

## Dynamics of inter-district developmental disparities in Haryana

Ekta Hooda, B. K. Hooda and Veena Manocha

Department of Mathematics, Statistics & Physics, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004 (Haryana), INDIA

\*Corresponding author. E-mail: bkhooda@gmail.com

Received: August 14, 2016; Revised received: February 7, 2017; Accepted: May 3, 2017

**Abstract:** The present study deals with the development disparities in districts of Haryana according to their level of development. The study utilized data over three points of time, viz. 1991-92, 2001-02, and 2011-12. Assessment of development in agricultural, industrial, infrastructural and socio-economic sectors has been studied using composite indices based on forty indicators. Out of the forty indicators, 19 were directly concerned with agricultural development, 4, 8 and 9 respectively reflected the progress of development in industrial, infrastructural, and socio-economic sectors. Sector-wise indices were combined to obtain weighted index for the overall development. The study indicated wide disparities in level of development among districts of Haryana in all the periods of study. The district of Mahendragarh lagged behind in almost all the sectors considered for this study. The districts of Faridabad and Gurgaon lagged behind in agriculture while the district of Karnal excelled in agriculture in all the three periods. The districts of Ambala, Faridabad and Gurgaon ranked first in overall development in 1991-92, 2001-02 and 2011-12, respectively, whereas Mahendragarh ranked last in 1991-92 and 2001-02 and the newly formed district Mewat in 2011-12. Spearman's rank correlation was used to study relationships among sectoral developments. Kruskal Wallis test indicated significant changes in development level of industry and infrastructure sectors over the periods 1991-92, 2001-02 and 2011-12.

**Keywords:** Composite Indices of Development, Kruskal Wallis Test, Regional Disparities, Spearman's rank correlation.

### INTRODUCTION

Development is a multi-dimensional phenomenon and may be defined as a process, which improves the quality of life. Depending upon its geographical and climatic conditions, development in a region varies over both time and space. Development of social sector along with technology absorption in agriculture, infrastructure and industry can be considered as the primary objective of any socio-economic efforts for betterment of the society (Bhatia and Rai, 2004).

The process of development cannot be captured fully by any single indicator. Also, a number of indicators analyzed individually do not provide an easily comprehensible picture of the true development patterns. Ranking, indexing and principal component analysis (PCA) based methods have generally been used for estimating levels of regional development, (Prabhu and Sarkar, 1992). In simple ranking method, each district is ranked as per the values of various indicators and then the individual ranks are added to get a total rank of the district. In indexing method, an index of development for each district is computed on the basis of the selected indicators. In PCA based method the researcher can develop new and orthogonal dimensions with decreasing variance. Narain *et al.* (1991) developed methodology for the construction of

composite index which has been applied by Narain *et al.* (2007a, 2009) and many others to analyze the data on socio-economic dimensions of different states of India and to observe wide disparities in the levels of development. Tanwar *et al.* (2016) used composite index and PCA methods to study the dynamics of socio-economic development of Eastern Uttar Pradesh.

Socio-economic development has attracted attention of policy maker not only in developing countries but also in the advanced countries of the world. Economic planning of a country is aimed at bringing about a balanced regional development and reduction in regional disparities in the pace of development. Many developmental programmes have been formulated and executed in India since independence to enhance the quality of life of people by providing basic necessities for effective improvement in their social and economic standard. These programmes have been taken through five year plans and annual plans. The overall socio-economic condition of the masses has considerably improved after independence. The literacy level, housing condition and quality of life have gone up. Unfortunately, the disparities in level of development can still be observed at districts and state levels with certain areas went ahead leaving other lagged behind

(Narian *et al.*, 2007b). Therefore, the present study has been planned to study the dynamics of inter-district development in Haryana. Assessment of development in agricultural, industrial, infrastructural and socio-economic sectors has been studied using composite indices based on forty indicators. The relationships between developments in agriculture, industry, infrastructural facilities and socio-economic sectors have been studied using the Spearman's rank correlation coefficient. The study utilized data for different districts over three points of time, 1991-92, 2001-02, and 2011-12. Knowledge of the development scenario at district level helps in identifying the relative position of districts and shifts in development patterns over time. Hooda and Tonk (1998) classified districts of Haryana using 1995-96 data but no rigorous attempt has been made to study the dynamics of development over time and space in the state of Haryana. This study gives development patterns of districts over the period 1991-92, 2001-02 and 2011-12 and throws light on the relationship among agricultural, industry, infrastructure facilities and socio-economic sector developments in districts of Haryana. Statistical significance of changes in the level of development over the periods has been examined to study dynamics in development with respect to agricultural, industry, infrastructure facilities and socio-economic sectors.

