Sangrur	297	322	346
Barnala	NA	289	286
Patiala	265	288	238
Fatehgarh Sahib	301	325	366
Mean	200.32	294.32	312.09
S.D.	138.34	65.25	55.84
C.V.	69.06	22.17	17.89

Source: Statistical Abstract of Punjab, Various Issues.

Figure 6: Metalled Road Length



Source: Table 4

The data, focuses on the length of metalled roads per lakh population across various districts over three decades (2000-01, 2010-11, 2020-21). The data reveals significant disparities in metalled road length per lakh of population across different districts in Punjab over the years 2000-01, 2010-11 and 2020-21. Advanced districts consistently performing above the mean include Rupnagar, Hoshiarpur, S.B.S. Nagar and Shri Muktsar Sahib. Rupnagar shows significant improvement and high values with 359 km in 2000-01, 376 km in 2010-11 and 403 km in 2020-21. Hoshiarpur maintained consistently high values with 322 km in 2000-01, 347 km in 2010-11 and 373 km in 2020-21. S.B.S. Nagar, despite missing data for 2000-01, had exceptionally high values of 400 km in 2010-11 and 397 km in 2020-21. Shri Muktsar Sahib had the highest values overall with 430 km in 2000-01, 452 km in 2010-11 and 424 km in 2020-21. Conversely, backward districts consistently performing below the mean include Amritsar,

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Patiala, Jalandhar and S.A.S. Nagar. Amritsar showed values of 198 km in 2000-01, slightly improving to 213 km in 2010-11 but remaining stagnant at 213 km in 2020-21. Patiala had values of 265 km in 2000-01, improving slightly to 288 km in 2010-11 but then dropping to 238 km in 2020-21. Jalandhar, although initially high, saw a decline from 244 km in 2000-01 and 264 km in 2010-11 to 224 km in 2020-21. S.A.S. Nagar, with data starting from 2010-11, had 236 km in 2010-11 and 279 km in 2020-21, both below the mean. The overall trend indicates that while some districts have significantly improved or maintained their road infrastructure, others have stagnated or declined. The disparity in the coefficient of variation (C.V.), which decreased from 69.06 in 2000-01 to 17.89 in 2020-21, suggests that although disparities have lessened over time, significant variability still exists. Strategic efforts are necessary to ensure balanced road infrastructure development across all districts in Punjab, providing equitable access and enhancing overall socio-economic outcomes.

Table 5: Metalled Road Length per 100 sq. km of Area

Districts	Metalled Road Length per 100 sq. km of Area		
	2000-01	**2010-11**	**2020-21**
Gurdaspur	102	120	156
Pathankot	0	NA	NA
Amritsar	181	204	228
Tarn Taran	0	126	153
Kapurthala	123	147	169
Jalandhar	200	221	206
S.B.S. Nagar	0	195	199
Hoshiarpur	146	164	187
Rupnagar	170	189	217
S.A.S. Nagar	0	219	328
Ludhiana	248	268	283
Firozpur	45	67	66
Fazilka	0	NA	NA
Faridkot	116	133	137
Shri Muktsar Sahib	139	158	167
Moga	129	151	163
Bathinda	92	113	143
Mansa	90	108	125
Sangrur	125	149	176
Barnala	0	124	135
Patiala	151	172	164
Fatehgarh Sahib	146	167	205
Mean	137.69	161.53	181.79
S.D.	46.39	46.22	56.44
C.V.	33.69	28.62	31.05

Source: Statistical Abstract of Punjab, Various Issues.

