

Social Infrastructure in Haryana- A Study of Inter-District Disparities**Dr. Santosh Nandal¹**

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In this paper an attempt has been made to study the social infrastructure in Haryana along with inter-district disparities for the year 2000-01 and 2017-18. The study also analyzed the developed and less developed districts in social infrastructure. Simple statistical tools like mean and Coefficient of Variance have been used to measure the inter-district disparities. Composite index has been constructed to find out the development of districts. Principal Component Analysis has been used to get factor loadings and weights of selected indicators. It was found from the study that there are wide spread of disparities in the development levels of different districts. Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure while in 2017-18 Bhiwani district was on the top position.

Introduction

Infrastructure describes the physical structure of facilities which are required to provide goods and services to public. It is linked with economy directly or indirectly or we can say that it effect economy through its spillover effects. It includes all those activities which do not directly generate income themselves but provide support and substance to the income generation activities.

Infrastructure means something that comes before the actual structure. It is foundation to build the structure of economy. Infrastructure consist permanent structure which is used for a long time to give inputs to the economy like network of road, railway facility, electricity, schools, colleges and hospitals etc.

Role of Infrastructure in Economic Growth and Development

. Infrastructure plays an important role in overall development. Many economists describe the importance of infrastructure in economic development. In fact, developmental activities depend upon infrastructure facilities. It is considered the prerequisite of development. In the words of Dr. V.K.R.V. Rao, "The link between infrastructure and development is not once for all affairs.

It is a continuous process; and progress in development has to be preceded, accompanied and followed by progress in infrastructure, if we are to fulfill our declared objective of a self-accelerated process of economic development."

The infrastructural network has dual character; it is a crucial factor of development as well as a component of development. The regions which have weak infrastructure network remain less developed and it is generally accepted fact that agriculture, industry and other development activities are constrained by available infrastructural facilities. Different types of infrastructural facilities affect the overall development including agriculture, industry and human development in which infrastructure plays a leader role and follower is the development (Majumder, R. 2004).

Classification of Infrastructure

Infrastructure can be classified into two category i.e. economic infrastructure and social infrastructure. Social infrastructure is also divided into two education and health infrastructure.

Social infrastructure is essential for an economy development. Social infrastructure concept is very wide and plays extremely significant role in economy development as it executes the task of human development resources by means of skill generation, education, awareness creation, training, research and development and health care to increase the efficiency of production. Social infrastructure plays an important role in enhancing the human capital. Advancement in knowledge and the dispersion of new ideas and activities are necessary to eliminate economic backwardness and install the human abilities that are more favourable to economic achievement. (AnuKapil and P.S. Raikhy) It has been recognized that physical capital growth is directly related to considerable formation of human capital.

Education is considered as catalyst for the development of human resource. This is the key social infrastructure indicators which have direct relation with productive manpower, level of income and standard of living. Less developed countries need educated professionals in all areas to boost the development and growth. UNESCO suggests minimum fifteen percent of national expenditure on educational facilities. Education acts as the base for research and development. Being an integral part of development progress, it cannot be looked separately.

Objectives of the Study

- To study the overall development of social infrastructure in Haryana.
- To analyse inter-district disparities in social infrastructure.
- To identify the developed and less developed districts.
- To categories districts on the basis of the value of Infrastructure Development index.

Research Methodology

The current study focused on overall growth and development of social infrastructure in the state of Haryana. The study also analyzed inter-districts disparities, developed and backward districts in social infrastructure. Social Infrastructure considered education (number of schools, teachers, students and student-teacher ratio) and health (number of hospitals, CHCs, PHCs, sub-centres, dispensaries, number of beds per lakh of population) indicators to show growth and development of social infrastructure. For inter-districts disparities and to identify developed and backward districts; only a few indicators have been taken in

consideration due to the unavailability of complete data on district level. The selection of indicators had been done after extensive review of literature.

The present study is empirical by nature. To accomplish the objectives, secondary data from different sources like; Statistical abstract of Haryana, Census 2001 and 2011 and Economic survey of Haryana have been used. In order to identify inter-district disparities and development ranks of 21 districts of Haryana; data of 12 indicators from social infrastructure for two points of time 2000-01 and 2017-18 have been used. For inter-district disparities; simple statistical tools like Mean, Standard Deviation and Coefficient of Variance have been calculated and considered. Raychaudhuri, A. and Haldar, S. (2009) method has been considered to run PCA for giving weights to the indicators and to construct Composite Index.

To run PCA, raw data was first converted into normalized data for each district. This was done to form raw data unit free and get relative spot of every district. Best and worst values of all indicators were identified for each district in order to calculate normalized value. Normalized value falls between 0 and 1 always.

$$NV_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$$

Where $R = \text{best } X_{ij} - \text{worst } X_{ij}$

$i = i\text{-th observation and } j = j\text{-th district}$

The next step after obtaining the normalized value was to run PCA to get factor loadings and weights of selected indicators. SPSS software was used to run PCA. From PCA, Initial Eigen values which are more than 01 were also identified. Weights for each selected indicator were obtained by multiplication of first initial Eigen value to first factor value and so on and then by adding all the values (which came after multiplication) together.

The next step was to construct the composite index. Composite Index was calculated; firstly, weight of selected indicator was multiplied by same indicator's normalized value, secondly, all indicators values (came after multiplication) were added together and divided by the total weights of selected indicators. The same procedure was followed for every district and for both types of infrastructure (Education and Health) at two selected points of time, 2000-01 and 2017-18.

The next step was to calculate Infrastructural Development Index (IDI) for selected two points of time separately for each district. This was done by using simple arithmetic average of composite index value of education and health infrastructure for respective point of time. The formula is mentioned below:

$$IDI = 1/2 [\text{Composite Index of Education Infrastructure} + \text{Composite Index of Health Infrastructure}]$$

On the basis of the Infrastructural Development Index (IDI) ranks had been given to the districts in descending order. The next step was to segregate the districts into three categories- Developed, Moderately Developed, Less Developed to expedite inter-district comparison. Pradhan, P. and Kumar, S. (2015) study had been considered for district categorization. Mean, Standard Deviation and Coefficient of Variance were calculated for IDI of each selected point of time. The developed districts were those which had IDI value equal or higher than the value came after adding mean value and 0.5 multiplied to S.D. value. The less developed districts were those which had IDI value equal or lower than the value came after subtracting 0.5 multiplied to S.D. value from mean value. The districts whose values lied between these two values were considered as moderately developed.

Education

Education is important resource to accelerate economic growth and investment in the region and it is prime indicator for quality of life and HDI (Human Development Index). Haryana requires quality and strong infrastructure to keep pace with growing economy.

Table-1**Development of Educational Infrastructure**

Education Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Primary Schools	11040	12179	13904	9690	9974
Number of Middle Schools	1887	2168	3483	4479	5238
Number of High Schools	4138	5317	6983	7663	8024
Number of Students in primary School	2017855	1997491	2284255	1633573	2504133
Number of Students in Middle School	951494	1159836	1249777	1038326	1448258
Number of Students in High Schools	804899	872806	1426723	1475045	1552812
Number of Teachers in Primary School	48463	50621	28000	33077	92649
Number of Teachers in Middle School	8396	11139	22835	31426	43311
Number of Teachers in High School	57479	68185	99796	86190	83561
Student-Teacher ratio in Primary School	42	39	79	71	27
Student-Teacher ratio in Middle School	113	104	55	45	33
Student-Teacher ratio in High School	14	13	14	17	19

Source: Statistical Abstract of Haryana, Various Issues.

The above table 1 explains the development of educational infrastructure in Haryana from 2000-01 to 2017-18. The number of primary schools first increased from 11040 in 2000-01 to 13904 in 2010-11, but then decreased to 9974 in 2017-18 while number of middle and high schools had increased continuously over the year from 1887 and 4138 respectively in 2000-01 to 5238 and 8024 respectively in 2017-18. The number of students in primary and middle schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of students in high schools had shown continuous growth from 804899 in 2000-01 to 1552812 in 2017-18. The number of teachers in primary and high schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of teachers in middle schools had shown continuous growth from 8396 in 2000-01 to 43311 in 2017-18. Student-teacher ratio in primary schools had increased from 42 in 2000-01 to 79 in 2010-11 but after it was decreased and remained only 27 in 2017-18 which is a good sign of development. Student-teacher ratio in middle schools continuously decreased over the years from 113 in 2000-01 to 33 in 2017-18. Student-teacher ratio in high schools had increased from 14 in 2000-01 to 19 in 2017-18, which was a bad sign of educational infrastructure development.

Health

Haryana is committed to provide quality of health services to its citizens. Health centres which include hospitals, CHCs, PHCs, Sub-centres, Dispensaries provide accessible, adequate and quality health care services on reasonable pricing.

Table-2
Health Infrastructure in Haryana

Health Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Hospitals	78	62	68	57	62
Number of CHCs	64	81	86	94	125
Number of PHCs	402	409	429	468	499
Number of Sub-Centres	2299	2433	2465	2630	2636
Number of Dispensary	229	193	193	125	63
Number of Beds per lakh of Population	995	815	833	726	866

*Source: Statistical Abstract of Haryana, Various Issues.
Census of India*

Table 2 reveals the health infrastructure in Haryana at different time periods. Number of hospitals had been declined from 78 in 2000-01 to 62 in 2017-18. Number of CHCs, PHCs and sub-centres had shown continuous growth from 2000-01 to 2017-18. Number of CHCs had grown from 64 to 125, PHCs had grown to 499 from 402 and sub-centres had grown from 2299 to 2636. But there was a decrease registered in number of dispensaries from 229 in 2000-01 to 63 in 2017-18, while number of beds per lakh of population had been declined from 995 in 2000-01 to 726 in 2015-16 but later increased to 866 in 2017-18.

Table-3
Inter-District Disparities in Educational Infrastructure

Districts	Number of Primary Schools per 100 sq. km. of Area		Number of Middle Schools per 100 sq. km. of Area		Number of High Schools per 100 sq. km. of Area	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	36	34	4	15	12	20
Panchkula	30	35	5	14	9	15
Yamunanagar	31	36	3	19	9	20
Kurukshetra	37	36	6	17	9	19
Kaithal	20	18	3	9	6	14
Karnal	24	24	4	12	8	17
Panipat	24	25	5	22	11	27
Sonipat	31	25	7	12	15	24
Rohtak	21	15	4	7	14	23
Jhajjar	30	19	5	7	14	22
Faridabad	49	43	8	64	19	74
Palwal	N.A	31	N.A	25	N.A	25
Gurugram	31	34	5	21	8	31

Nuh	N.A	33	N.A	24	N.A	11
Rewari	32	29	5	10	8	21
Mahendragarh	40	26	6	10	10	18
Bhiwani	19	15	3	6	7	14
Jind	23	17	5	7	10	17
Hisar	13	15	3	8	9	16
Fatehabad	14	18	3	7	6	11
Sirsa	13	13	3	5	5	8
Mean	27	26	5	15	10	21
S.D.	9.55	8.75	1.50	12.81	3.52	13.28
C.V.	35	33.91	33.34	83.64	35.47	62.40

Calculated by self

Table 3 describes inter district disparities in selected educational infrastructure particulars in study period which is divided in two time periods. The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods. Faridabad and Sirsa districts performed highest and lowest respectively in all three indicators throughout the time periods.

Table-4

Inter-District Disparities in Educational Infrastructure

Districts	Student-Teacher ratio in Primary Schools		Student-Teacher ratio in Middle Schools		Student-Teacher ratio in High/Senior Secondary Schools	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	40	25	202	30	14	16
Panchkula	39	15	90	16	11	16
Yamunanagar	42	29	147	32	17	22
Kurukshetra	41	19	107	30	15	17
Kaithal	57	17	150	26	17	20
Karnal	41	31	105	36	14	18
Panipat	47	24	146	28	17	22
Sonipat	38	52	89	59	11	16
Rohtak	34	29	121	32	11	16
Jhajjar	28	16	130	26	14	15
Faridabad	40	37	125	42	12	27
Palwal	N.A	23	N.A	24	N.A	23
Gurugram	55	83	102	73	12	22
Nuh	N.A	36	N.A	46	N.A	30
Rewari	36	28	118	29	19	16
Mahendragarh	36	24	95	24	16	15
Bhiwani	40	25	107	33	17	17
Jind	45	25	86	37	14	19
Hisar	45	23	147	35	14	16
Fatehabad	51	24	93	34	15	21

Sirsa	49	25	98	36	14	20
Mean	42	29	119	35	14	19
S.D.	7.23	14.72	29.49	12.50	2.37	3.97
C.V.	17.07	50.62	24.82	36.11	16.46	20.66

Calculated by self

The above table 4 reveals the inter district disparities in the selected indicators of educational infrastructure in the districts of Haryana in 2000-01 and 2017-18. Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.

Table-5
Inter-District Disparities in the Health Infrastructure

Districts	Number of Hospitals per lakh of Population		Number of CHCs per lakh of Population		Number of PHCs per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	0.79	0.27	0.20	0.35	1.48	1.77
Panchkula	0.64	0.18	0.43	0.36	1.71	1.78
Yamunanagar	0.58	0.25	0.38	0.58	1.73	1.65
Kurukshetra	0.12	0.10	0.36	0.62	2.06	2.18
Kaithal	0.11	0.09	0.32	0.56	2.33	2.23
Karnal	0.16	0.20	0.31	0.40	1.96	1.73
Panipat	0.31	0.17	0.10	0.58	1.55	1.58
Sonapat	0.08	0.14	0.39	0.62	2.03	2.55
Rohtak	0.85	0.28	0.43	0.57	2.45	2.17
Jhajjar	0.23	0.42	0.23	0.63	1.93	2.82
Faridabad	0.27	0.11	0.14	0.22	1.00	0.77
Palwal	N.A	0.19	N.A	0.48	N.A	1.82
Gurugram	0.30	0.33	0.24	0.20	1.51	0.79
Nuh	N.A	0.09	N.A	0.28	N.A	1.93
Rewari	0.26	0.22	0.52	0.56	1.83	2.11
Mahendragarh	0.12	0.22	0.37	0.76	2.46	2.71
Bhiwani	0.63	0.49	0.42	0.61	2.60	2.69
Jind	0.34	0.30	0.25	0.52	2.19	2.10
Hisar	0.72	0.34	0.39	0.46	2.15	2.12
Fatehabad	0.25	0.32	0.37	0.53	1.98	2.55
Sirsa	0.27	0.31	0.18	0.62	2.06	2.24
Mean	0.37	0.24	0.32	0.50	1.95	2.01
S.D.	0.25	0.11	0.11	0.15	0.39	0.54
C.V.	67.25	45.21	35.58	29.59	20.23	27.06

Calculated by self

The above table 5 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in

case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.

Table-6
Inter-District Disparities in Health Infrastructure

Districts	Number of Sub-centres per lakh of Population		Number of Dispensaries per lakh of Population		Number of Beds per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	9.76	9.22	1.18	0.27	68	45
Panchkula	10.03	9.09	2.13	2.32	65	68
Yamunanagar	10.75	9.22	1.54	0.08	52	34
Kurukshetra	10.18	12.13	0.97	0.10	33	34
Kaithal	12.15	13.40	0.32	0.00	32	32
Karnal	9.03	9.96	1.26	0.47	36	32
Panipat	10.34	7.47	0.72	0.17	34	25
Sonipat	8.60	11.31	1.17	0.21	29	25
Rohtak	17.23	10.74	1.60	0.47	202	34
Jhajjar	13.86	13.15	0.91	0.31	21	48
Faridabad	5.33	3.15	1.64	0.39	37	21
Palwal	N.A	8.54	N.A	0.00	N.A	18
Gurugram	9.34	5.02	0.78	0.20	27	26
Nuh	N.A	12.67	N.A	0.00	N.A	21
Rewari	13.33	12.44	0.65	0.22	32	44
Mahendragarh	14.15	13.01	0.49	0.00	39	39
Bhiwani	14.18	13.46	1.12	0.18	70	51
Jind	10.84	12.22	0.76	0.15	63	32
Hisar	11.38	11.47	1.11	0.29	87	40
Fatehabad	12.28	14.33	0.87	0.11	33	41
Sirsa	12.45	11.89	1.07	0.15	35	32
Mean	11.33	10.66	1.07	0.29	52.37	35.33
S.D.	2.62	2.87	0.44	0.49	40.48	11.77
C.V.	23.16	26.94	41.09	167.71	77.29	33.31

Calculated by self

The above table 6 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.

Table-7
Results of Factor Analysis for Education Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.961	0.187	0.959	3.2308	23.22
No. of Middle Schools per 100 sq km of Area	0.98	0.074	0.966	3.1544	22.67
No. of High Schools per 100 sq km of Area	0.978	0.139	0.976	3.2263	23.19
Student-Teacher ratio of Primary Schools	-0.169	0.242	0.087	0.8195	5.89
Student-Teacher ratio of Middle Schools	-0.051	0.851	0.727	1.1824	8.50
Student-Teacher ratio of High Schools	-0.505	0.6	0.615	2.3008	16.54
Variance (%)	52.132	20.032	Total	13.9142	100.00
Cumulative variance (%)	52.132	72.165			

KMO measures of sampling adequacy- 0.457
Significance level of Bartlett's test of sphericity- 0.000

Table 7 indicates factor analysis result of education infrastructure for year of 200-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which explain cumulative variance of 72.17 percent. First factor explained 52.13 percent and second factor explain 20.03 percent of total cumulative variance. The communality values lied in ranging of 0.615 to 0.976 for all indicators except student-teacher ratio in primary school which was at 0.087. Factors value showed that three out of six variables had higher contribution in first component and two variables had majorly contributed to second component, remaining one variable which is student-teacher ratio in primary school had least contribution in both components. Weights of the indicators which came out with the use of initial Eigen value and factors value varied between 0.8195-3.2308. The variables which contributed largely to first component got higher and almost equal importance in weights as well. Student-Teacher ratio in primary schools had lowest relative weights (5.89), hence least contribution to educational infrastructure development.

Table-8

Results of Factor Analysis for Health Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communal ity	Weights	Weights (in %)
Number of Hospitals per lakh of Population	0.643	0.645	0.83	2.9893	18.07
Number of CHCs per lakh of Population	0.664	-0.201	0.481	2.1908	13.24
Number of PHCs per lakh of Population	0.695	-0.619	0.866	3.0804	18.62
Number of Sub-centre per lakh of Population	0.792	-0.45	0.831	3.0182	18.24
Number of Dispensaries per lakh of Population	0.225	0.864	0.798	2.2760	13.76
Number of Beds per lakh of Population	0.837	0.371	0.838	2.9882	18.06
Variance (%)	45.27	32.112	Total	16.5429	100.00
Cumulative variance (%)	45.27	77.382			

KMO measures of sampling adequacy- 0.636
Significance level of Bartlett's test of sphericity- 0.000

Table 8 points out the result of factor analysis with weights for health infrastructure for the period of 2000-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which together explain 77 percent cumulative variance. Individually both factors explained 45.27 percent and 32.11 percent respectively. Communality values lied in the range of 0.798 to 0.866 that means two factors were sufficient to explain the variance of original variables, except the number of CHCs per lakh of population which was at 0.481. The factor values showed that number of CHCs per lakh of population, number of sub-centers per lakh of population and number of beds per lakh of population had higher association with first factor whereas number of dispensaries per lakh of population had contributed significantly in second factor. But, number of hospitals and number of PHCs per lakh of population contributed less in both factors. From the selected variables, four variables got almost equal importance in weights which were more than 18 percent. Remaining two variables contributed about 13 percent each in weights.

Table-9

Results of Factor Analysis for Education Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.73	-0.358	0.661	2.9255	15.92
No. of Middle Schools per 100 sq km of Area	0.897	-0.415	0.976	3.5560	19.36
No. of High Schools per 100 sq km of Area	0.804	-0.296	0.734	3.0688	16.70
Student-Teacher ratio of Primary Schools	0.646	0.733	0.954	3.2377	17.62
Student-Teacher ratio of Middle Schools	0.593	0.79	0.975	3.1547	17.17
Student-Teacher ratio of High Schools	0.701	-0.1	0.501	2.4292	13.22
Variance (%)	54.05	25.979	Total	18.3720	100.00
Cumulative variance (%)	54.05	80.029			

KMO measures of sampling adequacy- 0.386
Significance level of Bartlett's test of sphericity- 0.000

The above table 9 reveals the result of factor analysis for education infrastructure for 2017-18. KMO and Bartlett's test shows significance level and applicability of factor analysis. Again two factors had come out from selected six variables. First factor explained 54 percent and second factor explained 26 percent, in together both of these factors explained 80 percent of variance. Half of the variables contributed more than 90 percent in Communality values and remaining half contributed in the range of 0.501 to 0.734. Four out of six variables contributed highly in the growth of first factor and remaining two variables which were student-teacher ratio in primary (0.733) and middle schools (0.79) contributed in second factor. From selected indicators, number of middle school per 100 sq. km. performed highest in weights with a value of 19.36 percent, followed by student-teacher ratio in primary (17.62) and middle schools ((17.17). No. of primary schools per 100 sq. km. of area (15.92) and student-teacher ratio in high schools had performed least in weights as well as education infrastructure development.

Table-10

Results of Factor Analysis for Health Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
Number of hospitals per lakh of population	0.484	0.307	0.329	1.9444	12.50
Number of CHCs per lakh of population	0.824	-0.274	0.755	2.8837	18.54
Number of PHCs per lakh of population	0.964	-0.086	0.937	2.9711	19.10
Number of sub-centre per lakh of population	0.904	-0.128	0.833	2.8675	18.43
Number of dispensaries per lakh of population	-0.152	0.908	0.848	2.0033	12.88
Number of beds per lakh of population	0.495	0.836	0.943	2.8844	18.54
Variance (%)	48.816	28.594	Total	15.5545	100
Cumulative variance (%)	48.816	77.41			

KMO measures of sampling adequacy- 0.437
Significance level of Bartlett's test of sphericity- 0.000

Table 10 depicts the result of factor analysis for health infrastructure. KMO and Bartlett's test values were significant that made factor analysis possible. Two factors had been derived from all six selected variables. First factor explained 49 percent variance and second factor did 28 percent. Total cumulative variance was 77 percent. In first factor, three variables were highly associated namely number of CHCs (0.824), PHCs (0.964) and sub-centers (0.904) per lakh of population. While two factors; number of dispensaries (0.908) and beds (0.836) per lakh of population contributed to second factor. Remaining variable; number of hospitals per lakh of population contributed with small amount in both factors. The communality values for all variables except number of hospitals per lakh of population were found more than 75 percent in the range of 0.755 to 0.943. Four variables which were number of PHCs (19.10), CHCs (18.54), beds (18.54), sub-centers (18.43) percent per lakh of population, received highest and almost equal weights. Number of hospitals and number of dispensaries per lakh of population got 12.50 percent and 12.88 percent of weights respectively and contributed least to health infrastructure development.

District-wise Composite Index using PCA techniques

Table 11 and 12 show district-wise Infrastructure development for years 2000-01 and 2017-18. Procedure has been discussed in methodology.

Table-11

District-wise Composite Index of Infrastructure for the year 2000-01

Districts	Education Index	Health Index	R1	R2
Ambala	0.2557	0.4342	5	6
Panchkula	0.0959	0.5717	19	4
Yamuna Nagar	0.2480	0.4974	6	5
Kurukshetra	0.2186	0.3505	9	13
Kaithal	0.2470	0.3467	7	14
Karnal	0.1467	0.3399	14	15
Panipat	0.2754	0.2382	3	18
Sonipat	0.1438	0.3340	15	16
Rohtak	0.1041	0.9139	18	1
Jhajjar	0.1876	0.3601	10	12
Faridabad	0.7644	0.1735	1	19
Gurugram	0.3306	0.2576	2	17
Rewari	0.2747	0.4300	4	8
Mahendgarh	0.2303	0.4305	8	7
Bhiwani	0.1838	0.6616	11	2
Jind	0.1590	0.4066	13	9
Hisar	0.1594	0.5941	12	3
Fatehabad	0.1409	0.3994	16	10
Sirsa	0.1135	0.3733	17	11
Mean	0.23	0.43		
S.D.	0.15	0.17		
C.V. (%)	64.89	39.48		

Table 11 shows district-wise composite index of social infrastructure for 2000-01. This composite index was calculated with the help of weights and normalized value of that indicator for every district. Ranks to all districts have been given in descending order. R1 shows rank for education index and R2 for health index. Out of total 19 districts only 08 districts were found above district average in both types of infrastructure. In education index Faridabad and Gurugram were on top two position followed by Panipat, Rewari and Ambala. Panchkula and Rohtak were on bottom positions in education index. Again positions of districts changed in health index, district of Rohtak which was on last position in education index performed best in health index and got first position followed by Bhiwani, Hisar, Panchkula and Yamunanagar. Faridabad was on last position in health index. Value of coefficient of variance was found higher for education index (64.89 percent).

Table-12

District-wise Composite Index of Infrastructure for the year 2017-18

Districts	Education Index	Health Index	R1	R2
Ambala	0.2515	0.4143	9	15
Panchkula	0.1728	0.5874	13	5
Yamuna Nagar	0.3446	0.4217	5	14
Kurukshetra	0.2595	0.4865	8	12
Kaithal	0.1342	0.4762	17	13
Karnal	0.2323	0.3803	10	16
Panipat	0.2887	0.3329	7	17
Sonipat	0.3614	0.4927	4	11
Rohtak	0.1484	0.5229	16	9
Jhajjar	0.1066	0.7299	21	2
Faridabad	0.7610	0.0456	1	21
Palwal	0.3195	0.3107	6	18
Gurugram	0.6318	0.1485	2	20
Nuh	0.4531	0.3027	3	19
Rewari	0.2159	0.5465	11	7
Mahendgarh	0.1581	0.6473	15	3
Bhiwani	0.1238	0.7420	20	1
Jind	0.1750	0.5053	12	10
Hisar	0.1275	0.5249	19	8
Fatehabad	0.17113	0.6227	14	4
Sirsa	0.13024	0.5491	18	6
Mean	0.27	0.47		
S.D.	0.17	0.17		
C.V. (%)	64.70	37.12		

Table 12 reveals composite index of social infrastructure for 2017-18. In health index 13 out of 21 districts were above districts average, while in education index only 07 districts were above districts average. Faridabad and Gurugram continued to be on first and second position respectively in 2018-18 as well. Jhajjar and Bhiwani performed worst in education index and dropped down to bottom two positions. In health index, Bhiwani district did excellent and got first position, Jhajjar district also improved continuously over the years and came on second position in 2017-18. Faridabad, Gurugram continued their last positions in 2017-18 as well. The coefficient of variance found again higher in education index (64.70 percent). It was found that throughout the study period higher districts disparities were found in education index.

Infrastructure Development Index- District wise

Infrastructure development index was obtained by taking out the average of district-wise composite index values. Ranks to each district were given in descending values order. Procedure has been discussed in methodology.

Table-13

District-wise Infrastructure Development Index Calculated from Composite Index Values

Districts	2000-01		2017-18	
	IDI	Rank	IDI	Rank
Ambala	0.3450	7	0.3329	16
Panchkula	0.3338	8	0.3801	10
Yamuna Nagar	0.3727	5	0.3832	8
Kurukshetra	0.2846	12	0.373	12
Kaithal	0.2969	10	0.3052	21
Karnal	0.2433	18	0.3063	20
Panipat	0.2568	16	0.3108	19
Sonipat	0.2389	19	0.4271	2
Rohtak	0.509	1	0.3357	15
Jhajjar	0.2739	14	0.4183	3
Faridabad	0.4690	2	0.4033	4
Palwal	0	-	0.3151	18
Gurugram	0.2941	11	0.3902	7
Nuh	0	-	0.3779	11
Rewari	0.3524	6	0.3812	9
Mahendergarh	0.3304	9	0.4027	5
Bhiwani	0.4227	3	0.4329	1
Jind	0.2828	13	0.3402	13
Hisar	0.3768	4	0.3262	17
Fatehabad	0.2702	15	0.3969	6
Sirsa	0.2434	17	0.3397	14

Table 13 presents district-wise infrastructure development index which was derived from average of composite index values of both infrastructure (Education and Health). Rohtak district was found on top of the table in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonipat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.

Classification of Districts on the basis of Infrastructural Development Index

In this sub-section districts have been classified in three categories: Developed, Moderately developed, and less developed by using average and standard deviation values of Infrastructure development index. Procedure has been discussed in methodology.

Table-14
District-wise classification based on Infrastructure Development Index Values

Districts	2000-01		2017-18	
	IDI	Category	IDI	Category
Ambala	0.3450	MD	0.3329	LD
Panchkula	0.3338	MD	0.3801	MD
Yamuna Nagar	0.3727	D	0.3832	MD
Kurukshetra	0.2846	LD	0.373	MD
Kaithal	0.2969	MD	0.3052	LD
Karnal	0.2433	LD	0.3063	LD
Panipat	0.2568	LD	0.3108	LD
Sonapat	0.2389	LD	0.4271	D
Rohtak	0.509	D	0.3357	LD
Jhajjar	0.2739	LD	0.4183	D
Faridabad	0.4690	D	0.4033	D
Palwal	0	-	0.3151	LD
Gurugram	0.2941	MD	0.3902	D
Nuh	0	-	0.3779	MD
Rewari	0.3524	MD	0.3812	MD
Mahendergarh	0.3304	MD	0.4027	D
Bhiwani	0.4227	D	0.4329	D
Jind	0.2828	LD	0.3402	D
Hisar	0.3768	D	0.3262	LD
Fatehabad	0.2702	LD	0.4607	D
Sirsa	0.2434	LD	0.3815	LD

D: Developed, MD: Moderate Developed, LD: Less Developed

D= ≥ 0.3646 , MD= > 0.2877 & < 0.3646 and LD = ≤ 0.2877 for the year 2000-01

D= ≥ 0.3863 , MD= > 0.3450 & < 0.3863 and LD = ≤ 0.3450 for the year 2017-18

Table 14 shows classification of districts on the basis of Infrastructure Development index for two study periods that are 2000-01 and 2017-18. In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

Major Findings of the Study

- The study shows that there are less number of middle schools in comparison to primary and high school throughout the study period.
- Student-teacher ratio is decreasing continuous in primary and middle schools which is an excellent sign of development.
- The study found that the total numbers of dispensaries are decreasing continuously over the years and reached to only 63 in 2017-18 from 229 in 2000-01. It has happened because people in rural areas stopped going to dispensaries for treatment and prefer to move to city hospitals.
- Number of hospitals had declined from 78 in 2000-01 to 62 in 2017-18 because of that number of beds per lakh of population also showed declining trends.

- The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods.
- Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.
- The disparity in case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.
- The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.
- Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonapat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.
- In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

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Social Infrastructure in Haryana- A Study of Inter-District Disparities**Dr. Santosh Nandal¹**

Professor

Monika²

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^{1,2}Department of Economics, M.D. University, Rohtak, Haryana**Abstract**

In this paper an attempt has been made to study the social infrastructure in Haryana along with inter-district disparities for the year 2000-01 and 2017-18. The study also analyzed the developed and less developed districts in social infrastructure. Simple statistical tools like mean and Coefficient of Variance have been used to measure the inter-district disparities. Composite index has been constructed to find out the development of districts. Principal Component Analysis has been used to get factor loadings and weights of selected indicators. It was found from the study that there are wide spread of disparities in the development levels of different districts. Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure while in 2017-18 Bhiwani district was on the top position.

