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ANALYSIS OF SUSTAINABLE LIVELIHOOD SECURITY: A CASE STUDY OF ALLAPUR S RURBAN CLUSTER

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ABSTRACT

This study shows the current scenario of sustainable livelihood security index of Allapur S Rurban cluster, located in the newly born Telengana State. Calculating economic efficiency index, ecological security index and social equity index and eventually Sustainable Livelihood Security index (SLSI) were carried out at the village levels using spatial and non-spatial data. Normalisation of the selected indicators were first done and then calculated. Results from the study indicate that the study area possesses a very low SLSI with only Narayanpur and Odandapur village which cover 11.13 per cent of the total geographical area of the cluster as sustainable and secure villages. 59.58 per cent of the geographical area and 65.83 per cent of the population are moderately sustainable category. Whereas, eight villages which accounted for 27.37 per cent population of the total cluster are under less sustainable and very less sustainable category. There is an urgent need to reorient development programmers and carry out priority-wise development investments into these vulnerable villages to provide resources and opportunities to ameliorate their ecological security, economic efficiency and social equity which further sustainable livelihood security.

Keywords: Ecological Security, Economic Efficiency, Rurban, Social Equity, Sustainable Development, Sustainable Livelihood Security Index.

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Introduction

The word sustainability was first brought up more than three decades ago which was widely and easily accepted as a significant conceptual framework to position policies and development (William et al., 2000). The concealed tensions exist amongst all the relevant aspects of sustainable development (Giddlings et al., 2002; Jenks and Dempsey, 2005). Bruntdland Commission, set up on environmental and developmental concerns stated that, livelihood is to be capable of making living in a manner which is socially, economically and ecologically sustainable (Bull, 2015). Blueprints for bettering the livelihoods are regularly confined to the unsustainable rural wealth or reserves, colossal population progression, an ill-protected agrarian environment and notable community-based inequity of a kind that in the dissimilar dispersal of opulence and allotment of land entitlements (Wu, 2004; Qu et al., 2011; Dai and Dien, 2013; Ouyang et al., 2014; Shaw and Kristjanson, 2014).

Any entity which possesses many characteristics, lots of aspects need to be considered when evaluation of that entity is to be processed (Liu, 2008). As add-on to this when the decisions are to be taken for a complex system, comprehensive considerations require plenty of pertinent factors (Qin, 2012; Vahabzadeh et al., 2011). The sustainable Livelihood Security Index (SLSI) brought forward by Saleth and Swaminathan (1993) can be utilised to identify the indispensable constraints for sustainable development or sustainable livelihood for a given stretch of terrain (Moser, 1996). This SLSI is able to figure out solutions for problems at various levels whether they are macro or micro and, with no trouble generalises at variable contexts like, the farmers belong to a village, villages belong to a district, States belong to a country (Uma, 1993; Hatai and Sen, 2008; Singh and Hiremath, 2010; Sajjad et al., 2014). So far, examples have been applied to assess livelihood security of the farmers in high and low-land communities of Kali-Khola tilled watershed, western Nepal (Bhandari and grant, 2007). So, for the research study, SLSI is used as a convenient tool for evaluation of certain parameters of the study area.

The plainness and clarity of indicators makes this a reliable and appropriate when the matter comes to generalisation over various evaluation levels (Singh and Hiremath, 2010). The SLSI requires a feasible and convenient bulk of comfortably accessible economical, ecological equity relevant information.

Study Area

Government of India has brought the "Shyama Prasad Mukherjee Rurban Mission (SPMRM)" which is a rural development project where urban facilities are to be facilitated like digital connectivity, LPG feasibility, etc. Here, Government of India is to apply the efficacy of the project not only in a single village-wise approach but, with a broader aspect where it is to fulfil a clusterification approach. A clusterification approach means that the villages will altogether be treated as a single unit. The area regarding this study is in Tandur mandal a selected "Rurban" cluster named Allapur S

(Figure 1). The Allapur S cluster is located between 17.12.28 and 17.24.38 N latitudes and 77.26.8 and 77.40.7 longitudes and covers a geographical area of 234.8 kms which contains twenty- five villages.

The average annual temperature ranges between 21.2° C and 35.4° C with a mean annual temperature of 27.4°C. The annual rainfall of the study area is 1078 mm. In January precipitation is lowest with an average of 4 mm. The highest amount of precipitation occurs in July with an average of 303 mm. The area is geologically enriched with blue and yellow limestone. Redgram production in this area is also famous. However, it has a very low forest cover of 14.09 per cent whereas forest cover of total India is 24.16 per cent. Home-based industries are almost absent in this area, which can enhance the economy. Primary literacy rate of the area is also very less with 28.24 per cent literates. So, the area cannot be counted as sustainably secured as it requires an adaption of employment intensive system and environment-friendly progress protocols for intercession.