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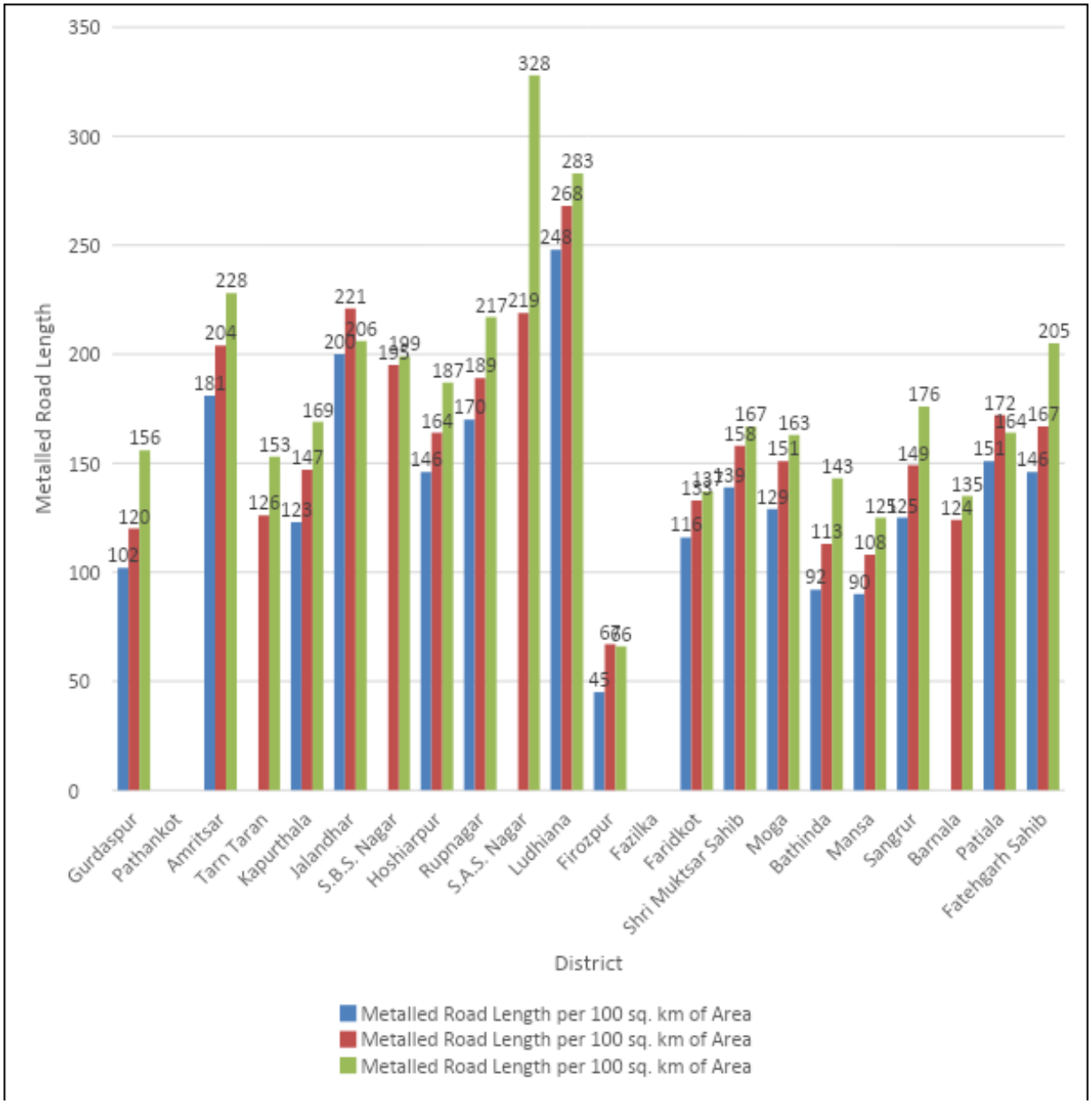
Figure 7: Metalled Road Length per 100 sq. km of Area



Source: Table 5

The provided table details the metalled road length per 100 square kilometers across various districts in Punjab over the years 2000, 2010 and 2020-21. The analysis of this data highlights significant inter-district disparities in economic infrastructure, specifically in terms of road development. In 2000, Jalandhar and Ludhiana had the highest metalled road lengths, with 200 and 248 kilometers per 100 square kilometers, respectively. Districts like Pathankot, Tarn Taran, S.B.S. Nagar, S.A.S. Nagar, Fazilka and Barnala reported no data, indicating either negligible or unrecorded road development at that time. By 2010, there was a notable increase in road length across most districts, with Amritsar, Kapurthala and Rupnagar showing substantial improvements. Pathankot and Fazilka still lacked data, possibly due to administrative or

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developmental delays. The data from 2020-21 reveals further advancements, with S.A.S. Nagar experiencing a significant increase to 328 kilometers per 100 square kilometers, the highest among all districts. This period also saw incremental growth in districts like Gurdaspur, Tarn Taran and Hoshiarpur. Despite these improvements, some districts, particularly Pathankot and Fazilka, still lack data, highlighting persistent regional disparities. Analyzing the mean values and variability offers additional insights.

The mean metalled road length increased from 137.69 kilometers in 2000 to 181.79 kilometers in 2020-21, reflecting overall progress in infrastructure development. However, the standard deviation (S.D.) and coefficient of variation (C.V.) indicate fluctuations in growth consistency. The S.D. slightly increased from 46.39 in 2000 to 56.44 in 2020-21, suggesting growing disparities among districts. Similarly, the C.V. showed variations, decreasing from 33.69 in 2000 to 28.62 in 2010, before rising again to 31.05 in 2020-21, pointing to fluctuating rates of development across the regions. This data underscores the uneven progress in road infrastructure among Punjab's districts over the past two decades. While some districts have made significant strides, others lag behind, underscoring the need for targeted policies to address these disparities and promote balanced regional development.