Introduction

Infrastructure describes the physical structure of facilities which are required to provide goods and services to public. It is linked with economy directly or indirectly or we can say that it effect economy through its spillover effects. It includes all those activities which do not directly generate income themselves but provide support and substance to the income generation activities.

Infrastructure means something that comes before the actual structure. It is foundation to build the structure of economy. Infrastructure consist permanent structure which is used for a long time to give inputs to the economy like network of road, railway facility, electricity, schools, colleges and hospitals etc.

Role of Infrastructure in Economic Growth and Development

. Infrastructure plays an important role in overall development. Many economists describe the importance of infrastructure in economic development. In fact, developmental activities depend upon infrastructure facilities. It is considered the prerequisite of development. In the words of Dr. V.K.R.V. Rao, "The link between infrastructure and development is not once for all affairs.

It is a continuous process; and progress in development has to be preceded, accompanied and followed by progress in infrastructure, if we are to fulfill our declared objective of a self-accelerated process of economic development."

The infrastructural network has dual character; it is a crucial factor of development as well as a component of development. The regions which have weak infrastructure network remain less developed and it is generally accepted fact that agriculture, industry and other development activities are constrained by available infrastructural facilities. Different types of infrastructural facilities affect the overall development including agriculture, industry and human development in which infrastructure plays a leader role and follower is the development (Majumder, R. 2004).

Classification of Infrastructure

Infrastructure can be classified into two category i.e. economic infrastructure and social infrastructure. Social infrastructure is also divided into two education and health infrastructure.

Social infrastructure is essential for an economy development. Social infrastructure concept is very wide and plays extremely significant role in economy development as it executes the task of human development resources by means of skill generation, education, awareness creation, training, research and development and health care to increase the efficiency of production. Social infrastructure plays an important role in enhancing the human capital. Advancement in knowledge and the dispersion of new ideas and activities are necessary to eliminate economic backwardness and install the human abilities that are more favourable to economic achievement. (AnuKapil and P.S. Raikhy) It has been recognized that physical capital growth is directly related to considerable formation of human capital.

Education is considered as catalyst for the development of human resource. This is the key social infrastructure indicators which have direct relation with productive manpower, level of income and standard of living. Less developed countries need educated professionals in all areas to boost the development and growth. UNESCO suggests minimum fifteen percent of national expenditure on educational facilities. Education acts as the base for research and development. Being an integral part of development progress, it cannot be looked separately.

Objectives of the Study

- To study the overall development of social infrastructure in Haryana.
- To analyse inter-district disparities in social infrastructure.
- To identify the developed and less developed districts.
- To categories districts on the basis of the value of Infrastructure Development index.

Research Methodology

The current study focused on overall growth and development of social infrastructure in the state of Haryana. The study also analyzed inter-districts disparities, developed and backward districts in social infrastructure. Social Infrastructure considered education (number of schools, teachers, students and student-teacher ratio) and health (number of hospitals, CHCs, PHCs, sub-centres, dispensaries, number of beds per lakh of population) indicators to show growth and development of social infrastructure. For inter-districts disparities and to identify developed and backward districts; only a few indicators have been taken in

consideration due to the unavailability of complete data on district level. The selection of indicators had been done after extensive review of literature.

The present study is empirical by nature. To accomplish the objectives, secondary data from different sources like; Statistical abstract of Haryana, Census 2001 and 2011 and Economic survey of Haryana have been used. In order to identify inter-district disparities and development ranks of 21 districts of Haryana; data of 12 indicators from social infrastructure for two points of time 2000-01 and 2017-18 have been used. For inter-district disparities; simple statistical tools like Mean, Standard Deviation and Coefficient of Variance have been calculated and considered. Raychaudhuri, A. and Haldar, S. (2009) method has been considered to run PCA for giving weights to the indicators and to construct Composite Index.

To run PCA, raw data was first converted into normalized data for each district. This was done to form raw data unit free and get relative spot of every district. Best and worst values of all indicators were identified for each district in order to calculate normalized value. Normalized value falls between 0 and 1 always.

$$NV_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$$

Where R = best X_{ij} - worst X_{ij}

i = i-th observation and j = j-th district

The next step after obtaining the normalized value was to run PCA to get factor loadings and weights of selected indicators. SPSS software was used to run PCA. From PCA, Initial Eigen values which are more than 01 were also identified. Weights for each selected indicator were obtained by multiplication of first initial Eigen value to first factor value and so on and then by adding all the values (which came after multiplication) together.

The next step was to construct the composite index. Composite Index was calculated; firstly, weight of selected indicator was multiplied by same indicator's normalized value, secondly, all indicators values (came after multiplication) were added together and divided by the total weights of selected indicators. The same procedure was followed for every district and for both types of infrastructure (Education and Health) at two selected points of time, 2000-01 and 2017-18.

The next step was to calculate Infrastructural Development Index (IDI) for selected two points of time separately for each district. This was done by using simple arithmetic average of composite index value of education and health infrastructure for respective point of time. The formula is mentioned below:

$$IDI = 1/2 [\text{Composite Index of Education Infrastructure} + \text{Composite Index of Health Infrastructure}]$$

On the basis of the Infrastructural Development Index (IDI) ranks had been given to the districts in descending order. The next step was to segregate the districts into three categories- Developed, Moderately Developed, Less Developed to expedite inter-district comparison. Pradhan, P. and Kumar, S. (2015) study had been considered for district categorization. Mean, Standard Deviation and Coefficient of Variance were calculated for IDI of each selected point of time. The developed districts were those which had IDI value equal or higher than the value came after adding mean value and 0.5 multiplied to S.D. value. The less developed districts were those which had IDI value equal or lower than the value came after subtracting 0.5 multiplied to S.D. value from mean value. The districts whose values lied between these two values were considered as moderately developed.

Education

Education is important resource to accelerate economic growth and investment in the region and it is prime indicator for quality of life and HDI (Human Development Index). Haryana requires quality and strong infrastructure to keep pace with growing economy.

Table-1**Development of Educational Infrastructure**

Education Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Primary Schools	11040	12179	13904	9690	9974
Number of Middle Schools	1887	2168	3483	4479	5238
Number of High Schools	4138	5317	6983	7663	8024
Number of Students in primary School	2017855	1997491	2284255	1633573	2504133
Number of Students in Middle School	951494	1159836	1249777	1038326	1448258
Number of Students in High Schools	804899	872806	1426723	1475045	1552812
Number of Teachers in Primary School	48463	50621	28000	33077	92649
Number of Teachers in Middle School	8396	11139	22835	31426	43311
Number of Teachers in High School	57479	68185	99796	86190	83561
Student-Teacher ratio in Primary School	42	39	79	71	27
Student-Teacher ratio in Middle School	113	104	55	45	33
Student-Teacher ratio in High School	14	13	14	17	19

Source: Statistical Abstract of Haryana, Various Issues.

The above table 1 explains the development of educational infrastructure in Haryana from 2000-01 to 2017-18. The number of primary schools first increased from 11040 in 2000-01 to 13904 in 2010-11, but then decreased to 9974 in 2017-18 while number of middle and high schools had increased continuously over the year from 1887 and 4138 respectively in 2000-01 to 5238 and 8024 respectively in 2017-18. The number of students in primary and middle schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of students in high schools had shown continuous growth from 804899 in 2000-01 to 1552812 in 2017-18. The number of teachers in primary and high schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of teachers in middle schools had shown continuous growth from 8396 in 2000-01 to 43311 in 2017-18. Student-teacher ratio in primary schools had increased from 42 in 2000-01 to 79 in 2010-11 but after it was decreased and remained only 27 in 2017-18 which is a good sign of development. Student-teacher ratio in middle schools continuously decreased over the years from 113 in 2000-01 to 33 in 2017-18. Student-teacher ratio in high schools had increased from 14 in 2000-01 to 19 in 2017-18, which was a bad sign of educational infrastructure development.

Health

Haryana is committed to provide quality of health services to its citizens. Health centres which include hospitals, CHCs, PHCs, Sub-centres, Dispensaries provide accessible, adequate and quality health care services on reasonable pricing.

Table-2
Health Infrastructure in Haryana

Health Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Hospitals	78	62	68	57	62
Number of CHCs	64	81	86	94	125
Number of PHCs	402	409	429	468	499
Number of Sub-Centres	2299	2433	2465	2630	2636
Number of Dispensary	229	193	193	125	63
Number of Beds per lakh of Population	995	815	833	726	866

*Source: Statistical Abstract of Haryana, Various Issues.
Census of India*

Table 2 reveals the health infrastructure in Haryana at different time periods. Number of hospitals had been declined from 78 in 2000-01 to 62 in 2017-18. Number of CHCs, PHCs and sub-centres had shown continuous growth from 2000-01 to 2017-18. Number of CHCs had grown from 64 to 125, PHCs had grown to 499 from 402 and sub-centres had grown from 2299 to 2636. But there was a decrease registered in number of dispensaries from 229 in 2000-01 to 63 in 2017-18, while number of beds per lakh of population had been declined from 995 in 2000-01 to 726 in 2015-16 but later increased to 866 in 2017-18.

Table-3
Inter-District Disparities in Educational Infrastructure

Districts	Number of Primary Schools per 100 sq. km. of Area		Number of Middle Schools per 100 sq. km. of Area		Number of High Schools per 100 sq. km. of Area	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	36	34	4	15	12	20
Panchkula	30	35	5	14	9	15
Yamunanagar	31	36	3	19	9	20
Kurukshetra	37	36	6	17	9	19
Kaithal	20	18	3	9	6	14
Karnal	24	24	4	12	8	17
Panipat	24	25	5	22	11	27
Sonipat	31	25	7	12	15	24
Rohtak	21	15	4	7	14	23
Jhajjar	30	19	5	7	14	22
Faridabad	49	43	8	64	19	74
Palwal	N.A	31	N.A	25	N.A	25
Gurugram	31	34	5	21	8	31

Nuh	N.A	33	N.A	24	N.A	11
Rewari	32	29	5	10	8	21
Mahendragarh	40	26	6	10	10	18
Bhiwani	19	15	3	6	7	14
Jind	23	17	5	7	10	17
Hisar	13	15	3	8	9	16
Fatehabad	14	18	3	7	6	11
Sirsa	13	13	3	5	5	8
Mean	27	26	5	15	10	21
S.D.	9.55	8.75	1.50	12.81	3.52	13.28
C.V.	35	33.91	33.34	83.64	35.47	62.40

Calculated by self

Table 3 describes inter district disparities in selected educational infrastructure particulars in study period which is divided in two time periods. The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods. Faridabad and Sirsa districts performed highest and lowest respectively in all three indicators throughout the time periods.

Table-4

Inter-District Disparities in Educational Infrastructure

Districts	Student-Teacher ratio in Primary Schools		Student-Teacher ratio in Middle Schools		Student-Teacher ratio in High/Senior Secondary Schools	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	40	25	202	30	14	16
Panchkula	39	15	90	16	11	16
Yamunanagar	42	29	147	32	17	22
Kurukshetra	41	19	107	30	15	17
Kaithal	57	17	150	26	17	20
Karnal	41	31	105	36	14	18
Panipat	47	24	146	28	17	22
Sonipat	38	52	89	59	11	16
Rohtak	34	29	121	32	11	16
Jhajjar	28	16	130	26	14	15
Faridabad	40	37	125	42	12	27
Palwal	N.A	23	N.A	24	N.A	23
Gurugram	55	83	102	73	12	22
Nuh	N.A	36	N.A	46	N.A	30
Rewari	36	28	118	29	19	16
Mahendragarh	36	24	95	24	16	15
Bhiwani	40	25	107	33	17	17
Jind	45	25	86	37	14	19
Hisar	45	23	147	35	14	16
Fatehabad	51	24	93	34	15	21

Sirsa	49	25	98	36	14	20
Mean	42	29	119	35	14	19
S.D.	7.23	14.72	29.49	12.50	2.37	3.97
C.V.	17.07	50.62	24.82	36.11	16.46	20.66

Calculated by self

The above table 4 reveals the inter district disparities in the selected indicators of educational infrastructure in the districts of Haryana in 2000-01 and 2017-18. Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.

Table-5
Inter-District Disparities in the Health Infrastructure

Districts	Number of Hospitals per lakh of Population		Number of CHCs per lakh of Population		Number of PHCs per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	0.79	0.27	0.20	0.35	1.48	1.77
Panchkula	0.64	0.18	0.43	0.36	1.71	1.78
Yamunanagar	0.58	0.25	0.38	0.58	1.73	1.65
Kurukshetra	0.12	0.10	0.36	0.62	2.06	2.18
Kaithal	0.11	0.09	0.32	0.56	2.33	2.23
Karnal	0.16	0.20	0.31	0.40	1.96	1.73
Panipat	0.31	0.17	0.10	0.58	1.55	1.58
Sonapat	0.08	0.14	0.39	0.62	2.03	2.55
Rohtak	0.85	0.28	0.43	0.57	2.45	2.17
Jhajjar	0.23	0.42	0.23	0.63	1.93	2.82
Faridabad	0.27	0.11	0.14	0.22	1.00	0.77
Palwal	N.A	0.19	N.A	0.48	N.A	1.82
Gurugram	0.30	0.33	0.24	0.20	1.51	0.79
Nuh	N.A	0.09	N.A	0.28	N.A	1.93
Rewari	0.26	0.22	0.52	0.56	1.83	2.11
Mahendragarh	0.12	0.22	0.37	0.76	2.46	2.71
Bhiwani	0.63	0.49	0.42	0.61	2.60	2.69
Jind	0.34	0.30	0.25	0.52	2.19	2.10
Hisar	0.72	0.34	0.39	0.46	2.15	2.12
Fatehabad	0.25	0.32	0.37	0.53	1.98	2.55
Sirsa	0.27	0.31	0.18	0.62	2.06	2.24
Mean	0.37	0.24	0.32	0.50	1.95	2.01
S.D.	0.25	0.11	0.11	0.15	0.39	0.54
C.V.	67.25	45.21	35.58	29.59	20.23	27.06

Calculated by self

The above table 5 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in

case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.

Table-6
Inter-District Disparities in Health Infrastructure

Districts	Number of Sub-centres per lakh of Population		Number of Dispensaries per lakh of Population		Number of Beds per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	9.76	9.22	1.18	0.27	68	45
Panchkula	10.03	9.09	2.13	2.32	65	68
Yamunanagar	10.75	9.22	1.54	0.08	52	34
Kurukshetra	10.18	12.13	0.97	0.10	33	34
Kaithal	12.15	13.40	0.32	0.00	32	32
Karnal	9.03	9.96	1.26	0.47	36	32
Panipat	10.34	7.47	0.72	0.17	34	25
Sonipat	8.60	11.31	1.17	0.21	29	25
Rohtak	17.23	10.74	1.60	0.47	202	34
Jhajjar	13.86	13.15	0.91	0.31	21	48
Faridabad	5.33	3.15	1.64	0.39	37	21
Palwal	N.A	8.54	N.A	0.00	N.A	18
Gurugram	9.34	5.02	0.78	0.20	27	26
Nuh	N.A	12.67	N.A	0.00	N.A	21
Rewari	13.33	12.44	0.65	0.22	32	44
Mahendragarh	14.15	13.01	0.49	0.00	39	39
Bhiwani	14.18	13.46	1.12	0.18	70	51
Jind	10.84	12.22	0.76	0.15	63	32
Hisar	11.38	11.47	1.11	0.29	87	40
Fatehabad	12.28	14.33	0.87	0.11	33	41
Sirsa	12.45	11.89	1.07	0.15	35	32
Mean	11.33	10.66	1.07	0.29	52.37	35.33
S.D.	2.62	2.87	0.44	0.49	40.48	11.77
C.V.	23.16	26.94	41.09	167.71	77.29	33.31

Calculated by self

The above table 6 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.

Table-7
Results of Factor Analysis for Education Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.961	0.187	0.959	3.2308	23.22
No. of Middle Schools per 100 sq km of Area	0.98	0.074	0.966	3.1544	22.67
No. of High Schools per 100 sq km of Area	0.978	0.139	0.976	3.2263	23.19
Student-Teacher ratio of Primary Schools	-0.169	0.242	0.087	0.8195	5.89
Student-Teacher ratio of Middle Schools	-0.051	0.851	0.727	1.1824	8.50
Student-Teacher ratio of High Schools	-0.505	0.6	0.615	2.3008	16.54
Variance (%)	52.132	20.032	Total	13.9142	100.00
Cumulative variance (%)	52.132	72.165			

KMO measures of sampling adequacy- 0.457
Significance level of Bartlett's test of sphericity- 0.000

Table 7 indicates factor analysis result of education infrastructure for year of 200-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which explain cumulative variance of 72.17 percent. First factor explained 52.13 percent and second factor explain 20.03 percent of total cumulative variance. The communality values lied in ranging of 0.615 to 0.976 for all indicators except student-teacher ratio in primary school which was at 0.087. Factors value showed that three out of six variables had higher contribution in first component and two variables had majorly contributed to second component, remaining one variable which is student-teacher ratio in primary school had least contribution in both components. Weights of the indicators which came out with the use of initial Eigen value and factors value varied between 0.8195-3.2308. The variables which contributed largely to first component got higher and almost equal importance in weights as well. Student-Teacher ratio in primary schools had lowest relative weights (5.89), hence least contribution to educational infrastructure development.

Table-8

Results of Factor Analysis for Health Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communal ity	Weights	Weights (in %)
Number of Hospitals per lakh of Population	0.643	0.645	0.83	2.9893	18.07
Number of CHCs per lakh of Population	0.664	-0.201	0.481	2.1908	13.24
Number of PHCs per lakh of Population	0.695	-0.619	0.866	3.0804	18.62
Number of Sub-centre per lakh of Population	0.792	-0.45	0.831	3.0182	18.24
Number of Dispensaries per lakh of Population	0.225	0.864	0.798	2.2760	13.76
Number of Beds per lakh of Population	0.837	0.371	0.838	2.9882	18.06
Variance (%)	45.27	32.112	Total	16.5429	100.00
Cumulative variance (%)	45.27	77.382			

KMO measures of sampling adequacy- 0.636
Significance level of Bartlett's test of sphericity- 0.000

Table 8 points out the result of factor analysis with weights for health infrastructure for the period of 2000-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which together explain 77 percent cumulative variance. Individually both factors explained 45.27 percent and 32.11 percent respectively. Communality values lied in the range of 0.798 to 0.866 that means two factors were sufficient to explain the variance of original variables, except the number of CHCs per lakh of population which was at 0.481. The factor values showed that number of CHCs per lakh of population, number of sub-centers per lakh of population and number of beds per lakh of population had higher association with first factor whereas number of dispensaries per lakh of population had contributed significantly in second factor. But, number of hospitals and number of PHCs per lakh of population contributed less in both factors. From the selected variables, four variables got almost equal importance in weights which were more than 18 percent. Remaining two variables contributed about 13 percent each in weights.

Table-9

Results of Factor Analysis for Education Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.73	-0.358	0.661	2.9255	15.92
No. of Middle Schools per 100 sq km of Area	0.897	-0.415	0.976	3.5560	19.36
No. of High Schools per 100 sq km of Area	0.804	-0.296	0.734	3.0688	16.70
Student-Teacher ratio of Primary Schools	0.646	0.733	0.954	3.2377	17.62
Student-Teacher ratio of Middle Schools	0.593	0.79	0.975	3.1547	17.17
Student-Teacher ratio of High Schools	0.701	-0.1	0.501	2.4292	13.22
Variance (%)	54.05	25.979	Total	18.3720	100.00
Cumulative variance (%)	54.05	80.029			

KMO measures of sampling adequacy- 0.386

Significance level of Bartlett's test of sphericity- 0.000

The above table 9 reveals the result of factor analysis for education infrastructure for 2017-18. KMO and Bartlett's test shows significance level and applicability of factor analysis. Again two factors had come out from selected six variables. First factor explained 54 percent and second factor explained 26 percent, in together both of these factors explained 80 percent of variance. Half of the variables contributed more than 90 percent in Communality values and remaining half contributed in the range of 0.501 to 0.734. Four out of six variables contributed highly in the growth of first factor and remaining two variables which were student-teacher ratio in primary (0.733) and middle schools (0.79) contributed in second factor. From selected indicators, number of middle school per 100 sq. km. performed highest in weights with a value of 19.36 percent, followed by student-teacher ratio in primary (17.62) and middle schools ((17.17). No. of primary schools per 100 sq. km. of area (15.92) and student-teacher ratio in high schools had performed least in weights as well as education infrastructure development.

Table-10

Results of Factor Analysis for Health Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
Number of hospitals per lakh of population	0.484	0.307	0.329	1.9444	12.50
Number of CHCs per lakh of population	0.824	-0.274	0.755	2.8837	18.54
Number of PHCs per lakh of population	0.964	-0.086	0.937	2.9711	19.10
Number of sub-centre per lakh of population	0.904	-0.128	0.833	2.8675	18.43
Number of dispensaries per lakh of population	-0.152	0.908	0.848	2.0033	12.88
Number of beds per lakh of population	0.495	0.836	0.943	2.8844	18.54
Variance (%)	48.816	28.594	Total	15.5545	100
Cumulative variance (%)	48.816	77.41			

KMO measures of sampling adequacy- 0.437
Significance level of Bartlett's test of sphericity- 0.000

Table 10 depicts the result of factor analysis for health infrastructure. KMO and Bartlett's test values were significant that made factor analysis possible. Two factors had been derived from all six selected variables. First factor explained 49 percent variance and second factor did 28 percent. Total cumulative variance was 77 percent. In first factor, three variables were highly associated namely number of CHCs (0.824), PHCs (0.964) and sub-centers (0.904) per lakh of population. While two factors; number of dispensaries (0.908) and beds (0.836) per lakh of population contributed to second factor. Remaining variable; number of hospitals per lakh of population contributed with small amount in both factors. The communality values for all variables except number of hospitals per lakh of population were found more than 75 percent in the range of 0.755 to 0.943. Four variables which were number of PHCs (19.10), CHCs (18.54), beds (18.54), sub-centers (18.43) percent per lakh of population, received highest and almost equal weights. Number of hospitals and number of dispensaries per lakh of population got 12.50 percent and 12.88 percent of weights respectively and contributed least to health infrastructure development.

District-wise Composite Index using PCA techniques

Table 11 and 12 show district-wise Infrastructure development for years 2000-01 and 2017-18. Procedure has been discussed in methodology.

Table-11

District-wise Composite Index of Infrastructure for the year 2000-01

Districts	Education Index	Health Index	R1	R2
Ambala	0.2557	0.4342	5	6
Panchkula	0.0959	0.5717	19	4
Yamuna Nagar	0.2480	0.4974	6	5
Kurukshetra	0.2186	0.3505	9	13
Kaithal	0.2470	0.3467	7	14
Karnal	0.1467	0.3399	14	15
Panipat	0.2754	0.2382	3	18
Sonipat	0.1438	0.3340	15	16
Rohtak	0.1041	0.9139	18	1
Jhajjar	0.1876	0.3601	10	12
Faridabad	0.7644	0.1735	1	19
Gurugram	0.3306	0.2576	2	17
Rewari	0.2747	0.4300	4	8
Mahendergarh	0.2303	0.4305	8	7
Bhiwani	0.1838	0.6616	11	2
Jind	0.1590	0.4066	13	9
Hisar	0.1594	0.5941	12	3
Fatehabad	0.1409	0.3994	16	10
Sirsa	0.1135	0.3733	17	11
Mean	0.23	0.43		
S.D.	0.15	0.17		
C.V. (%)	64.89	39.48		

Table 11 shows district-wise composite index of social infrastructure for 2000-01. This composite index was calculated with the help of weights and normalized value of that indicator for every district. Ranks to all districts have been given in descending order. R1 shows rank for education index and R2 for health index. Out of total 19 districts only 08 districts were found above district average in both types of infrastructure. In education index Faridabad and Gurugram were on top two position followed by Panipat, Rewari and Ambala. Panchkula and Rohtak were on bottom positions in education index. Again positions of districts changed in health index, district of Rohtak which was on last position in education index performed best in health index and got first position followed by Bhiwani, Hisar, Panchkula and Yamunanagar. Faridabad was on last position in health index. Value of coefficient of variance was found higher for education index (64.89 percent).

Table-12

District-wise Composite Index of Infrastructure for the year 2017-18

Districts	Education Index	Health Index	R1	R2
Ambala	0.2515	0.4143	9	15
Panchkula	0.1728	0.5874	13	5
Yamuna Nagar	0.3446	0.4217	5	14
Kurukshetra	0.2595	0.4865	8	12
Kaithal	0.1342	0.4762	17	13
Karnal	0.2323	0.3803	10	16
Panipat	0.2887	0.3329	7	17
Sonipat	0.3614	0.4927	4	11
Rohtak	0.1484	0.5229	16	9
Jhajjar	0.1066	0.7299	21	2
Faridabad	0.7610	0.0456	1	21
Palwal	0.3195	0.3107	6	18
Gurugram	0.6318	0.1485	2	20
Nuh	0.4531	0.3027	3	19
Rewari	0.2159	0.5465	11	7
Mahendgarh	0.1581	0.6473	15	3
Bhiwani	0.1238	0.7420	20	1
Jind	0.1750	0.5053	12	10
Hisar	0.1275	0.5249	19	8
Fatehabad	0.17113	0.6227	14	4
Sirsa	0.13024	0.5491	18	6
Mean	0.27	0.47		
S.D.	0.17	0.17		
C.V. (%)	64.70	37.12		

Table 12 reveals composite index of social infrastructure for 2017-18. In health index 13 out of 21 districts were above districts average, while in education index only 07 districts were above districts average. Faridabad and Gurugram continued to be on first and second position respectively in 2018-18 as well. Jhajjar and Bhiwani performed worst in education index and dropped down to bottom two positions. In health index, Bhiwani district did excellent and got first position, Jhajjar district also improved continuously over the years and came on second position in 2017-18. Faridabad, Gurugram continued their last positions in 2017-18 as well. The coefficient of variance found again higher in education index (64.70 percent). It was found that throughout the study period higher districts disparities were found in education index.

Infrastructure Development Index- District wise

Infrastructure development index was obtained by taking out the average of district-wise composite index values. Ranks to each district were given in descending values order. Procedure has been discussed in methodology.

Table-13

District-wise Infrastructure Development Index Calculated from Composite Index Values

Districts	2000-01		2017-18	
	IDI	Rank	IDI	Rank
Ambala	0.3450	7	0.3329	16
Panchkula	0.3338	8	0.3801	10
Yamuna Nagar	0.3727	5	0.3832	8
Kurukshetra	0.2846	12	0.373	12
Kaithal	0.2969	10	0.3052	21
Karnal	0.2433	18	0.3063	20
Panipat	0.2568	16	0.3108	19
Sonipat	0.2389	19	0.4271	2
Rohtak	0.509	1	0.3357	15
Jhajjar	0.2739	14	0.4183	3
Faridabad	0.4690	2	0.4033	4
Palwal	0	-	0.3151	18
Gurugram	0.2941	11	0.3902	7
Nuh	0	-	0.3779	11
Rewari	0.3524	6	0.3812	9
Mahendergarh	0.3304	9	0.4027	5
Bhiwani	0.4227	3	0.4329	1
Jind	0.2828	13	0.3402	13
Hisar	0.3768	4	0.3262	17
Fatehabad	0.2702	15	0.3969	6
Sirsa	0.2434	17	0.3397	14

Table 13 presents district-wise infrastructure development index which was derived from average of composite index values of both infrastructure (Education and Health). Rohtak district was found on top of the table in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonipat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.

Classification of Districts on the basis of Infrastructural Development Index

In this sub-section districts have been classified in three categories: Developed, Moderately developed, and less developed by using average and standard deviation values of Infrastructure development index. Procedure has been discussed in methodology.

Table-14
District-wise classification based on Infrastructure Development Index Values

Districts	2000-01		2017-18	
	IDI	Category	IDI	Category
Ambala	0.3450	MD	0.3329	LD
Panchkula	0.3338	MD	0.3801	MD
Yamuna Nagar	0.3727	D	0.3832	MD
Kurukshetra	0.2846	LD	0.373	MD
Kaithal	0.2969	MD	0.3052	LD
Karnal	0.2433	LD	0.3063	LD
Panipat	0.2568	LD	0.3108	LD
Sonapat	0.2389	LD	0.4271	D
Rohtak	0.509	D	0.3357	LD
Jhajjar	0.2739	LD	0.4183	D
Faridabad	0.4690	D	0.4033	D
Palwal	0	-	0.3151	LD
Gurugram	0.2941	MD	0.3902	D
Nuh	0	-	0.3779	MD
Rewari	0.3524	MD	0.3812	MD
Mahendergarh	0.3304	MD	0.4027	D
Bhiwani	0.4227	D	0.4329	D
Jind	0.2828	LD	0.3402	D
Hisar	0.3768	D	0.3262	LD
Fatehabad	0.2702	LD	0.4607	D
Sirsa	0.2434	LD	0.3815	LD

D: Developed, MD: Moderate Developed, LD: Less Developed

D= ≥ 0.3646 , MD= > 0.2877 & < 0.3646 and LD = ≤ 0.2877 for the year 2000-01

D= ≥ 0.3863 , MD= > 0.3450 & < 0.3863 and LD = ≤ 0.3450 for the year 2017-18

Table 14 shows classification of districts on the basis of Infrastructure Development index for two study periods that are 2000-01 and 2017-18. In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

Major Findings of the Study

- The study shows that there are less number of middle schools in comparison to primary and high school throughout the study period.
- Student-teacher ratio is decreasing continuous in primary and middle schools which is an excellent sign of development.
- The study found that the total numbers of dispensaries are decreasing continuously over the years and reached to only 63 in 2017-18 from 229 in 2000-01. It has happened because people in rural areas stopped going to dispensaries for treatment and prefer to move to city hospitals.
- Number of hospitals had declined from 78 in 2000-01 to 62 in 2017-18 because of that number of beds per lakh of population also showed declining trends.

- The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods.
- Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.
- The disparity in case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.
- The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.
- Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonapat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.
- In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

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Social Infrastructure in Haryana- A Study of Inter-District Disparities**Dr. Santosh Nandal¹**

Professor

Monika²

Research Scholar

^{1,2}Department of Economics, M.D. University, Rohtak, Haryana**Abstract**

In this paper an attempt has been made to study the social infrastructure in Haryana along with inter-district disparities for the year 2000-01 and 2017-18. The study also analyzed the developed and less developed districts in social infrastructure. Simple statistical tools like mean and Coefficient of Variance have been used to measure the inter-district disparities. Composite index has been constructed to find out the development of districts. Principal Component Analysis has been used to get factor loadings and weights of selected indicators. It was found from the study that there are wide spread of disparities in the development levels of different districts. Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure while in 2017-18 Bhiwani district was on the top position.

