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RESEARCH NOTES

Dimensions of Regional Disparity in Sustainable Agricultural Development of Gujarat

Mahima Gopal Ghabru and Ganga Devi*

ABSTRACT

Sustainable Livelihood Security Index (SLSI) was constructed for 26 districts of Gujarat for the TE 2013-14 using the Prem Narain methodology. The districts were classified according to different levels of development based on SLSI using fractile classification. Rajkot, Ahmedabad, Surat, Banaskantha were found to be highly developed while Anand, Kheda, Jamnagar, Bhavnagar were medium developed and Dahod, Bharuch, Dangs, Patan, Porbandar were low developed districts according to SLSI. The study puts forth that regional disparity exists among districts of Gujarat in terms of ecology, economy and equity where the developed districts of state rank high but the tribal belt fares poorly in sustainable agricultural development. Model districts have been identified to bring about uniform development among low ranking districts.

Keywords: Sustainable Livelihood Security Index, Regional disparity, Fractile classification, Model districts.

JEL: Q01, R58, O13.

I

INTRODUCTION

A decent agricultural growth is the pre-requisite for inclusive growth, poverty reduction, development of rural economy and enhancing of farm incomes in rural areas of India. In order to ensure a holistic rural development sustainable agriculture, in terms of food security, rural employment, and environmentally sustainable technologies such as soil conservation, sustainable natural resource management and biodiversity protection are essential. Sustainable development implies attainment of the objectives of inter-generational equity. In order to analyse sustainability of an area Swaminathan (1991) defined Sustainable Livelihood Security Index (SLSI) in which livelihood options which are ecologically secure, economically efficient and socially equitable are assessed. It implies the protection or assurance of the means of livelihood for the masses not only at present time but also in future. Sustainable Livelihood Security Index can help to identify whether necessary conditions for sustainable development are present in a given region/ecosystem or not.

*Department of Agricultural Economics, B.A College of Agriculture, Anand Agricultural University, Anand-388 110 (Gujarat).

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II

METHODOLOGY

SLSI was constructed for 26 districts of Gujarat using the Prem Narain methodology. District-wise secondary data were collected for TE 2013-14. Secondary data used for the study was collected from various sources published by Government of Gujarat, Directorate of Economics and Statistics Gujarat, Directorate of Agriculture, Directorate of Animal Husbandry, National Dairy Development Board (NDDB), *Statistical Abstracts of Gujarat State*, *Health Statistics*, Directorate of Rural Development *etc*. Data were collected on various indicators of ecology, economy and equity. The + sign indicates a positive impact and – sign indicates a negative impact of the variables. The selected variables are given below:

(a) Ecological Security Indicators
- (i) Population density (per km^2) (-)
- (ii) Proportion of geographical area under forest (%) (+)
- (iii) Cropping intensity (%) (+)
- (iv) Livestock density (per km^2) (+)
- (v) Net irrigated area (ha) (+)
- (vi) Population growth (%) (-)
- (vii) Net annual groundwater availability (ha m) (+)

(b) Economic Efficiency Indicators
- (i) Total food grain yield (kg/ha) (+)
- (ii) Total milk production (tonne) (+)
- (iii) Net sown area (ha) (+)
- (iv) Fertiliser consumption (kg/ha) (-)
- (v) Unemployment (-)

(c) Social Equity Indicators
- (i) Percentage of population below poverty line (%) (-)
- (ii) Literacy rate (%) (+)
- (iii) Female literacy (%) (+)
- (iv) Infant mortality rate (%) (-)
- (v) Rural road connectivity (km per lakh of population) (+)
- (vi) Households electrified (No. of households) (+)
- (vii) Number of commercial banks (per lakh population) (+)
- (viii) Number of primary health centres (per lakh population) (+)

Prem Narain methodology used for constructing SLSI is given below:

Let $[X_{ij}]$ be the data matrix

i=1,2,3,…,n (Number of area unit)

j=1,2,3…,k (Number of indicators)

$[X_{ij}]$ includes values from different population distributions and they might be recorded in different units of measurement, hence they are not quite suitable for simple addition for obtaining the composite index. Therefore, $[X_{ij}]$ was transformed to $[Z_{ij}]$ as follows (Narain *et al*., 1991):

$$Z_{ij} = \frac{X_{ij} - \bar{X}_j}{S_j}$$

where,
$\bar{X}j$ = mean of the j-th indicator
S_j = Standard deviation of the j-th indicator
$[Z_{ij}]$ = matrix of the standardised indicators.