The data indicates significant disparities in metalled road length per 100 sq. km of area across different districts in Punjab over the years 2000-01, 2010-11 and 2020-21. Advanced districts consistently performing above the mean include Ludhiana, S.A.S. Nagar, Amritsar and Rupnagar. Ludhiana demonstrated consistently high values, with 248 km in 2000-01, increasing to 268 km in 2010-11 and further to 283 km in 2020-21. S.A.S. Nagar, with data starting from 2010-11, showed exceptional growth from 219 km to 328 km in 2020-21. Amritsar showed steady improvement, increasing from 181 km in 2000-01 to 228 km in 2020-21. Rupnagar also performed strongly, increasing from 170 km in 2000-01 to 217 km in 2020-21. Conversely, backward districts consistently performing below the mean include Firozpur, Bathinda, Mansa and Faridkot. Firozpur had consistently low values, with 45 km in 2000-01, slightly increasing to 67 km in 2010-11 and decreasing to 66 km in 2020-21. Bathinda, despite some improvement, remained below the mean with 92 km in 2000-01, 113 km in 2010-11 and 143 km in 2020-21. Mansa showed gradual improvement but still remained below the mean, with 90 km in 2000-01, 108 km in 2010-11 and 125 km in 2020-21. Faridkot showed moderate growth, with 116 km in 2000-01, 133 km in 2010-11 and 137 km in 2020-21. Overall, while there has been a general increase in metalled road length per 100 sq. km of area over the years, the disparity suggests that strategic efforts are necessary to ensure balanced road infrastructure development across all districts in Punjab. This balanced development is essential for equitable access to transportation infrastructure, which can significantly impact socio-economic outcomes in the state.

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Table 6: **Number of Post Offices**

Districts	**Number of Post Offices**		
	2000-01	**2010-11**	**2020-21**
Gurdaspur	185	204	204
Pathankot	NA	72	75
Amritsar	261	285	285
Tarn Taran	NA	187	187
Kapurthala	267	292	120
Jalandhar	183	201	368
S.B.S. Nagar	NA	174	172
Hoshiarpur	325	352	358
Rupnagar	98	115	118
S.A.S. Nagar	NA	95	96
Ludhiana	367	391	392
Firozpur	105	125	126
Fazilka	NA	137	142
Faridkot	72	88	72
Shri Muktsar Sahib	96	114	136
Moga	153	173	167
Bathinda	137	155	156
Mansa	85	100	100
Sangrur	162	184	202
Barnala	NA	82	70
Patiala	173	194	173
Fatehgarh Sahib	70	80	100
Mean	171.19	172.73	173.59
S.D.	88.06	86.68	93.53
C.V.	51.44	50.19	53.88

Source: Statistical Abstract of Punjab, Various Issues.

Figure 8: Number of Post Offices

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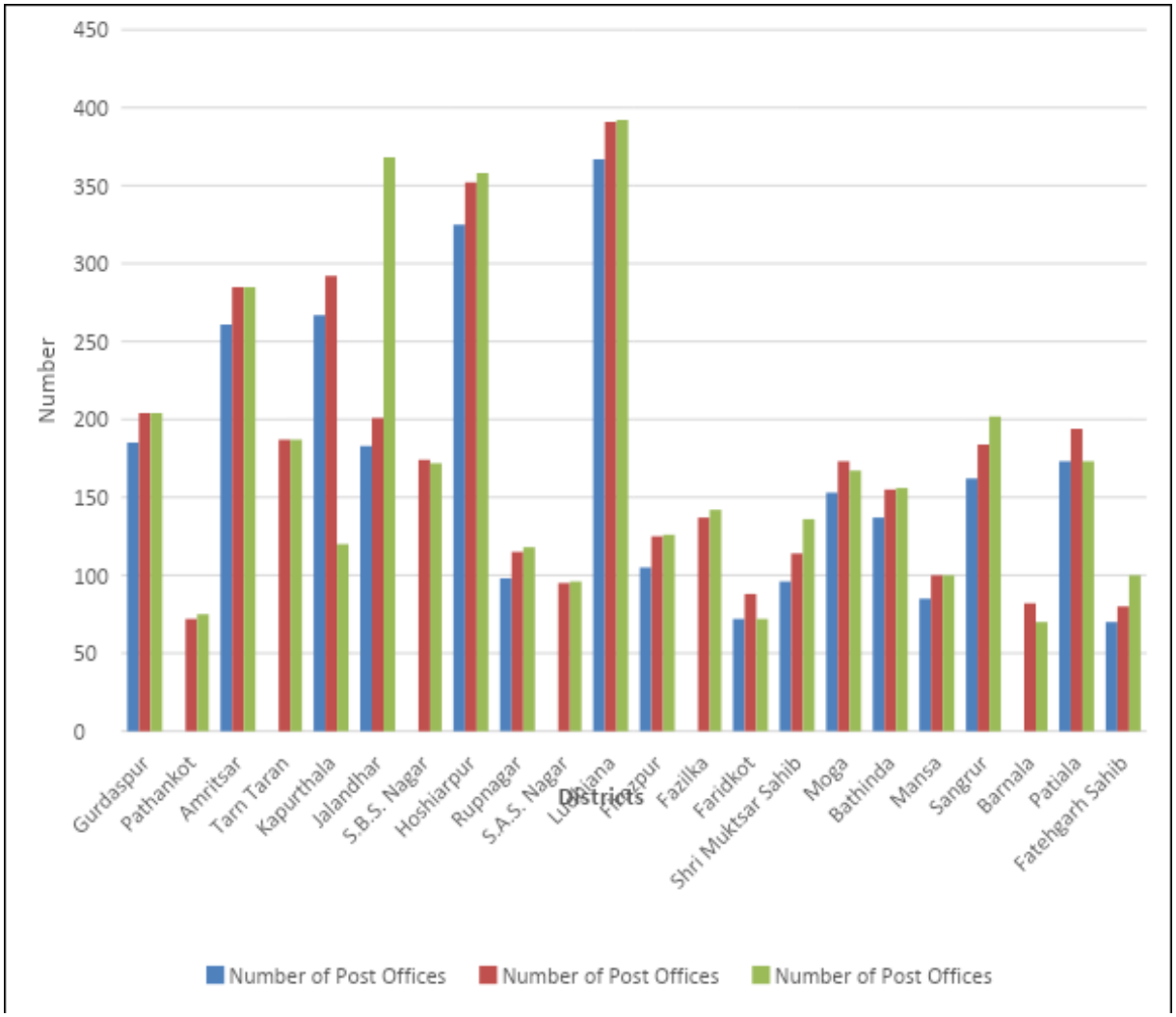