## MATERIALS AND METHODS

**Study area:** For this study, an individual district has been considered as the unit of analysis. The number of districts in Haryana increased with the creation of new districts over the years. The number of districts was 16, 19 and 21, respectively in periods 1991-92, 2001-02 and 2011-12. The necessary secondary data were collected from the various issues of Statistical Abstract of Haryana published by Department of Economic and Statistics Government of Haryana, and census of India 2011. Assessment of development in agricultural, industrial, infrastructural and socio-economic sectors has been studied using composite indices based on forty indicators. Out of the forty indicators, 19 were directly concerned with agricultural development, 4, 8 and 9 respectively reflected the progress of development in the industrial, infrastructural and socio-economic sector. The sector wise composite indices of development for different districts have been constructed by using the data on the following indicators:

1. Percentage of gross area sown under foodgrain to total cropped area
2. Irrigation intensity
3. Percentage of gross area sown under commercial crops to total cropped area
4. Gross value from agriculture/ha at current prices
5. Gross value of agriculture output per capita(rural) at current prices
6. Percentage of area under HYV of wheat to total

cropped area

7. Productivity of cereals( $t/ha$ )
8. Productivity of pulses( $t/ha$ )
9. Productivity of oilseeds( $t/ha$ )
10. Number of regulated markets
11. Percentage of agriculture workers to total work force
12. Cropping intensity
13. Average annual rainfall
14. Number of tractors/000ha of gross cropped area
15. Tubewells and pumpsets/000ha of gross cropped area
16. Fertilizer consumption(in kg) in terms of nutrients / ha of gross cropped area
17. Cattle per sq km
18. Buffaloes per sq km
19. Poultry per sq km

### Indicators for industry sector

20. Number of registered working factories
21. Number of workers per lakh population in registered factories
22. Per capita value added by manufacturing (at current prices)
23. Percentage of manufacturing industry workers to total work force

### Indicators for infrastructure sector

24. Number of hospitals per lakh population
25. Number of beds in hospital per lakh population
26. Number of Civil Veterinary Hospitals and Civil Veterinary Dispensaries
27. Surfaced road length per 100 sq km of geographical area
28. Scheduled commercial banks
29. Per capita deposits in scheduled commercial banks
30. Number of middle and high schools per 1000 school going children
31. Number of villages connected to metal roads (%)

### Indicators for socio-economic sector

32. Main workers as % of total population
33. Literacy (%)
34. Female literacy (%)
35. Population density per sq km
36. Infant mortality rate
37. Number of registered motor vehicles/lakh population
38. Number of vehicles on road/lakh population
39. Number of cooperative societies/lakh population
40. Urban population (%)

### Method of analysis:

#### Construction of Composite development index (Narain *et al.*, 1991):

Let  $X_{ij}$  denote be the value of  $j^{\text{th}}$  indicator of development for the  $i^{\text{th}}$  district, where  $I = 1, 2, \dots, n$  and  $j = 1, 2, \dots, p$ . The methodological steps for construction of CI given by Narian *et al.* (1991) are summarized below:

Step-1: Standardize data for each indicator using the transformation

$$Z_{ij} = \frac{X_{ij} - \bar{X}_j}{s_j}, \text{ where,}$$

$$\bar{X}_j = \frac{1}{n} \sum_{i=1}^n X_{ij}$$

Step-2: Identify the best value development ( $Z_{oj}$  for  $j^{\text{th}}$  indicator), i.e. maximum/minimum depending upon the direction of impact of the indicator.

Step-3: Obtain the pattern of development ( $C_i$ ) for  $i^{\text{th}}$  district as

$$C_i = \left[ \sum_{j=1}^p (Z_{ij} - Z_{oj})^2 \right]^{1/2}.$$

Step-4: Compute the composite index  $D_i = C_i /$

$$(\bar{C} + 2s),$$

Where,

$$\bar{C} = \sum_{i=1}^n C_i / n$$

and

$$s = \sqrt{\sum (C_i - \bar{C})^2 / n}.$$

According to Narian *et al.* (1991) the value of composite index is non-negative and lies between 0 and 1. Also, a value closer to zero indicates the higher level of development while the value closer to 1 indicates the lower level of development. However,  $D_i$  may exceed 1 in probability and the normalized index defined below always lies between 0 and 1 and includes the values 0 and 1. The ranking of districts based on normalized indices is identical to CI based ranking.