From $[Z_{ij}]$ best value of each indicator was identified and denoted by Z_{oj}. The best value will be either maximum or minimum value of the indicator depending upon the direction of the impact of the indicator on the level of development. For obtaining the pattern of development P_{ij} was calculated as follows:

$$P_{ij} = (Z_{ij} - Z_{oj})^2$$

Pattern of development C_i is given as:

$$C_i = \left[\frac{\sum_{j=1}^{k} P_{ij}}{(CV)j}\right] 1/2$$

where $(CV)_j$ is the coefficient of variation of j-th indicator in X_{ij}.
The distance between districts i and p is given by d_{ip}

$$d_{ip} = \left[\sum (Z_{ij} - Z_{pj})2\right] 1/2$$

i = 1,2,..,n p=1,2,..,n
Here $d_{ii} = 0$ and $d_{ip} = d_{pi}$
$[Z_{ij}]$ = matrix of the standardised indicators for i-th district
$[Z_{pj}]$ = matrix of the standardised indicators for p-th district
d_{ip} can be written as:

$$d_{ip} = \begin{matrix} 0 & d_{12} & - & - & d_{1n} \\ d_{21} & 0 & - & - & d_{2n} \\ - & - & - & - & d_{3n} \\ d_{n1} & d_{n2} & - & - & 0 \end{matrix}$$

Minimum distance for each row was calculated and denoted by d_i. Critical Distance (CD) was computed as follows:

$$CD = \bar{d} + 2sd$$

where $\bar{d}$ = mean of d_i

S_d = standard deviation of d_i

Model districts were those districts whose composite index was more than that of a low developed district and whose development distance from particular low developed district was less than or equal to Critical Distance (CD).

Status of Development

To evaluate status of development districts were classified according to the level of development in this study using fractile classification. Fractile classification from the assumed distribution of mean of the composite indices will provide a more meaningful characterisation of different stages of development. Level of development was worked out as:

Level of development = $\bar{X} \pm 0.5$ S.D.

Districts having composite index greater than or equal to (Mean + 0.5 SD) were classified as highly developed districts, whereas, districts having composite index less than or equal to (Mean - 0.5 SD) were classified as low developed districts. Districts with composite index lying between (Mean- 0.5 SD) and (Mean + 0.5 SD) were categorised as medium level developed districts.

III

RESULTS AND DISCUSSION

Table 1 puts forth the Sustainable Livelihood Security Index (SLSI) values for districts of Gujarat using the Prem Narain Methodology. Banaskantha (0.404) ranks first in SLSI followed by Rajkot (0.403), Sabarkantha (0.359) and Surat (0.350), Narmada (0.091), Porbandar (0.082) and Dangs (0.067) ranked low. The high ranking districts had high economic efficiency and equity values. On the other hand, low ranking districts had poor values in all sub-indices hence development in these districts is comparatively less sustainable. Singh and Hiremath (2008) conducted a district level study on Sustainable Livelihood Security Index in Gujarat and found that Surat ranked first and Dahod ranked last in the SLSI ranking.

A simple ranking of districts on the basis of SLSI and its component indices was done for identification of districts according to different levels of development. The fractile groups were used to classify the various stages of development.