Source: Table 6

The table provided outlines the number of post offices in various districts over three decades: 2000-01, 2010-11 and 2020-21. It highlights the inter-district disparities in economic infrastructure within these regions. Analyzing this data reveals significant variations and trends over time, indicating both growth and decline in the number of post offices across different districts. For instance, districts such as Amritsar, Hoshiarpur and Ludhiana have consistently maintained a higher number of post offices, showing a stable infrastructure in these areas. Amritsar's number of post offices remained constant at 285 from 2010-11 to 2020-21, while Hoshiarpur saw a slight increase from 352 to 358 over the same period. Ludhiana also exhibited a steady rise from 391 to 392, signifying minimal but consistent growth. Conversely, some districts like Kapurthala and Barnala show a notable decrease in the number of post offices.

Kapurthala experienced a significant drop from 292 in 2010-11 to 120 in 2020-21. Similarly, Barnala's count decreased from 82 to 70, reflecting a potential shift in infrastructure focus or population dynamics. Newly formed districts such as Pathankot, Tarn Taran, S.B.S. Nagar, S.A.S. Nagar and Fazilka, which lacked data for 2000-01, indicate their infrastructural development over the later years. Pathankot and Fazilka, for instance, show an increase in the number of post offices from their initial count, suggesting infrastructural expansion to cater to

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the growing needs of these areas. The mean number of post offices across all districts slightly increased from 171.19 in 2000-01 to 173.59 in 2020-21, indicating overall growth. However, the standard deviation (S.D.) and coefficient of variation (C.V.) values suggest that disparities among districts have remained, with S.D. slightly increasing from 86.68 in 2010-11 to 93.53 in 2020-21 and C.V. also rising from 50.19 to 53.88. This points to an increasing variation in the distribution of post offices across districts, reflecting ongoing economic disparities. In conclusion, while some districts show stability or growth in the number of post offices, others demonstrate a decline, emphasizing the uneven distribution of economic infrastructure. The data indicates both positive trends in expanding infrastructure in new districts and challenges in maintaining or increasing infrastructure in established ones, highlighting the complexity of inter-district economic disparities.

Advanced districts consistently performing above the mean include Ludhiana, Hoshiarpur, Amritsar and Jalandhar. Ludhiana demonstrated the highest and consistently increasing numbers, with 367 post offices in 2000-01, increasing to 391 in 2010-11 and further to 392 in 2020-21. Hoshiarpur had 325 post offices in 2000-01, increasing to 352 in 2010-11 and 358 in 2020-21. Amritsar showed consistently high values, with 261 post offices in 2000-01, increasing to 285 in both 2010-11 and 2020-21. Jalandhar showed significant improvement, with 183 post offices in 2000-01, increasing to 201 in 2010-11 and a substantial rise to 368 in 2020-21.

Backward districts consistently performing below the mean include Barnala, Faridkot, S.A.S. Nagar and Rupnagar. Barnala had consistently low numbers, with no data for 2000-01 and showing values of 82 in 2010-11 and decreasing to 70 in 2020-21. Faridkot had 72 post offices in 2000-01, increased to 88 in 2010-11 but decreased back to 72 in 2020-21. S.A.S. Nagar had relatively low and stable numbers, with no data for 2000-01 but showed 95 post offices in 2010-11 and only a slight increase to 96 in 2020-21. Rupnagar showed moderate growth, with 98 post offices in 2000-01, increasing to 115 in 2010-11 and 118 in 2020-21.

The data reveals significant disparities in the number of post offices across different districts in Punjab. Advanced districts like Ludhiana, Hoshiarpur, Amritsar and Jalandhar have shown substantial improvements and consistently high numbers, reflecting robust infrastructure development and maintenance. These districts consistently perform above the mean, showcasing their advanced status in postal infrastructure. Conversely, backward districts like Barnala, Faridkot, S.A.S. Nagar and Rupnagar have shown limited growth and remain below the mean, indicating potential areas for targeted infrastructure enhancement. These districts consistently perform below the mean, highlighting the need for strategic investments to improve their postal services. Overall, while there has been a general increase in the number of post offices over the years, the disparity suggests that strategic efforts are necessary to ensure balanced postal infrastructure development across all districts in Punjab. This balanced development is essential for equitable access to postal services, which can significantly impact socio-economic outcomes in the state.