Introduction

Infrastructure describes the physical structure of facilities which are required to provide goods and services to public. It is linked with economy directly or indirectly or we can say that it effect economy through its spillover effects. It includes all those activities which do not directly generate income themselves but provide support and substance to the income generation activities.

Infrastructure means something that comes before the actual structure. It is foundation to build the structure of economy. Infrastructure consist permanent structure which is used for a long time to give inputs to the economy like network of road, railway facility, electricity, schools, colleges and hospitals etc.

Role of Infrastructure in Economic Growth and Development

. Infrastructure plays an important role in overall development. Many economists describe the importance of infrastructure in economic development. In fact, developmental activities depend upon infrastructure facilities. It is considered the prerequisite of development. In the words of Dr. V.K.R.V. Rao, "The link between infrastructure and development is not once for all affairs.

It is a continuous process; and progress in development has to be preceded, accompanied and followed by progress in infrastructure, if we are to fulfill our declared objective of a self-accelerated process of economic development."

The infrastructural network has dual character; it is a crucial factor of development as well as a component of development. The regions which have weak infrastructure network remain less developed and it is generally accepted fact that agriculture, industry and other development activities are constrained by available infrastructural facilities. Different types of infrastructural facilities affect the overall development including agriculture, industry and human development in which infrastructure plays a leader role and follower is the development (Majumder, R. 2004).

Classification of Infrastructure

Infrastructure can be classified into two category i.e. economic infrastructure and social infrastructure. Social infrastructure is also divided into two education and health infrastructure.

Social infrastructure is essential for an economy development. Social infrastructure concept is very wide and plays extremely significant role in economy development as it executes the task of human development resources by means of skill generation, education, awareness creation, training, research and development and health care to increase the efficiency of production. Social infrastructure plays an important role in enhancing the human capital. Advancement in knowledge and the dispersion of new ideas and activities are necessary to eliminate economic backwardness and install the human abilities that are more favourable to economic achievement. (AnuKapil and P.S. Raikhy) It has been recognized that physical capital growth is directly related to considerable formation of human capital.

Education is considered as catalyst for the development of human resource. This is the key social infrastructure indicators which have direct relation with productive manpower, level of income and standard of living. Less developed countries need educated professionals in all areas to boost the development and growth. UNESCO suggests minimum fifteen percent of national expenditure on educational facilities. Education acts as the base for research and development. Being an integral part of development progress, it cannot be looked separately.

Objectives of the Study

- To study the overall development of social infrastructure in Haryana.
- To analyse inter-district disparities in social infrastructure.
- To identify the developed and less developed districts.
- To categories districts on the basis of the value of Infrastructure Development index.

Research Methodology

The current study focused on overall growth and development of social infrastructure in the state of Haryana. The study also analyzed inter-districts disparities, developed and backward districts in social infrastructure. Social Infrastructure considered education (number of schools, teachers, students and student-teacher ratio) and health (number of hospitals, CHCs, PHCs, sub-centres, dispensaries, number of beds per lakh of population) indicators to show growth and development of social infrastructure. For inter-districts disparities and to identify developed and backward districts; only a few indicators have been taken in

consideration due to the unavailability of complete data on district level. The selection of indicators had been done after extensive review of literature.

The present study is empirical by nature. To accomplish the objectives, secondary data from different sources like; Statistical abstract of Haryana, Census 2001 and 2011 and Economic survey of Haryana have been used. In order to identify inter-district disparities and development ranks of 21 districts of Haryana; data of 12 indicators from social infrastructure for two points of time 2000-01 and 2017-18 have been used. For inter-district disparities; simple statistical tools like Mean, Standard Deviation and Coefficient of Variance have been calculated and considered. Raychaudhuri, A. and Haldar, S. (2009) method has been considered to run PCA for giving weights to the indicators and to construct Composite Index.

To run PCA, raw data was first converted into normalized data for each district. This was done to form raw data unit free and get relative spot of every district. Best and worst values of all indicators were identified for each district in order to calculate normalized value. Normalized value falls between 0 and 1 always.

$$NV_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$$

Where R = best X_{ij} - worst X_{ij}

i = i-th observation and j = j-th district

The next step after obtaining the normalized value was to run PCA to get factor loadings and weights of selected indicators. SPSS software was used to run PCA. From PCA, Initial Eigen values which are more than 01 were also identified. Weights for each selected indicator were obtained by multiplication of first initial Eigen value to first factor value and so on and then by adding all the values (which came after multiplication) together.

The next step was to construct the composite index. Composite Index was calculated; firstly, weight of selected indicator was multiplied by same indicator's normalized value, secondly, all indicators values (came after multiplication) were added together and divided by the total weights of selected indicators. The same procedure was followed for every district and for both types of infrastructure (Education and Health) at two selected points of time, 2000-01 and 2017-18.

The next step was to calculate Infrastructural Development Index (IDI) for selected two points of time separately for each district. This was done by using simple arithmetic average of composite index value of education and health infrastructure for respective point of time. The formula is mentioned below:

$$IDI = 1/2 [\text{Composite Index of Education Infrastructure} + \text{Composite Index of Health Infrastructure}]$$

On the basis of the Infrastructural Development Index (IDI) ranks had been given to the districts in descending order. The next step was to segregate the districts into three categories- Developed, Moderately Developed, Less Developed to expedite inter-district comparison. Pradhan, P. and Kumar, S. (2015) study had been considered for district categorization. Mean, Standard Deviation and Coefficient of Variance were calculated for IDI of each selected point of time. The developed districts were those which had IDI value equal or higher than the value came after adding mean value and 0.5 multiplied to S.D. value. The less developed districts were those which had IDI value equal or lower than the value came after subtracting 0.5 multiplied to S.D. value from mean value. The districts whose values lied between these two values were considered as moderately developed.

Education

Education is important resource to accelerate economic growth and investment in the region and it is prime indicator for quality of life and HDI (Human Development Index). Haryana requires quality and strong infrastructure to keep pace with growing economy.

Table-1**Development of Educational Infrastructure**

Education Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Primary Schools	11040	12179	13904	9690	9974
Number of Middle Schools	1887	2168	3483	4479	5238
Number of High Schools	4138	5317	6983	7663	8024
Number of Students in primary School	2017855	1997491	2284255	1633573	2504133
Number of Students in Middle School	951494	1159836	1249777	1038326	1448258
Number of Students in High Schools	804899	872806	1426723	1475045	1552812
Number of Teachers in Primary School	48463	50621	28000	33077	92649
Number of Teachers in Middle School	8396	11139	22835	31426	43311
Number of Teachers in High School	57479	68185	99796	86190	83561
Student-Teacher ratio in Primary School	42	39	79	71	27
Student-Teacher ratio in Middle School	113	104	55	45	33
Student-Teacher ratio in High School	14	13	14	17	19

Source: Statistical Abstract of Haryana, Various Issues.

The above table 1 explains the development of educational infrastructure in Haryana from 2000-01 to 2017-18. The number of primary schools first increased from 11040 in 2000-01 to 13904 in 2010-11, but then decreased to 9974 in 2017-18 while number of middle and high schools had increased continuously over the year from 1887 and 4138 respectively in 2000-01 to 5238 and 8024 respectively in 2017-18. The number of students in primary and middle schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of students in high schools had shown continuous growth from 804899 in 2000-01 to 1552812 in 2017-18. The number of teachers in primary and high schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of teachers in middle schools had shown continuous growth from 8396 in 2000-01 to 43311 in 2017-18. Student-teacher ratio in primary schools had increased from 42 in 2000-01 to 79 in 2010-11 but after it was decreased and remained only 27 in 2017-18 which is a good sign of development. Student-teacher ratio in middle schools continuously decreased over the years from 113 in 2000-01 to 33 in 2017-18. Student-teacher ratio in high schools had increased from 14 in 2000-01 to 19 in 2017-18, which was a bad sign of educational infrastructure development.

Health

Haryana is committed to provide quality of health services to its citizens. Health centres which include hospitals, CHCs, PHCs, Sub-centres, Dispensaries provide accessible, adequate and quality health care services on reasonable pricing.

Table-2
Health Infrastructure in Haryana

Health Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Hospitals	78	62	68	57	62
Number of CHCs	64	81	86	94	125
Number of PHCs	402	409	429	468	499
Number of Sub-Centres	2299	2433	2465	2630	2636
Number of Dispensary	229	193	193	125	63
Number of Beds per lakh of Population	995	815	833	726	866

*Source: Statistical Abstract of Haryana, Various Issues.
Census of India*

Table 2 reveals the health infrastructure in Haryana at different time periods. Number of hospitals had been declined from 78 in 2000-01 to 62 in 2017-18. Number of CHCs, PHCs and sub-centres had shown continuous growth from 2000-01 to 2017-18. Number of CHCs had grown from 64 to 125, PHCs had grown to 499 from 402 and sub-centres had grown from 2299 to 2636. But there was a decrease registered in number of dispensaries from 229 in 2000-01 to 63 in 2017-18, while number of beds per lakh of population had been declined from 995 in 2000-01 to 726 in 2015-16 but later increased to 866 in 2017-18.

Table-3
Inter-District Disparities in Educational Infrastructure

Districts	Number of Primary Schools per 100 sq. km. of Area		Number of Middle Schools per 100 sq. km. of Area		Number of High Schools per 100 sq. km. of Area	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	36	34	4	15	12	20
Panchkula	30	35	5	14	9	15
Yamunanagar	31	36	3	19	9	20
Kurukshetra	37	36	6	17	9	19
Kaithal	20	18	3	9	6	14
Karnal	24	24	4	12	8	17
Panipat	24	25	5	22	11	27
Sonipat	31	25	7	12	15	24
Rohtak	21	15	4	7	14	23
Jhajjar	30	19	5	7	14	22
Faridabad	49	43	8	64	19	74
Palwal	N.A	31	N.A	25	N.A	25
Gurugram	31	34	5	21	8	31

Nuh	N.A	33	N.A	24	N.A	11
Rewari	32	29	5	10	8	21
Mahendragarh	40	26	6	10	10	18
Bhiwani	19	15	3	6	7	14
Jind	23	17	5	7	10	17
Hisar	13	15	3	8	9	16
Fatehabad	14	18	3	7	6	11
Sirsa	13	13	3	5	5	8
Mean	27	26	5	15	10	21
S.D.	9.55	8.75	1.50	12.81	3.52	13.28
C.V.	35	33.91	33.34	83.64	35.47	62.40

Calculated by self

Table 3 describes inter district disparities in selected educational infrastructure particulars in study period which is divided in two time periods. The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods. Faridabad and Sirsa districts performed highest and lowest respectively in all three indicators throughout the time periods.

Table-4

Inter-District Disparities in Educational Infrastructure

Districts	Student-Teacher ratio in Primary Schools		Student-Teacher ratio in Middle Schools		Student-Teacher ratio in High/Senior Secondary Schools	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	40	25	202	30	14	16
Panchkula	39	15	90	16	11	16
Yamunanagar	42	29	147	32	17	22
Kurukshetra	41	19	107	30	15	17
Kaithal	57	17	150	26	17	20
Karnal	41	31	105	36	14	18
Panipat	47	24	146	28	17	22
Sonipat	38	52	89	59	11	16
Rohtak	34	29	121	32	11	16
Jhajjar	28	16	130	26	14	15
Faridabad	40	37	125	42	12	27
Palwal	N.A	23	N.A	24	N.A	23
Gurugram	55	83	102	73	12	22
Nuh	N.A	36	N.A	46	N.A	30
Rewari	36	28	118	29	19	16
Mahendragarh	36	24	95	24	16	15
Bhiwani	40	25	107	33	17	17
Jind	45	25	86	37	14	19
Hisar	45	23	147	35	14	16
Fatehabad	51	24	93	34	15	21

Sirsa	49	25	98	36	14	20
Mean	42	29	119	35	14	19
S.D.	7.23	14.72	29.49	12.50	2.37	3.97
C.V.	17.07	50.62	24.82	36.11	16.46	20.66

Calculated by self

The above table 4 reveals the inter district disparities in the selected indicators of educational infrastructure in the districts of Haryana in 2000-01 and 2017-18. Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.

Table-5
Inter-District Disparities in the Health Infrastructure

Districts	Number of Hospitals per lakh of Population		Number of CHCs per lakh of Population		Number of PHCs per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	0.79	0.27	0.20	0.35	1.48	1.77
Panchkula	0.64	0.18	0.43	0.36	1.71	1.78
Yamunanagar	0.58	0.25	0.38	0.58	1.73	1.65
Kurukshetra	0.12	0.10	0.36	0.62	2.06	2.18
Kaithal	0.11	0.09	0.32	0.56	2.33	2.23
Karnal	0.16	0.20	0.31	0.40	1.96	1.73
Panipat	0.31	0.17	0.10	0.58	1.55	1.58
Sonapat	0.08	0.14	0.39	0.62	2.03	2.55
Rohtak	0.85	0.28	0.43	0.57	2.45	2.17
Jhajjar	0.23	0.42	0.23	0.63	1.93	2.82
Faridabad	0.27	0.11	0.14	0.22	1.00	0.77
Palwal	N.A	0.19	N.A	0.48	N.A	1.82
Gurugram	0.30	0.33	0.24	0.20	1.51	0.79
Nuh	N.A	0.09	N.A	0.28	N.A	1.93
Rewari	0.26	0.22	0.52	0.56	1.83	2.11
Mahendragarh	0.12	0.22	0.37	0.76	2.46	2.71
Bhiwani	0.63	0.49	0.42	0.61	2.60	2.69
Jind	0.34	0.30	0.25	0.52	2.19	2.10
Hisar	0.72	0.34	0.39	0.46	2.15	2.12
Fatehabad	0.25	0.32	0.37	0.53	1.98	2.55
Sirsa	0.27	0.31	0.18	0.62	2.06	2.24
Mean	0.37	0.24	0.32	0.50	1.95	2.01
S.D.	0.25	0.11	0.11	0.15	0.39	0.54
C.V.	67.25	45.21	35.58	29.59	20.23	27.06

Calculated by self

The above table 5 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in

case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.

Table-6
Inter-District Disparities in Health Infrastructure

Districts	Number of Sub-centres per lakh of Population		Number of Dispensaries per lakh of Population		Number of Beds per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	9.76	9.22	1.18	0.27	68	45
Panchkula	10.03	9.09	2.13	2.32	65	68
Yamunanagar	10.75	9.22	1.54	0.08	52	34
Kurukshetra	10.18	12.13	0.97	0.10	33	34
Kaithal	12.15	13.40	0.32	0.00	32	32
Karnal	9.03	9.96	1.26	0.47	36	32
Panipat	10.34	7.47	0.72	0.17	34	25
Sonipat	8.60	11.31	1.17	0.21	29	25
Rohtak	17.23	10.74	1.60	0.47	202	34
Jhajjar	13.86	13.15	0.91	0.31	21	48
Faridabad	5.33	3.15	1.64	0.39	37	21
Palwal	N.A	8.54	N.A	0.00	N.A	18
Gurugram	9.34	5.02	0.78	0.20	27	26
Nuh	N.A	12.67	N.A	0.00	N.A	21
Rewari	13.33	12.44	0.65	0.22	32	44
Mahendragarh	14.15	13.01	0.49	0.00	39	39
Bhiwani	14.18	13.46	1.12	0.18	70	51
Jind	10.84	12.22	0.76	0.15	63	32
Hisar	11.38	11.47	1.11	0.29	87	40
Fatehabad	12.28	14.33	0.87	0.11	33	41
Sirsa	12.45	11.89	1.07	0.15	35	32
Mean	11.33	10.66	1.07	0.29	52.37	35.33
S.D.	2.62	2.87	0.44	0.49	40.48	11.77
C.V.	23.16	26.94	41.09	167.71	77.29	33.31

Calculated by self

The above table 6 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.

Table-7
Results of Factor Analysis for Education Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.961	0.187	0.959	3.2308	23.22
No. of Middle Schools per 100 sq km of Area	0.98	0.074	0.966	3.1544	22.67
No. of High Schools per 100 sq km of Area	0.978	0.139	0.976	3.2263	23.19
Student-Teacher ratio of Primary Schools	-0.169	0.242	0.087	0.8195	5.89
Student-Teacher ratio of Middle Schools	-0.051	0.851	0.727	1.1824	8.50
Student-Teacher ratio of High Schools	-0.505	0.6	0.615	2.3008	16.54
Variance (%)	52.132	20.032	Total	13.9142	100.00
Cumulative variance (%)	52.132	72.165			

KMO measures of sampling adequacy- 0.457
Significance level of Bartlett's test of sphericity- 0.000

Table 7 indicates factor analysis result of education infrastructure for year of 200-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which explain cumulative variance of 72.17 percent. First factor explained 52.13 percent and second factor explain 20.03 percent of total cumulative variance. The communality values lied in ranging of 0.615 to 0.976 for all indicators except student-teacher ratio in primary school which was at 0.087. Factors value showed that three out of six variables had higher contribution in first component and two variables had majorly contributed to second component, remaining one variable which is student-teacher ratio in primary school had least contribution in both components. Weights of the indicators which came out with the use of initial Eigen value and factors value varied between 0.8195-3.2308. The variables which contributed largely to first component got higher and almost equal importance in weights as well. Student-Teacher ratio in primary schools had lowest relative weights (5.89), hence least contribution to educational infrastructure development.

Table-8

Results of Factor Analysis for Health Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communal ity	Weights	Weights (in %)
Number of Hospitals per lakh of Population	0.643	0.645	0.83	2.9893	18.07
Number of CHCs per lakh of Population	0.664	-0.201	0.481	2.1908	13.24
Number of PHCs per lakh of Population	0.695	-0.619	0.866	3.0804	18.62
Number of Sub-centre per lakh of Population	0.792	-0.45	0.831	3.0182	18.24
Number of Dispensaries per lakh of Population	0.225	0.864	0.798	2.2760	13.76
Number of Beds per lakh of Population	0.837	0.371	0.838	2.9882	18.06
Variance (%)	45.27	32.112	Total	16.5429	100.00
Cumulative variance (%)	45.27	77.382			

KMO measures of sampling adequacy- 0.636
Significance level of Bartlett's test of sphericity- 0.000

Table 8 points out the result of factor analysis with weights for health infrastructure for the period of 2000-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which together explain 77 percent cumulative variance. Individually both factors explained 45.27 percent and 32.11 percent respectively. Communality values lied in the range of 0.798 to 0.866 that means two factors were sufficient to explain the variance of original variables, except the number of CHCs per lakh of population which was at 0.481. The factor values showed that number of CHCs per lakh of population, number of sub-centers per lakh of population and number of beds per lakh of population had higher association with first factor whereas number of dispensaries per lakh of population had contributed significantly in second factor. But, number of hospitals and number of PHCs per lakh of population contributed less in both factors. From the selected variables, four variables got almost equal importance in weights which were more than 18 percent. Remaining two variables contributed about 13 percent each in weights.

Table-9

Results of Factor Analysis for Education Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.73	-0.358	0.661	2.9255	15.92
No. of Middle Schools per 100 sq km of Area	0.897	-0.415	0.976	3.5560	19.36
No. of High Schools per 100 sq km of Area	0.804	-0.296	0.734	3.0688	16.70
Student-Teacher ratio of Primary Schools	0.646	0.733	0.954	3.2377	17.62
Student-Teacher ratio of Middle Schools	0.593	0.79	0.975	3.1547	17.17
Student-Teacher ratio of High Schools	0.701	-0.1	0.501	2.4292	13.22
Variance (%)	54.05	25.979	Total	18.3720	100.00
Cumulative variance (%)	54.05	80.029			

KMO measures of sampling adequacy- 0.386
Significance level of Bartlett's test of sphericity- 0.000

The above table 9 reveals the result of factor analysis for education infrastructure for 2017-18. KMO and Bartlett's test shows significance level and applicability of factor analysis. Again two factors had come out from selected six variables. First factor explained 54 percent and second factor explained 26 percent, in together both of these factors explained 80 percent of variance. Half of the variables contributed more than 90 percent in Communality values and remaining half contributed in the range of 0.501 to 0.734. Four out of six variables contributed highly in the growth of first factor and remaining two variables which were student-teacher ratio in primary (0.733) and middle schools (0.79) contributed in second factor. From selected indicators, number of middle school per 100 sq. km. performed highest in weights with a value of 19.36 percent, followed by student-teacher ratio in primary (17.62) and middle schools ((17.17). No. of primary schools per 100 sq. km. of area (15.92) and student-teacher ratio in high schools had performed least in weights as well as education infrastructure development.

Table-10

Results of Factor Analysis for Health Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
Number of hospitals per lakh of population	0.484	0.307	0.329	1.9444	12.50
Number of CHCs per lakh of population	0.824	-0.274	0.755	2.8837	18.54
Number of PHCs per lakh of population	0.964	-0.086	0.937	2.9711	19.10
Number of sub-centre per lakh of population	0.904	-0.128	0.833	2.8675	18.43
Number of dispensaries per lakh of population	-0.152	0.908	0.848	2.0033	12.88
Number of beds per lakh of population	0.495	0.836	0.943	2.8844	18.54
Variance (%)	48.816	28.594	Total	15.5545	100
Cumulative variance (%)	48.816	77.41			

KMO measures of sampling adequacy- 0.437
Significance level of Bartlett's test of sphericity- 0.000

Table 10 depicts the result of factor analysis for health infrastructure. KMO and Bartlett's test values were significant that made factor analysis possible. Two factors had been derived from all six selected variables. First factor explained 49 percent variance and second factor did 28 percent. Total cumulative variance was 77 percent. In first factor, three variables were highly associated namely number of CHCs (0.824), PHCs (0.964) and sub-centers (0.904) per lakh of population. While two factors; number of dispensaries (0.908) and beds (0.836) per lakh of population contributed to second factor. Remaining variable; number of hospitals per lakh of population contributed with small amount in both factors. The communality values for all variables except number of hospitals per lakh of population were found more than 75 percent in the range of 0.755 to 0.943. Four variables which were number of PHCs (19.10), CHCs (18.54), beds (18.54), sub-centers (18.43) percent per lakh of population, received highest and almost equal weights. Number of hospitals and number of dispensaries per lakh of population got 12.50 percent and 12.88 percent of weights respectively and contributed least to health infrastructure development.

District-wise Composite Index using PCA techniques

Table 11 and 12 show district-wise Infrastructure development for years 2000-01 and 2017-18. Procedure has been discussed in methodology.

Table-11

District-wise Composite Index of Infrastructure for the year 2000-01

Districts	Education Index	Health Index	R1	R2
Ambala	0.2557	0.4342	5	6
Panchkula	0.0959	0.5717	19	4
Yamuna Nagar	0.2480	0.4974	6	5
Kurukshetra	0.2186	0.3505	9	13
Kaithal	0.2470	0.3467	7	14
Karnal	0.1467	0.3399	14	15
Panipat	0.2754	0.2382	3	18
Sonipat	0.1438	0.3340	15	16
Rohtak	0.1041	0.9139	18	1
Jhajjar	0.1876	0.3601	10	12
Faridabad	0.7644	0.1735	1	19
Gurugram	0.3306	0.2576	2	17
Rewari	0.2747	0.4300	4	8
Mahendergarh	0.2303	0.4305	8	7
Bhiwani	0.1838	0.6616	11	2
Jind	0.1590	0.4066	13	9
Hisar	0.1594	0.5941	12	3
Fatehabad	0.1409	0.3994	16	10
Sirsa	0.1135	0.3733	17	11
Mean	0.23	0.43		
S.D.	0.15	0.17		
C.V. (%)	64.89	39.48		

Table 11 shows district-wise composite index of social infrastructure for 2000-01. This composite index was calculated with the help of weights and normalized value of that indicator for every district. Ranks to all districts have been given in descending order. R1 shows rank for education index and R2 for health index. Out of total 19 districts only 08 districts were found above district average in both types of infrastructure. In education index Faridabad and Gurugram were on top two position followed by Panipat, Rewari and Ambala. Panchkula and Rohtak were on bottom positions in education index. Again positions of districts changed in health index, district of Rohtak which was on last position in education index performed best in health index and got first position followed by Bhiwani, Hisar, Panchkula and Yamunanagar. Faridabad was on last position in health index. Value of coefficient of variance was found higher for education index (64.89 percent).

Table-12

District-wise Composite Index of Infrastructure for the year 2017-18

Districts	Education Index	Health Index	R1	R2
Ambala	0.2515	0.4143	9	15
Panchkula	0.1728	0.5874	13	5
Yamuna Nagar	0.3446	0.4217	5	14
Kurukshetra	0.2595	0.4865	8	12
Kaithal	0.1342	0.4762	17	13
Karnal	0.2323	0.3803	10	16
Panipat	0.2887	0.3329	7	17
Sonipat	0.3614	0.4927	4	11
Rohtak	0.1484	0.5229	16	9
Jhajjar	0.1066	0.7299	21	2
Faridabad	0.7610	0.0456	1	21
Palwal	0.3195	0.3107	6	18
Gurugram	0.6318	0.1485	2	20
Nuh	0.4531	0.3027	3	19
Rewari	0.2159	0.5465	11	7
Mahendgarh	0.1581	0.6473	15	3
Bhiwani	0.1238	0.7420	20	1
Jind	0.1750	0.5053	12	10
Hisar	0.1275	0.5249	19	8
Fatehabad	0.17113	0.6227	14	4
Sirsa	0.13024	0.5491	18	6
Mean	0.27	0.47		
S.D.	0.17	0.17		
C.V. (%)	64.70	37.12		

Table 12 reveals composite index of social infrastructure for 2017-18. In health index 13 out of 21 districts were above districts average, while in education index only 07 districts were above districts average. Faridabad and Gurugram continued to be on first and second position respectively in 2018-18 as well. Jhajjar and Bhiwani performed worst in education index and dropped down to bottom two positions. In health index, Bhiwani district did excellent and got first position, Jhajjar district also improved continuously over the years and came on second position in 2017-18. Faridabad, Gurugram continued their last positions in 2017-18 as well. The coefficient of variance found again higher in education index (64.70 percent). It was found that throughout the study period higher districts disparities were found in education index.

Infrastructure Development Index- District wise

Infrastructure development index was obtained by taking out the average of district-wise composite index values. Ranks to each district were given in descending values order. Procedure has been discussed in methodology.

Table-13

District-wise Infrastructure Development Index Calculated from Composite Index Values

Districts	2000-01		2017-18	
	IDI	Rank	IDI	Rank
Ambala	0.3450	7	0.3329	16
Panchkula	0.3338	8	0.3801	10
Yamuna Nagar	0.3727	5	0.3832	8
Kurukshetra	0.2846	12	0.373	12
Kaithal	0.2969	10	0.3052	21
Karnal	0.2433	18	0.3063	20
Panipat	0.2568	16	0.3108	19
Sonipat	0.2389	19	0.4271	2
Rohtak	0.509	1	0.3357	15
Jhajjar	0.2739	14	0.4183	3
Faridabad	0.4690	2	0.4033	4
Palwal	0	-	0.3151	18
Gurugram	0.2941	11	0.3902	7
Nuh	0	-	0.3779	11
Rewari	0.3524	6	0.3812	9
Mahendergarh	0.3304	9	0.4027	5
Bhiwani	0.4227	3	0.4329	1
Jind	0.2828	13	0.3402	13
Hisar	0.3768	4	0.3262	17
Fatehabad	0.2702	15	0.3969	6
Sirsa	0.2434	17	0.3397	14

Table 13 presents district-wise infrastructure development index which was derived from average of composite index values of both infrastructure (Education and Health). Rohtak district was found on top of the table in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonipat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.

Classification of Districts on the basis of Infrastructural Development Index

In this sub-section districts have been classified in three categories: Developed, Moderately developed, and less developed by using average and standard deviation values of Infrastructure development index. Procedure has been discussed in methodology.

Table-14

District-wise classification based on Infrastructure Development Index Values

Districts	2000-01		2017-18	
	IDI	Category	IDI	Category
Ambala	0.3450	MD	0.3329	LD
Panchkula	0.3338	MD	0.3801	MD
Yamuna Nagar	0.3727	D	0.3832	MD
Kurukshetra	0.2846	LD	0.373	MD
Kaithal	0.2969	MD	0.3052	LD
Karnal	0.2433	LD	0.3063	LD
Panipat	0.2568	LD	0.3108	LD
Sonapat	0.2389	LD	0.4271	D
Rohtak	0.509	D	0.3357	LD
Jhajjar	0.2739	LD	0.4183	D
Faridabad	0.4690	D	0.4033	D
Palwal	0	-	0.3151	LD
Gurugram	0.2941	MD	0.3902	D
Nuh	0	-	0.3779	MD
Rewari	0.3524	MD	0.3812	MD
Mahendergarh	0.3304	MD	0.4027	D
Bhiwani	0.4227	D	0.4329	D
Jind	0.2828	LD	0.3402	D
Hisar	0.3768	D	0.3262	LD
Fatehabad	0.2702	LD	0.4607	D
Sirsa	0.2434	LD	0.3815	LD

D: Developed, MD: Moderate Developed, LD: Less Developed

D= ≥ 0.3646 , MD= > 0.2877 & < 0.3646 and LD = ≤ 0.2877 for the year 2000-01

D= ≥ 0.3863 , MD= > 0.3450 & < 0.3863 and LD = ≤ 0.3450 for the year 2017-18

Table 14 shows classification of districts on the basis of Infrastructure Development index for two study periods that are 2000-01 and 2017-18. In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compared to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

Major Findings of the Study

- The study shows that there are less number of middle schools in comparison to primary and high school throughout the study period.
- Student-teacher ratio is decreasing continuously in primary and middle schools which is an excellent sign of development.
- The study found that the total numbers of dispensaries are decreasing continuously over the years and reached to only 63 in 2017-18 from 229 in 2000-01. It has happened because people in rural areas stopped going to dispensaries for treatment and prefer to move to city hospitals.
- Number of hospitals had declined from 78 in 2000-01 to 62 in 2017-18 because of that number of beds per lakh of population also showed declining trends.

- The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods.
- Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.
- The disparity in case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.
- The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.
- Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonapat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.
- In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

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Social Infrastructure in Haryana- A Study of Inter-District Disparities**Dr. Santosh Nandal¹**

Professor

Monika²

Research Scholar

^{1,2}Department of Economics, M.D. University, Rohtak, Haryana**Abstract**

In this paper an attempt has been made to study the social infrastructure in Haryana along with inter-district disparities for the year 2000-01 and 2017-18. The study also analyzed the developed and less developed districts in social infrastructure. Simple statistical tools like mean and Coefficient of Variance have been used to measure the inter-district disparities. Composite index has been constructed to find out the development of districts. Principal Component Analysis has been used to get factor loadings and weights of selected indicators. It was found from the study that there are wide spread of disparities in the development levels of different districts. Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure while in 2017-18 Bhiwani district was on the top position.

Introduction

Infrastructure describes the physical structure of facilities which are required to provide goods and services to public. It is linked with economy directly or indirectly or we can say that it effect economy through its spillover effects. It includes all those activities which do not directly generate income themselves but provide support and substance to the income generation activities.