The categorisation of districts into high, medium and low developed for ESI, EEI and SEI during TE 2013-14 is given in Table 2. Surat, Banaskantha, Dahod, Rajkot, Junagadh, Sabarkantha, Mehsana, Anand and Panchmahal ranked high in ecological

TABLE 1. THE INDICES VALUE OF SUSTAINABLE LIVELIHOOD SECURITY INDEX CALCULATED BY PREM NARAIN METHOD FOR DISTRICTS OF GUJARAT DURING TE 2013-14

Districts	Ecological security index	Rank	Economic efficiency index	Rank	Social equity index	Rank	SLSI	Rank
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Kachchh	0.113	21	0.280	16	0.224	8	0.219	17
Banaskantha	0.335	3	0.649	1	0.082	25	0.404	1
Patan	0.970	24	0.265	17	0.121	20	0.171	22
Mehsana	0.227	12	0.456	6	0.234	6	0.331	6
Sabarkantha	0.294	4	0.552	2	0.117	22	0.359	3
Gandhinagar	0.167	16	0.308	14	0.221	9	0.245	15
Ahmedabad	0.254	7	0.197	19	0.493	1	0.296	10
Surendranagar	0.075	23	0.461	5	0.159	18	0.271	13
Rajkot	0.250	9	0.534	3	0.342	4	0.403	2
Jamnagar	0.125	18	0.396	10	0.245	5	0.281	12
Porbandar	- 0.003	26	0.131	24	0.085	24	0.082	25
Junagadh	0.257	6	0.494	4	0.210	12	0.349	5
Amreli	0.076	22	0.415	9	0.164	17	0.253	14
Bhavnagar	0.134	19	0.434	8	0.198	14	0.286	11
Anand	0.253	8	0.386	11	0.218	11	0.303	9
Kheda	0.236	11	0.438	7	0.193	16	0.314	7
Panchmahal	0.280	5	0.297	15	0.121	21	0.242	16
Dahod	0.344	2	0.167	21	0.026	26	0.174	21
Vadodara	0.224	13	0.326	12	0.360	3	0.307	8
Narmada	0.138	17	0.057	25	0.099	23	0.091	24
Bharuch	0.036	25	0.160	22	0.227	7	0.146	23
Surat	0.349	1	0.325	13	0.391	2	0.350	4
Tapi	0.167	15	0.168	20	0.201	13	0.177	20
Dangs	0.123	20	- 0.006	26	0.127	19	0.067	26
Navsari	0.201	14	0.244	18	0.195	15	0.218	18
Valsad	0.238	10	0.153	23	0.219	10	0.195	19

security in TE 2013-14 owing to better status of ecological resources in these districts. Ahmedabad, Vadodara, Navsari, Jamnagar and Kheda were found to be medium developed while Bhavnagar, Gandhinagar, Kachchh, Amreli, Surendranagar, Patan, Bharuch and Porbandar were found low developed. High developed districts comprise 30 per cent of area in the state with a population of 44 per cent, medium developed districts account for 24 per cent of area with a population of 34 per cent and low developed districts cover 46 per cent area with a population of 22 per cent.

Eight districts, i.e., Banaskantha, Rajkot, Junagadh, Surendranagar, Sabarkantha, Amreli and Bhavnagar covering 41 per cent of area in the state with a population of 34 per cent were placed under high developed districts. Mehsana, Kheda, Anand, Vadodara, Kachchh, Gandhinagar, Ahmedabad, Navsari and Panchmahal were placed in the category of medium developed districts. These districts are thickly populated with 51 per cent of population residing here, covering 44 per cent of area in the state. Patan, Tapi, Bharuch, Dahod, Valsad, Porbandar, Narmada and Dangs comprising 15 per cent of area and 15 per cent of total population were ranked as low developed districts.