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5.2.2 Inter-district Disparities in Selected Indicators of Social Infrastructure

Table 7: Population Served Per Primary School

Districts	**Population Served Per Primary School**		
	2000-01	**2010-11**	**2020-21**
Gurdaspur	1035	1234	1254
Pathankot	NA	1250	1215
Amritsar	1388	1633	1832
Tarn Taran	NA	1789	2277
Kapurthala	871	1068	1062
Jalandhar	1028	1271	1219
S.B.S. Nagar	NA	1271	1153
Hoshiarpur	897	1101	1189
Rupnagar	846	1003	1010
S.A.S. Nagar	NA	1285	1230
Ludhiana	1407	1756	1881
Firozpur	1067	1213	1355
Fazilka	NA	2238	2033
Faridkot	1798	2310	2300
Shri Muktsar Sahib	2161	2400	2431
Moga	2180	2589	2584
Bathinda	2239	2717	2764
Mansa	2029	2424	2400
Sangrur	1720	2018	2118
Barnala	NA	2834	3023
Patiala	1108	1301	1450
Fatehgarh Sahib	825	1024	1068
Mean	1412.44	1714.95	1765.82
S.D.	528.13	615.49	637.42
C.V.	3739.00%	35.89	36.10%

Source: Statistical Abstract of Punjab, Various Issues

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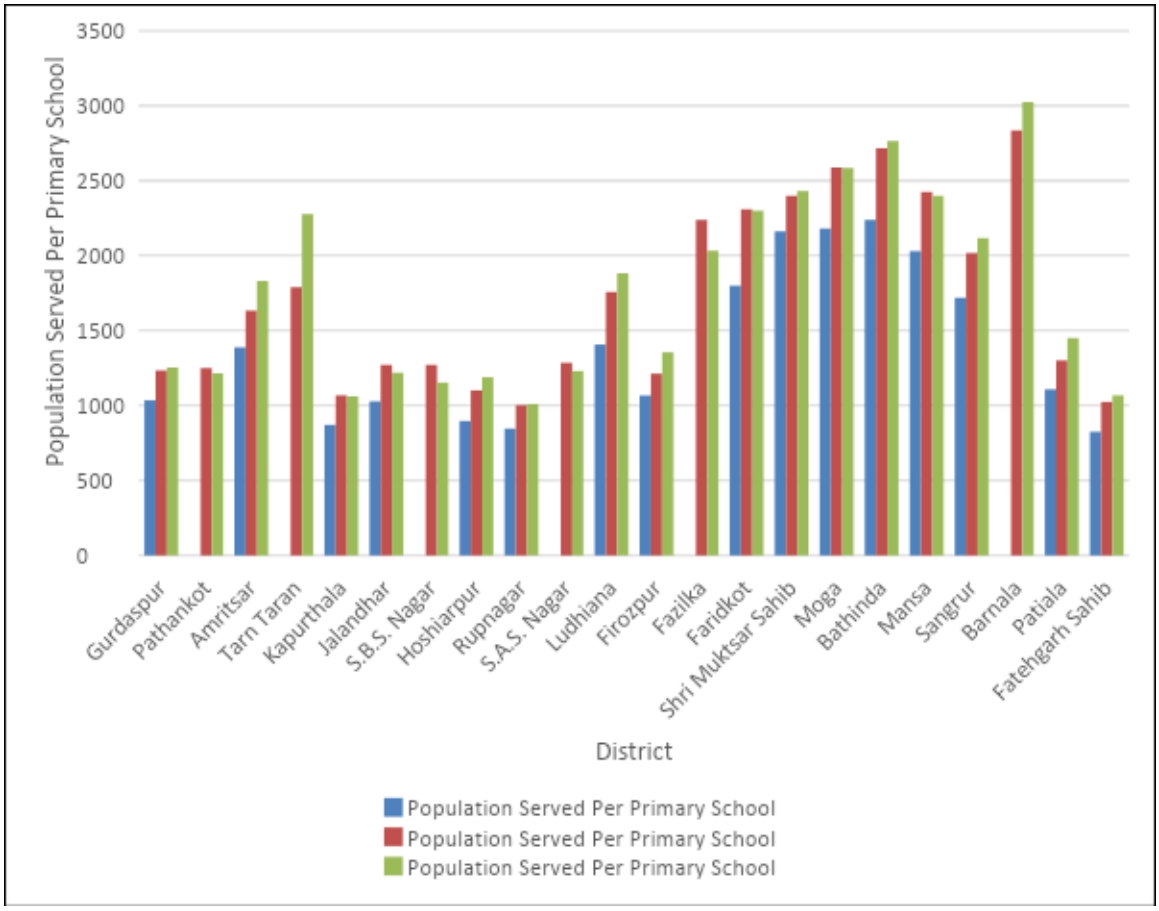
Figure 9: Population Served Per Primary School