**Weighted mean index for overall development (Iyenagar and Sudarsha, 1982):** Let  $D_{ik}$  denote the value of composite index of  $i^{\text{th}}$  district for the sector  $k$  ( $k=1, 2, 3, 4$ ) for various sectors, i.e. agriculture, industry, infrastructure and socio-economic respectively). Then normalized index (Hooda and Tonk, 1998) of  $i^{\text{th}}$  district for the sector 'k' is given by

$$Y_{ik} = \frac{D_{ik} - \min(D_{1k}, D_{2k}, \dots, D_{nk})}{\max(D_{1k}, D_{2k}, \dots, D_{nk}) - \min(D_{1k}, D_{2k}, \dots, D_{nk})}$$

However, if  $D_{ik}$  is negatively associated with development, i.e. lower is better (as the composite indices calculated in our case), then the normalized index  $Y_{ik}$  is positively related with the development and is given by

$$Y_{ik} = \frac{\max(D_{1k}, D_{2k}, \dots, D_{nk}) - D_{ik}}{\max(D_{1k}, D_{2k}, \dots, D_{nk}) - \min(D_{1k}, D_{2k}, \dots, D_{nk})}$$

The normalized composite index increase or decrease in the direction of the development i.e. lower values imply lesser development and higher values imply higher development level.

The weighted mean index representing the overall development was computed using the formula suggested by Iyenagar and Sudarshan (1982),

$$\bar{Y}_{wi} = \sum_{k=1}^4 W_k Y_{ik}$$

Where, ( $0 \leq W_k \leq 1$  and  $W_1 + W_2 + W_3 + W_4 = 1$ ) are the weights attached with the various sectoral indices and  $W_k$  is computed as:

$$W_k = \frac{K}{\sqrt{\text{Var}(Y_k)}}, \text{ where,}$$

$$K = \left[ \sum_{k=1}^4 \frac{1}{\sqrt{\text{Var}(Y_k)}} \right]^{-1}$$

The weighted  $\bar{Y}_{wi}$  mean which represents the overall development of a district also lies between zero and one. The districts were classified as less developed, developing and developed using the following criteria:

Less developed: if  $\bar{Y}_{wi} < \text{mean}(\bar{Y}_{wi}) - \text{sd}(\bar{Y}_{wi})$

Developed : if  $\bar{Y}_{wi} > \text{mean}(\bar{Y}_{wi}) + \text{sd}(\bar{Y}_{wi})$  and

Developing : if  $\text{mean}(\bar{Y}_{wi}) - \text{sd}(\bar{Y}_{wi}) \leq \bar{Y}_{wi} \leq \text{mean}(\bar{Y}_{wi}) + \text{sd}(\bar{Y}_{wi})$

**Change in Development levels over periods:**

After computing the composite indices of development for each sector over different time periods, it is of interest to examine the statistical significance of changes in the level of development over various periods. The Kruskal-Wallis test was used to test the null hypothesis of no change in the level of development over the periods, i.e. 1991-92, 2001-02 and 2011-12 with respect to agricultural, industrial, infrastructural facilities, socio-economic status and overall development in the state of Haryana.

The Kruskal Wallis test statistic H is defined as:

$$H = \frac{12}{N(N+1)} \sum_{j=1}^k \frac{R_j^2}{n_j} - 3(N+1)$$

Here,  $n_j$  is the number of districts in  $j^{\text{th}}$  period;  $k$  is the number of periods and  $R_j$  denote the sum of ranks of the  $j^{\text{th}}$  period for all the districts and