Infrastructure means something that comes before the actual structure. It is foundation to build the structure of economy. Infrastructure consist permanent structure which is used for a long time to give inputs to the economy like network of road, railway facility, electricity, schools, colleges and hospitals etc.

Role of Infrastructure in Economic Growth and Development

. Infrastructure plays an important role in overall development. Many economists describe the importance of infrastructure in economic development. In fact, developmental activities depend upon infrastructure facilities. It is considered the prerequisite of development. In the words of Dr. V.K.R.V. Rao, "The link between infrastructure and development is not once for all affairs.

It is a continuous process; and progress in development has to be preceded, accompanied and followed by progress in infrastructure, if we are to fulfill our declared objective of a self-accelerated process of economic development."

The infrastructural network has dual character; it is a crucial factor of development as well as a component of development. The regions which have weak infrastructure network remain less developed and it is generally accepted fact that agriculture, industry and other development activities are constrained by available infrastructural facilities. Different types of infrastructural facilities affect the overall development including agriculture, industry and human development in which infrastructure plays a leader role and follower is the development (Majumder, R. 2004).

Classification of Infrastructure

Infrastructure can be classified into two category i.e. economic infrastructure and social infrastructure. Social infrastructure is also divided into two education and health infrastructure.

Social infrastructure is essential for an economy development. Social infrastructure concept is very wide and plays extremely significant role in economy development as it executes the task of human development resources by means of skill generation, education, awareness creation, training, research and development and health care to increase the efficiency of production. Social infrastructure plays an important role in enhancing the human capital. Advancement in knowledge and the dispersion of new ideas and activities are necessary to eliminate economic backwardness and install the human abilities that are more favourable to economic achievement. (AnuKapil and P.S. Raikhy) It has been recognized that physical capital growth is directly related to considerable formation of human capital.

Education is considered as catalyst for the development of human resource. This is the key social infrastructure indicators which have direct relation with productive manpower, level of income and standard of living. Less developed countries need educated professionals in all areas to boost the development and growth. UNESCO suggests minimum fifteen percent of national expenditure on educational facilities. Education acts as the base for research and development. Being an integral part of development progress, it cannot be looked separately.

Objectives of the Study

- To study the overall development of social infrastructure in Haryana.
- To analyse inter-district disparities in social infrastructure.
- To identify the developed and less developed districts.
- To categories districts on the basis of the value of Infrastructure Development index.

Research Methodology

The current study focused on overall growth and development of social infrastructure in the state of Haryana. The study also analyzed inter-districts disparities, developed and backward districts in social infrastructure. Social Infrastructure considered education (number of schools, teachers, students and student-teacher ratio) and health (number of hospitals, CHCs, PHCs, sub-centres, dispensaries, number of beds per lakh of population) indicators to show growth and development of social infrastructure. For inter-districts disparities and to identify developed and backward districts; only a few indicators have been taken in

consideration due to the unavailability of complete data on district level. The selection of indicators had been done after extensive review of literature.

The present study is empirical by nature. To accomplish the objectives, secondary data from different sources like; Statistical abstract of Haryana, Census 2001 and 2011 and Economic survey of Haryana have been used. In order to identify inter-district disparities and development ranks of 21 districts of Haryana; data of 12 indicators from social infrastructure for two points of time 2000-01 and 2017-18 have been used. For inter-district disparities; simple statistical tools like Mean, Standard Deviation and Coefficient of Variance have been calculated and considered. Raychaudhuri, A. and Haldar, S. (2009) method has been considered to run PCA for giving weights to the indicators and to construct Composite Index.

To run PCA, raw data was first converted into normalized data for each district. This was done to form raw data unit free and get relative spot of every district. Best and worst values of all indicators were identified for each district in order to calculate normalized value. Normalized value falls between 0 and 1 always.

$$NV_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$$

Where $R = \text{best } X_{ij} - \text{worst } X_{ij}$

$i = i\text{-th observation and } j = j\text{-th district}$

The next step after obtaining the normalized value was to run PCA to get factor loadings and weights of selected indicators. SPSS software was used to run PCA. From PCA, Initial Eigen values which are more than 01 were also identified. Weights for each selected indicator were obtained by multiplication of first initial Eigen value to first factor value and so on and then by adding all the values (which came after multiplication) together.

The next step was to construct the composite index. Composite Index was calculated; firstly, weight of selected indicator was multiplied by same indicator's normalized value, secondly, all indicators values (came after multiplication) were added together and divided by the total weights of selected indicators. The same procedure was followed for every district and for both types of infrastructure (Education and Health) at two selected points of time, 2000-01 and 2017-18.

The next step was to calculate Infrastructural Development Index (IDI) for selected two points of time separately for each district. This was done by using simple arithmetic average of composite index value of education and health infrastructure for respective point of time. The formula is mentioned below:

$$IDI = 1/2 [\text{Composite Index of Education Infrastructure} + \text{Composite Index of Health Infrastructure}]$$

On the basis of the Infrastructural Development Index (IDI) ranks had been given to the districts in descending order. The next step was to segregate the districts into three categories- Developed, Moderately Developed, Less Developed to expedite inter-district comparison. Pradhan, P. and Kumar, S. (2015) study had been considered for district categorization. Mean, Standard Deviation and Coefficient of Variance were calculated for IDI of each selected point of time. The developed districts were those which had IDI value equal or higher than the value came after adding mean value and 0.5 multiplied to S.D. value. The less developed districts were those which had IDI value equal or lower than the value came after subtracting 0.5 multiplied to S.D. value from mean value. The districts whose values lied between these two values were considered as moderately developed.

Education

Education is important resource to accelerate economic growth and investment in the region and it is prime indicator for quality of life and HDI (Human Development Index). Haryana requires quality and strong infrastructure to keep pace with growing economy.

Table-1**Development of Educational Infrastructure**

Education Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Primary Schools	11040	12179	13904	9690	9974
Number of Middle Schools	1887	2168	3483	4479	5238
Number of High Schools	4138	5317	6983	7663	8024
Number of Students in primary School	2017855	1997491	2284255	1633573	2504133
Number of Students in Middle School	951494	1159836	1249777	1038326	1448258
Number of Students in High Schools	804899	872806	1426723	1475045	1552812
Number of Teachers in Primary School	48463	50621	28000	33077	92649
Number of Teachers in Middle School	8396	11139	22835	31426	43311
Number of Teachers in High School	57479	68185	99796	86190	83561
Student-Teacher ratio in Primary School	42	39	79	71	27
Student-Teacher ratio in Middle School	113	104	55	45	33
Student-Teacher ratio in High School	14	13	14	17	19

Source: Statistical Abstract of Haryana, Various Issues.

The above table 1 explains the development of educational infrastructure in Haryana from 2000-01 to 2017-18. The number of primary schools first increased from 11040 in 2000-01 to 13904 in 2010-11, but then decreased to 9974 in 2017-18 while number of middle and high schools had increased continuously over the year from 1887 and 4138 respectively in 2000-01 to 5238 and 8024 respectively in 2017-18. The number of students in primary and middle schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of students in high schools had shown continuous growth from 804899 in 2000-01 to 1552812 in 2017-18. The number of teachers in primary and high schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of teachers in middle schools had shown continuous growth from 8396 in 2000-01 to 43311 in 2017-18. Student-teacher ratio in primary schools had increased from 42 in 2000-01 to 79 in 2010-11 but after it was decreased and remained only 27 in 2017-18 which is a good sign of development. Student-teacher ratio in middle schools continuously decreased over the years from 113 in 2000-01 to 33 in 2017-18. Student-teacher ratio in high schools had increased from 14 in 2000-01 to 19 in 2017-18, which was a bad sign of educational infrastructure development.

Health

Haryana is committed to provide quality of health services to its citizens. Health centres which include hospitals, CHCs, PHCs, Sub-centres, Dispensaries provide accessible, adequate and quality health care services on reasonable pricing.

Table-2
Health Infrastructure in Haryana

Health Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Hospitals	78	62	68	57	62
Number of CHCs	64	81	86	94	125
Number of PHCs	402	409	429	468	499
Number of Sub-Centres	2299	2433	2465	2630	2636
Number of Dispensary	229	193	193	125	63
Number of Beds per lakh of Population	995	815	833	726	866

*Source: Statistical Abstract of Haryana, Various Issues.
Census of India*

Table 2 reveals the health infrastructure in Haryana at different time periods. Number of hospitals had been declined from 78 in 2000-01 to 62 in 2017-18. Number of CHCs, PHCs and sub-centres had shown continuous growth from 2000-01 to 2017-18. Number of CHCs had grown from 64 to 125, PHCs had grown to 499 from 402 and sub-centres had grown from 2299 to 2636. But there was a decrease registered in number of dispensaries from 229 in 2000-01 to 63 in 2017-18, while number of beds per lakh of population had been declined from 995 in 2000-01 to 726 in 2015-16 but later increased to 866 in 2017-18.

Table-3
Inter-District Disparities in Educational Infrastructure

Districts	Number of Primary Schools per 100 sq. km. of Area		Number of Middle Schools per 100 sq. km. of Area		Number of High Schools per 100 sq. km. of Area	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	36	34	4	15	12	20
Panchkula	30	35	5	14	9	15
Yamunanagar	31	36	3	19	9	20
Kurukshetra	37	36	6	17	9	19
Kaithal	20	18	3	9	6	14
Karnal	24	24	4	12	8	17
Panipat	24	25	5	22	11	27
Sonipat	31	25	7	12	15	24
Rohtak	21	15	4	7	14	23
Jhajjar	30	19	5	7	14	22
Faridabad	49	43	8	64	19	74
Palwal	N.A	31	N.A	25	N.A	25
Gurugram	31	34	5	21	8	31

Nuh	N.A	33	N.A	24	N.A	11
Rewari	32	29	5	10	8	21
Mahendragarh	40	26	6	10	10	18
Bhiwani	19	15	3	6	7	14
Jind	23	17	5	7	10	17
Hisar	13	15	3	8	9	16
Fatehabad	14	18	3	7	6	11
Sirsa	13	13	3	5	5	8
Mean	27	26	5	15	10	21
S.D.	9.55	8.75	1.50	12.81	3.52	13.28
C.V.	35	33.91	33.34	83.64	35.47	62.40

Calculated by self

Table 3 describes inter district disparities in selected educational infrastructure particulars in study period which is divided in two time periods. The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods. Faridabad and Sirsa districts performed highest and lowest respectively in all three indicators throughout the time periods.

Table-4

Inter-District Disparities in Educational Infrastructure

Districts	Student-Teacher ratio in Primary Schools		Student-Teacher ratio in Middle Schools		Student-Teacher ratio in High/Senior Secondary Schools	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	40	25	202	30	14	16
Panchkula	39	15	90	16	11	16
Yamunanagar	42	29	147	32	17	22
Kurukshetra	41	19	107	30	15	17
Kaithal	57	17	150	26	17	20
Karnal	41	31	105	36	14	18
Panipat	47	24	146	28	17	22
Sonipat	38	52	89	59	11	16
Rohtak	34	29	121	32	11	16
Jhajjar	28	16	130	26	14	15
Faridabad	40	37	125	42	12	27
Palwal	N.A	23	N.A	24	N.A	23
Gurugram	55	83	102	73	12	22
Nuh	N.A	36	N.A	46	N.A	30
Rewari	36	28	118	29	19	16
Mahendragarh	36	24	95	24	16	15
Bhiwani	40	25	107	33	17	17
Jind	45	25	86	37	14	19
Hisar	45	23	147	35	14	16
Fatehabad	51	24	93	34	15	21

Sirsa	49	25	98	36	14	20
Mean	42	29	119	35	14	19
S.D.	7.23	14.72	29.49	12.50	2.37	3.97
C.V.	17.07	50.62	24.82	36.11	16.46	20.66

Calculated by self

The above table 4 reveals the inter district disparities in the selected indicators of educational infrastructure in the districts of Haryana in 2000-01 and 2017-18. Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.

Table-5
Inter-District Disparities in the Health Infrastructure

Districts	Number of Hospitals per lakh of Population		Number of CHCs per lakh of Population		Number of PHCs per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	0.79	0.27	0.20	0.35	1.48	1.77
Panchkula	0.64	0.18	0.43	0.36	1.71	1.78
Yamunanagar	0.58	0.25	0.38	0.58	1.73	1.65
Kurukshetra	0.12	0.10	0.36	0.62	2.06	2.18
Kaithal	0.11	0.09	0.32	0.56	2.33	2.23
Karnal	0.16	0.20	0.31	0.40	1.96	1.73
Panipat	0.31	0.17	0.10	0.58	1.55	1.58
Sonapat	0.08	0.14	0.39	0.62	2.03	2.55
Rohtak	0.85	0.28	0.43	0.57	2.45	2.17
Jhajjar	0.23	0.42	0.23	0.63	1.93	2.82
Faridabad	0.27	0.11	0.14	0.22	1.00	0.77
Palwal	N.A	0.19	N.A	0.48	N.A	1.82
Gurugram	0.30	0.33	0.24	0.20	1.51	0.79
Nuh	N.A	0.09	N.A	0.28	N.A	1.93
Rewari	0.26	0.22	0.52	0.56	1.83	2.11
Mahendragarh	0.12	0.22	0.37	0.76	2.46	2.71
Bhiwani	0.63	0.49	0.42	0.61	2.60	2.69
Jind	0.34	0.30	0.25	0.52	2.19	2.10
Hisar	0.72	0.34	0.39	0.46	2.15	2.12
Fatehabad	0.25	0.32	0.37	0.53	1.98	2.55
Sirsa	0.27	0.31	0.18	0.62	2.06	2.24
Mean	0.37	0.24	0.32	0.50	1.95	2.01
S.D.	0.25	0.11	0.11	0.15	0.39	0.54
C.V.	67.25	45.21	35.58	29.59	20.23	27.06

Calculated by self

The above table 5 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in

case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.

Table-6
Inter-District Disparities in Health Infrastructure

Districts	Number of Sub-centres per lakh of Population		Number of Dispensaries per lakh of Population		Number of Beds per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	9.76	9.22	1.18	0.27	68	45
Panchkula	10.03	9.09	2.13	2.32	65	68
Yamunanagar	10.75	9.22	1.54	0.08	52	34
Kurukshetra	10.18	12.13	0.97	0.10	33	34
Kaithal	12.15	13.40	0.32	0.00	32	32
Karnal	9.03	9.96	1.26	0.47	36	32
Panipat	10.34	7.47	0.72	0.17	34	25
Sonipat	8.60	11.31	1.17	0.21	29	25
Rohtak	17.23	10.74	1.60	0.47	202	34
Jhajjar	13.86	13.15	0.91	0.31	21	48
Faridabad	5.33	3.15	1.64	0.39	37	21
Palwal	N.A	8.54	N.A	0.00	N.A	18
Gurugram	9.34	5.02	0.78	0.20	27	26
Nuh	N.A	12.67	N.A	0.00	N.A	21
Rewari	13.33	12.44	0.65	0.22	32	44
Mahendragarh	14.15	13.01	0.49	0.00	39	39
Bhiwani	14.18	13.46	1.12	0.18	70	51
Jind	10.84	12.22	0.76	0.15	63	32
Hisar	11.38	11.47	1.11	0.29	87	40
Fatehabad	12.28	14.33	0.87	0.11	33	41
Sirsa	12.45	11.89	1.07	0.15	35	32
Mean	11.33	10.66	1.07	0.29	52.37	35.33
S.D.	2.62	2.87	0.44	0.49	40.48	11.77
C.V.	23.16	26.94	41.09	167.71	77.29	33.31

Calculated by self

The above table 6 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.

Table-7
Results of Factor Analysis for Education Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.961	0.187	0.959	3.2308	23.22
No. of Middle Schools per 100 sq km of Area	0.98	0.074	0.966	3.1544	22.67
No. of High Schools per 100 sq km of Area	0.978	0.139	0.976	3.2263	23.19
Student-Teacher ratio of Primary Schools	-0.169	0.242	0.087	0.8195	5.89
Student-Teacher ratio of Middle Schools	-0.051	0.851	0.727	1.1824	8.50
Student-Teacher ratio of High Schools	-0.505	0.6	0.615	2.3008	16.54
Variance (%)	52.132	20.032	Total	13.9142	100.00
Cumulative variance (%)	52.132	72.165			

KMO measures of sampling adequacy- 0.457
Significance level of Bartlett's test of sphericity- 0.000

Table 7 indicates factor analysis result of education infrastructure for year of 200-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which explain cumulative variance of 72.17 percent. First factor explained 52.13 percent and second factor explain 20.03 percent of total cumulative variance. The communality values lied in ranging of 0.615 to 0.976 for all indicators except student-teacher ratio in primary school which was at 0.087. Factors value showed that three out of six variables had higher contribution in first component and two variables had majorly contributed to second component, remaining one variable which is student-teacher ratio in primary school had least contribution in both components. Weights of the indicators which came out with the use of initial Eigen value and factors value varied between 0.8195-3.2308. The variables which contributed largely to first component got higher and almost equal importance in weights as well. Student-Teacher ratio in primary schools had lowest relative weights (5.89), hence least contribution to educational infrastructure development.

Table-8

Results of Factor Analysis for Health Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communal ity	Weights	Weights (in %)
Number of Hospitals per lakh of Population	0.643	0.645	0.83	2.9893	18.07
Number of CHCs per lakh of Population	0.664	-0.201	0.481	2.1908	13.24
Number of PHCs per lakh of Population	0.695	-0.619	0.866	3.0804	18.62
Number of Sub-centre per lakh of Population	0.792	-0.45	0.831	3.0182	18.24
Number of Dispensaries per lakh of Population	0.225	0.864	0.798	2.2760	13.76
Number of Beds per lakh of Population	0.837	0.371	0.838	2.9882	18.06
Variance (%)	45.27	32.112	Total	16.5429	100.00
Cumulative variance (%)	45.27	77.382			

KMO measures of sampling adequacy- 0.636
Significance level of Bartlett's test of sphericity- 0.000

Table 8 points out the result of factor analysis with weights for health infrastructure for the period of 2000-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which together explain 77 percent cumulative variance. Individually both factors explained 45.27 percent and 32.11 percent respectively. Communality values lied in the range of 0.798 to 0.866 that means two factors were sufficient to explain the variance of original variables, except the number of CHCs per lakh of population which was at 0.481. The factor values showed that number of CHCs per lakh of population, number of sub-centers per lakh of population and number of beds per lakh of population had higher association with first factor whereas number of dispensaries per lakh of population had contributed significantly in second factor. But, number of hospitals and number of PHCs per lakh of population contributed less in both factors. From the selected variables, four variables got almost equal importance in weights which were more than 18 percent. Remaining two variables contributed about 13 percent each in weights.

Table-9

Results of Factor Analysis for Education Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.73	-0.358	0.661	2.9255	15.92
No. of Middle Schools per 100 sq km of Area	0.897	-0.415	0.976	3.5560	19.36
No. of High Schools per 100 sq km of Area	0.804	-0.296	0.734	3.0688	16.70
Student-Teacher ratio of Primary Schools	0.646	0.733	0.954	3.2377	17.62
Student-Teacher ratio of Middle Schools	0.593	0.79	0.975	3.1547	17.17
Student-Teacher ratio of High Schools	0.701	-0.1	0.501	2.4292	13.22
Variance (%)	54.05	25.979	Total	18.3720	100.00
Cumulative variance (%)	54.05	80.029			

KMO measures of sampling adequacy- 0.386
Significance level of Bartlett's test of sphericity- 0.000

The above table 9 reveals the result of factor analysis for education infrastructure for 2017-18. KMO and Bartlett's test shows significance level and applicability of factor analysis. Again two factors had come out from selected six variables. First factor explained 54 percent and second factor explained 26 percent, in together both of these factors explained 80 percent of variance. Half of the variables contributed more than 90 percent in Communality values and remaining half contributed in the range of 0.501 to 0.734. Four out of six variables contributed highly in the growth of first factor and remaining two variables which were student-teacher ratio in primary (0.733) and middle schools (0.79) contributed in second factor. From selected indicators, number of middle school per 100 sq. km. performed highest in weights with a value of 19.36 percent, followed by student-teacher ratio in primary (17.62) and middle schools ((17.17). No. of primary schools per 100 sq. km. of area (15.92) and student-teacher ratio in high schools had performed least in weights as well as education infrastructure development.

Table-10

Results of Factor Analysis for Health Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
Number of hospitals per lakh of population	0.484	0.307	0.329	1.9444	12.50
Number of CHCs per lakh of population	0.824	-0.274	0.755	2.8837	18.54
Number of PHCs per lakh of population	0.964	-0.086	0.937	2.9711	19.10
Number of sub-centre per lakh of population	0.904	-0.128	0.833	2.8675	18.43
Number of dispensaries per lakh of population	-0.152	0.908	0.848	2.0033	12.88
Number of beds per lakh of population	0.495	0.836	0.943	2.8844	18.54
Variance (%)	48.816	28.594	Total	15.5545	100
Cumulative variance (%)	48.816	77.41			

KMO measures of sampling adequacy- 0.437
Significance level of Bartlett's test of sphericity- 0.000

Table 10 depicts the result of factor analysis for health infrastructure. KMO and Bartlett's test values were significant that made factor analysis possible. Two factors had been derived from all six selected variables. First factor explained 49 percent variance and second factor did 28 percent. Total cumulative variance was 77 percent. In first factor, three variables were highly associated namely number of CHCs (0.824), PHCs (0.964) and sub-centers (0.904) per lakh of population. While two factors; number of dispensaries (0.908) and beds (0.836) per lakh of population contributed to second factor. Remaining variable; number of hospitals per lakh of population contributed with small amount in both factors. The communality values for all variables except number of hospitals per lakh of population were found more than 75 percent in the range of 0.755 to 0.943. Four variables which were number of PHCs (19.10), CHCs (18.54), beds (18.54), sub-centers (18.43) percent per lakh of population, received highest and almost equal weights. Number of hospitals and number of dispensaries per lakh of population got 12.50 percent and 12.88 percent of weights respectively and contributed least to health infrastructure development.

District-wise Composite Index using PCA techniques

Table 11 and 12 show district-wise Infrastructure development for years 2000-01 and 2017-18. Procedure has been discussed in methodology.

Table-11

District-wise Composite Index of Infrastructure for the year 2000-01

Districts	Education Index	Health Index	R1	R2
Ambala	0.2557	0.4342	5	6
Panchkula	0.0959	0.5717	19	4
Yamuna Nagar	0.2480	0.4974	6	5
Kurukshetra	0.2186	0.3505	9	13
Kaithal	0.2470	0.3467	7	14
Karnal	0.1467	0.3399	14	15
Panipat	0.2754	0.2382	3	18
Sonipat	0.1438	0.3340	15	16
Rohtak	0.1041	0.9139	18	1
Jhajjar	0.1876	0.3601	10	12
Faridabad	0.7644	0.1735	1	19
Gurugram	0.3306	0.2576	2	17
Rewari	0.2747	0.4300	4	8
Mahendergarh	0.2303	0.4305	8	7
Bhiwani	0.1838	0.6616	11	2
Jind	0.1590	0.4066	13	9
Hisar	0.1594	0.5941	12	3
Fatehabad	0.1409	0.3994	16	10
Sirsa	0.1135	0.3733	17	11
Mean	0.23	0.43		
S.D.	0.15	0.17		
C.V. (%)	64.89	39.48		

Table 11 shows district-wise composite index of social infrastructure for 2000-01. This composite index was calculated with the help of weights and normalized value of that indicator for every district. Ranks to all districts have been given in descending order. R1 shows rank for education index and R2 for health index. Out of total 19 districts only 08 districts were found above district average in both types of infrastructure. In education index Faridabad and Gurugram were on top two position followed by Panipat, Rewari and Ambala. Panchkula and Rohtak were on bottom positions in education index. Again positions of districts changed in health index, district of Rohtak which was on last position in education index performed best in health index and got first position followed by Bhiwani, Hisar, Panchkula and Yamunanagar. Faridabad was on last position in health index. Value of coefficient of variance was found higher for education index (64.89 percent).

Table-12

District-wise Composite Index of Infrastructure for the year 2017-18

Districts	Education Index	Health Index	R1	R2
Ambala	0.2515	0.4143	9	15
Panchkula	0.1728	0.5874	13	5
Yamuna Nagar	0.3446	0.4217	5	14
Kurukshetra	0.2595	0.4865	8	12
Kaithal	0.1342	0.4762	17	13
Karnal	0.2323	0.3803	10	16
Panipat	0.2887	0.3329	7	17
Sonipat	0.3614	0.4927	4	11
Rohtak	0.1484	0.5229	16	9
Jhajjar	0.1066	0.7299	21	2
Faridabad	0.7610	0.0456	1	21
Palwal	0.3195	0.3107	6	18
Gurugram	0.6318	0.1485	2	20
Nuh	0.4531	0.3027	3	19
Rewari	0.2159	0.5465	11	7
Mahendgarh	0.1581	0.6473	15	3
Bhiwani	0.1238	0.7420	20	1
Jind	0.1750	0.5053	12	10
Hisar	0.1275	0.5249	19	8
Fatehabad	0.17113	0.6227	14	4
Sirsa	0.13024	0.5491	18	6
Mean	0.27	0.47		
S.D.	0.17	0.17		
C.V. (%)	64.70	37.12		

Table 12 reveals composite index of social infrastructure for 2017-18. In health index 13 out of 21 districts were above districts average, while in education index only 07 districts were above districts average. Faridabad and Gurugram continued to be on first and second position respectively in 2018-18 as well. Jhajjar and Bhiwani performed worst in education index and dropped down to bottom two positions. In health index, Bhiwani district did excellent and got first position, Jhajjar district also improved continuously over the years and came on second position in 2017-18. Faridabad, Gurugram continued their last positions in 2017-18 as well. The coefficient of variance found again higher in education index (64.70 percent). It was found that throughout the study period higher districts disparities were found in education index.

Infrastructure Development Index- District wise

Infrastructure development index was obtained by taking out the average of district-wise composite index values. Ranks to each district were given in descending values order. Procedure has been discussed in methodology.

Table-13

District-wise Infrastructure Development Index Calculated from Composite Index Values

Districts	2000-01		2017-18	
	IDI	Rank	IDI	Rank
Ambala	0.3450	7	0.3329	16
Panchkula	0.3338	8	0.3801	10
Yamuna Nagar	0.3727	5	0.3832	8
Kurukshetra	0.2846	12	0.373	12
Kaithal	0.2969	10	0.3052	21
Karnal	0.2433	18	0.3063	20
Panipat	0.2568	16	0.3108	19
Sonipat	0.2389	19	0.4271	2
Rohtak	0.509	1	0.3357	15
Jhajjar	0.2739	14	0.4183	3
Faridabad	0.4690	2	0.4033	4
Palwal	0	-	0.3151	18
Gurugram	0.2941	11	0.3902	7
Nuh	0	-	0.3779	11
Rewari	0.3524	6	0.3812	9
Mahendergarh	0.3304	9	0.4027	5
Bhiwani	0.4227	3	0.4329	1
Jind	0.2828	13	0.3402	13
Hisar	0.3768	4	0.3262	17
Fatehabad	0.2702	15	0.3969	6
Sirsa	0.2434	17	0.3397	14

Table 13 presents district-wise infrastructure development index which was derived from average of composite index values of both infrastructure (Education and Health). Rohtak district was found on top of the table in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonipat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.

Classification of Districts on the basis of Infrastructural Development Index

In this sub-section districts have been classified in three categories: Developed, Moderately developed, and less developed by using average and standard deviation values of Infrastructure development index. Procedure has been discussed in methodology.

Table-14
District-wise classification based on Infrastructure Development Index Values

Districts	2000-01		2017-18	
	IDI	Category	IDI	Category
Ambala	0.3450	MD	0.3329	LD
Panchkula	0.3338	MD	0.3801	MD
Yamuna Nagar	0.3727	D	0.3832	MD
Kurukshetra	0.2846	LD	0.373	MD
Kaithal	0.2969	MD	0.3052	LD
Karnal	0.2433	LD	0.3063	LD
Panipat	0.2568	LD	0.3108	LD
Sonapat	0.2389	LD	0.4271	D
Rohtak	0.509	D	0.3357	LD
Jhajjar	0.2739	LD	0.4183	D
Faridabad	0.4690	D	0.4033	D
Palwal	0	-	0.3151	LD
Gurugram	0.2941	MD	0.3902	D
Nuh	0	-	0.3779	MD
Rewari	0.3524	MD	0.3812	MD
Mahendergarh	0.3304	MD	0.4027	D
Bhiwani	0.4227	D	0.4329	D
Jind	0.2828	LD	0.3402	D
Hisar	0.3768	D	0.3262	LD
Fatehabad	0.2702	LD	0.4607	D
Sirsa	0.2434	LD	0.3815	LD

D: Developed, MD: Moderate Developed, LD: Less Developed

D= ≥ 0.3646 , MD= > 0.2877 & < 0.3646 and LD = ≤ 0.2877 for the year 2000-01

D= ≥ 0.3863 , MD= > 0.3450 & < 0.3863 and LD = ≤ 0.3450 for the year 2017-18

Table 14 shows classification of districts on the basis of Infrastructure Development index for two study periods that are 2000-01 and 2017-18. In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

Major Findings of the Study

- The study shows that there are less number of middle schools in comparison to primary and high school throughout the study period.
- Student-teacher ratio is decreasing continuous in primary and middle schools which is an excellent sign of development.
- The study found that the total numbers of dispensaries are decreasing continuously over the years and reached to only 63 in 2017-18 from 229 in 2000-01. It has happened because people in rural areas stopped going to dispensaries for treatment and prefer to move to city hospitals.
- Number of hospitals had declined from 78 in 2000-01 to 62 in 2017-18 because of that number of beds per lakh of population also showed declining trends.

- The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods.
- Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.
- The disparity in case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.
- The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.
- Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonapat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.
- In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

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Social Infrastructure in Haryana- A Study of Inter-District Disparities**Dr. Santosh Nandal¹**

Professor

Monika²

Research Scholar

^{1,2}Department of Economics, M.D. University, Rohtak, Haryana**Abstract**

In this paper an attempt has been made to study the social infrastructure in Haryana along with inter-district disparities for the year 2000-01 and 2017-18. The study also analyzed the developed and less developed districts in social infrastructure. Simple statistical tools like mean and Coefficient of Variance have been used to measure the inter-district disparities. Composite index has been constructed to find out the development of districts. Principal Component Analysis has been used to get factor loadings and weights of selected indicators. It was found from the study that there are wide spread of disparities in the development levels of different districts. Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure while in 2017-18 Bhiwani district was on the top position.

Introduction

Infrastructure describes the physical structure of facilities which are required to provide goods and services to public. It is linked with economy directly or indirectly or we can say that it effect economy through its spillover effects. It includes all those activities which do not directly generate income themselves but provide support and substance to the income generation activities.

Infrastructure means something that comes before the actual structure. It is foundation to build the structure of economy. Infrastructure consist permanent structure which is used for a long time to give inputs to the economy like network of road, railway facility, electricity, schools, colleges and hospitals etc.