Source: Table 7

The data highlights significant disparities among the districts in terms of access to primary education. In 2000-01, the mean population served per primary school was 1412.44, with districts like Gurdaspur and Hoshiarpur showing better infrastructure with lower population figures (1035 and 897 respectively), while districts like Faridkot and Moga had notably higher populations served per school (1798 and 2180 respectively). By 2010-11, there is an evident increase in the mean population served per primary school to 1714.95. The standard deviation also increased from 528.13 to 615.49, indicating growing variability in educational infrastructure across districts. For instance, districts like Tarn Taran and Bathinda experienced significant increases in the population served per school (1789 and 2717 respectively), whereas districts like Kapurthala and Rupnagar managed to keep their figures relatively low (1068 and 1003 respectively). In 2020-21, the mean population served per primary school further increased to 1765.82, with the standard deviation rising to 637.42, suggesting persistent and even widening disparities. Some districts, such as Barnala and Bathinda, showed alarming figures of over 3000 and 2764 respectively, indicating severe stress on their educational infrastructure.

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Districts like Fatehgarh Sahib and Kapurthala maintained better conditions with figures around 1068 and 1062 respectively. Throughout the decades, certain districts like Amritsar and Ludhiana consistently showed higher populations served per school, reflecting ongoing challenges in meeting educational infrastructure needs. The coefficient of variation (C.V.) remained relatively stable, fluctuating slightly around 36%, suggesting that while the overall disparity levels remained high, they did not drastically change in their relative spread. In summary, this data illustrates a persistent and growing disparity in educational infrastructure across different districts, with some districts facing significant challenges in providing adequate access to primary education. The increasing mean and standard deviation over the decades underscore the need for targeted policies to address these disparities and ensure equitable access to educational resources.

Advanced districts consistently performing below the mean (indicating fewer people served per primary school and better access) include Rupnagar, Kapurthala, Fatehgarh Sahib and Hoshiarpur. Rupnagar shows consistently good values with 846 in 2000-01, 1003 in 2010-11 and 1010 in 2020-21. Kapurthala had 871 in 2000-01, increasing slightly to 1068 in 2010-11 and maintaining at 1062 in 2020-21. Fatehgarh Sahib consistently had low values, with 825 in 2000-01, increasing to 1024 in 2010-11 and slightly to 1068 in 2020-21. Hoshiarpur showed reasonable values with 897 in 2000-01, 1101 in 2010-11 and 1189 in 2020-21.
Backward districts consistently performing above the mean (indicating more people served per primary school and lesser access) include Barnala, Moga, Bathinda and Shri Muktsar Sahib. Barnala had the highest values in recent years, with 2834 in 2010-11, increasing to 3023 in 2020-21, indicating significantly lower access to primary schools. Moga consistently had high numbers, with 2180 in 2000-01, increasing to 2589 in 2010-11 and slightly decreasing to 2584 in 2020-21. Bathinda had high values, with 2239 in 2000-01, 2717 in 2010-11 and 2764 in 2020-21. Shri Muktsar Sahib had high values, with 2161 in 2000-01, increasing to 2400 in 2010-11 and 2431 in 2020-21.
The data reveals significant disparities in the population served per primary school across different districts in Punjab. Advanced districts like Rupnagar, Kapurthala, Fatehgarh Sahib and Hoshiarpur have shown consistently low values, indicating better access to primary schools and reflecting strong educational infrastructure. These districts consistently perform below the mean, showcasing their advanced status in primary education access. Conversely, backward districts like Barnala, Moga, Bathinda and Shri Muktsar Sahib have shown high values, indicating more people served per primary school and thus lesser access. These districts consistently perform above the mean, highlighting the need for strategic investments to improve primary education access. There has been a general trend of increasing population served per primary school over the years, the disparity suggests that strategic efforts are necessary to ensure balanced educational infrastructure development across all districts in Punjab. This balanced development is essential for equitable access to primary education, which can significantly impact socio-economic outcomes in the state.

Table 8: Population Served Per Middle School

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Districts	Population Served Per Middle School		
	2000-01	2010-11	2020-21
Gurdaspur	3042	3534	3153
Pathankot	NA	4075	3595
Amritsar	3864	4373	4645
Tarn Taran	NA	4038	4509
Kapurthala	2198	2327	2220
Jalandhar	2190	2484	2911
S.B.S. Nagar	NA	2513	2301
Hoshiarpur	2491	2831	3084
Rupnagar	1884	2086	2014
S.A.S. Nagar	NA	3875	2461
Ludhiana	2843	3338	3466
Firozpur	4057	4557	3713
Fazilka	NA	4757	4122
Faridkot	1968	2161	3330
Shri Muktsar Sahib	3137	3666	2910
Moga	3355	3776	3791
Bathinda	3685	4034	3851
Mansa	3077	3370	3532
Sangrur	3319	3646	3700
Barnala	NA	4150	4341
Patiala	3727	4136	3721
Fatehgarh Sahib	3069	3276	2137
Mean	2994.1	3500.1	3341.2
S.D.	683.8	792	770.3
C.V.	22.84	22.63	23.05

Source: Statistical Abstract of Punjab, Various Issues.