$$N = \sum_{j=1}^k n_j$$

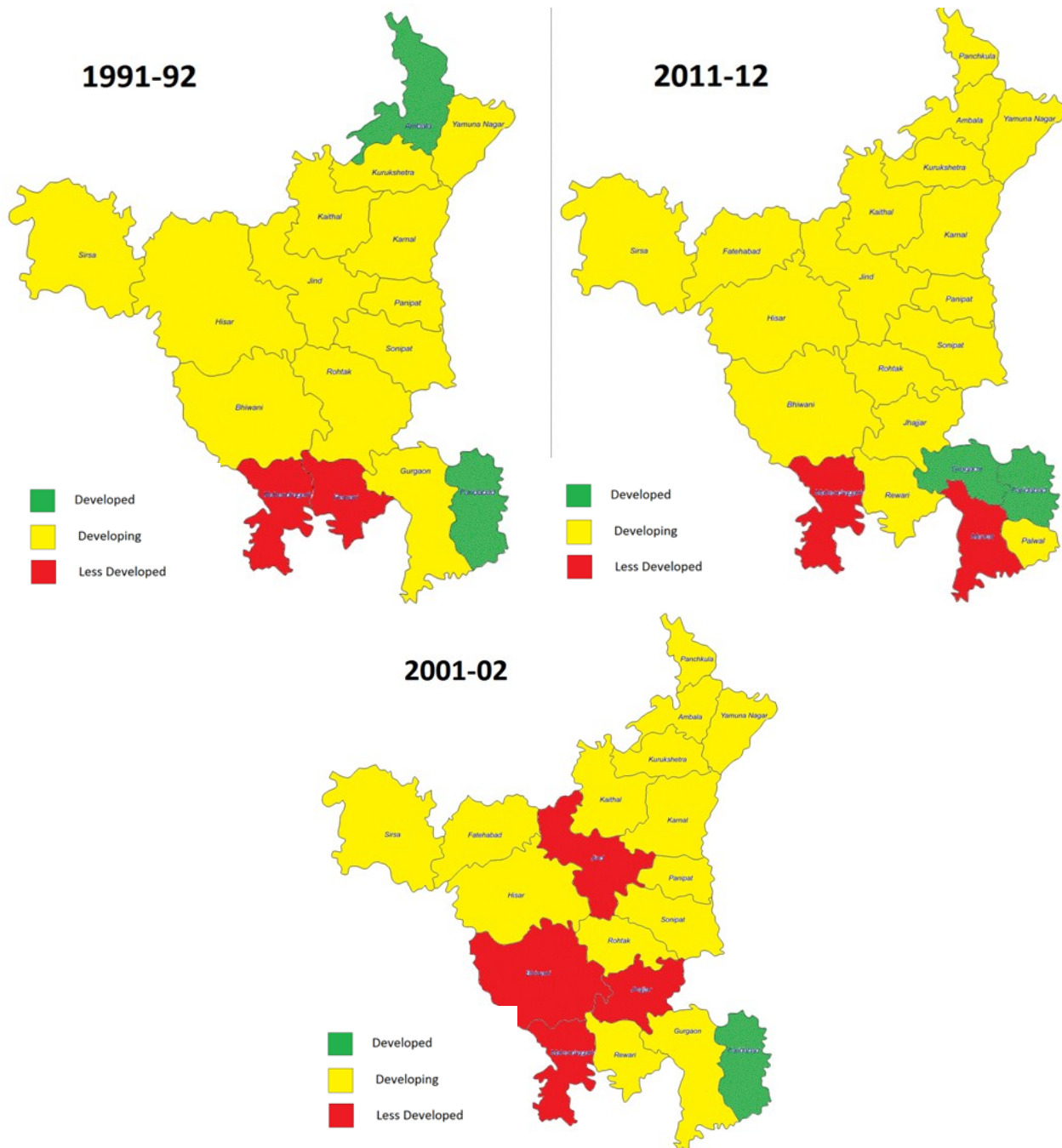
Under null hypothesis, the statistic  $H$  is distributed as chi-square with  $(k-1)$  degrees of freedom.

## RESULTS AND DISCUSSION

The composite indices of development along with the

district ranks for three periods are given in Tables 1 to Table 3, along with the CV for the composite indices.

In case of agricultural development, it may be seen from the Table 1 that for the period 1991-92, out of sixteen districts of the state in existence the district of Karnal was ranked first followed by Kurukshetra and Kaithal. The district of Bhiwani was ranked last followed by Rewari in agricultural development. Three more districts (Panchkula, Jhajjar and Fatehabad) were created in the nineties and in the period 2001-02, data from nineteen districts were used in the analysis. It may be observed from the Table 2 that in Period II,



**Fig. 1.** Development disparities and dynamics in Haryana during 1991-92, 2001-02 and 2011-12.

**Table 1.** Composite Indices (CI) of Development for various districts during 1991-92.

Districts	Agriculture		Industry		Infrastructure		Socio-Economic	
	CI	Rank	CI	Rank	CI	Rank	CI	Rank
Ambala	0.663	8	0.595	6	0.219	1	0.327	1
Yamunanagar	0.636	4	0.438	2	0.310	5	0.700	8
Kurukshetra	0.451	2	0.743	11	0.348	9	0.596	6
Kaithal	0.602	3	0.766	15	0.383	16	0.867	15
Karnal	0.406	1	0.641	7	0.351	10	0.532	3
Panipat	0.648	5	0.562	3	0.381	15	0.594	5
Sonipat	0.661	7	0.593	5	0.365	13	0.584	4
Rohtak	0.884	14	0.710	10	0.265	3	0.701	9
Faridabad	0.768	11	0.000	1	0.337	6	0.385	2
Gurgaon	0.805	12	0.587	4	0.345	8	0.656	7
Rewari	0.894	15	0.652	8	0.352	11	0.785	12
Mahendragarh	0.867	13	0.780	16	0.380	14	0.954	16
Bhiwani	0.927	16	0.746	12	0.302	4	0.814	13
Jind	0.659	6	0.761	14	0.359	12	0.815	14
Hisar	0.712	9	0.709	9	0.225	2	0.767	11
Sirsa	0.763	10	0.755	13	0.339	7	0.714	10
CV	20.50	-	29.71	-	15.25	-	24.13	-