Role of Infrastructure in Economic Growth and Development

. Infrastructure plays an important role in overall development. Many economists describe the importance of infrastructure in economic development. In fact, developmental activities depend upon infrastructure facilities. It is considered the prerequisite of development. In the words of Dr. V.K.R.V. Rao, "The link between infrastructure and development is not once for all affairs.

It is a continuous process; and progress in development has to be preceded, accompanied and followed by progress in infrastructure, if we are to fulfill our declared objective of a self-accelerated process of economic development."

The infrastructural network has dual character; it is a crucial factor of development as well as a component of development. The regions which have weak infrastructure network remain less developed and it is generally accepted fact that agriculture, industry and other development activities are constrained by available infrastructural facilities. Different types of infrastructural facilities affect the overall development including agriculture, industry and human development in which infrastructure plays a leader role and follower is the development (Majumder, R. 2004).

Classification of Infrastructure

Infrastructure can be classified into two category i.e. economic infrastructure and social infrastructure. Social infrastructure is also divided into two education and health infrastructure.

Social infrastructure is essential for an economy development. Social infrastructure concept is very wide and plays extremely significant role in economy development as it executes the task of human development resources by means of skill generation, education, awareness creation, training, research and development and health care to increase the efficiency of production. Social infrastructure plays an important role in enhancing the human capital. Advancement in knowledge and the dispersion of new ideas and activities are necessary to eliminate economic backwardness and install the human abilities that are more favourable to economic achievement. (AnuKapil and P.S. Raikhy) It has been recognized that physical capital growth is directly related to considerable formation of human capital.

Education is considered as catalyst for the development of human resource. This is the key social infrastructure indicators which have direct relation with productive manpower, level of income and standard of living. Less developed countries need educated professionals in all areas to boost the development and growth. UNESCO suggests minimum fifteen percent of national expenditure on educational facilities. Education acts as the base for research and development. Being an integral part of development progress, it cannot be looked separately.

Objectives of the Study

- To study the overall development of social infrastructure in Haryana.
- To analyse inter-district disparities in social infrastructure.
- To identify the developed and less developed districts.
- To categories districts on the basis of the value of Infrastructure Development index.

Research Methodology

The current study focused on overall growth and development of social infrastructure in the state of Haryana. The study also analyzed inter-districts disparities, developed and backward districts in social infrastructure. Social Infrastructure considered education (number of schools, teachers, students and student-teacher ratio) and health (number of hospitals, CHCs, PHCs, sub-centres, dispensaries, number of beds per lakh of population) indicators to show growth and development of social infrastructure. For inter-districts disparities and to identify developed and backward districts; only a few indicators have been taken in

consideration due to the unavailability of complete data on district level. The selection of indicators had been done after extensive review of literature.

The present study is empirical by nature. To accomplish the objectives, secondary data from different sources like; Statistical abstract of Haryana, Census 2001 and 2011 and Economic survey of Haryana have been used. In order to identify inter-district disparities and development ranks of 21 districts of Haryana; data of 12 indicators from social infrastructure for two points of time 2000-01 and 2017-18 have been used. For inter-district disparities; simple statistical tools like Mean, Standard Deviation and Coefficient of Variance have been calculated and considered. Raychaudhuri, A. and Haldar, S. (2009) method has been considered to run PCA for giving weights to the indicators and to construct Composite Index.

To run PCA, raw data was first converted into normalized data for each district. This was done to form raw data unit free and get relative spot of every district. Best and worst values of all indicators were identified for each district in order to calculate normalized value. Normalized value falls between 0 and 1 always.

$$NV_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$$

Where $R = \text{best } X_{ij} - \text{worst } X_{ij}$

$i = i\text{-th observation and } j = j\text{-th district}$

The next step after obtaining the normalized value was to run PCA to get factor loadings and weights of selected indicators. SPSS software was used to run PCA. From PCA, Initial Eigen values which are more than 01 were also identified. Weights for each selected indicator were obtained by multiplication of first initial Eigen value to first factor value and so on and then by adding all the values (which came after multiplication) together.

The next step was to construct the composite index. Composite Index was calculated; firstly, weight of selected indicator was multiplied by same indicator's normalized value, secondly, all indicators values (came after multiplication) were added together and divided by the total weights of selected indicators. The same procedure was followed for every district and for both types of infrastructure (Education and Health) at two selected points of time, 2000-01 and 2017-18.

The next step was to calculate Infrastructural Development Index (IDI) for selected two points of time separately for each district. This was done by using simple arithmetic average of composite index value of education and health infrastructure for respective point of time. The formula is mentioned below:

$$IDI = 1/2 [\text{Composite Index of Education Infrastructure} + \text{Composite Index of Health Infrastructure}]$$

On the basis of the Infrastructural Development Index (IDI) ranks had been given to the districts in descending order. The next step was to segregate the districts into three categories- Developed, Moderately Developed, Less Developed to expedite inter-district comparison. Pradhan, P. and Kumar, S. (2015) study had been considered for district categorization. Mean, Standard Deviation and Coefficient of Variance were calculated for IDI of each selected point of time. The developed districts were those which had IDI value equal or higher than the value came after adding mean value and 0.5 multiplied to S.D. value. The less developed districts were those which had IDI value equal or lower than the value came after subtracting 0.5 multiplied to S.D. value from mean value. The districts whose values lied between these two values were considered as moderately developed.

Education

Education is important resource to accelerate economic growth and investment in the region and it is prime indicator for quality of life and HDI (Human Development Index). Haryana requires quality and strong infrastructure to keep pace with growing economy.

Table-1**Development of Educational Infrastructure**

Education Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Primary Schools	11040	12179	13904	9690	9974
Number of Middle Schools	1887	2168	3483	4479	5238
Number of High Schools	4138	5317	6983	7663	8024
Number of Students in primary School	2017855	1997491	2284255	1633573	2504133
Number of Students in Middle School	951494	1159836	1249777	1038326	1448258
Number of Students in High Schools	804899	872806	1426723	1475045	1552812
Number of Teachers in Primary School	48463	50621	28000	33077	92649
Number of Teachers in Middle School	8396	11139	22835	31426	43311
Number of Teachers in High School	57479	68185	99796	86190	83561
Student-Teacher ratio in Primary School	42	39	79	71	27
Student-Teacher ratio in Middle School	113	104	55	45	33
Student-Teacher ratio in High School	14	13	14	17	19

Source: Statistical Abstract of Haryana, Various Issues.

The above table 1 explains the development of educational infrastructure in Haryana from 2000-01 to 2017-18. The number of primary schools first increased from 11040 in 2000-01 to 13904 in 2010-11, but then decreased to 9974 in 2017-18 while number of middle and high schools had increased continuously over the year from 1887 and 4138 respectively in 2000-01 to 5238 and 8024 respectively in 2017-18. The number of students in primary and middle schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of students in high schools had shown continuous growth from 804899 in 2000-01 to 1552812 in 2017-18. The number of teachers in primary and high schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of teachers in middle schools had shown continuous growth from 8396 in 2000-01 to 43311 in 2017-18. Student-teacher ratio in primary schools had increased from 42 in 2000-01 to 79 in 2010-11 but after it was decreased and remained only 27 in 2017-18 which is a good sign of development. Student-teacher ratio in middle schools continuously decreased over the years from 113 in 2000-01 to 33 in 2017-18. Student-teacher ratio in high schools had increased from 14 in 2000-01 to 19 in 2017-18, which was a bad sign of educational infrastructure development.

Health

Haryana is committed to provide quality of health services to its citizens. Health centres which include hospitals, CHCs, PHCs, Sub-centres, Dispensaries provide accessible, adequate and quality health care services on reasonable pricing.

Table-2
Health Infrastructure in Haryana

Health Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Hospitals	78	62	68	57	62
Number of CHCs	64	81	86	94	125
Number of PHCs	402	409	429	468	499
Number of Sub-Centres	2299	2433	2465	2630	2636
Number of Dispensary	229	193	193	125	63
Number of Beds per lakh of Population	995	815	833	726	866

*Source: Statistical Abstract of Haryana, Various Issues.
Census of India*

Table 2 reveals the health infrastructure in Haryana at different time periods. Number of hospitals had been declined from 78 in 2000-01 to 62 in 2017-18. Number of CHCs, PHCs and sub-centres had shown continuous growth from 2000-01 to 2017-18. Number of CHCs had grown from 64 to 125, PHCs had grown to 499 from 402 and sub-centres had grown from 2299 to 2636. But there was a decrease registered in number of dispensaries from 229 in 2000-01 to 63 in 2017-18, while number of beds per lakh of population had been declined from 995 in 2000-01 to 726 in 2015-16 but later increased to 866 in 2017-18.

Table-3
Inter-District Disparities in Educational Infrastructure

Districts	Number of Primary Schools per 100 sq. km. of Area		Number of Middle Schools per 100 sq. km. of Area		Number of High Schools per 100 sq. km. of Area	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	36	34	4	15	12	20
Panchkula	30	35	5	14	9	15
Yamunanagar	31	36	3	19	9	20
Kurukshetra	37	36	6	17	9	19
Kaithal	20	18	3	9	6	14
Karnal	24	24	4	12	8	17
Panipat	24	25	5	22	11	27
Sonipat	31	25	7	12	15	24
Rohtak	21	15	4	7	14	23
Jhajjar	30	19	5	7	14	22
Faridabad	49	43	8	64	19	74
Palwal	N.A	31	N.A	25	N.A	25
Gurugram	31	34	5	21	8	31

Nuh	N.A	33	N.A	24	N.A	11
Rewari	32	29	5	10	8	21
Mahendragarh	40	26	6	10	10	18
Bhiwani	19	15	3	6	7	14
Jind	23	17	5	7	10	17
Hisar	13	15	3	8	9	16
Fatehabad	14	18	3	7	6	11
Sirsa	13	13	3	5	5	8
Mean	27	26	5	15	10	21
S.D.	9.55	8.75	1.50	12.81	3.52	13.28
C.V.	35	33.91	33.34	83.64	35.47	62.40

Calculated by self

Table 3 describes inter district disparities in selected educational infrastructure particulars in study period which is divided in two time periods. The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods. Faridabad and Sirsa districts performed highest and lowest respectively in all three indicators throughout the time periods.

Table-4

Inter-District Disparities in Educational Infrastructure

Districts	Student-Teacher ratio in Primary Schools		Student-Teacher ratio in Middle Schools		Student-Teacher ratio in High/Senior Secondary Schools	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	40	25	202	30	14	16
Panchkula	39	15	90	16	11	16
Yamunanagar	42	29	147	32	17	22
Kurukshetra	41	19	107	30	15	17
Kaithal	57	17	150	26	17	20
Karnal	41	31	105	36	14	18
Panipat	47	24	146	28	17	22
Sonipat	38	52	89	59	11	16
Rohtak	34	29	121	32	11	16
Jhajjar	28	16	130	26	14	15
Faridabad	40	37	125	42	12	27
Palwal	N.A	23	N.A	24	N.A	23
Gurugram	55	83	102	73	12	22
Nuh	N.A	36	N.A	46	N.A	30
Rewari	36	28	118	29	19	16
Mahendragarh	36	24	95	24	16	15
Bhiwani	40	25	107	33	17	17
Jind	45	25	86	37	14	19
Hisar	45	23	147	35	14	16
Fatehabad	51	24	93	34	15	21

Sirsa	49	25	98	36	14	20
Mean	42	29	119	35	14	19
S.D.	7.23	14.72	29.49	12.50	2.37	3.97
C.V.	17.07	50.62	24.82	36.11	16.46	20.66

Calculated by self

The above table 4 reveals the inter district disparities in the selected indicators of educational infrastructure in the districts of Haryana in 2000-01 and 2017-18. Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.

Table-5
Inter-District Disparities in the Health Infrastructure

Districts	Number of Hospitals per lakh of Population		Number of CHCs per lakh of Population		Number of PHCs per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	0.79	0.27	0.20	0.35	1.48	1.77
Panchkula	0.64	0.18	0.43	0.36	1.71	1.78
Yamunanagar	0.58	0.25	0.38	0.58	1.73	1.65
Kurukshetra	0.12	0.10	0.36	0.62	2.06	2.18
Kaithal	0.11	0.09	0.32	0.56	2.33	2.23
Karnal	0.16	0.20	0.31	0.40	1.96	1.73
Panipat	0.31	0.17	0.10	0.58	1.55	1.58
Sonapat	0.08	0.14	0.39	0.62	2.03	2.55
Rohtak	0.85	0.28	0.43	0.57	2.45	2.17
Jhajjar	0.23	0.42	0.23	0.63	1.93	2.82
Faridabad	0.27	0.11	0.14	0.22	1.00	0.77
Palwal	N.A	0.19	N.A	0.48	N.A	1.82
Gurugram	0.30	0.33	0.24	0.20	1.51	0.79
Nuh	N.A	0.09	N.A	0.28	N.A	1.93
Rewari	0.26	0.22	0.52	0.56	1.83	2.11
Mahendragarh	0.12	0.22	0.37	0.76	2.46	2.71
Bhiwani	0.63	0.49	0.42	0.61	2.60	2.69
Jind	0.34	0.30	0.25	0.52	2.19	2.10
Hisar	0.72	0.34	0.39	0.46	2.15	2.12
Fatehabad	0.25	0.32	0.37	0.53	1.98	2.55
Sirsa	0.27	0.31	0.18	0.62	2.06	2.24
Mean	0.37	0.24	0.32	0.50	1.95	2.01
S.D.	0.25	0.11	0.11	0.15	0.39	0.54
C.V.	67.25	45.21	35.58	29.59	20.23	27.06

Calculated by self

The above table 5 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in

case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.

Table-6
Inter-District Disparities in Health Infrastructure

Districts	Number of Sub-centres per lakh of Population		Number of Dispensaries per lakh of Population		Number of Beds per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	9.76	9.22	1.18	0.27	68	45
Panchkula	10.03	9.09	2.13	2.32	65	68
Yamunanagar	10.75	9.22	1.54	0.08	52	34
Kurukshetra	10.18	12.13	0.97	0.10	33	34
Kaithal	12.15	13.40	0.32	0.00	32	32
Karnal	9.03	9.96	1.26	0.47	36	32
Panipat	10.34	7.47	0.72	0.17	34	25
Sonipat	8.60	11.31	1.17	0.21	29	25
Rohtak	17.23	10.74	1.60	0.47	202	34
Jhajjar	13.86	13.15	0.91	0.31	21	48
Faridabad	5.33	3.15	1.64	0.39	37	21
Palwal	N.A	8.54	N.A	0.00	N.A	18
Gurugram	9.34	5.02	0.78	0.20	27	26
Nuh	N.A	12.67	N.A	0.00	N.A	21
Rewari	13.33	12.44	0.65	0.22	32	44
Mahendragarh	14.15	13.01	0.49	0.00	39	39
Bhiwani	14.18	13.46	1.12	0.18	70	51
Jind	10.84	12.22	0.76	0.15	63	32
Hisar	11.38	11.47	1.11	0.29	87	40
Fatehabad	12.28	14.33	0.87	0.11	33	41
Sirsa	12.45	11.89	1.07	0.15	35	32
Mean	11.33	10.66	1.07	0.29	52.37	35.33
S.D.	2.62	2.87	0.44	0.49	40.48	11.77
C.V.	23.16	26.94	41.09	167.71	77.29	33.31

Calculated by self

The above table 6 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.

Table-7
Results of Factor Analysis for Education Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.961	0.187	0.959	3.2308	23.22
No. of Middle Schools per 100 sq km of Area	0.98	0.074	0.966	3.1544	22.67
No. of High Schools per 100 sq km of Area	0.978	0.139	0.976	3.2263	23.19
Student-Teacher ratio of Primary Schools	-0.169	0.242	0.087	0.8195	5.89
Student-Teacher ratio of Middle Schools	-0.051	0.851	0.727	1.1824	8.50
Student-Teacher ratio of High Schools	-0.505	0.6	0.615	2.3008	16.54
Variance (%)	52.132	20.032	Total	13.9142	100.00
Cumulative variance (%)	52.132	72.165			

KMO measures of sampling adequacy- 0.457
Significance level of Bartlett's test of sphericity- 0.000

Table 7 indicates factor analysis result of education infrastructure for year of 200-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which explain cumulative variance of 72.17 percent. First factor explained 52.13 percent and second factor explain 20.03 percent of total cumulative variance. The communality values lied in ranging of 0.615 to 0.976 for all indicators except student-teacher ratio in primary school which was at 0.087. Factors value showed that three out of six variables had higher contribution in first component and two variables had majorly contributed to second component, remaining one variable which is student-teacher ratio in primary school had least contribution in both components. Weights of the indicators which came out with the use of initial Eigen value and factors value varied between 0.8195-3.2308. The variables which contributed largely to first component got higher and almost equal importance in weights as well. Student-Teacher ratio in primary schools had lowest relative weights (5.89), hence least contribution to educational infrastructure development.

Table-8

Results of Factor Analysis for Health Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communal ity	Weights	Weights (in %)
Number of Hospitals per lakh of Population	0.643	0.645	0.83	2.9893	18.07
Number of CHCs per lakh of Population	0.664	-0.201	0.481	2.1908	13.24
Number of PHCs per lakh of Population	0.695	-0.619	0.866	3.0804	18.62
Number of Sub-centre per lakh of Population	0.792	-0.45	0.831	3.0182	18.24
Number of Dispensaries per lakh of Population	0.225	0.864	0.798	2.2760	13.76
Number of Beds per lakh of Population	0.837	0.371	0.838	2.9882	18.06
Variance (%)	45.27	32.112	Total	16.5429	100.00
Cumulative variance (%)	45.27	77.382			

KMO measures of sampling adequacy- 0.636
Significance level of Bartlett's test of sphericity- 0.000

Table 8 points out the result of factor analysis with weights for health infrastructure for the period of 2000-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which together explain 77 percent cumulative variance. Individually both factors explained 45.27 percent and 32.11 percent respectively. Communality values lied in the range of 0.798 to 0.866 that means two factors were sufficient to explain the variance of original variables, except the number of CHCs per lakh of population which was at 0.481. The factor values showed that number of CHCs per lakh of population, number of sub-centers per lakh of population and number of beds per lakh of population had higher association with first factor whereas number of dispensaries per lakh of population had contributed significantly in second factor. But, number of hospitals and number of PHCs per lakh of population contributed less in both factors. From the selected variables, four variables got almost equal importance in weights which were more than 18 percent. Remaining two variables contributed about 13 percent each in weights.

Table-9

Results of Factor Analysis for Education Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.73	-0.358	0.661	2.9255	15.92
No. of Middle Schools per 100 sq km of Area	0.897	-0.415	0.976	3.5560	19.36
No. of High Schools per 100 sq km of Area	0.804	-0.296	0.734	3.0688	16.70
Student-Teacher ratio of Primary Schools	0.646	0.733	0.954	3.2377	17.62
Student-Teacher ratio of Middle Schools	0.593	0.79	0.975	3.1547	17.17
Student-Teacher ratio of High Schools	0.701	-0.1	0.501	2.4292	13.22
Variance (%)	54.05	25.979	Total	18.3720	100.00
Cumulative variance (%)	54.05	80.029			

KMO measures of sampling adequacy- 0.386
Significance level of Bartlett's test of sphericity- 0.000

The above table 9 reveals the result of factor analysis for education infrastructure for 2017-18. KMO and Bartlett's test shows significance level and applicability of factor analysis. Again two factors had come out from selected six variables. First factor explained 54 percent and second factor explained 26 percent, in together both of these factors explained 80 percent of variance. Half of the variables contributed more than 90 percent in Communality values and remaining half contributed in the range of 0.501 to 0.734. Four out of six variables contributed highly in the growth of first factor and remaining two variables which were student-teacher ratio in primary (0.733) and middle schools (0.79) contributed in second factor. From selected indicators, number of middle school per 100 sq. km. performed highest in weights with a value of 19.36 percent, followed by student-teacher ratio in primary (17.62) and middle schools ((17.17). No. of primary schools per 100 sq. km. of area (15.92) and student-teacher ratio in high schools had performed least in weights as well as education infrastructure development.

Table-10

Results of Factor Analysis for Health Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
Number of hospitals per lakh of population	0.484	0.307	0.329	1.9444	12.50
Number of CHCs per lakh of population	0.824	-0.274	0.755	2.8837	18.54
Number of PHCs per lakh of population	0.964	-0.086	0.937	2.9711	19.10
Number of sub-centre per lakh of population	0.904	-0.128	0.833	2.8675	18.43
Number of dispensaries per lakh of population	-0.152	0.908	0.848	2.0033	12.88
Number of beds per lakh of population	0.495	0.836	0.943	2.8844	18.54
Variance (%)	48.816	28.594	Total	15.5545	100
Cumulative variance (%)	48.816	77.41			

KMO measures of sampling adequacy- 0.437
Significance level of Bartlett's test of sphericity- 0.000

Table 10 depicts the result of factor analysis for health infrastructure. KMO and Bartlett's test values were significant that made factor analysis possible. Two factors had been derived from all six selected variables. First factor explained 49 percent variance and second factor did 28 percent. Total cumulative variance was 77 percent. In first factor, three variables were highly associated namely number of CHCs (0.824), PHCs (0.964) and sub-centers (0.904) per lakh of population. While two factors; number of dispensaries (0.908) and beds (0.836) per lakh of population contributed to second factor. Remaining variable; number of hospitals per lakh of population contributed with small amount in both factors. The communality values for all variables except number of hospitals per lakh of population were found more than 75 percent in the range of 0.755 to 0.943. Four variables which were number of PHCs (19.10), CHCs (18.54), beds (18.54), sub-centers (18.43) percent per lakh of population, received highest and almost equal weights. Number of hospitals and number of dispensaries per lakh of population got 12.50 percent and 12.88 percent of weights respectively and contributed least to health infrastructure development.

District-wise Composite Index using PCA techniques

Table 11 and 12 show district-wise Infrastructure development for years 2000-01 and 2017-18. Procedure has been discussed in methodology.

Table-11

District-wise Composite Index of Infrastructure for the year 2000-01

Districts	Education Index	Health Index	R1	R2
Ambala	0.2557	0.4342	5	6
Panchkula	0.0959	0.5717	19	4
Yamuna Nagar	0.2480	0.4974	6	5
Kurukshetra	0.2186	0.3505	9	13
Kaithal	0.2470	0.3467	7	14
Karnal	0.1467	0.3399	14	15
Panipat	0.2754	0.2382	3	18
Sonipat	0.1438	0.3340	15	16
Rohtak	0.1041	0.9139	18	1
Jhajjar	0.1876	0.3601	10	12
Faridabad	0.7644	0.1735	1	19
Gurugram	0.3306	0.2576	2	17
Rewari	0.2747	0.4300	4	8
Mahendergarh	0.2303	0.4305	8	7
Bhiwani	0.1838	0.6616	11	2
Jind	0.1590	0.4066	13	9
Hisar	0.1594	0.5941	12	3
Fatehabad	0.1409	0.3994	16	10
Sirsa	0.1135	0.3733	17	11
Mean	0.23	0.43		
S.D.	0.15	0.17		
C.V. (%)	64.89	39.48		

Table 11 shows district-wise composite index of social infrastructure for 2000-01. This composite index was calculated with the help of weights and normalized value of that indicator for every district. Ranks to all districts have been given in descending order. R1 shows rank for education index and R2 for health index. Out of total 19 districts only 08 districts were found above district average in both types of infrastructure. In education index Faridabad and Gurugram were on top two position followed by Panipat, Rewari and Ambala. Panchkula and Rohtak were on bottom positions in education index. Again positions of districts changed in health index, district of Rohtak which was on last position in education index performed best in health index and got first position followed by Bhiwani, Hisar, Panchkula and Yamunanagar. Faridabad was on last position in health index. Value of coefficient of variance was found higher for education index (64.89 percent).

Table-12

District-wise Composite Index of Infrastructure for the year 2017-18

Districts	Education Index	Health Index	R1	R2
Ambala	0.2515	0.4143	9	15
Panchkula	0.1728	0.5874	13	5
Yamuna Nagar	0.3446	0.4217	5	14
Kurukshetra	0.2595	0.4865	8	12
Kaithal	0.1342	0.4762	17	13
Karnal	0.2323	0.3803	10	16
Panipat	0.2887	0.3329	7	17
Sonipat	0.3614	0.4927	4	11
Rohtak	0.1484	0.5229	16	9
Jhajjar	0.1066	0.7299	21	2
Faridabad	0.7610	0.0456	1	21
Palwal	0.3195	0.3107	6	18
Gurugram	0.6318	0.1485	2	20
Nuh	0.4531	0.3027	3	19
Rewari	0.2159	0.5465	11	7
Mahendgarh	0.1581	0.6473	15	3
Bhiwani	0.1238	0.7420	20	1
Jind	0.1750	0.5053	12	10
Hisar	0.1275	0.5249	19	8
Fatehabad	0.17113	0.6227	14	4
Sirsa	0.13024	0.5491	18	6
Mean	0.27	0.47		
S.D.	0.17	0.17		
C.V. (%)	64.70	37.12		

Table 12 reveals composite index of social infrastructure for 2017-18. In health index 13 out of 21 districts were above districts average, while in education index only 07 districts were above districts average. Faridabad and Gurugram continued to be on first and second position respectively in 2018-18 as well. Jhajjar and Bhiwani performed worst in education index and dropped down to bottom two positions. In health index, Bhiwani district did excellent and got first position, Jhajjar district also improved continuously over the years and came on second position in 2017-18. Faridabad, Gurugram continued their last positions in 2017-18 as well. The coefficient of variance found again higher in education index (64.70 percent). It was found that throughout the study period higher districts disparities were found in education index.

Infrastructure Development Index- District wise

Infrastructure development index was obtained by taking out the average of district-wise composite index values. Ranks to each district were given in descending values order. Procedure has been discussed in methodology.

Table-13

District-wise Infrastructure Development Index Calculated from Composite Index Values

Districts	2000-01		2017-18	
	IDI	Rank	IDI	Rank
Ambala	0.3450	7	0.3329	16
Panchkula	0.3338	8	0.3801	10
Yamuna Nagar	0.3727	5	0.3832	8
Kurukshetra	0.2846	12	0.373	12
Kaithal	0.2969	10	0.3052	21
Karnal	0.2433	18	0.3063	20
Panipat	0.2568	16	0.3108	19
Sonipat	0.2389	19	0.4271	2
Rohtak	0.509	1	0.3357	15
Jhajjar	0.2739	14	0.4183	3
Faridabad	0.4690	2	0.4033	4
Palwal	0	-	0.3151	18
Gurugram	0.2941	11	0.3902	7
Nuh	0	-	0.3779	11
Rewari	0.3524	6	0.3812	9
Mahendergarh	0.3304	9	0.4027	5
Bhiwani	0.4227	3	0.4329	1
Jind	0.2828	13	0.3402	13
Hisar	0.3768	4	0.3262	17
Fatehabad	0.2702	15	0.3969	6
Sirsa	0.2434	17	0.3397	14

Table 13 presents district-wise infrastructure development index which was derived from average of composite index values of both infrastructure (Education and Health). Rohtak district was found on top of the table in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonipat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.

Classification of Districts on the basis of Infrastructural Development Index

In this sub-section districts have been classified in three categories: Developed, Moderately developed, and less developed by using average and standard deviation values of Infrastructure development index. Procedure has been discussed in methodology.

Table-14
District-wise classification based on Infrastructure Development Index Values

Districts	2000-01		2017-18	
	IDI	Category	IDI	Category
Ambala	0.3450	MD	0.3329	LD
Panchkula	0.3338	MD	0.3801	MD
Yamuna Nagar	0.3727	D	0.3832	MD
Kurukshetra	0.2846	LD	0.373	MD
Kaithal	0.2969	MD	0.3052	LD
Karnal	0.2433	LD	0.3063	LD
Panipat	0.2568	LD	0.3108	LD
Sonapat	0.2389	LD	0.4271	D
Rohtak	0.509	D	0.3357	LD
Jhajjar	0.2739	LD	0.4183	D
Faridabad	0.4690	D	0.4033	D
Palwal	0	-	0.3151	LD
Gurugram	0.2941	MD	0.3902	D
Nuh	0	-	0.3779	MD
Rewari	0.3524	MD	0.3812	MD
Mahendergarh	0.3304	MD	0.4027	D
Bhiwani	0.4227	D	0.4329	D
Jind	0.2828	LD	0.3402	D
Hisar	0.3768	D	0.3262	LD
Fatehabad	0.2702	LD	0.4607	D
Sirsa	0.2434	LD	0.3815	LD

D: Developed, MD: Moderate Developed, LD: Less Developed

D= ≥ 0.3646 , MD= > 0.2877 & < 0.3646 and LD = ≤ 0.2877 for the year 2000-01

D= ≥ 0.3863 , MD= > 0.3450 & < 0.3863 and LD = ≤ 0.3450 for the year 2017-18

Table 14 shows classification of districts on the basis of Infrastructure Development index for two study periods that are 2000-01 and 2017-18. In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

Major Findings of the Study

- The study shows that there are less number of middle schools in comparison to primary and high school throughout the study period.
- Student-teacher ratio is decreasing continuous in primary and middle schools which is an excellent sign of development.
- The study found that the total numbers of dispensaries are decreasing continuously over the years and reached to only 63 in 2017-18 from 229 in 2000-01. It has happened because people in rural areas stopped going to dispensaries for treatment and prefer to move to city hospitals.
- Number of hospitals had declined from 78 in 2000-01 to 62 in 2017-18 because of that number of beds per lakh of population also showed declining trends.

- The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods.
- Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.
- The disparity in case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.
- The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.
- Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonapat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.
- In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

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Social Infrastructure in Haryana- A Study of Inter-District Disparities**Dr. Santosh Nandal¹**

Professor

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^{1,2}Department of Economics, M.D. University, Rohtak, Haryana**Abstract**

In this paper an attempt has been made to study the social infrastructure in Haryana along with inter-district disparities for the year 2000-01 and 2017-18. The study also analyzed the developed and less developed districts in social infrastructure. Simple statistical tools like mean and Coefficient of Variance have been used to measure the inter-district disparities. Composite index has been constructed to find out the development of districts. Principal Component Analysis has been used to get factor loadings and weights of selected indicators. It was found from the study that there are wide spread of disparities in the development levels of different districts. Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure while in 2017-18 Bhiwani district was on the top position.

Introduction

Infrastructure describes the physical structure of facilities which are required to provide goods and services to public. It is linked with economy directly or indirectly or we can say that it effect economy through its spillover effects. It includes all those activities which do not directly generate income themselves but provide support and substance to the income generation activities.

Infrastructure means something that comes before the actual structure. It is foundation to build the structure of economy. Infrastructure consist permanent structure which is used for a long time to give inputs to the economy like network of road, railway facility, electricity, schools, colleges and hospitals etc.

Role of Infrastructure in Economic Growth and Development

. Infrastructure plays an important role in overall development. Many economists describe the importance of infrastructure in economic development. In fact, developmental activities depend upon infrastructure facilities. It is considered the prerequisite of development. In the words of Dr. V.K.R.V. Rao, "The link between infrastructure and development is not once for all affairs.