Figure 9: Population Served Per Middle School

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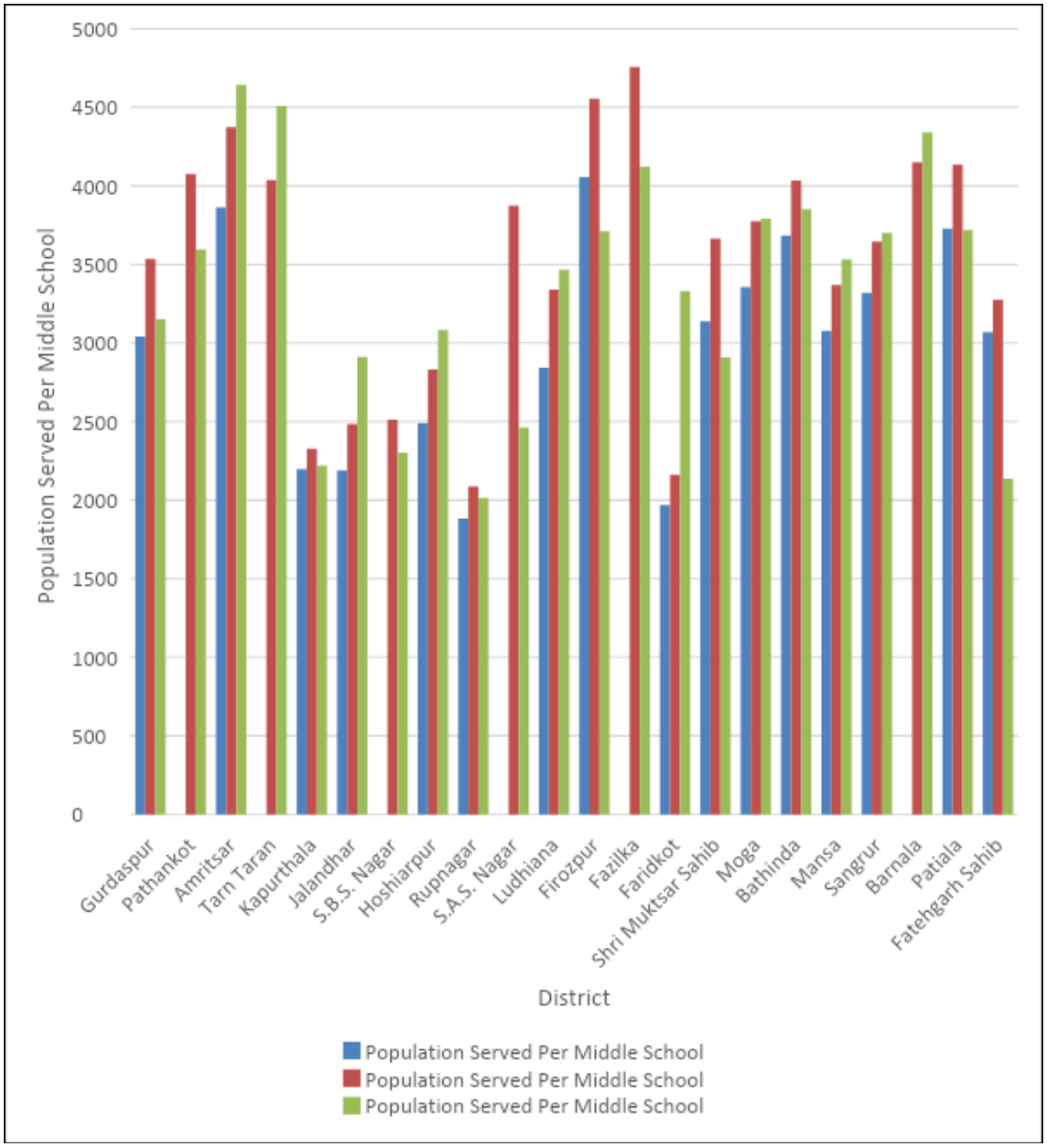

Source: Table 8

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The provided table illustrates the inter-district disparities in educational infrastructure in Punjab, India, by showing the population served per middle school across different districts for the years 2000-01, 2010-11 and 2020-21. The analysis of these data reveals several important trends and insights. Over the two decades from 2000 to 2021, there is a noticeable variation in the number of people served per middle school in different districts. For instance, in 2000-01, Kapurthala and Jalandhar had relatively low populations served per middle school (2198 and 2190 respectively), indicating better educational infrastructure compared to districts like Amritsar and Firozpur, which had higher figures (3864 and 4057 respectively). By 2020-21, although there were improvements in some districts, significant disparities remained. Kapurthala still maintained a lower population served per middle school (2220), whereas Amritsar and Moga saw an increase, with Amritsar reaching 4645 and Moga 3791. Pathankot, Tarn Taran, S.B.S. Nagar, S.A.S. Nagar and Fazilka districts have no data available for 2000-01 as they were formed later. However, by 2010-11 and 2020-21, their data reflects the existing disparities, with Pathankot serving 4075 people per middle school in 2010-11 and reducing to 3595 in 2020-21, indicating some improvement. Analyzing the mean, standard deviation (S.D.) and coefficient of variation (C.V.) over the years further highlights the overall trends and disparities.