**Table 2.** Composite Indices (CI) of Development for various districts during 2001-02.

Districts	Agriculture		Industry		Infrastructure		Socio-Economic	
	CI	Rank	CI	Rank	CI	Rank	CI	Rank
Ambala	0.822	11	0.367	8	0.703	6	0.637	5
Panchkula	0.890	15	0.364	7	0.703	5	0.450	1
Yamunanagar	0.762	8	0.261	3	0.720	7	0.733	9
Kurukshetra	0.648	2	0.419	14	0.858	11	0.612	4
Kaithal	0.667	3	0.448	18	0.924	18	0.868	18
Karnal	0.619	1	0.367	9	0.824	10	0.689	6
Panipat	0.716	7	0.316	4	0.791	8	0.595	3
Sonipat	0.712	6	0.359	5	0.874	15	0.788	11
Rohtak	0.845	12	0.390	11	0.626	1	0.767	10
Jhajjar	0.935	17	0.373	10	0.876	16	0.797	14
Faridabad	0.852	13	0.079	1	0.675	3	0.457	2
Gurgaon	0.937	18	0.195	2	0.683	4	0.713	7
Rewari	0.890	14	0.361	6	0.964	19	0.792	12
Mahendragarh	0.948	19	0.403	13	0.913	17	0.795	13
Bhiwani	0.920	16	0.439	15	0.819	9	0.872	19
Jind	0.670	4	0.439	16	0.873	14	0.834	16
Hisar	0.768	9	0.398	12	0.666	2	0.732	8
Fatehabad	0.694	5	0.454	19	0.868	13	0.856	17
Sirsa	0.778	10	0.440	17	0.865	12	0.824	15
CV	13.36	-	25.46	-	12.40	-	16.93	-

the district of Karnal occupied first position followed by Kurukshetra and Kaithal once again whereas the district of Mahendragarh occupied the last position in agriculture sector instead of Bhiwani as in Period-I. In period-III, i.e. during 2011-12, data from twenty-one districts were used for construction of composite indices and the indices along with the ranks of districts are presented in Table 3. Again, as in period-II, the districts of Karnal and Mahendragarh occupied the

first and last position respectively in agricultural development in the Period-III. The coefficient of variation for agriculture sector was maximum(20.58%) in the period 1991-92 and minimum (12.54%) in the period 2011-12 implying that the regional disparities in agriculture sector had declined over time.

In case of industrial development in Period-I, the district of Faridabad ranked first with CI value of zero indicating that Faridabad performed best in all the four

**Table 3.** Composite Indices (CI) of Development for various districts during 2011-12.

Districts	Agriculture		Industry		Infrastructure		Socio-Economic	
	CI	Rank	CI	Rank	CI	Rank	CI	Rank
Ambala	0.740	9	0.708	12	0.833	12	0.668	7
Panchkula	0.911	17	0.695	11	0.809	8	0.426	2
Yamunanagar	0.712	7	0.600	3	0.792	5	0.729	11
Kurukshetra	0.666	2	0.773	16	0.829	11	0.631	4
Kaithal	0.710	6	0.808	17	0.874	17	0.790	14
Karnal	0.661	1	0.715	13	0.907	18	0.661	6
Panipat	0.702	4	0.610	4	0.848	14	0.660	5
Sonipat	0.715	8	0.674	8	0.813	10	0.702	9
Rohtak	0.862	14	0.723	14	0.672	1	0.770	13
Jhajjar	0.900	15	0.671	7	0.793	6	0.745	12
Faridabad	0.788	11	0.329	2	0.808	7	0.340	1
Palwal	0.761	10	0.660	6	0.951	19	0.837	20
Gurgaon	0.901	16	0.103	1	0.695	2	0.450	3
Mewat	0.937	20	0.685	10	0.998	21	0.990	21
Rewari	0.920	18	0.620	5	0.858	15	0.689	8
Mahendragarh	0.972	21	0.674	9	0.997	20	0.813	18
Bhiwani	0.932	19	0.811	18	0.736	3	0.819	19
Jind	0.694	3	0.813	19	0.868	16	0.791	15
Hisar	0.801	13	0.745	15	0.739	4	0.714	10
Fatehabad	0.707	5	0.819	21	0.847	13	0.800	16
Sirsa	0.799	12	0.816	20	0.813	9	0.811	17
CV	12.54	-	24.73	-	10.05	-	20.77	-

indicators of industrial development included in the present study. The districts of Yamunanagar and Panipat ranked second and third respectively, whereas the district of Mahendragarh ranked last. The district of Faridabad retained the first position in period-II followed by Gurgaon, whereas the district of Fatehabad was placed at last position. In period-III, out of twenty-one districts in the state, Gurgaon captured the first position while Fatehabad was once again ranked at the last position. The coefficient of variation tended to decrease over the three periods suggesting that regional disparities in industrial sector declined during the three decades.