It is a continuous process; and progress in development has to be preceded, accompanied and followed by progress in infrastructure, if we are to fulfill our declared objective of a self-accelerated process of economic development."

The infrastructural network has dual character; it is a crucial factor of development as well as a component of development. The regions which have weak infrastructure network remain less developed and it is generally accepted fact that agriculture, industry and other development activities are constrained by available infrastructural facilities. Different types of infrastructural facilities affect the overall development including agriculture, industry and human development in which infrastructure plays a leader role and follower is the development (Majumder, R. 2004).

Classification of Infrastructure

Infrastructure can be classified into two category i.e. economic infrastructure and social infrastructure. Social infrastructure is also divided into two education and health infrastructure.

Social infrastructure is essential for an economy development. Social infrastructure concept is very wide and plays extremely significant role in economy development as it executes the task of human development resources by means of skill generation, education, awareness creation, training, research and development and health care to increase the efficiency of production. Social infrastructure plays an important role in enhancing the human capital. Advancement in knowledge and the dispersion of new ideas and activities are necessary to eliminate economic backwardness and install the human abilities that are more favourable to economic achievement. (AnuKapil and P.S. Raikhy) It has been recognized that physical capital growth is directly related to considerable formation of human capital.

Education is considered as catalyst for the development of human resource. This is the key social infrastructure indicators which have direct relation with productive manpower, level of income and standard of living. Less developed countries need educated professionals in all areas to boost the development and growth. UNESCO suggests minimum fifteen percent of national expenditure on educational facilities. Education acts as the base for research and development. Being an integral part of development progress, it cannot be looked separately.

Objectives of the Study

- To study the overall development of social infrastructure in Haryana.
- To analyse inter-district disparities in social infrastructure.
- To identify the developed and less developed districts.
- To categories districts on the basis of the value of Infrastructure Development index.

Research Methodology

The current study focused on overall growth and development of social infrastructure in the state of Haryana. The study also analyzed inter-districts disparities, developed and backward districts in social infrastructure. Social Infrastructure considered education (number of schools, teachers, students and student-teacher ratio) and health (number of hospitals, CHCs, PHCs, sub-centres, dispensaries, number of beds per lakh of population) indicators to show growth and development of social infrastructure. For inter-districts disparities and to identify developed and backward districts; only a few indicators have been taken in

consideration due to the unavailability of complete data on district level. The selection of indicators had been done after extensive review of literature.

The present study is empirical by nature. To accomplish the objectives, secondary data from different sources like; Statistical abstract of Haryana, Census 2001 and 2011 and Economic survey of Haryana have been used. In order to identify inter-district disparities and development ranks of 21 districts of Haryana; data of 12 indicators from social infrastructure for two points of time 2000-01 and 2017-18 have been used. For inter-district disparities; simple statistical tools like Mean, Standard Deviation and Coefficient of Variance have been calculated and considered. Raychaudhuri, A. and Haldar, S. (2009) method has been considered to run PCA for giving weights to the indicators and to construct Composite Index.

To run PCA, raw data was first converted into normalized data for each district. This was done to form raw data unit free and get relative spot of every district. Best and worst values of all indicators were identified for each district in order to calculate normalized value. Normalized value falls between 0 and 1 always.

$$NV_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$$

Where $R = \text{best } X_{ij} - \text{worst } X_{ij}$

$i = i\text{-th observation and } j = j\text{-th district}$

The next step after obtaining the normalized value was to run PCA to get factor loadings and weights of selected indicators. SPSS software was used to run PCA. From PCA, Initial Eigen values which are more than 01 were also identified. Weights for each selected indicator were obtained by multiplication of first initial Eigen value to first factor value and so on and then by adding all the values (which came after multiplication) together.

The next step was to construct the composite index. Composite Index was calculated; firstly, weight of selected indicator was multiplied by same indicator's normalized value, secondly, all indicators values (came after multiplication) were added together and divided by the total weights of selected indicators. The same procedure was followed for every district and for both types of infrastructure (Education and Health) at two selected points of time, 2000-01 and 2017-18.

The next step was to calculate Infrastructural Development Index (IDI) for selected two points of time separately for each district. This was done by using simple arithmetic average of composite index value of education and health infrastructure for respective point of time. The formula is mentioned below:

$$IDI = 1/2 [\text{Composite Index of Education Infrastructure} + \text{Composite Index of Health Infrastructure}]$$

On the basis of the Infrastructural Development Index (IDI) ranks had been given to the districts in descending order. The next step was to segregate the districts into three categories- Developed, Moderately Developed, Less Developed to expedite inter-district comparison. Pradhan, P. and Kumar, S. (2015) study had been considered for district categorization. Mean, Standard Deviation and Coefficient of Variance were calculated for IDI of each selected point of time. The developed districts were those which had IDI value equal or higher than the value came after adding mean value and 0.5 multiplied to S.D. value. The less developed districts were those which had IDI value equal or lower than the value came after subtracting 0.5 multiplied to S.D. value from mean value. The districts whose values lied between these two values were considered as moderately developed.

Education

Education is important resource to accelerate economic growth and investment in the region and it is prime indicator for quality of life and HDI (Human Development Index). Haryana requires quality and strong infrastructure to keep pace with growing economy.

Table-1**Development of Educational Infrastructure**

Education Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Primary Schools	11040	12179	13904	9690	9974
Number of Middle Schools	1887	2168	3483	4479	5238
Number of High Schools	4138	5317	6983	7663	8024
Number of Students in primary School	2017855	1997491	2284255	1633573	2504133
Number of Students in Middle School	951494	1159836	1249777	1038326	1448258
Number of Students in High Schools	804899	872806	1426723	1475045	1552812
Number of Teachers in Primary School	48463	50621	28000	33077	92649
Number of Teachers in Middle School	8396	11139	22835	31426	43311
Number of Teachers in High School	57479	68185	99796	86190	83561
Student-Teacher ratio in Primary School	42	39	79	71	27
Student-Teacher ratio in Middle School	113	104	55	45	33
Student-Teacher ratio in High School	14	13	14	17	19

Source: Statistical Abstract of Haryana, Various Issues.

The above table 1 explains the development of educational infrastructure in Haryana from 2000-01 to 2017-18. The number of primary schools first increased from 11040 in 2000-01 to 13904 in 2010-11, but then decreased to 9974 in 2017-18 while number of middle and high schools had increased continuously over the year from 1887 and 4138 respectively in 2000-01 to 5238 and 8024 respectively in 2017-18. The number of students in primary and middle schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of students in high schools had shown continuous growth from 804899 in 2000-01 to 1552812 in 2017-18. The number of teachers in primary and high schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of teachers in middle schools had shown continuous growth from 8396 in 2000-01 to 43311 in 2017-18. Student-teacher ratio in primary schools had increased from 42 in 2000-01 to 79 in 2010-11 but after it was decreased and remained only 27 in 2017-18 which is a good sign of development. Student-teacher ratio in middle schools continuously decreased over the years from 113 in 2000-01 to 33 in 2017-18. Student-teacher ratio in high schools had increased from 14 in 2000-01 to 19 in 2017-18, which was a bad sign of educational infrastructure development.

Health

Haryana is committed to provide quality of health services to its citizens. Health centres which include hospitals, CHCs, PHCs, Sub-centres, Dispensaries provide accessible, adequate and quality health care services on reasonable pricing.

Table-2
Health Infrastructure in Haryana

Health Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Hospitals	78	62	68	57	62
Number of CHCs	64	81	86	94	125
Number of PHCs	402	409	429	468	499
Number of Sub-Centres	2299	2433	2465	2630	2636
Number of Dispensary	229	193	193	125	63
Number of Beds per lakh of Population	995	815	833	726	866

*Source: Statistical Abstract of Haryana, Various Issues.
Census of India*

Table 2 reveals the health infrastructure in Haryana at different time periods. Number of hospitals had been declined from 78 in 2000-01 to 62 in 2017-18. Number of CHCs, PHCs and sub-centres had shown continuous growth from 2000-01 to 2017-18. Number of CHCs had grown from 64 to 125, PHCs had grown to 499 from 402 and sub-centres had grown from 2299 to 2636. But there was a decrease registered in number of dispensaries from 229 in 2000-01 to 63 in 2017-18, while number of beds per lakh of population had been declined from 995 in 2000-01 to 726 in 2015-16 but later increased to 866 in 2017-18.

Table-3
Inter-District Disparities in Educational Infrastructure

Districts	Number of Primary Schools per 100 sq. km. of Area		Number of Middle Schools per 100 sq. km. of Area		Number of High Schools per 100 sq. km. of Area	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	36	34	4	15	12	20
Panchkula	30	35	5	14	9	15
Yamunanagar	31	36	3	19	9	20
Kurukshetra	37	36	6	17	9	19
Kaithal	20	18	3	9	6	14
Karnal	24	24	4	12	8	17
Panipat	24	25	5	22	11	27
Sonipat	31	25	7	12	15	24
Rohtak	21	15	4	7	14	23
Jhajjar	30	19	5	7	14	22
Faridabad	49	43	8	64	19	74
Palwal	N.A	31	N.A	25	N.A	25
Gurugram	31	34	5	21	8	31

Nuh	N.A	33	N.A	24	N.A	11
Rewari	32	29	5	10	8	21
Mahendragarh	40	26	6	10	10	18
Bhiwani	19	15	3	6	7	14
Jind	23	17	5	7	10	17
Hisar	13	15	3	8	9	16
Fatehabad	14	18	3	7	6	11
Sirsa	13	13	3	5	5	8
Mean	27	26	5	15	10	21
S.D.	9.55	8.75	1.50	12.81	3.52	13.28
C.V.	35	33.91	33.34	83.64	35.47	62.40

Calculated by self

Table 3 describes inter district disparities in selected educational infrastructure particulars in study period which is divided in two time periods. The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods. Faridabad and Sirsa districts performed highest and lowest respectively in all three indicators throughout the time periods.

Table-4

Inter-District Disparities in Educational Infrastructure

Districts	Student-Teacher ratio in Primary Schools		Student-Teacher ratio in Middle Schools		Student-Teacher ratio in High/Senior Secondary Schools	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	40	25	202	30	14	16
Panchkula	39	15	90	16	11	16
Yamunanagar	42	29	147	32	17	22
Kurukshetra	41	19	107	30	15	17
Kaithal	57	17	150	26	17	20
Karnal	41	31	105	36	14	18
Panipat	47	24	146	28	17	22
Sonipat	38	52	89	59	11	16
Rohtak	34	29	121	32	11	16
Jhajjar	28	16	130	26	14	15
Faridabad	40	37	125	42	12	27
Palwal	N.A	23	N.A	24	N.A	23
Gurugram	55	83	102	73	12	22
Nuh	N.A	36	N.A	46	N.A	30
Rewari	36	28	118	29	19	16
Mahendragarh	36	24	95	24	16	15
Bhiwani	40	25	107	33	17	17
Jind	45	25	86	37	14	19
Hisar	45	23	147	35	14	16
Fatehabad	51	24	93	34	15	21

Sirsa	49	25	98	36	14	20
Mean	42	29	119	35	14	19
S.D.	7.23	14.72	29.49	12.50	2.37	3.97
C.V.	17.07	50.62	24.82	36.11	16.46	20.66

Calculated by self

The above table 4 reveals the inter district disparities in the selected indicators of educational infrastructure in the districts of Haryana in 2000-01 and 2017-18. Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.

Table-5
Inter-District Disparities in the Health Infrastructure

Districts	Number of Hospitals per lakh of Population		Number of CHCs per lakh of Population		Number of PHCs per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	0.79	0.27	0.20	0.35	1.48	1.77
Panchkula	0.64	0.18	0.43	0.36	1.71	1.78
Yamunanagar	0.58	0.25	0.38	0.58	1.73	1.65
Kurukshetra	0.12	0.10	0.36	0.62	2.06	2.18
Kaithal	0.11	0.09	0.32	0.56	2.33	2.23
Karnal	0.16	0.20	0.31	0.40	1.96	1.73
Panipat	0.31	0.17	0.10	0.58	1.55	1.58
Sonapat	0.08	0.14	0.39	0.62	2.03	2.55
Rohtak	0.85	0.28	0.43	0.57	2.45	2.17
Jhajjar	0.23	0.42	0.23	0.63	1.93	2.82
Faridabad	0.27	0.11	0.14	0.22	1.00	0.77
Palwal	N.A	0.19	N.A	0.48	N.A	1.82
Gurugram	0.30	0.33	0.24	0.20	1.51	0.79
Nuh	N.A	0.09	N.A	0.28	N.A	1.93
Rewari	0.26	0.22	0.52	0.56	1.83	2.11
Mahendragarh	0.12	0.22	0.37	0.76	2.46	2.71
Bhiwani	0.63	0.49	0.42	0.61	2.60	2.69
Jind	0.34	0.30	0.25	0.52	2.19	2.10
Hisar	0.72	0.34	0.39	0.46	2.15	2.12
Fatehabad	0.25	0.32	0.37	0.53	1.98	2.55
Sirsa	0.27	0.31	0.18	0.62	2.06	2.24
Mean	0.37	0.24	0.32	0.50	1.95	2.01
S.D.	0.25	0.11	0.11	0.15	0.39	0.54
C.V.	67.25	45.21	35.58	29.59	20.23	27.06

Calculated by self

The above table 5 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in

case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.

Table-6
Inter-District Disparities in Health Infrastructure

Districts	Number of Sub-centres per lakh of Population		Number of Dispensaries per lakh of Population		Number of Beds per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	9.76	9.22	1.18	0.27	68	45
Panchkula	10.03	9.09	2.13	2.32	65	68
Yamunanagar	10.75	9.22	1.54	0.08	52	34
Kurukshetra	10.18	12.13	0.97	0.10	33	34
Kaithal	12.15	13.40	0.32	0.00	32	32
Karnal	9.03	9.96	1.26	0.47	36	32
Panipat	10.34	7.47	0.72	0.17	34	25
Sonipat	8.60	11.31	1.17	0.21	29	25
Rohtak	17.23	10.74	1.60	0.47	202	34
Jhajjar	13.86	13.15	0.91	0.31	21	48
Faridabad	5.33	3.15	1.64	0.39	37	21
Palwal	N.A	8.54	N.A	0.00	N.A	18
Gurugram	9.34	5.02	0.78	0.20	27	26
Nuh	N.A	12.67	N.A	0.00	N.A	21
Rewari	13.33	12.44	0.65	0.22	32	44
Mahendragarh	14.15	13.01	0.49	0.00	39	39
Bhiwani	14.18	13.46	1.12	0.18	70	51
Jind	10.84	12.22	0.76	0.15	63	32
Hisar	11.38	11.47	1.11	0.29	87	40
Fatehabad	12.28	14.33	0.87	0.11	33	41
Sirsa	12.45	11.89	1.07	0.15	35	32
Mean	11.33	10.66	1.07	0.29	52.37	35.33
S.D.	2.62	2.87	0.44	0.49	40.48	11.77
C.V.	23.16	26.94	41.09	167.71	77.29	33.31

Calculated by self

The above table 6 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.

Table-7
Results of Factor Analysis for Education Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.961	0.187	0.959	3.2308	23.22
No. of Middle Schools per 100 sq km of Area	0.98	0.074	0.966	3.1544	22.67
No. of High Schools per 100 sq km of Area	0.978	0.139	0.976	3.2263	23.19
Student-Teacher ratio of Primary Schools	-0.169	0.242	0.087	0.8195	5.89
Student-Teacher ratio of Middle Schools	-0.051	0.851	0.727	1.1824	8.50
Student-Teacher ratio of High Schools	-0.505	0.6	0.615	2.3008	16.54
Variance (%)	52.132	20.032	Total	13.9142	100.00
Cumulative variance (%)	52.132	72.165			

KMO measures of sampling adequacy- 0.457
Significance level of Bartlett's test of sphericity- 0.000

Table 7 indicates factor analysis result of education infrastructure for year of 200-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which explain cumulative variance of 72.17 percent. First factor explained 52.13 percent and second factor explain 20.03 percent of total cumulative variance. The communality values lied in ranging of 0.615 to 0.976 for all indicators except student-teacher ratio in primary school which was at 0.087. Factors value showed that three out of six variables had higher contribution in first component and two variables had majorly contributed to second component, remaining one variable which is student-teacher ratio in primary school had least contribution in both components. Weights of the indicators which came out with the use of initial Eigen value and factors value varied between 0.8195-3.2308. The variables which contributed largely to first component got higher and almost equal importance in weights as well. Student-Teacher ratio in primary schools had lowest relative weights (5.89), hence least contribution to educational infrastructure development.

Table-8

Results of Factor Analysis for Health Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communal ity	Weights	Weights (in %)
Number of Hospitals per lakh of Population	0.643	0.645	0.83	2.9893	18.07
Number of CHCs per lakh of Population	0.664	-0.201	0.481	2.1908	13.24
Number of PHCs per lakh of Population	0.695	-0.619	0.866	3.0804	18.62
Number of Sub-centre per lakh of Population	0.792	-0.45	0.831	3.0182	18.24
Number of Dispensaries per lakh of Population	0.225	0.864	0.798	2.2760	13.76
Number of Beds per lakh of Population	0.837	0.371	0.838	2.9882	18.06
Variance (%)	45.27	32.112	Total	16.5429	100.00
Cumulative variance (%)	45.27	77.382			

KMO measures of sampling adequacy- 0.636
Significance level of Bartlett's test of sphericity- 0.000

Table 8 points out the result of factor analysis with weights for health infrastructure for the period of 2000-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which together explain 77 percent cumulative variance. Individually both factors explained 45.27 percent and 32.11 percent respectively. Communality values lied in the range of 0.798 to 0.866 that means two factors were sufficient to explain the variance of original variables, except the number of CHCs per lakh of population which was at 0.481. The factor values showed that number of CHCs per lakh of population, number of sub-centers per lakh of population and number of beds per lakh of population had higher association with first factor whereas number of dispensaries per lakh of population had contributed significantly in second factor. But, number of hospitals and number of PHCs per lakh of population contributed less in both factors. From the selected variables, four variables got almost equal importance in weights which were more than 18 percent. Remaining two variables contributed about 13 percent each in weights.

Table-9

Results of Factor Analysis for Education Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.73	-0.358	0.661	2.9255	15.92
No. of Middle Schools per 100 sq km of Area	0.897	-0.415	0.976	3.5560	19.36
No. of High Schools per 100 sq km of Area	0.804	-0.296	0.734	3.0688	16.70
Student-Teacher ratio of Primary Schools	0.646	0.733	0.954	3.2377	17.62
Student-Teacher ratio of Middle Schools	0.593	0.79	0.975	3.1547	17.17
Student-Teacher ratio of High Schools	0.701	-0.1	0.501	2.4292	13.22
Variance (%)	54.05	25.979	Total	18.3720	100.00
Cumulative variance (%)	54.05	80.029			

KMO measures of sampling adequacy- 0.386
Significance level of Bartlett's test of sphericity- 0.000

The above table 9 reveals the result of factor analysis for education infrastructure for 2017-18. KMO and Bartlett's test shows significance level and applicability of factor analysis. Again two factors had come out from selected six variables. First factor explained 54 percent and second factor explained 26 percent, in together both of these factors explained 80 percent of variance. Half of the variables contributed more than 90 percent in Communality values and remaining half contributed in the range of 0.501 to 0.734. Four out of six variables contributed highly in the growth of first factor and remaining two variables which were student-teacher ratio in primary (0.733) and middle schools (0.79) contributed in second factor. From selected indicators, number of middle school per 100 sq. km. performed highest in weights with a value of 19.36 percent, followed by student-teacher ratio in primary (17.62) and middle schools ((17.17). No. of primary schools per 100 sq. km. of area (15.92) and student-teacher ratio in high schools had performed least in weights as well as education infrastructure development.

Table-10

Results of Factor Analysis for Health Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
Number of hospitals per lakh of population	0.484	0.307	0.329	1.9444	12.50
Number of CHCs per lakh of population	0.824	-0.274	0.755	2.8837	18.54
Number of PHCs per lakh of population	0.964	-0.086	0.937	2.9711	19.10
Number of sub-centre per lakh of population	0.904	-0.128	0.833	2.8675	18.43
Number of dispensaries per lakh of population	-0.152	0.908	0.848	2.0033	12.88
Number of beds per lakh of population	0.495	0.836	0.943	2.8844	18.54
Variance (%)	48.816	28.594	Total	15.5545	100
Cumulative variance (%)	48.816	77.41			

KMO measures of sampling adequacy- 0.437
Significance level of Bartlett's test of sphericity- 0.000

Table 10 depicts the result of factor analysis for health infrastructure. KMO and Bartlett's test values were significant that made factor analysis possible. Two factors had been derived from all six selected variables. First factor explained 49 percent variance and second factor did 28 percent. Total cumulative variance was 77 percent. In first factor, three variables were highly associated namely number of CHCs (0.824), PHCs (0.964) and sub-centers (0.904) per lakh of population. While two factors; number of dispensaries (0.908) and beds (0.836) per lakh of population contributed to second factor. Remaining variable; number of hospitals per lakh of population contributed with small amount in both factors. The communality values for all variables except number of hospitals per lakh of population were found more than 75 percent in the range of 0.755 to 0.943. Four variables which were number of PHCs (19.10), CHCs (18.54), beds (18.54), sub-centers (18.43) percent per lakh of population, received highest and almost equal weights. Number of hospitals and number of dispensaries per lakh of population got 12.50 percent and 12.88 percent of weights respectively and contributed least to health infrastructure development.

District-wise Composite Index using PCA techniques

Table 11 and 12 show district-wise Infrastructure development for years 2000-01 and 2017-18. Procedure has been discussed in methodology.

Table-11

District-wise Composite Index of Infrastructure for the year 2000-01

Districts	Education Index	Health Index	R1	R2
Ambala	0.2557	0.4342	5	6
Panchkula	0.0959	0.5717	19	4
Yamuna Nagar	0.2480	0.4974	6	5
Kurukshetra	0.2186	0.3505	9	13
Kaithal	0.2470	0.3467	7	14
Karnal	0.1467	0.3399	14	15
Panipat	0.2754	0.2382	3	18
Sonipat	0.1438	0.3340	15	16
Rohtak	0.1041	0.9139	18	1
Jhajjar	0.1876	0.3601	10	12
Faridabad	0.7644	0.1735	1	19
Gurugram	0.3306	0.2576	2	17
Rewari	0.2747	0.4300	4	8
Mahendergarh	0.2303	0.4305	8	7
Bhiwani	0.1838	0.6616	11	2
Jind	0.1590	0.4066	13	9
Hisar	0.1594	0.5941	12	3
Fatehabad	0.1409	0.3994	16	10
Sirsa	0.1135	0.3733	17	11
Mean	0.23	0.43		
S.D.	0.15	0.17		
C.V. (%)	64.89	39.48		

Table 11 shows district-wise composite index of social infrastructure for 2000-01. This composite index was calculated with the help of weights and normalized value of that indicator for every district. Ranks to all districts have been given in descending order. R1 shows rank for education index and R2 for health index. Out of total 19 districts only 08 districts were found above district average in both types of infrastructure. In education index Faridabad and Gurugram were on top two position followed by Panipat, Rewari and Ambala. Panchkula and Rohtak were on bottom positions in education index. Again positions of districts changed in health index, district of Rohtak which was on last position in education index performed best in health index and got first position followed by Bhiwani, Hisar, Panchkula and Yamunanagar. Faridabad was on last position in health index. Value of coefficient of variance was found higher for education index (64.89 percent).

Table-12

District-wise Composite Index of Infrastructure for the year 2017-18

Districts	Education Index	Health Index	R1	R2
Ambala	0.2515	0.4143	9	15
Panchkula	0.1728	0.5874	13	5
Yamuna Nagar	0.3446	0.4217	5	14
Kurukshetra	0.2595	0.4865	8	12
Kaithal	0.1342	0.4762	17	13
Karnal	0.2323	0.3803	10	16
Panipat	0.2887	0.3329	7	17
Sonipat	0.3614	0.4927	4	11
Rohtak	0.1484	0.5229	16	9
Jhajjar	0.1066	0.7299	21	2
Faridabad	0.7610	0.0456	1	21
Palwal	0.3195	0.3107	6	18
Gurugram	0.6318	0.1485	2	20
Nuh	0.4531	0.3027	3	19
Rewari	0.2159	0.5465	11	7
Mahendgarh	0.1581	0.6473	15	3
Bhiwani	0.1238	0.7420	20	1
Jind	0.1750	0.5053	12	10
Hisar	0.1275	0.5249	19	8
Fatehabad	0.17113	0.6227	14	4
Sirsa	0.13024	0.5491	18	6
Mean	0.27	0.47		
S.D.	0.17	0.17		
C.V. (%)	64.70	37.12		

Table 12 reveals composite index of social infrastructure for 2017-18. In health index 13 out of 21 districts were above districts average, while in education index only 07 districts were above districts average. Faridabad and Gurugram continued to be on first and second position respectively in 2018-18 as well. Jhajjar and Bhiwani performed worst in education index and dropped down to bottom two positions. In health index, Bhiwani district did excellent and got first position, Jhajjar district also improved continuously over the years and came on second position in 2017-18. Faridabad, Gurugram continued their last positions in 2017-18 as well. The coefficient of variance found again higher in education index (64.70 percent). It was found that throughout the study period higher districts disparities were found in education index.

Infrastructure Development Index- District wise

Infrastructure development index was obtained by taking out the average of district-wise composite index values. Ranks to each district were given in descending values order. Procedure has been discussed in methodology.

Table-13

District-wise Infrastructure Development Index Calculated from Composite Index Values

Districts	2000-01		2017-18	
	IDI	Rank	IDI	Rank
Ambala	0.3450	7	0.3329	16
Panchkula	0.3338	8	0.3801	10
Yamuna Nagar	0.3727	5	0.3832	8
Kurukshetra	0.2846	12	0.373	12
Kaithal	0.2969	10	0.3052	21
Karnal	0.2433	18	0.3063	20
Panipat	0.2568	16	0.3108	19
Sonipat	0.2389	19	0.4271	2
Rohtak	0.509	1	0.3357	15
Jhajjar	0.2739	14	0.4183	3
Faridabad	0.4690	2	0.4033	4
Palwal	0	-	0.3151	18
Gurugram	0.2941	11	0.3902	7
Nuh	0	-	0.3779	11
Rewari	0.3524	6	0.3812	9
Mahendergarh	0.3304	9	0.4027	5
Bhiwani	0.4227	3	0.4329	1
Jind	0.2828	13	0.3402	13
Hisar	0.3768	4	0.3262	17
Fatehabad	0.2702	15	0.3969	6
Sirsa	0.2434	17	0.3397	14

Table 13 presents district-wise infrastructure development index which was derived from average of composite index values of both infrastructure (Education and Health). Rohtak district was found on top of the table in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonipat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.

Classification of Districts on the basis of Infrastructural Development Index

In this sub-section districts have been classified in three categories: Developed, Moderately developed, and less developed by using average and standard deviation values of Infrastructure development index. Procedure has been discussed in methodology.

Table-14
District-wise classification based on Infrastructure Development Index Values

Districts	2000-01		2017-18	
	IDI	Category	IDI	Category
Ambala	0.3450	MD	0.3329	LD
Panchkula	0.3338	MD	0.3801	MD
Yamuna Nagar	0.3727	D	0.3832	MD
Kurukshetra	0.2846	LD	0.373	MD
Kaithal	0.2969	MD	0.3052	LD
Karnal	0.2433	LD	0.3063	LD
Panipat	0.2568	LD	0.3108	LD
Sonapat	0.2389	LD	0.4271	D
Rohtak	0.509	D	0.3357	LD
Jhajjar	0.2739	LD	0.4183	D
Faridabad	0.4690	D	0.4033	D
Palwal	0	-	0.3151	LD
Gurugram	0.2941	MD	0.3902	D
Nuh	0	-	0.3779	MD
Rewari	0.3524	MD	0.3812	MD
Mahendergarh	0.3304	MD	0.4027	D
Bhiwani	0.4227	D	0.4329	D
Jind	0.2828	LD	0.3402	D
Hisar	0.3768	D	0.3262	LD
Fatehabad	0.2702	LD	0.4607	D
Sirsa	0.2434	LD	0.3815	LD

D: Developed, MD: Moderate Developed, LD: Less Developed

D= ≥ 0.3646 , MD= > 0.2877 & < 0.3646 and LD = ≤ 0.2877 for the year 2000-01

D= ≥ 0.3863 , MD= > 0.3450 & < 0.3863 and LD = ≤ 0.3450 for the year 2017-18

Table 14 shows classification of districts on the basis of Infrastructure Development index for two study periods that are 2000-01 and 2017-18. In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

Major Findings of the Study

- The study shows that there are less number of middle schools in comparison to primary and high school throughout the study period.
- Student-teacher ratio is decreasing continuous in primary and middle schools which is an excellent sign of development.
- The study found that the total numbers of dispensaries are decreasing continuously over the years and reached to only 63 in 2017-18 from 229 in 2000-01. It has happened because people in rural areas stopped going to dispensaries for treatment and prefer to move to city hospitals.
- Number of hospitals had declined from 78 in 2000-01 to 62 in 2017-18 because of that number of beds per lakh of population also showed declining trends.

- The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods.
- Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.
- The disparity in case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.
- The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.
- Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonapat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.
- In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

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Social Infrastructure in Haryana- A Study of Inter-District Disparities**Dr. Santosh Nandal¹**

Professor

Monika²

Research Scholar

^{1,2}Department of Economics, M.D. University, Rohtak, Haryana**Abstract**

In this paper an attempt has been made to study the social infrastructure in Haryana along with inter-district disparities for the year 2000-01 and 2017-18. The study also analyzed the developed and less developed districts in social infrastructure. Simple statistical tools like mean and Coefficient of Variance have been used to measure the inter-district disparities. Composite index has been constructed to find out the development of districts. Principal Component Analysis has been used to get factor loadings and weights of selected indicators. It was found from the study that there are wide spread of disparities in the development levels of different districts. Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure while in 2017-18 Bhiwani district was on the top position.

Introduction

Infrastructure describes the physical structure of facilities which are required to provide goods and services to public. It is linked with economy directly or indirectly or we can say that it effect economy through its spillover effects. It includes all those activities which do not directly generate income themselves but provide support and substance to the income generation activities.

Infrastructure means something that comes before the actual structure. It is foundation to build the structure of economy. Infrastructure consist permanent structure which is used for a long time to give inputs to the economy like network of road, railway facility, electricity, schools, colleges and hospitals etc.

Role of Infrastructure in Economic Growth and Development

. Infrastructure plays an important role in overall development. Many economists describe the importance of infrastructure in economic development. In fact, developmental activities depend upon infrastructure facilities. It is considered the prerequisite of development. In the words of Dr. V.K.R.V. Rao, "The link between infrastructure and development is not once for all affairs.

It is a continuous process; and progress in development has to be preceded, accompanied and followed by progress in infrastructure, if we are to fulfill our declared objective of a self-accelerated process of economic development."