The mean population served per middle school increased from 2994.1 in 2000-01 to 3500.1 in 2010-11, before slightly decreasing to 3341.2 in 2020-21. This fluctuation suggests that while there have been improvements in some districts, the overall infrastructure has not kept pace with the population growth uniformly across the districts. The standard deviation, which measures the dispersion of the population served per middle school, increased from 683.8 in 2000-01 to 792 in 2010-11 and then slightly decreased to 770.3 in 2020-21. This indicates that the disparity among districts widened from 2000 to 2010 but showed some signs of narrowing by 2020. However, the coefficient of variation, which standardizes the standard deviation relative to the mean, remained relatively stable around 22-23%, indicating persistent relative disparities over the two decades. In summary, the data reflects significant inter-district disparities in educational infrastructure in Punjab. While some districts have shown improvements, others still lag, resulting in uneven distribution of educational resources. The persistent variation in the population served per middle school highlights the need for targeted policies to address these disparities and ensure equitable educational opportunities across all districts.

Advanced districts consistently performing below the mean (indicating fewer people served per middle school and better access) include Rupnagar, Kapurthala, Fatehgarh Sahib and S.B.S. Nagar. Rupnagar demonstrated consistently good values with 1884 in 2000-01, 2086 in 2010-11 and 2014 in 2020-21. Kapurthala was another strong performer with 2198 in 2000-01, 2327 in 2010-11 and maintaining at 2220 in 2020-21. Fatehgarh Sahib showed significant improvement, having 3069 in 2000-01, 3276 in 2010-11 and drastically improving to 2137 in 2020-21. Though data for S.B.S. Nagar is not available for 2000-01, it had 2513 in 2010-11 and improved to 2301 in 2020-21.

Backward districts consistently performing above the mean (indicating more people served per middle school and lesser access) include Amritsar, Fazilka, Barnala and Moga. Amritsar had consistently high values with 3864 in 2000-01, increasing to 4373 in 2010-11 and further to 4645 in 2020-21, indicating significantly lower access to middle schools. Fazilka, though data is not available for 2000-01, had 4757 in 2010-11 and slightly decreased to 4122 in 2020-21. Barnala showed high values with 4150 in 2010-11 and increased to 4341 in 2020-21. Moga had consistently high numbers, with 3355 in 2000-01, increasing to 3776 in 2010-11 and further to 3791 in 2020-21.

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The data reveals significant disparities in the population served per middle school across different districts in Punjab. Advanced districts like Rupnagar, Kapurthala, Fatehgarh Sahib and S.B.S. Nagar have shown consistently low values, indicating better access to middle schools and reflecting strong educational infrastructure. These districts consistently perform below the mean, showcasing their advanced status in middle school education access. Conversely, backward districts like Amritsar, Fazilka, Barnala and Moga have shown high values, indicating more people served per middle school and thus lesser access. These districts consistently perform above the mean, highlighting the need for strategic investments to improve middle school education access. The disparity suggests that strategic efforts are necessary to ensure balanced educational infrastructure development across all districts in Punjab. This balanced development is essential for equitable access to middle school education, which can significantly impact socio-economic outcomes in the state.

7 Conclusion

The analysis of inter-district disparities in economic and social infrastructure in Haryana and Punjab reveals significant variations across the districts, emphasizing the need for targeted interventions to ensure balanced regional development. In Haryana, the disparities in metalled road length per population and area highlight that while some districts like Kaithal and Ambala have developed robust road infrastructures, others like Faridabad and Gurugram have seen a decline. The distribution of post offices per lakh of population indicates a reduction in postal infrastructure in some districts, reflecting potential urbanization and digital communication trends. The uneven distribution of educational infrastructure, with advanced districts like Faridabad and Yamunanagar showing substantial increases in school numbers while backward districts like Sirsa and Hisar exhibit minimal growth, underscores the need for focused educational investments. In Punjab, the disparities in road infrastructure are evident, with advanced districts like Rupnagar and Ludhiana consistently performing above the mean, while districts like Firozpur and Barnala lag behind. The number of post offices shows similar trends, with some districts experiencing a decline. Educational infrastructure analysis indicates that advanced districts have better access to primary and middle schools, whereas backward districts like Moga and Amritsar continue to struggle with higher populations served per school, reflecting inadequate educational facilities. The persistent and, in some cases, widening disparities across both states suggest that while overall infrastructure development has improved, it has not been uniformly distributed. The use of the Coefficient of Variation (CV) as a statistical tool has effectively highlighted these disparities, providing a clear picture of the relative variability in infrastructure development. To address these disparities, policymakers need to design and implement targeted strategies that focus on improving infrastructure in the backward districts. Ensuring equitable access to transportation, communication and educational facilities is crucial for fostering balanced socio-economic development. Strategic investments and policy reforms are necessary to bridge the gaps and promote uniform growth across all districts in Haryana and Punjab. This study provides a foundation for further research and policy formulation aimed at reducing regional disparities and enhancing the overall development of these states. By prioritizing the development of underperforming districts, Haryana and Punjab can achieve more balanced regional growth, ultimately contributing to the nation's broader socio-economic progress.

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