The development in infrastructural sector is extremely essential for improving the overall level of development which depends on agricultural growth, economic and social advancement, and infrastructural facilities for public health, education and communication systems. With respect to infrastructural facilities, the district of Ambala was ranked first followed by Hisar and the district of Kaithal was ranked last in the period 1991-92 while the district of Rohtak occupied the first position followed by Hisar and the district of Rewari was at the lowest web of development in the period 2001-02. The district of Rohtak was ranked first followed by Gurgaon in period-III of this study while Mewat was ranked last. The coefficient of variation in this sector tended to decline over the periods indicating that the regional disparities in case of infrastructural facilities declined substantially over the periods. CV

values also indicated that regional disparities were lowest in case of infrastructure sector development level as compared to other three sectors.

The analysis of the socio-economic sector revealed that the district of Ambala captured the first rank followed by Faridabad for the period-I while the district of Mahendragarh was ranked last. In period-II, the newly formed district Panchkula got first rank followed by Faridabad while the district of Bhiwani was ranked last. It is worth noting that Ambala slipped to fifth position from the first position in Period-I which may be attributed to the separation of area under Panchkula which earlier formed a part of Ambala district. The districts of Faridabad and Panchkula shuffled their ranks in period-III, with Faridabad securing the first rank. The newly formed district of Mewat was ranked last in socio-economic development in period-III. The coefficient of variation declined in the second period and tended to increase in the third period implying that disparities widened slightly towards the third period.

The ranks of districts representing the level of overall development over the periods 1991-92, 2001-02 and 2011-12 are given in Table 4. The district of Ambala ranked first in overall development in the period 1991-92 followed by Faridabad while the district of Mahendragarh ranked last. The district of Faridabad improved its position during 2001-02 and obtained rank followed by Panipat while Ambala slipped to 7<sup>th</sup> place in overall development. A similar pattern was

**Table 4.** Weighted Mean Index of Overall Development

Period-I (1991 = 92)			Period-II (2001-02)			Period-III (20011-12)		
District	$\bar{Y}_{wi}$	Rank	District	$\bar{Y}_{wi}$	Rank	District	$\bar{Y}_{wi}$	Rank
Ambala	0.667	1	Ambala	0.476	7	Ambala	0.455	8
Yamunanagar	0.460	4	Panchkula	0.541	3	Panchkula	0.476	7
Kurukshetra	0.428	5	Yamunanagar	0.530	4	Yamunanagar	0.520	3
Kaithal	0.191	13	Kurukshetra	0.456	9	Kurukshetra	0.496	5
Karnal	0.508	3	Kaithal	0.225	14	Kaithal	0.353	15
Panipat	0.359	8	Karnal	0.495	6	Karnal	0.450	11
Sonipat	0.367	7	Panipat	0.548	2	Panipat	0.509	4
Rohtak	0.308	9	Sonipat	0.346	11	Sonipat	0.485	6
Faridabad	0.651	2	Rohtak	0.423	10	Rohtak	0.451	10
Gurgaon	0.300	10	Jhajjar	0.178	16	Jhajjar	0.366	13
Rewari	0.173	15	Faridabad	0.804	1	Faridabad	0.731	2
Mahendragarh	0.032	16	Gurgaon	0.503	5	Palwal	0.298	19
Bhiwani	0.179	14	Rewari	0.158	17	Gurgaon	0.784	1
Jind	0.220	12	Mahendragarh	0.121	19	Mewat	0.073	21
Hisar	0.413	6	Bhiwani	0.135	18	Rewari	0.348	16
Sirsa	0.242	11	Jind	0.286	12	Mahendragarh	0.136	20
			Hisar	0.459	8	Bhiwani	0.303	18
			Fatehabad	0.250	13	Jind	0.365	14
			Sirsa	0.224	15	Hisar	0.454	9
						Fatehabad	0.366	12
						Sirsa	0.331	17

**Table 5.** Pair-wise Rank Correlations between different pairs of sectors.

Pair of Sectors	1991-92	2001-02	2011-12
Agriculture & Industry	0.001	-0.298	-0.238
Agriculture & Infrastructure	-0.172	-0.217	-0.044
Agriculture & Socio-Economic	0.375	-0.070	0.053
Industry & Infrastructure	0.024	0.521*	0.248
Industry & Socio-Economic	0.636**	0.613**	0.649**
Infrastructure & Socio-Economic	0.304	0.551*	0.424