The infrastructural network has dual character; it is a crucial factor of development as well as a component of development. The regions which have weak infrastructure network remain less developed and it is generally accepted fact that agriculture, industry and other development activities are constrained by available infrastructural facilities. Different types of infrastructural facilities affect the overall development including agriculture, industry and human development in which infrastructure plays a leader role and follower is the development (Majumder, R. 2004).

Classification of Infrastructure

Infrastructure can be classified into two category i.e. economic infrastructure and social infrastructure. Social infrastructure is also divided into two education and health infrastructure.

Social infrastructure is essential for an economy development. Social infrastructure concept is very wide and plays extremely significant role in economy development as it executes the task of human development resources by means of skill generation, education, awareness creation, training, research and development and health care to increase the efficiency of production. Social infrastructure plays an important role in enhancing the human capital. Advancement in knowledge and the dispersion of new ideas and activities are necessary to eliminate economic backwardness and install the human abilities that are more favourable to economic achievement. (AnuKapil and P.S. Raikhy) It has been recognized that physical capital growth is directly related to considerable formation of human capital.

Education is considered as catalyst for the development of human resource. This is the key social infrastructure indicators which have direct relation with productive manpower, level of income and standard of living. Less developed countries need educated professionals in all areas to boost the development and growth. UNESCO suggests minimum fifteen percent of national expenditure on educational facilities. Education acts as the base for research and development. Being an integral part of development progress, it cannot be looked separately.

Objectives of the Study

- To study the overall development of social infrastructure in Haryana.
- To analyse inter-district disparities in social infrastructure.
- To identify the developed and less developed districts.
- To categories districts on the basis of the value of Infrastructure Development index.

Research Methodology

The current study focused on overall growth and development of social infrastructure in the state of Haryana. The study also analyzed inter-districts disparities, developed and backward districts in social infrastructure. Social Infrastructure considered education (number of schools, teachers, students and student-teacher ratio) and health (number of hospitals, CHCs, PHCs, sub-centres, dispensaries, number of beds per lakh of population) indicators to show growth and development of social infrastructure. For inter-districts disparities and to identify developed and backward districts; only a few indicators have been taken in

consideration due to the unavailability of complete data on district level. The selection of indicators had been done after extensive review of literature.

The present study is empirical by nature. To accomplish the objectives, secondary data from different sources like; Statistical abstract of Haryana, Census 2001 and 2011 and Economic survey of Haryana have been used. In order to identify inter-district disparities and development ranks of 21 districts of Haryana; data of 12 indicators from social infrastructure for two points of time 2000-01 and 2017-18 have been used. For inter-district disparities; simple statistical tools like Mean, Standard Deviation and Coefficient of Variance have been calculated and considered. Raychaudhuri, A. and Haldar, S. (2009) method has been considered to run PCA for giving weights to the indicators and to construct Composite Index.

To run PCA, raw data was first converted into normalized data for each district. This was done to form raw data unit free and get relative spot of every district. Best and worst values of all indicators were identified for each district in order to calculate normalized value. Normalized value falls between 0 and 1 always.

$$NV_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$$

Where $R = \text{best } X_{ij} - \text{worst } X_{ij}$

$i = i\text{-th observation and } j = j\text{-th district}$

The next step after obtaining the normalized value was to run PCA to get factor loadings and weights of selected indicators. SPSS software was used to run PCA. From PCA, Initial Eigen values which are more than 01 were also identified. Weights for each selected indicator were obtained by multiplication of first initial Eigen value to first factor value and so on and then by adding all the values (which came after multiplication) together.

The next step was to construct the composite index. Composite Index was calculated; firstly, weight of selected indicator was multiplied by same indicator's normalized value, secondly, all indicators values (came after multiplication) were added together and divided by the total weights of selected indicators. The same procedure was followed for every district and for both types of infrastructure (Education and Health) at two selected points of time, 2000-01 and 2017-18.

The next step was to calculate Infrastructural Development Index (IDI) for selected two points of time separately for each district. This was done by using simple arithmetic average of composite index value of education and health infrastructure for respective point of time. The formula is mentioned below:

$$IDI = 1/2 [\text{Composite Index of Education Infrastructure} + \text{Composite Index of Health Infrastructure}]$$

On the basis of the Infrastructural Development Index (IDI) ranks had been given to the districts in descending order. The next step was to segregate the districts into three categories- Developed, Moderately Developed, Less Developed to expedite inter-district comparison. Pradhan, P. and Kumar, S. (2015) study had been considered for district categorization. Mean, Standard Deviation and Coefficient of Variance were calculated for IDI of each selected point of time. The developed districts were those which had IDI value equal or higher than the value came after adding mean value and 0.5 multiplied to S.D. value. The less developed districts were those which had IDI value equal or lower than the value came after subtracting 0.5 multiplied to S.D. value from mean value. The districts whose values lied between these two values were considered as moderately developed.

Education

Education is important resource to accelerate economic growth and investment in the region and it is prime indicator for quality of life and HDI (Human Development Index). Haryana requires quality and strong infrastructure to keep pace with growing economy.

Table-1**Development of Educational Infrastructure**

Education Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Primary Schools	11040	12179	13904	9690	9974
Number of Middle Schools	1887	2168	3483	4479	5238
Number of High Schools	4138	5317	6983	7663	8024
Number of Students in primary School	2017855	1997491	2284255	1633573	2504133
Number of Students in Middle School	951494	1159836	1249777	1038326	1448258
Number of Students in High Schools	804899	872806	1426723	1475045	1552812
Number of Teachers in Primary School	48463	50621	28000	33077	92649
Number of Teachers in Middle School	8396	11139	22835	31426	43311
Number of Teachers in High School	57479	68185	99796	86190	83561
Student-Teacher ratio in Primary School	42	39	79	71	27
Student-Teacher ratio in Middle School	113	104	55	45	33
Student-Teacher ratio in High School	14	13	14	17	19

Source: Statistical Abstract of Haryana, Various Issues.

The above table 1 explains the development of educational infrastructure in Haryana from 2000-01 to 2017-18. The number of primary schools first increased from 11040 in 2000-01 to 13904 in 2010-11, but then decreased to 9974 in 2017-18 while number of middle and high schools had increased continuously over the year from 1887 and 4138 respectively in 2000-01 to 5238 and 8024 respectively in 2017-18. The number of students in primary and middle schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of students in high schools had shown continuous growth from 804899 in 2000-01 to 1552812 in 2017-18. The number of teachers in primary and high schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of teachers in middle schools had shown continuous growth from 8396 in 2000-01 to 43311 in 2017-18. Student-teacher ratio in primary schools had increased from 42 in 2000-01 to 79 in 2010-11 but after it was decreased and remained only 27 in 2017-18 which is a good sign of development. Student-teacher ratio in middle schools continuously decreased over the years from 113 in 2000-01 to 33 in 2017-18. Student-teacher ratio in high schools had increased from 14 in 2000-01 to 19 in 2017-18, which was a bad sign of educational infrastructure development.

Health

Haryana is committed to provide quality of health services to its citizens. Health centres which include hospitals, CHCs, PHCs, Sub-centres, Dispensaries provide accessible, adequate and quality health care services on reasonable pricing.

Table-2
Health Infrastructure in Haryana

Health Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Hospitals	78	62	68	57	62
Number of CHCs	64	81	86	94	125
Number of PHCs	402	409	429	468	499
Number of Sub-Centres	2299	2433	2465	2630	2636
Number of Dispensary	229	193	193	125	63
Number of Beds per lakh of Population	995	815	833	726	866

*Source: Statistical Abstract of Haryana, Various Issues.
Census of India*

Table 2 reveals the health infrastructure in Haryana at different time periods. Number of hospitals had been declined from 78 in 2000-01 to 62 in 2017-18. Number of CHCs, PHCs and sub-centres had shown continuous growth from 2000-01 to 2017-18. Number of CHCs had grown from 64 to 125, PHCs had grown to 499 from 402 and sub-centres had grown from 2299 to 2636. But there was a decrease registered in number of dispensaries from 229 in 2000-01 to 63 in 2017-18, while number of beds per lakh of population had been declined from 995 in 2000-01 to 726 in 2015-16 but later increased to 866 in 2017-18.

Table-3
Inter-District Disparities in Educational Infrastructure

Districts	Number of Primary Schools per 100 sq. km. of Area		Number of Middle Schools per 100 sq. km. of Area		Number of High Schools per 100 sq. km. of Area	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	36	34	4	15	12	20
Panchkula	30	35	5	14	9	15
Yamunanagar	31	36	3	19	9	20
Kurukshetra	37	36	6	17	9	19
Kaithal	20	18	3	9	6	14
Karnal	24	24	4	12	8	17
Panipat	24	25	5	22	11	27
Sonipat	31	25	7	12	15	24
Rohtak	21	15	4	7	14	23
Jhajjar	30	19	5	7	14	22
Faridabad	49	43	8	64	19	74
Palwal	N.A	31	N.A	25	N.A	25
Gurugram	31	34	5	21	8	31

Nuh	N.A	33	N.A	24	N.A	11
Rewari	32	29	5	10	8	21
Mahendragarh	40	26	6	10	10	18
Bhiwani	19	15	3	6	7	14
Jind	23	17	5	7	10	17
Hisar	13	15	3	8	9	16
Fatehabad	14	18	3	7	6	11
Sirsa	13	13	3	5	5	8
Mean	27	26	5	15	10	21
S.D.	9.55	8.75	1.50	12.81	3.52	13.28
C.V.	35	33.91	33.34	83.64	35.47	62.40

Calculated by self

Table 3 describes inter district disparities in selected educational infrastructure particulars in study period which is divided in two time periods. The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods. Faridabad and Sirsa districts performed highest and lowest respectively in all three indicators throughout the time periods.

Table-4

Inter-District Disparities in Educational Infrastructure

Districts	Student-Teacher ratio in Primary Schools		Student-Teacher ratio in Middle Schools		Student-Teacher ratio in High/Senior Secondary Schools	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	40	25	202	30	14	16
Panchkula	39	15	90	16	11	16
Yamunanagar	42	29	147	32	17	22
Kurukshetra	41	19	107	30	15	17
Kaithal	57	17	150	26	17	20
Karnal	41	31	105	36	14	18
Panipat	47	24	146	28	17	22
Sonipat	38	52	89	59	11	16
Rohtak	34	29	121	32	11	16
Jhajjar	28	16	130	26	14	15
Faridabad	40	37	125	42	12	27
Palwal	N.A	23	N.A	24	N.A	23
Gurugram	55	83	102	73	12	22
Nuh	N.A	36	N.A	46	N.A	30
Rewari	36	28	118	29	19	16
Mahendragarh	36	24	95	24	16	15
Bhiwani	40	25	107	33	17	17
Jind	45	25	86	37	14	19
Hisar	45	23	147	35	14	16
Fatehabad	51	24	93	34	15	21

Sirsa	49	25	98	36	14	20
Mean	42	29	119	35	14	19
S.D.	7.23	14.72	29.49	12.50	2.37	3.97
C.V.	17.07	50.62	24.82	36.11	16.46	20.66

Calculated by self

The above table 4 reveals the inter district disparities in the selected indicators of educational infrastructure in the districts of Haryana in 2000-01 and 2017-18. Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.

Table-5
Inter-District Disparities in the Health Infrastructure

Districts	Number of Hospitals per lakh of Population		Number of CHCs per lakh of Population		Number of PHCs per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	0.79	0.27	0.20	0.35	1.48	1.77
Panchkula	0.64	0.18	0.43	0.36	1.71	1.78
Yamunanagar	0.58	0.25	0.38	0.58	1.73	1.65
Kurukshetra	0.12	0.10	0.36	0.62	2.06	2.18
Kaithal	0.11	0.09	0.32	0.56	2.33	2.23
Karnal	0.16	0.20	0.31	0.40	1.96	1.73
Panipat	0.31	0.17	0.10	0.58	1.55	1.58
Sonapat	0.08	0.14	0.39	0.62	2.03	2.55
Rohtak	0.85	0.28	0.43	0.57	2.45	2.17
Jhajjar	0.23	0.42	0.23	0.63	1.93	2.82
Faridabad	0.27	0.11	0.14	0.22	1.00	0.77
Palwal	N.A	0.19	N.A	0.48	N.A	1.82
Gurugram	0.30	0.33	0.24	0.20	1.51	0.79
Nuh	N.A	0.09	N.A	0.28	N.A	1.93
Rewari	0.26	0.22	0.52	0.56	1.83	2.11
Mahendragarh	0.12	0.22	0.37	0.76	2.46	2.71
Bhiwani	0.63	0.49	0.42	0.61	2.60	2.69
Jind	0.34	0.30	0.25	0.52	2.19	2.10
Hisar	0.72	0.34	0.39	0.46	2.15	2.12
Fatehabad	0.25	0.32	0.37	0.53	1.98	2.55
Sirsa	0.27	0.31	0.18	0.62	2.06	2.24
Mean	0.37	0.24	0.32	0.50	1.95	2.01
S.D.	0.25	0.11	0.11	0.15	0.39	0.54
C.V.	67.25	45.21	35.58	29.59	20.23	27.06

Calculated by self

The above table 5 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in

case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.

Table-6
Inter-District Disparities in Health Infrastructure

Districts	Number of Sub-centres per lakh of Population		Number of Dispensaries per lakh of Population		Number of Beds per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	9.76	9.22	1.18	0.27	68	45
Panchkula	10.03	9.09	2.13	2.32	65	68
Yamunanagar	10.75	9.22	1.54	0.08	52	34
Kurukshetra	10.18	12.13	0.97	0.10	33	34
Kaithal	12.15	13.40	0.32	0.00	32	32
Karnal	9.03	9.96	1.26	0.47	36	32
Panipat	10.34	7.47	0.72	0.17	34	25
Sonipat	8.60	11.31	1.17	0.21	29	25
Rohtak	17.23	10.74	1.60	0.47	202	34
Jhajjar	13.86	13.15	0.91	0.31	21	48
Faridabad	5.33	3.15	1.64	0.39	37	21
Palwal	N.A	8.54	N.A	0.00	N.A	18
Gurugram	9.34	5.02	0.78	0.20	27	26
Nuh	N.A	12.67	N.A	0.00	N.A	21
Rewari	13.33	12.44	0.65	0.22	32	44
Mahendragarh	14.15	13.01	0.49	0.00	39	39
Bhiwani	14.18	13.46	1.12	0.18	70	51
Jind	10.84	12.22	0.76	0.15	63	32
Hisar	11.38	11.47	1.11	0.29	87	40
Fatehabad	12.28	14.33	0.87	0.11	33	41
Sirsa	12.45	11.89	1.07	0.15	35	32
Mean	11.33	10.66	1.07	0.29	52.37	35.33
S.D.	2.62	2.87	0.44	0.49	40.48	11.77
C.V.	23.16	26.94	41.09	167.71	77.29	33.31

Calculated by self

The above table 6 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.

Table-7
Results of Factor Analysis for Education Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.961	0.187	0.959	3.2308	23.22
No. of Middle Schools per 100 sq km of Area	0.98	0.074	0.966	3.1544	22.67
No. of High Schools per 100 sq km of Area	0.978	0.139	0.976	3.2263	23.19
Student-Teacher ratio of Primary Schools	-0.169	0.242	0.087	0.8195	5.89
Student-Teacher ratio of Middle Schools	-0.051	0.851	0.727	1.1824	8.50
Student-Teacher ratio of High Schools	-0.505	0.6	0.615	2.3008	16.54
Variance (%)	52.132	20.032	Total	13.9142	100.00
Cumulative variance (%)	52.132	72.165			

KMO measures of sampling adequacy- 0.457
Significance level of Bartlett's test of sphericity- 0.000

Table 7 indicates factor analysis result of education infrastructure for year of 200-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which explain cumulative variance of 72.17 percent. First factor explained 52.13 percent and second factor explain 20.03 percent of total cumulative variance. The communality values lied in ranging of 0.615 to 0.976 for all indicators except student-teacher ratio in primary school which was at 0.087. Factors value showed that three out of six variables had higher contribution in first component and two variables had majorly contributed to second component, remaining one variable which is student-teacher ratio in primary school had least contribution in both components. Weights of the indicators which came out with the use of initial Eigen value and factors value varied between 0.8195-3.2308. The variables which contributed largely to first component got higher and almost equal importance in weights as well. Student-Teacher ratio in primary schools had lowest relative weights (5.89), hence least contribution to educational infrastructure development.

Table-8

Results of Factor Analysis for Health Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communal ity	Weights	Weights (in %)
Number of Hospitals per lakh of Population	0.643	0.645	0.83	2.9893	18.07
Number of CHCs per lakh of Population	0.664	-0.201	0.481	2.1908	13.24
Number of PHCs per lakh of Population	0.695	-0.619	0.866	3.0804	18.62
Number of Sub-centre per lakh of Population	0.792	-0.45	0.831	3.0182	18.24
Number of Dispensaries per lakh of Population	0.225	0.864	0.798	2.2760	13.76
Number of Beds per lakh of Population	0.837	0.371	0.838	2.9882	18.06
Variance (%)	45.27	32.112	Total	16.5429	100.00
Cumulative variance (%)	45.27	77.382			

KMO measures of sampling adequacy- 0.636
Significance level of Bartlett's test of sphericity- 0.000

Table 8 points out the result of factor analysis with weights for health infrastructure for the period of 2000-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which together explain 77 percent cumulative variance. Individually both factors explained 45.27 percent and 32.11 percent respectively. Communality values lied in the range of 0.798 to 0.866 that means two factors were sufficient to explain the variance of original variables, except the number of CHCs per lakh of population which was at 0.481. The factor values showed that number of CHCs per lakh of population, number of sub-centers per lakh of population and number of beds per lakh of population had higher association with first factor whereas number of dispensaries per lakh of population had contributed significantly in second factor. But, number of hospitals and number of PHCs per lakh of population contributed less in both factors. From the selected variables, four variables got almost equal importance in weights which were more than 18 percent. Remaining two variables contributed about 13 percent each in weights.

Table-9

Results of Factor Analysis for Education Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.73	-0.358	0.661	2.9255	15.92
No. of Middle Schools per 100 sq km of Area	0.897	-0.415	0.976	3.5560	19.36
No. of High Schools per 100 sq km of Area	0.804	-0.296	0.734	3.0688	16.70
Student-Teacher ratio of Primary Schools	0.646	0.733	0.954	3.2377	17.62
Student-Teacher ratio of Middle Schools	0.593	0.79	0.975	3.1547	17.17
Student-Teacher ratio of High Schools	0.701	-0.1	0.501	2.4292	13.22
Variance (%)	54.05	25.979	Total	18.3720	100.00
Cumulative variance (%)	54.05	80.029			

KMO measures of sampling adequacy- 0.386
Significance level of Bartlett's test of sphericity- 0.000

The above table 9 reveals the result of factor analysis for education infrastructure for 2017-18. KMO and Bartlett's test shows significance level and applicability of factor analysis. Again two factors had come out from selected six variables. First factor explained 54 percent and second factor explained 26 percent, in together both of these factors explained 80 percent of variance. Half of the variables contributed more than 90 percent in Communality values and remaining half contributed in the range of 0.501 to 0.734. Four out of six variables contributed highly in the growth of first factor and remaining two variables which were student-teacher ratio in primary (0.733) and middle schools (0.79) contributed in second factor. From selected indicators, number of middle school per 100 sq. km. performed highest in weights with a value of 19.36 percent, followed by student-teacher ratio in primary (17.62) and middle schools ((17.17). No. of primary schools per 100 sq. km. of area (15.92) and student-teacher ratio in high schools had performed least in weights as well as education infrastructure development.

Table-10

Results of Factor Analysis for Health Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
Number of hospitals per lakh of population	0.484	0.307	0.329	1.9444	12.50
Number of CHCs per lakh of population	0.824	-0.274	0.755	2.8837	18.54
Number of PHCs per lakh of population	0.964	-0.086	0.937	2.9711	19.10
Number of sub-centre per lakh of population	0.904	-0.128	0.833	2.8675	18.43
Number of dispensaries per lakh of population	-0.152	0.908	0.848	2.0033	12.88
Number of beds per lakh of population	0.495	0.836	0.943	2.8844	18.54
Variance (%)	48.816	28.594	Total	15.5545	100
Cumulative variance (%)	48.816	77.41			

KMO measures of sampling adequacy- 0.437
Significance level of Bartlett's test of sphericity- 0.000

Table 10 depicts the result of factor analysis for health infrastructure. KMO and Bartlett's test values were significant that made factor analysis possible. Two factors had been derived from all six selected variables. First factor explained 49 percent variance and second factor did 28 percent. Total cumulative variance was 77 percent. In first factor, three variables were highly associated namely number of CHCs (0.824), PHCs (0.964) and sub-centers (0.904) per lakh of population. While two factors; number of dispensaries (0.908) and beds (0.836) per lakh of population contributed to second factor. Remaining variable; number of hospitals per lakh of population contributed with small amount in both factors. The communality values for all variables except number of hospitals per lakh of population were found more than 75 percent in the range of 0.755 to 0.943. Four variables which were number of PHCs (19.10), CHCs (18.54), beds (18.54), sub-centers (18.43) percent per lakh of population, received highest and almost equal weights. Number of hospitals and number of dispensaries per lakh of population got 12.50 percent and 12.88 percent of weights respectively and contributed least to health infrastructure development.

District-wise Composite Index using PCA techniques

Table 11 and 12 show district-wise Infrastructure development for years 2000-01 and 2017-18. Procedure has been discussed in methodology.

Table-11

District-wise Composite Index of Infrastructure for the year 2000-01

Districts	Education Index	Health Index	R1	R2
Ambala	0.2557	0.4342	5	6
Panchkula	0.0959	0.5717	19	4
Yamuna Nagar	0.2480	0.4974	6	5
Kurukshetra	0.2186	0.3505	9	13
Kaithal	0.2470	0.3467	7	14
Karnal	0.1467	0.3399	14	15
Panipat	0.2754	0.2382	3	18
Sonipat	0.1438	0.3340	15	16
Rohtak	0.1041	0.9139	18	1
Jhajjar	0.1876	0.3601	10	12
Faridabad	0.7644	0.1735	1	19
Gurugram	0.3306	0.2576	2	17
Rewari	0.2747	0.4300	4	8
Mahendergarh	0.2303	0.4305	8	7
Bhiwani	0.1838	0.6616	11	2
Jind	0.1590	0.4066	13	9
Hisar	0.1594	0.5941	12	3
Fatehabad	0.1409	0.3994	16	10
Sirsa	0.1135	0.3733	17	11
Mean	0.23	0.43		
S.D.	0.15	0.17		
C.V. (%)	64.89	39.48		

Table 11 shows district-wise composite index of social infrastructure for 2000-01. This composite index was calculated with the help of weights and normalized value of that indicator for every district. Ranks to all districts have been given in descending order. R1 shows rank for education index and R2 for health index. Out of total 19 districts only 08 districts were found above district average in both types of infrastructure. In education index Faridabad and Gurugram were on top two position followed by Panipat, Rewari and Ambala. Panchkula and Rohtak were on bottom positions in education index. Again positions of districts changed in health index, district of Rohtak which was on last position in education index performed best in health index and got first position followed by Bhiwani, Hisar, Panchkula and Yamunanagar. Faridabad was on last position in health index. Value of coefficient of variance was found higher for education index (64.89 percent).

Table-12

District-wise Composite Index of Infrastructure for the year 2017-18

Districts	Education Index	Health Index	R1	R2
Ambala	0.2515	0.4143	9	15
Panchkula	0.1728	0.5874	13	5
Yamuna Nagar	0.3446	0.4217	5	14
Kurukshetra	0.2595	0.4865	8	12
Kaithal	0.1342	0.4762	17	13
Karnal	0.2323	0.3803	10	16
Panipat	0.2887	0.3329	7	17
Sonipat	0.3614	0.4927	4	11
Rohtak	0.1484	0.5229	16	9
Jhajjar	0.1066	0.7299	21	2
Faridabad	0.7610	0.0456	1	21
Palwal	0.3195	0.3107	6	18
Gurugram	0.6318	0.1485	2	20
Nuh	0.4531	0.3027	3	19
Rewari	0.2159	0.5465	11	7
Mahendgarh	0.1581	0.6473	15	3
Bhiwani	0.1238	0.7420	20	1
Jind	0.1750	0.5053	12	10
Hisar	0.1275	0.5249	19	8
Fatehabad	0.17113	0.6227	14	4
Sirsa	0.13024	0.5491	18	6
Mean	0.27	0.47		
S.D.	0.17	0.17		
C.V. (%)	64.70	37.12		

Table 12 reveals composite index of social infrastructure for 2017-18. In health index 13 out of 21 districts were above districts average, while in education index only 07 districts were above districts average. Faridabad and Gurugram continued to be on first and second position respectively in 2018-18 as well. Jhajjar and Bhiwani performed worst in education index and dropped down to bottom two positions. In health index, Bhiwani district did excellent and got first position, Jhajjar district also improved continuously over the years and came on second position in 2017-18. Faridabad, Gurugram continued their last positions in 2017-18 as well. The coefficient of variance found again higher in education index (64.70 percent). It was found that throughout the study period higher districts disparities were found in education index.

Infrastructure Development Index- District wise

Infrastructure development index was obtained by taking out the average of district-wise composite index values. Ranks to each district were given in descending values order. Procedure has been discussed in methodology.

Table-13

District-wise Infrastructure Development Index Calculated from Composite Index Values

Districts	2000-01		2017-18	
	IDI	Rank	IDI	Rank
Ambala	0.3450	7	0.3329	16
Panchkula	0.3338	8	0.3801	10
Yamuna Nagar	0.3727	5	0.3832	8
Kurukshetra	0.2846	12	0.373	12
Kaithal	0.2969	10	0.3052	21
Karnal	0.2433	18	0.3063	20
Panipat	0.2568	16	0.3108	19
Sonipat	0.2389	19	0.4271	2
Rohtak	0.509	1	0.3357	15
Jhajjar	0.2739	14	0.4183	3
Faridabad	0.4690	2	0.4033	4
Palwal	0	-	0.3151	18
Gurugram	0.2941	11	0.3902	7
Nuh	0	-	0.3779	11
Rewari	0.3524	6	0.3812	9
Mahendergarh	0.3304	9	0.4027	5
Bhiwani	0.4227	3	0.4329	1
Jind	0.2828	13	0.3402	13
Hisar	0.3768	4	0.3262	17
Fatehabad	0.2702	15	0.3969	6
Sirsa	0.2434	17	0.3397	14

Table 13 presents district-wise infrastructure development index which was derived from average of composite index values of both infrastructure (Education and Health). Rohtak district was found on top of the table in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonipat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.

Classification of Districts on the basis of Infrastructural Development Index

In this sub-section districts have been classified in three categories: Developed, Moderately developed, and less developed by using average and standard deviation values of Infrastructure development index. Procedure has been discussed in methodology.

Table-14
District-wise classification based on Infrastructure Development Index Values

Districts	2000-01		2017-18	
	IDI	Category	IDI	Category
Ambala	0.3450	MD	0.3329	LD
Panchkula	0.3338	MD	0.3801	MD
Yamuna Nagar	0.3727	D	0.3832	MD
Kurukshetra	0.2846	LD	0.373	MD
Kaithal	0.2969	MD	0.3052	LD
Karnal	0.2433	LD	0.3063	LD
Panipat	0.2568	LD	0.3108	LD
Sonapat	0.2389	LD	0.4271	D
Rohtak	0.509	D	0.3357	LD
Jhajjar	0.2739	LD	0.4183	D
Faridabad	0.4690	D	0.4033	D
Palwal	0	-	0.3151	LD
Gurugram	0.2941	MD	0.3902	D
Nuh	0	-	0.3779	MD
Rewari	0.3524	MD	0.3812	MD
Mahendergarh	0.3304	MD	0.4027	D
Bhiwani	0.4227	D	0.4329	D
Jind	0.2828	LD	0.3402	D
Hisar	0.3768	D	0.3262	LD
Fatehabad	0.2702	LD	0.4607	D
Sirsa	0.2434	LD	0.3815	LD

D: Developed, MD: Moderate Developed, LD: Less Developed

D= ≥ 0.3646 , MD= > 0.2877 & < 0.3646 and LD = ≤ 0.2877 for the year 2000-01

D= ≥ 0.3863 , MD= > 0.3450 & < 0.3863 and LD = ≤ 0.3450 for the year 2017-18

Table 14 shows classification of districts on the basis of Infrastructure Development index for two study periods that are 2000-01 and 2017-18. In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

Major Findings of the Study

- The study shows that there are less number of middle schools in comparison to primary and high school throughout the study period.
- Student-teacher ratio is decreasing continuous in primary and middle schools which is an excellent sign of development.
- The study found that the total numbers of dispensaries are decreasing continuously over the years and reached to only 63 in 2017-18 from 229 in 2000-01. It has happened because people in rural areas stopped going to dispensaries for treatment and prefer to move to city hospitals.
- Number of hospitals had declined from 78 in 2000-01 to 62 in 2017-18 because of that number of beds per lakh of population also showed declining trends.

- The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods.
- Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.
- The disparity in case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.
- The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.
- Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonapat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.
- In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

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Social Infrastructure in Haryana- A Study of Inter-District Disparities**Dr. Santosh Nandal¹**

Professor

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^{1,2}Department of Economics, M.D. University, Rohtak, Haryana**Abstract**

In this paper an attempt has been made to study the social infrastructure in Haryana along with inter-district disparities for the year 2000-01 and 2017-18. The study also analyzed the developed and less developed districts in social infrastructure. Simple statistical tools like mean and Coefficient of Variance have been used to measure the inter-district disparities. Composite index has been constructed to find out the development of districts. Principal Component Analysis has been used to get factor loadings and weights of selected indicators. It was found from the study that there are wide spread of disparities in the development levels of different districts. Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure while in 2017-18 Bhiwani district was on the top position.

Introduction

Infrastructure describes the physical structure of facilities which are required to provide goods and services to public. It is linked with economy directly or indirectly or we can say that it effect economy through its spillover effects. It includes all those activities which do not directly generate income themselves but provide support and substance to the income generation activities.

Infrastructure means something that comes before the actual structure. It is foundation to build the structure of economy. Infrastructure consist permanent structure which is used for a long time to give inputs to the economy like network of road, railway facility, electricity, schools, colleges and hospitals etc.

Role of Infrastructure in Economic Growth and Development

. Infrastructure plays an important role in overall development. Many economists describe the importance of infrastructure in economic development. In fact, developmental activities depend upon infrastructure facilities. It is considered the prerequisite of development. In the words of Dr. V.K.R.V. Rao, "The link between infrastructure and development is not once for all affairs.

It is a continuous process; and progress in development has to be preceded, accompanied and followed by progress in infrastructure, if we are to fulfill our declared objective of a self-accelerated process of economic development."

The infrastructural network has dual character; it is a crucial factor of development as well as a component of development. The regions which have weak infrastructure network remain less developed and it is generally accepted fact that agriculture, industry and other development activities are constrained by available infrastructural facilities. Different types of infrastructural facilities affect the overall development including agriculture, industry and human development in which infrastructure plays a leader role and follower is the development (Majumder, R. 2004).