TABLE 2. CLASSIFICATION OF DISTRICTS ACCORDING TO LEVEL OF DEVELOPMENT IN ESI, EEI AND SEI DURING THE TE 2013-14

		Ecological Security Index			
High	Rank	Medium	Rank	Low	Rank
(1)	(2)	(3)	(4)	(5)	(6)
Surat	1	Ahmedabad	10	Bhavnagar	18
Banaskantha	2	Vadodara	11	Gandhinagar	19
Dahod	3	Kheda	12	Kachchh	20
Rajkot	4	Valsad	12	Amreli	21
Junagadh	5	Tapi	13	Surendranagar	22
Sabarkantha	6	Navsari	14	Patan	23
Mehsana	7	The Dangs	15	Bharuch	24
Anand	8	Jamnagar	16	Porbandar	25
Panchmahal	9	Narmada	17		
		Economic Efficiency Index			
High	Rank	Medium	Rank	Low	Rank
Banaskantha	1	Mehsana	8	Patan	16
Rajkot	1	Kheda	9	Tapi	17
Junagadh	2	Anand	10	Bharuch	18
Surendranagar	3	Vadodara	11	Dahod	19
Sabarkantha	4	Kachchh	12	Valsad	20
Amreli	5	Surat	13	Porbandar	21
Bhavnagar	6	Gandhinagar	13	Narmada	22
Jamnagar	7	Ahmedabad	14	The Dangs	23
		Panchmahal	15		
		Navsari	15		
		Social Equity Index			
High	Rank	Medium	Rank	Low	Rank
Ahmedabad	1	Gandhinagar	6	Porbandar	18
Surat	2	Anand	7	Surendranagar	19
Vadodara	3	Navsari	8	Sabarkantha	20
Rajkot	4	Bharuch	9	Narmada	21
Mehsana	5	Jamnagar	10	Patan	22
		Kheda	11	Panchmahal	23
		Valsad	11	Banaskantha	24
		Junagadh	12	Dahod	25
		Tapi	13		
		Bhavnagar	14		
		Kachchh	15		
		The Dangs	16		
		Amreli	17		

Ahmedabad, Surat, Vadodara, Rajkot and Mehsana ranked high in social equity compared to Gandhinagar, Anand, Navsari, Bharuch, Jamnagar, Kheda, Junagadh and Tapi that ranked medium developed, while Porbandar, Surendrangar, Sabarkantha, Narmada, Patan, Panchmahal, Banskantha and Dahod were placed as low developed districts. The high developed districts cover 18 per cent of area with 39 per cent of population residing in these districts, 57 per cent of area is accounted by medium developed districts housing 38 per cent of state population and low developed districts comprise 25 per cent of area with 24 per cent of population living in these districts.

Perusal of Table 3 reveals that during TE 2013-14 Rajkot, Ahmedabad, Surat, Banaskantha, Junagadh, Mehsana, Vadodara and Sabarkantha were high developed, Anand, Kheda, Jamnagar, Bhavnagar, Gandhinagar, Navsari were medium developed and Dahod, Bharuch, Dangs, Patan, Narmada and Porbandar were low developed districts in SLSI. The high, medium and low developed districts cover 32 per cent, 55 per cent and 13 per cent of the state area, with 52 per cent, 36 per cent and 12 per cent of the population residing in them, respectively (Figure 1). Pal *et al*. (2015) categorised districts of Gandhinagar, Banaskantha, Mehsana, Surat, Anand, Kheda, Junagadh as high developed districts, Bhavnagar, Porbandar, Panchmahal, as medium developed and Amreli, Surendranagar, Dahod, Bharuch, Dang and Patan as low developed districts in agricultural status.

TABLE 3. CLASSIFICATION OF DISTRICTS ACCORDING TO LEVEL OF DEVELOPMENT IN SLSI DURING THE TE 2013-14

Sustainable Livelihood Security Index					
High	Rank	Medium	Rank	Low	Rank
(1)	(2)	(3)	(4)	(5)	(6)
Rajkot	1	Anand	9	Tapi	20
Ahmedabad	2	Kheda	10	Dahod	21
Surat	3	Jamnagar	11	Bharuch	22
Banaskantha	4	Bhavnagar	12	Dangs	23
Junagadh	5	Gandhinagar	13	Patan	23
Mehsana	6	Navsari	14	Narmada	24
Vadodara	7	Surendranagar	15	Porbandar	25
Sabarkantha	8	Amreli	16		
		Valsad	17		
		Kachchh	18		
		Panchmahal	19		