\*means 5% level of significance; \*\*means 1% level of significance

**Table 6.** Effect of Periods on Sector-Wise Developments (Kruskal Wallis Test).

Period	No. of Districts ( $n_j$ )	Median Ranks				
		Agriculture	Industry	Infrastructure	Socio-Economic	Overall
1991-92	16	20.91	34.38	8.05	24.75	24.75
2001-02	19	31.08	13.00	35.55	31.55	28.39
2011-12	21	31.95	38.05	37.36	28.60	31.45
Chi-Square value		4.89	26.44**	33.81**	1.51	1.54
p-value		0.087	< 0.001	< 0.001	0.469	0.464

observed in 2011-12 with exception that the district of Gurgaon emerged on the top in overall development and the newly formed district of Mewat ranked last. It was also observed that that the district of Faridabad and Yamunanagar have maintained their high ranks in

overall development while Gurgaon has improved its rank which may be attributed to separation of Mewat area and recent industrialization in National Capital Region. It was observed that Mahendragarh lagged behind in almost all sectors while the district of Karnal

**Table 7.** Classification of districts according to their development.

Development Level	Districts / Regions	Area (%)	Population (%)
<b>1991-92</b>			
Developed	Faridabad, Ambala	10.15	15.75
Developing	Kaithal, Sonipat, Gurgaon, Panipat, Hisar, Sirsa, Kurukshetra, Rohtak, Yamunanagar, Jind, Karnal, Bhiwani	82.52	76.33
Less Developed	Rewari, Mahendragarh	7.33	7.92
<b>2001-02</b>			
Developed	Faridabad	4.86	10.40
Developing	Sirsa, Kaithal, Fatehabad, Rewari, Sonipat, Rohtak, Kurukshetra, Hisar, Ambala, Karnal, Gurgaon, Yamunanagar, Panchkula, Panipat	72.39	71.15
Less Developed	Mahendragarh, Bhiwani, Jind, Jhajjar	22.73	18.44
<b>2011-12</b>			
Developed	Faridabad, Gurgaon	4.52	13.06
Developing	Palwal, Bhiwani, Sirsa, Rewari, Kaithal, Jind, Jhajjar, Fatehabad, Karnal, Rohtak, Hisar, Ambala, Panchkula, Sonipat, Kurukshetra, Panipat, Yamunanagar	87.77	79.00
Less Developed	Mewat, Mahendragarh	7.70	7.93

excelled in agriculture in all the three periods and districts of Faridabad and Gurgaon lagged behind in agriculture only.

#### **Inter relationship between sectoral developments:**

In order to examine the relationship among agriculture, industry, infrastructure facilities and socio-economic sector developments, pair-wise Spearman's rank correlations have been worked out and are presented in the Table 5 along with their p-values for testing significance.

It has been observed from the table that correlation coefficients between rankings of agriculture and industry were observed to be almost negligible and statistically non-significant though it showed negative correlation for the Period-II and Period-III. This implies that the districts which were agriculturally developed were lagging much behind in industrial sector and vice-versa. The correlation coefficients between the rankings of agricultural and infrastructural facilities are negative for all of the three periods but are still statistically non-significant indicating that development in the infrastructure and agriculture sectors are by and large independent of each other. The correlation between industry and infrastructure facilities development was quite low in the first period whereas it was high and significant at 5% level of significance in the second period. A high positive value indicates that significant development has taken place in infrastructural facilities and industrial sector during Period-II. In the period 2011-12, the association between these two sectors was positive but not statistically significant indicating absence of relationship between developments in these sectors.

The correlation between industry and socio-economic development was positive and highly significant (at 1% level of significance) in all of the three periods

indicating that the districts which were industrially developed were also developed at the overall socio-economic front. The correlations of infrastructural facilities with industry and socio-economic development were found significant in period-II only.

**Changes in development level over periods:** The values of Kruskal-Wallis Test statistic have been worked out to examine the statistical significance of changes in the level of development over the three periods with respect to agricultural, industrial, infrastructural facilities, socio-economic and overall development. The null hypothesis was assumed that there are no significant changes in the development of sectors over various periods of time. The value of statistic H (Table 6) was highly significant for the sectors of industry and infrastructure, while it was near significant in case of agriculture sector. It indicates that there was a significant change in industry and infrastructure development over the three periods. The median ranks for the industry sector declined in the period 2001-02, but again got a boost in the third period, leading to overall significant change whereas in case of infrastructure, it started with a low level but improved significantly in the next two decades leading to overall significant results.

**Classification of districts based on the level of development:** Various districts have been classified as developed, developing and less developed in overall development as per procedure explained in materials and methods and details are presented in the Table 7. The relative share of area and population affected under different levels of development in the state was also computed for policy implications. Relative share of area and population need to be considered for taking decisions related to policy formulation but such information could not find place in recent work related



to Haryana (Hooda and Tonk, 1998) and Uttar Pradesh (Tanwar *et al.*, 2016).