Classification of Infrastructure

Infrastructure can be classified into two category i.e. economic infrastructure and social infrastructure. Social infrastructure is also divided into two education and health infrastructure.

Social infrastructure is essential for an economy development. Social infrastructure concept is very wide and plays extremely significant role in economy development as it executes the task of human development resources by means of skill generation, education, awareness creation, training, research and development and health care to increase the efficiency of production. Social infrastructure plays an important role in enhancing the human capital. Advancement in knowledge and the dispersion of new ideas and activities are necessary to eliminate economic backwardness and install the human abilities that are more favourable to economic achievement. (AnuKapil and P.S. Raikhy) It has been recognized that physical capital growth is directly related to considerable formation of human capital.

Education is considered as catalyst for the development of human resource. This is the key social infrastructure indicators which have direct relation with productive manpower, level of income and standard of living. Less developed countries need educated professionals in all areas to boost the development and growth. UNESCO suggests minimum fifteen percent of national expenditure on educational facilities. Education acts as the base for research and development. Being an integral part of development progress, it cannot be looked separately.

Objectives of the Study

- To study the overall development of social infrastructure in Haryana.
- To analyse inter-district disparities in social infrastructure.
- To identify the developed and less developed districts.
- To categories districts on the basis of the value of Infrastructure Development index.

Research Methodology

The current study focused on overall growth and development of social infrastructure in the state of Haryana. The study also analyzed inter-districts disparities, developed and backward districts in social infrastructure. Social Infrastructure considered education (number of schools, teachers, students and student-teacher ratio) and health (number of hospitals, CHCs, PHCs, sub-centres, dispensaries, number of beds per lakh of population) indicators to show growth and development of social infrastructure. For inter-districts disparities and to identify developed and backward districts; only a few indicators have been taken in

consideration due to the unavailability of complete data on district level. The selection of indicators had been done after extensive review of literature.

The present study is empirical by nature. To accomplish the objectives, secondary data from different sources like; Statistical abstract of Haryana, Census 2001 and 2011 and Economic survey of Haryana have been used. In order to identify inter-district disparities and development ranks of 21 districts of Haryana; data of 12 indicators from social infrastructure for two points of time 2000-01 and 2017-18 have been used. For inter-district disparities; simple statistical tools like Mean, Standard Deviation and Coefficient of Variance have been calculated and considered. Raychaudhuri, A. and Haldar, S. (2009) method has been considered to run PCA for giving weights to the indicators and to construct Composite Index.

To run PCA, raw data was first converted into normalized data for each district. This was done to form raw data unit free and get relative spot of every district. Best and worst values of all indicators were identified for each district in order to calculate normalized value. Normalized value falls between 0 and 1 always.

$$NV_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$$

Where R = best X_{ij} - worst X_{ij}

i = i-th observation and j = j-th district

The next step after obtaining the normalized value was to run PCA to get factor loadings and weights of selected indicators. SPSS software was used to run PCA. From PCA, Initial Eigen values which are more than 01 were also identified. Weights for each selected indicator were obtained by multiplication of first initial Eigen value to first factor value and so on and then by adding all the values (which came after multiplication) together.

The next step was to construct the composite index. Composite Index was calculated; firstly, weight of selected indicator was multiplied by same indicator's normalized value, secondly, all indicators values (came after multiplication) were added together and divided by the total weights of selected indicators. The same procedure was followed for every district and for both types of infrastructure (Education and Health) at two selected points of time, 2000-01 and 2017-18.

The next step was to calculate Infrastructural Development Index (IDI) for selected two points of time separately for each district. This was done by using simple arithmetic average of composite index value of education and health infrastructure for respective point of time. The formula is mentioned below:

$$IDI = 1/2 [\text{Composite Index of Education Infrastructure} + \text{Composite Index of Health Infrastructure}]$$

On the basis of the Infrastructural Development Index (IDI) ranks had been given to the districts in descending order. The next step was to segregate the districts into three categories- Developed, Moderately Developed, Less Developed to expedite inter-district comparison. Pradhan, P. and Kumar, S. (2015) study had been considered for district categorization. Mean, Standard Deviation and Coefficient of Variance were calculated for IDI of each selected point of time. The developed districts were those which had IDI value equal or higher than the value came after adding mean value and 0.5 multiplied to S.D. value. The less developed districts were those which had IDI value equal or lower than the value came after subtracting 0.5 multiplied to S.D. value from mean value. The districts whose values lied between these two values were considered as moderately developed.

Education

Education is important resource to accelerate economic growth and investment in the region and it is prime indicator for quality of life and HDI (Human Development Index). Haryana requires quality and strong infrastructure to keep pace with growing economy.

Table-1**Development of Educational Infrastructure**

Education Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Primary Schools	11040	12179	13904	9690	9974
Number of Middle Schools	1887	2168	3483	4479	5238
Number of High Schools	4138	5317	6983	7663	8024
Number of Students in primary School	2017855	1997491	2284255	1633573	2504133
Number of Students in Middle School	951494	1159836	1249777	1038326	1448258
Number of Students in High Schools	804899	872806	1426723	1475045	1552812
Number of Teachers in Primary School	48463	50621	28000	33077	92649
Number of Teachers in Middle School	8396	11139	22835	31426	43311
Number of Teachers in High School	57479	68185	99796	86190	83561
Student-Teacher ratio in Primary School	42	39	79	71	27
Student-Teacher ratio in Middle School	113	104	55	45	33
Student-Teacher ratio in High School	14	13	14	17	19

Source: Statistical Abstract of Haryana, Various Issues.

The above table 1 explains the development of educational infrastructure in Haryana from 2000-01 to 2017-18. The number of primary schools first increased from 11040 in 2000-01 to 13904 in 2010-11, but then decreased to 9974 in 2017-18 while number of middle and high schools had increased continuously over the year from 1887 and 4138 respectively in 2000-01 to 5238 and 8024 respectively in 2017-18. The number of students in primary and middle schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of students in high schools had shown continuous growth from 804899 in 2000-01 to 1552812 in 2017-18. The number of teachers in primary and high schools had increased from 2000-01 to 2017-18 but not on continuous pace, while number of teachers in middle schools had shown continuous growth from 8396 in 2000-01 to 43311 in 2017-18. Student-teacher ratio in primary schools had increased from 42 in 2000-01 to 79 in 2010-11 but after it was decreased and remained only 27 in 2017-18 which is a good sign of development. Student-teacher ratio in middle schools continuously decreased over the years from 113 in 2000-01 to 33 in 2017-18. Student-teacher ratio in high schools had increased from 14 in 2000-01 to 19 in 2017-18, which was a bad sign of educational infrastructure development.

Health

Haryana is committed to provide quality of health services to its citizens. Health centres which include hospitals, CHCs, PHCs, Sub-centres, Dispensaries provide accessible, adequate and quality health care services on reasonable pricing.

Table-2
Health Infrastructure in Haryana

Health Particulars	2000-01	2005-06	2010-11	2015-16	2017-18
Number of Hospitals	78	62	68	57	62
Number of CHCs	64	81	86	94	125
Number of PHCs	402	409	429	468	499
Number of Sub-Centres	2299	2433	2465	2630	2636
Number of Dispensary	229	193	193	125	63
Number of Beds per lakh of Population	995	815	833	726	866

*Source: Statistical Abstract of Haryana, Various Issues.
Census of India*

Table 2 reveals the health infrastructure in Haryana at different time periods. Number of hospitals had been declined from 78 in 2000-01 to 62 in 2017-18. Number of CHCs, PHCs and sub-centres had shown continuous growth from 2000-01 to 2017-18. Number of CHCs had grown from 64 to 125, PHCs had grown to 499 from 402 and sub-centres had grown from 2299 to 2636. But there was a decrease registered in number of dispensaries from 229 in 2000-01 to 63 in 2017-18, while number of beds per lakh of population had been declined from 995 in 2000-01 to 726 in 2015-16 but later increased to 866 in 2017-18.

Table-3
Inter-District Disparities in Educational Infrastructure

Districts	Number of Primary Schools per 100 sq. km. of Area		Number of Middle Schools per 100 sq. km. of Area		Number of High Schools per 100 sq. km. of Area	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	36	34	4	15	12	20
Panchkula	30	35	5	14	9	15
Yamunanagar	31	36	3	19	9	20
Kurukshetra	37	36	6	17	9	19
Kaithal	20	18	3	9	6	14
Karnal	24	24	4	12	8	17
Panipat	24	25	5	22	11	27
Sonipat	31	25	7	12	15	24
Rohtak	21	15	4	7	14	23
Jhajjar	30	19	5	7	14	22
Faridabad	49	43	8	64	19	74
Palwal	N.A	31	N.A	25	N.A	25
Gurugram	31	34	5	21	8	31

Nuh	N.A	33	N.A	24	N.A	11
Rewari	32	29	5	10	8	21
Mahendragarh	40	26	6	10	10	18
Bhiwani	19	15	3	6	7	14
Jind	23	17	5	7	10	17
Hisar	13	15	3	8	9	16
Fatehabad	14	18	3	7	6	11
Sirsa	13	13	3	5	5	8
Mean	27	26	5	15	10	21
S.D.	9.55	8.75	1.50	12.81	3.52	13.28
C.V.	35	33.91	33.34	83.64	35.47	62.40

Calculated by self

Table 3 describes inter district disparities in selected educational infrastructure particulars in study period which is divided in two time periods. The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods. Faridabad and Sirsa districts performed highest and lowest respectively in all three indicators throughout the time periods.

Table-4

Inter-District Disparities in Educational Infrastructure

Districts	Student-Teacher ratio in Primary Schools		Student-Teacher ratio in Middle Schools		Student-Teacher ratio in High/Senior Secondary Schools	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	40	25	202	30	14	16
Panchkula	39	15	90	16	11	16
Yamunanagar	42	29	147	32	17	22
Kurukshetra	41	19	107	30	15	17
Kaithal	57	17	150	26	17	20
Karnal	41	31	105	36	14	18
Panipat	47	24	146	28	17	22
Sonipat	38	52	89	59	11	16
Rohtak	34	29	121	32	11	16
Jhajjar	28	16	130	26	14	15
Faridabad	40	37	125	42	12	27
Palwal	N.A	23	N.A	24	N.A	23
Gurugram	55	83	102	73	12	22
Nuh	N.A	36	N.A	46	N.A	30
Rewari	36	28	118	29	19	16
Mahendragarh	36	24	95	24	16	15
Bhiwani	40	25	107	33	17	17
Jind	45	25	86	37	14	19
Hisar	45	23	147	35	14	16
Fatehabad	51	24	93	34	15	21

Sirsa	49	25	98	36	14	20
Mean	42	29	119	35	14	19
S.D.	7.23	14.72	29.49	12.50	2.37	3.97
C.V.	17.07	50.62	24.82	36.11	16.46	20.66

Calculated by self

The above table 4 reveals the inter district disparities in the selected indicators of educational infrastructure in the districts of Haryana in 2000-01 and 2017-18. Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.

Table-5
Inter-District Disparities in the Health Infrastructure

Districts	Number of Hospitals per lakh of Population		Number of CHCs per lakh of Population		Number of PHCs per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	0.79	0.27	0.20	0.35	1.48	1.77
Panchkula	0.64	0.18	0.43	0.36	1.71	1.78
Yamunanagar	0.58	0.25	0.38	0.58	1.73	1.65
Kurukshetra	0.12	0.10	0.36	0.62	2.06	2.18
Kaithal	0.11	0.09	0.32	0.56	2.33	2.23
Karnal	0.16	0.20	0.31	0.40	1.96	1.73
Panipat	0.31	0.17	0.10	0.58	1.55	1.58
Sonapat	0.08	0.14	0.39	0.62	2.03	2.55
Rohtak	0.85	0.28	0.43	0.57	2.45	2.17
Jhajjar	0.23	0.42	0.23	0.63	1.93	2.82
Faridabad	0.27	0.11	0.14	0.22	1.00	0.77
Palwal	N.A	0.19	N.A	0.48	N.A	1.82
Gurugram	0.30	0.33	0.24	0.20	1.51	0.79
Nuh	N.A	0.09	N.A	0.28	N.A	1.93
Rewari	0.26	0.22	0.52	0.56	1.83	2.11
Mahendragarh	0.12	0.22	0.37	0.76	2.46	2.71
Bhiwani	0.63	0.49	0.42	0.61	2.60	2.69
Jind	0.34	0.30	0.25	0.52	2.19	2.10
Hisar	0.72	0.34	0.39	0.46	2.15	2.12
Fatehabad	0.25	0.32	0.37	0.53	1.98	2.55
Sirsa	0.27	0.31	0.18	0.62	2.06	2.24
Mean	0.37	0.24	0.32	0.50	1.95	2.01
S.D.	0.25	0.11	0.11	0.15	0.39	0.54
C.V.	67.25	45.21	35.58	29.59	20.23	27.06

Calculated by self

The above table 5 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in

case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.

Table-6
Inter-District Disparities in Health Infrastructure

Districts	Number of Sub-centres per lakh of Population		Number of Dispensaries per lakh of Population		Number of Beds per lakh of Population	
	2000-01	2017-18	2000-01	2017-18	2000-01	2017-18
Ambala	9.76	9.22	1.18	0.27	68	45
Panchkula	10.03	9.09	2.13	2.32	65	68
Yamunanagar	10.75	9.22	1.54	0.08	52	34
Kurukshetra	10.18	12.13	0.97	0.10	33	34
Kaithal	12.15	13.40	0.32	0.00	32	32
Karnal	9.03	9.96	1.26	0.47	36	32
Panipat	10.34	7.47	0.72	0.17	34	25
Sonipat	8.60	11.31	1.17	0.21	29	25
Rohtak	17.23	10.74	1.60	0.47	202	34
Jhajjar	13.86	13.15	0.91	0.31	21	48
Faridabad	5.33	3.15	1.64	0.39	37	21
Palwal	N.A	8.54	N.A	0.00	N.A	18
Gurugram	9.34	5.02	0.78	0.20	27	26
Nuh	N.A	12.67	N.A	0.00	N.A	21
Rewari	13.33	12.44	0.65	0.22	32	44
Mahendragarh	14.15	13.01	0.49	0.00	39	39
Bhiwani	14.18	13.46	1.12	0.18	70	51
Jind	10.84	12.22	0.76	0.15	63	32
Hisar	11.38	11.47	1.11	0.29	87	40
Fatehabad	12.28	14.33	0.87	0.11	33	41
Sirsa	12.45	11.89	1.07	0.15	35	32
Mean	11.33	10.66	1.07	0.29	52.37	35.33
S.D.	2.62	2.87	0.44	0.49	40.48	11.77
C.V.	23.16	26.94	41.09	167.71	77.29	33.31

Calculated by self

The above table 6 presents the inter district disparities in the selected indicators of health infrastructure in the districts of Haryana from 2000-01 to 2017-18. The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.

Table-7
Results of Factor Analysis for Education Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.961	0.187	0.959	3.2308	23.22
No. of Middle Schools per 100 sq km of Area	0.98	0.074	0.966	3.1544	22.67
No. of High Schools per 100 sq km of Area	0.978	0.139	0.976	3.2263	23.19
Student-Teacher ratio of Primary Schools	-0.169	0.242	0.087	0.8195	5.89
Student-Teacher ratio of Middle Schools	-0.051	0.851	0.727	1.1824	8.50
Student-Teacher ratio of High Schools	-0.505	0.6	0.615	2.3008	16.54
Variance (%)	52.132	20.032	Total	13.9142	100.00
Cumulative variance (%)	52.132	72.165			

KMO measures of sampling adequacy- 0.457
Significance level of Bartlett's test of sphericity- 0.000

Table 7 indicates factor analysis result of education infrastructure for year of 200-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which explain cumulative variance of 72.17 percent. First factor explained 52.13 percent and second factor explain 20.03 percent of total cumulative variance. The communality values lied in ranging of 0.615 to 0.976 for all indicators except student-teacher ratio in primary school which was at 0.087. Factors value showed that three out of six variables had higher contribution in first component and two variables had majorly contributed to second component, remaining one variable which is student-teacher ratio in primary school had least contribution in both components. Weights of the indicators which came out with the use of initial Eigen value and factors value varied between 0.8195-3.2308. The variables which contributed largely to first component got higher and almost equal importance in weights as well. Student-Teacher ratio in primary schools had lowest relative weights (5.89), hence least contribution to educational infrastructure development.

Table-8

Results of Factor Analysis for Health Infrastructure- 2000-01

Indicators	Factor 1	Factor 2	Communal ity	Weights	Weights (in %)
Number of Hospitals per lakh of Population	0.643	0.645	0.83	2.9893	18.07
Number of CHCs per lakh of Population	0.664	-0.201	0.481	2.1908	13.24
Number of PHCs per lakh of Population	0.695	-0.619	0.866	3.0804	18.62
Number of Sub-centre per lakh of Population	0.792	-0.45	0.831	3.0182	18.24
Number of Dispensaries per lakh of Population	0.225	0.864	0.798	2.2760	13.76
Number of Beds per lakh of Population	0.837	0.371	0.838	2.9882	18.06
Variance (%)	45.27	32.112	Total	16.5429	100.00
Cumulative variance (%)	45.27	77.382			

KMO measures of sampling adequacy- 0.636
Significance level of Bartlett's test of sphericity- 0.000

Table 8 points out the result of factor analysis with weights for health infrastructure for the period of 2000-01. Bartlett's test showed significant value that shows factor analysis possibility. Two factors have come out from the selected indicators which together explain 77 percent cumulative variance. Individually both factors explained 45.27 percent and 32.11 percent respectively. Communality values lied in the range of 0.798 to 0.866 that means two factors were sufficient to explain the variance of original variables, except the number of CHCs per lakh of population which was at 0.481. The factor values showed that number of CHCs per lakh of population, number of sub-centers per lakh of population and number of beds per lakh of population had higher association with first factor whereas number of dispensaries per lakh of population had contributed significantly in second factor. But, number of hospitals and number of PHCs per lakh of population contributed less in both factors. From the selected variables, four variables got almost equal importance in weights which were more than 18 percent. Remaining two variables contributed about 13 percent each in weights.

Table-9

Results of Factor Analysis for Education Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
No. of Primary Schools per 100 sq km of Area	0.73	-0.358	0.661	2.9255	15.92
No. of Middle Schools per 100 sq km of Area	0.897	-0.415	0.976	3.5560	19.36
No. of High Schools per 100 sq km of Area	0.804	-0.296	0.734	3.0688	16.70
Student-Teacher ratio of Primary Schools	0.646	0.733	0.954	3.2377	17.62
Student-Teacher ratio of Middle Schools	0.593	0.79	0.975	3.1547	17.17
Student-Teacher ratio of High Schools	0.701	-0.1	0.501	2.4292	13.22
Variance (%)	54.05	25.979	Total	18.3720	100.00
Cumulative variance (%)	54.05	80.029			

KMO measures of sampling adequacy- 0.386
Significance level of Bartlett's test of sphericity- 0.000

The above table 9 reveals the result of factor analysis for education infrastructure for 2017-18. KMO and Bartlett's test shows significance level and applicability of factor analysis. Again two factors had come out from selected six variables. First factor explained 54 percent and second factor explained 26 percent, in together both of these factors explained 80 percent of variance. Half of the variables contributed more than 90 percent in Communality values and remaining half contributed in the range of 0.501 to 0.734. Four out of six variables contributed highly in the growth of first factor and remaining two variables which were student-teacher ratio in primary (0.733) and middle schools (0.79) contributed in second factor. From selected indicators, number of middle school per 100 sq. km. performed highest in weights with a value of 19.36 percent, followed by student-teacher ratio in primary (17.62) and middle schools ((17.17). No. of primary schools per 100 sq. km. of area (15.92) and student-teacher ratio in high schools had performed least in weights as well as education infrastructure development.

Table-10

Results of Factor Analysis for Health Infrastructure- 2017-18

Indicators	Factor 1	Factor 2	Communality	Weights	Weights (in %)
Number of hospitals per lakh of population	0.484	0.307	0.329	1.9444	12.50
Number of CHCs per lakh of population	0.824	-0.274	0.755	2.8837	18.54
Number of PHCs per lakh of population	0.964	-0.086	0.937	2.9711	19.10
Number of sub-centre per lakh of population	0.904	-0.128	0.833	2.8675	18.43
Number of dispensaries per lakh of population	-0.152	0.908	0.848	2.0033	12.88
Number of beds per lakh of population	0.495	0.836	0.943	2.8844	18.54
Variance (%)	48.816	28.594	Total	15.5545	100
Cumulative variance (%)	48.816	77.41			

KMO measures of sampling adequacy- 0.437
Significance level of Bartlett's test of sphericity- 0.000

Table 10 depicts the result of factor analysis for health infrastructure. KMO and Bartlett's test values were significant that made factor analysis possible. Two factors had been derived from all six selected variables. First factor explained 49 percent variance and second factor did 28 percent. Total cumulative variance was 77 percent. In first factor, three variables were highly associated namely number of CHCs (0.824), PHCs (0.964) and sub-centers (0.904) per lakh of population. While two factors; number of dispensaries (0.908) and beds (0.836) per lakh of population contributed to second factor. Remaining variable; number of hospitals per lakh of population contributed with small amount in both factors. The communality values for all variables except number of hospitals per lakh of population were found more than 75 percent in the range of 0.755 to 0.943. Four variables which were number of PHCs (19.10), CHCs (18.54), beds (18.54), sub-centers (18.43) percent per lakh of population, received highest and almost equal weights. Number of hospitals and number of dispensaries per lakh of population got 12.50 percent and 12.88 percent of weights respectively and contributed least to health infrastructure development.

District-wise Composite Index using PCA techniques

Table 11 and 12 show district-wise Infrastructure development for years 2000-01 and 2017-18. Procedure has been discussed in methodology.

Table-11

District-wise Composite Index of Infrastructure for the year 2000-01

Districts	Education Index	Health Index	R1	R2
Ambala	0.2557	0.4342	5	6
Panchkula	0.0959	0.5717	19	4
Yamuna Nagar	0.2480	0.4974	6	5
Kurukshetra	0.2186	0.3505	9	13
Kaithal	0.2470	0.3467	7	14
Karnal	0.1467	0.3399	14	15
Panipat	0.2754	0.2382	3	18
Sonipat	0.1438	0.3340	15	16
Rohtak	0.1041	0.9139	18	1
Jhajjar	0.1876	0.3601	10	12
Faridabad	0.7644	0.1735	1	19
Gurugram	0.3306	0.2576	2	17
Rewari	0.2747	0.4300	4	8
Mahendergarh	0.2303	0.4305	8	7
Bhiwani	0.1838	0.6616	11	2
Jind	0.1590	0.4066	13	9
Hisar	0.1594	0.5941	12	3
Fatehabad	0.1409	0.3994	16	10
Sirsa	0.1135	0.3733	17	11
Mean	0.23	0.43		
S.D.	0.15	0.17		
C.V. (%)	64.89	39.48		

Table 11 shows district-wise composite index of social infrastructure for 2000-01. This composite index was calculated with the help of weights and normalized value of that indicator for every district. Ranks to all districts have been given in descending order. R1 shows rank for education index and R2 for health index. Out of total 19 districts only 08 districts were found above district average in both types of infrastructure. In education index Faridabad and Gurugram were on top two position followed by Panipat, Rewari and Ambala. Panchkula and Rohtak were on bottom positions in education index. Again positions of districts changed in health index, district of Rohtak which was on last position in education index performed best in health index and got first position followed by Bhiwani, Hisar, Panchkula and Yamunanagar. Faridabad was on last position in health index. Value of coefficient of variance was found higher for education index (64.89 percent).

Table-12

District-wise Composite Index of Infrastructure for the year 2017-18

Districts	Education Index	Health Index	R1	R2
Ambala	0.2515	0.4143	9	15
Panchkula	0.1728	0.5874	13	5
Yamuna Nagar	0.3446	0.4217	5	14
Kurukshetra	0.2595	0.4865	8	12
Kaithal	0.1342	0.4762	17	13
Karnal	0.2323	0.3803	10	16
Panipat	0.2887	0.3329	7	17
Sonipat	0.3614	0.4927	4	11
Rohtak	0.1484	0.5229	16	9
Jhajjar	0.1066	0.7299	21	2
Faridabad	0.7610	0.0456	1	21
Palwal	0.3195	0.3107	6	18
Gurugram	0.6318	0.1485	2	20
Nuh	0.4531	0.3027	3	19
Rewari	0.2159	0.5465	11	7
Mahendgarh	0.1581	0.6473	15	3
Bhiwani	0.1238	0.7420	20	1
Jind	0.1750	0.5053	12	10
Hisar	0.1275	0.5249	19	8
Fatehabad	0.17113	0.6227	14	4
Sirsa	0.13024	0.5491	18	6
Mean	0.27	0.47		
S.D.	0.17	0.17		
C.V. (%)	64.70	37.12		

Table 12 reveals composite index of social infrastructure for 2017-18. In health index 13 out of 21 districts were above districts average, while in education index only 07 districts were above districts average. Faridabad and Gurugram continued to be on first and second position respectively in 2018-18 as well. Jhajjar and Bhiwani performed worst in education index and dropped down to bottom two positions. In health index, Bhiwani district did excellent and got first position, Jhajjar district also improved continuously over the years and came on second position in 2017-18. Faridabad, Gurugram continued their last positions in 2017-18 as well. The coefficient of variance found again higher in education index (64.70 percent). It was found that throughout the study period higher districts disparities were found in education index.

Infrastructure Development Index- District wise

Infrastructure development index was obtained by taking out the average of district-wise composite index values. Ranks to each district were given in descending values order. Procedure has been discussed in methodology.

Table-13

District-wise Infrastructure Development Index Calculated from Composite Index Values

Districts	2000-01		2017-18	
	IDI	Rank	IDI	Rank
Ambala	0.3450	7	0.3329	16
Panchkula	0.3338	8	0.3801	10
Yamuna Nagar	0.3727	5	0.3832	8
Kurukshetra	0.2846	12	0.373	12
Kaithal	0.2969	10	0.3052	21
Karnal	0.2433	18	0.3063	20
Panipat	0.2568	16	0.3108	19
Sonipat	0.2389	19	0.4271	2
Rohtak	0.509	1	0.3357	15
Jhajjar	0.2739	14	0.4183	3
Faridabad	0.4690	2	0.4033	4
Palwal	0	-	0.3151	18
Gurugram	0.2941	11	0.3902	7
Nuh	0	-	0.3779	11
Rewari	0.3524	6	0.3812	9
Mahendergarh	0.3304	9	0.4027	5
Bhiwani	0.4227	3	0.4329	1
Jind	0.2828	13	0.3402	13
Hisar	0.3768	4	0.3262	17
Fatehabad	0.2702	15	0.3969	6
Sirsa	0.2434	17	0.3397	14

Table 13 presents district-wise infrastructure development index which was derived from average of composite index values of both infrastructure (Education and Health). Rohtak district was found on top of the table in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonipat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.

Classification of Districts on the basis of Infrastructural Development Index

In this sub-section districts have been classified in three categories: Developed, Moderately developed, and less developed by using average and standard deviation values of Infrastructure development index. Procedure has been discussed in methodology.

Table-14

District-wise classification based on Infrastructure Development Index Values

Districts	2000-01		2017-18	
	IDI	Category	IDI	Category
Ambala	0.3450	MD	0.3329	LD
Panchkula	0.3338	MD	0.3801	MD
Yamuna Nagar	0.3727	D	0.3832	MD
Kurukshetra	0.2846	LD	0.373	MD
Kaithal	0.2969	MD	0.3052	LD
Karnal	0.2433	LD	0.3063	LD
Panipat	0.2568	LD	0.3108	LD
Sonapat	0.2389	LD	0.4271	D
Rohtak	0.509	D	0.3357	LD
Jhajjar	0.2739	LD	0.4183	D
Faridabad	0.4690	D	0.4033	D
Palwal	0	-	0.3151	LD
Gurugram	0.2941	MD	0.3902	D
Nuh	0	-	0.3779	MD
Rewari	0.3524	MD	0.3812	MD
Mahendergarh	0.3304	MD	0.4027	D
Bhiwani	0.4227	D	0.4329	D
Jind	0.2828	LD	0.3402	D
Hisar	0.3768	D	0.3262	LD
Fatehabad	0.2702	LD	0.4607	D
Sirsa	0.2434	LD	0.3815	LD

D: Developed, MD: Moderate Developed, LD: Less Developed

D= ≥ 0.3646 , MD= > 0.2877 & < 0.3646 and LD = ≤ 0.2877 for the year 2000-01

D= ≥ 0.3863 , MD= > 0.3450 & < 0.3863 and LD = ≤ 0.3450 for the year 2017-18

Table 14 shows classification of districts on the basis of Infrastructure Development index for two study periods that are 2000-01 and 2017-18. In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

Major Findings of the Study

- The study shows that there are less number of middle schools in comparison to primary and high school throughout the study period.
- Student-teacher ratio is decreasing continuous in primary and middle schools which is an excellent sign of development.
- The study found that the total numbers of dispensaries are decreasing continuously over the years and reached to only 63 in 2017-18 from 229 in 2000-01. It has happened because people in rural areas stopped going to dispensaries for treatment and prefer to move to city hospitals.
- Number of hospitals had declined from 78 in 2000-01 to 62 in 2017-18 because of that number of beds per lakh of population also showed declining trends.

- The disparities in number of primary schools per 100 sq. km. of area have been decreased in 2017-18 as compare to 2000-01. The disparity in number of middle and high schools increased throughout the selected time periods.
- Inter-district disparities in student-teacher ratio in primary, middle and high schools have been increased in 2017-18 in comparison to 2000-01. Almost every district has improved the performance in reducing the student-teacher ratio in primary and middle schools while student-teacher ratio in high schools saw an increase in every district except Rewari and Mahendragarh from 2000-01 to 2017-18.
- The disparity in case of number of hospitals per lakh of population decreased from 67.25 in 2000-01 to 45.21 in 2017-18. The disparities in case of number of CHCs and PHCs per lakh of population decreased in 2017-18.
- The disparity in case of number of sub-centres and dispensaries per lakh of population increased over the selected time period. In case of dispensaries the disparities were increased drastically in 2017-18. The disparities in case of number of beds per lakh of population decreased over the time periods.
- Rohtak district was found on top in 2000-01, but in 2017-18 Rohtak severely slipped down to 15th position due to poor performance in health infrastructure. District of Hisar slipped down to 17th position in 2017-18 from fourth rank in 2000-01. Sonapat district exemplary improved its position from 14th in 2000-01 to third position in 2017-18. On the lowest side districts of Kaithal, Karnal and Panipat slipped down to last positions respectively in 2017-18.
- In 2000-01, there were five districts out of nineteen in the developed category, six in moderate developed category and eight districts were found in less developed category. That shows the number of less developed districts were more as compare to developed and moderately developed districts. In 2017-18, developed districts had increased whereas numbers of low developed districts remained same. That showed slight development of districts from 2000-01 to 2017-18.

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