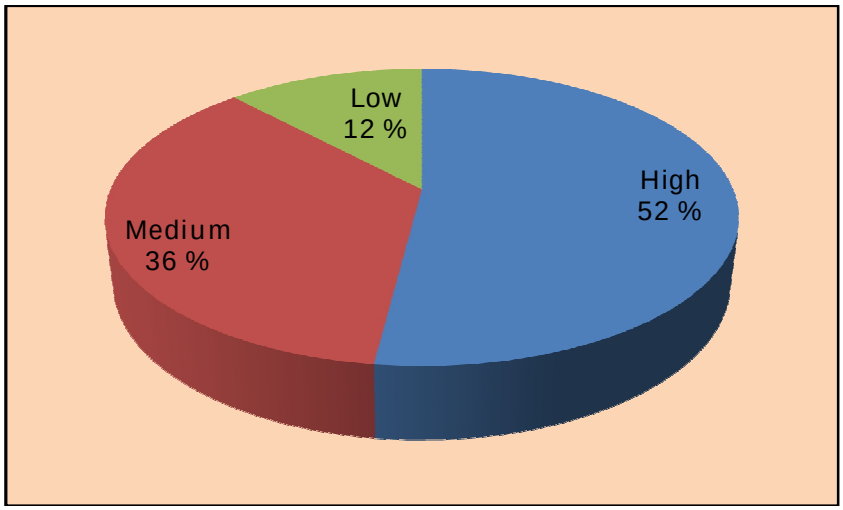

Figure 1. Proportion of Population under Different Levels of Development in SLSI during TE 2013-14.

Identification of Model Districts for Low Developed Districts

Classification of districts according to different levels of development would be inadequate until the extent of improvement required in various indicators of low developed districts is found. This will provide avenues to bring about uniform regional development thereby helping in readjusting resources and priorities to reduce the resource inequalities in the level of development among different districts. For estimation of potential targets of different indicators, model districts have been identified for the low developed districts. Model districts are better developed in comparison to low developed districts. Narain *et al.* (1999) identified model districts for low developed districts while studying inter-district variation of development in southern region of the country.

Six districts of the state, i.e., Patan, Porbandar, Narmada, Bharuch, Dangs and Dahod fall in the low developed category owing to their poor performance in equity and economic indicators. The ecological indicators like forest cover, cropping intensity, groundwater availability values also declined over years accounting for their low ranking. The districts Gandhinagar, Surendranagar, Navsari, Valsad, Amreli were found to be model districts for low ranking districts (Table 4).

TABLE 4. MODEL DISTRICTS FOR LOW DEVELOPED DISTRICTS DURING TE 2013-14

Sr.no. (1)	Low developed districts (2)	Model districts (3)
1.	Patan	Kachchh, Mehsana, Gandhinagar, Surendranagar, Jamnagar, Amreli, Bhavnagar, Kheda, Panchmahal, Navsari, Valsad
2.	Porbandar	Gandhinagar, Surendranagar, Jamnagar, Amreli, Narmada, Navsari, Valsad
3.	Narmada	Patan, Navsari, Valsad
4.	Bharuch	Kachchh, Gandhinagar, Surendranagar, Jamnagar, Amreli, Bhavnagar, Anand, Kheda, Navsari, Valsad
5.	Dangs	Valsad
6.	Dahod	Panchmahal

Model districts can serve as yardsticks for development of poor and low ranking districts of the state as development of these districts is achievable for low ranking districts. As low developed districts rank poor in economy and equity so major improvements are needed in the equity and economy indicators, while ecological resources need to be protected and sustained to maintain a sustainable livelihood state in the long run.

IV

CONCLUSIONS

Gujarat has been a leading state in agricultural growth and development but the growth needs to be sustainable in order to ensure a holistic development over the

years. The state experiences disparities in development within the districts in terms of ecology, economy and equity due to unevenly distributed resource base and different climatic conditions in various regions, hence a holistic development plan must be incorporated which bridges these gaps and leads to an overall development in the state. The tribal districts of the state lag behind in provision of better civic amenities and hence efforts must be directed towards increasing the economy and social equity of these districts.

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