In the year 1991-92, the districts of Faridabad and Ambala were classified as developed regions with an area of about 10 percent of the state area and a population of about 16 percent. In 2001-02, the district of Faridabad was the only district to be classified as developed district/region and it inhabited about 10 percent of the state population in about 5 percent of the state area. Following the similar trend, in the period 2011-12, the districts of Faridabad and Gurgaon were classified as developed districts with about 5 and 13 percent of the area and population, respectively. It is revealed from these results that the developed regions have a larger percent of population as compared to percentage area, which can be attributed to more inflow of population towards the developed regions due to better employment opportunities and resources for livelihood. During the period of 1991-92, the districts of Rewari and Mahendragarh have been categorised as the less-developed districts covering approximately 7 and 8 percent of area and population of the state. In period-II, the districts of Mahendragarh, Bhiwani, Rewari and Jhajjar districts were categorized as less-developed. These districts collectively covered about 28 and 18 percent of area and population of the state of Haryana, respectively. In the period of 2011-12, the district of Mahendragarh along with the newly formed district of Mewat has been categorized as less developed with about 8 percent each of area and population of the state. A complete picture of the developmental disparities in Haryana and its dynamics over the three periods is clearly visible in Fig.1.

### Conclusion

Significant changes were observed in development of industry and infrastructure sectors while agriculture sector revealed a near significant change over the periods 1991-92, 2001-02 and 2011-12. The district of Mahendragarh lagged behind in almost all sectors while the district of Karnal excelled in agriculture in all the three periods and districts of Faridabad and Gurgaon lagged behind in agriculture only. The correlation between industry and socio-economic development was positive and highly significant indicating that the districts which were industrially developed were also developed at the overall socio-economic front. Kruskal-Wallis Test indicated a significant change in industry and infrastructure development over the three periods. The district of Ambala ranked first in overall development in the period 1991-92 followed by Faridabad while the

district of Mahendragarh ranked last. The district of Faridabad improved its rank during 2001-02 and obtained first rank followed by Panipat while Ambala slipped to 7<sup>th</sup> place in overall development. A similar pattern was observed in 2011-12 with exception that the district of Gurgaon emerged on the top in overall development and the newly formed district of Mewat ranked last. The district of Faridabad and Yamunagar have maintained their high ranks in overall development while Gurgaon has improved its rank which may be attributed to separation of Mewat area and recent industrialization in National Capital Region. Classification of districts based on development levels revealed that the developed regions have a larger share of population as compared to area, which can be attributed to more inflow of population towards the developed regions due to better employment opportunities and resources for livelihood.

### REFERENCES

- Bhatia, V. K. and Rai, S. C. (2004) A research project report on Evaluation of Socio-economic Development in Small Areas. [planningcommission.nic.in/reports/sereport/ser/std\\_smlarea.pdf](http://planningcommission.nic.in/reports/sereport/ser/std_smlarea.pdf).
- Hooda, B.K. and Tonk, D.S. (1998). An assessment of regional development in Haryana. Proceedings of first annual conference of society of statistics, Computer and Application. October 23-25, 183-193
- Iyenagar, N.S. and Sudarshan, P. (1982). A method of classifying regions from multivariate data. *Economic and Political Weekly*, 18: 2047-2052
- Narain, P., Rai, S.C. and Shanti, S. (1991). Statistical evaluation of development on socio-economic front, *Jour. of Ind. Soc. of Agril. Stat.*, 43: 329-345
- Narain, P., Sharma, S.D., Rai, S.C. and Bhatia, V.K. (2007a). Statistical evaluation of socio-economic development at district level. *Jour. of Ind. Soc. of Agril. Stat.*, 61(2): 216-226
- Narain, P., Sharma, S.D., Rai, S.C. and Bhatia, V. K. (2007b) Statistical Evaluation of Socio-economic Development of Different States in India. *Jour. of Ind. Soc. of Agril. Stat.*, 61(3): 328-335
- Narain P., Sharma, S.D., Rai, S.C. and Bhatia, V.K. (2009). Inter district variation of socio-economic development in Andhra Pradesh. *Jour. of Ind. Soc. of Agril. Stat.*, 61 (1): 35-42
- Prabhu, K.S. and Sarkar, P.C. (1992). Identification of levels of development: case of Maharashtra. *Economic and Political Weekly*, 1927-37
- Tanwar, N., Kumar, S. Sisodia, B.V.S. and Hooda, B.K. (2016). Dynamics of socio-economic development of districts of eastern Uttar Pradesh. *Journal of Applied & Natural Science*, 8(1), 5-9