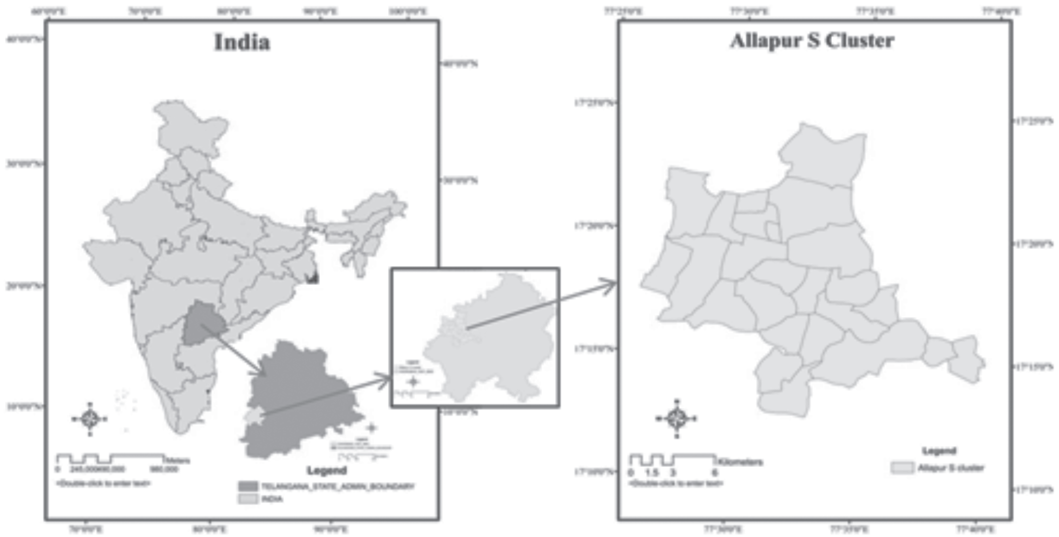

Figure 1: Location of Study Area

Data Used

Remote sensing data are suitable to extract spatial information because of its synoptic view, repetitive coverage and real time data acquisition (Belal and Moghanm, 2011, Shaw,R.,Das,A. 2017). In this study we used Landsat 8 satellite imageries to identify LULC of the study area which give us some useful data/ information i.e. amount of forest cover and amount built-up area in each village (Figure 2). Primary data were used for land productivity, rest of the data were collected from Rurban Mission Telangana department.

Figure 2: LULC of the Allapur S Rurban Cluster

Methodology

SLSI- the concept: SLSI has three pillars, i.e., Ecological Security Index (ESI), Economic Efficiency Index (EEI) and Social Equity Index (SEI). Under these pillars, several indicators are utilised for probable best fit decision in this integrated decision making process. As the indicators are reasoned on different scales and units, the methodology which is adopted is the same as utilised in UNDP's Human Development Index (UNDP, 2006) for normalising those considered indicators also to incur figures independent from the units and along with that for standardising their values. At first, the normalisation of the values is done so that all the values lie between 0 and 1. But before this above mentioned procedure, the identification of the functional relationships among the considered indicators and sustainability is also important. The probable functional relationships are of two types - positive relationships and negative relationships. Positive indicators are those whose increasing value indicates increase in sustainability and vice versa. Negative indicators are those whose decreasing value indicates increase in sustainability and vice versa.

When it comes to sustainability for every component, collected data are arranged in a rectangular matrix form, where rows represent villages and columns represent indicators.

Let, M (j=1,2,3,…,M) represents villages and considered indicators be represented by N (i=1,2,3,…,N). So, the Table now possesses M rows and N columns. Let, xij= value of ith indicator, corresponding to the jth village. The variable if holds positive functional relation with sustainability, then the normalisation can take place with the utilisation of equation (1).

Let, Z_{ij}= index for ith indicator, corresponding to the jth village.

$$Z_{ij} = \frac{x_{ij} - Min\{x_{ij}\}}{Max\{x_{ij}\} - Min\{x_{ij}\}} \qquad (1)$$

The variable if holds negative functional relation with sustainability, then the normalisation can take place with the utilisation of equation (2).

$$Z_{ij} = \frac{Min\{x_{ij}\} - x_{ij}}{Max\{x_{ij}\} - Min\{x_{ij}\}} \qquad (2)$$

Here, Max{xij} and Min{xij} are the respective Maximum and Minimum values of ith indicator amongst all the M villages.

X_{ij} is the observed/actual value of the ith indicator corresponding to jth village.

For all the indices, M= 1,2,3,…,j,..,25, as the cluster contains 25 villages and i=1,2,3,…,k, where, k=3 for all the ESI,EEI and SEI.

In present study equal weightages for all the indicators is given and ESI was reckoned by the use of equation (3).

$$\mathrm{ESI_j} = \sum\nolimits_1^i Zij \quad (3)$$

In a similar way, SEI and EEI are also reckoned. The SLS Index was calculated using equation (4).

Now, $SLSI_j = SEI_j + ESI_j + SEI_j$ …….(4)

For the significant customisation of ESIj for various villages, the four numbers of real numbers C_1, C_2, C_3 and $C_4 \in [0,1]$ are taken to divide the values attained into five linear intervals, which are: $[0, C_1]$,$[C_1, C_2]$, $[C_2, C_3]$, $[C_3, C_4]$ and $[C_4, 1]$ possessing exactly same probability weight which is 20 per cent :

$P[0 \le ESI_j \le C_1] = 0.20$

$P[C_1 \le ESI_j \le C_2] = 0.40$

$P[C_2 \le ESI_j \le C3] = 0.60$

$P[C_3 \le ESI_j \le C4] = 0.80$

All these equal spans are used in the present study to customise the different levels of Sustainability as following:

i) When $0 \le ESI_j \le C_1$, it implies very less sustainable ecological security

ii) When $C_1 \le ESI_j \le C_2$, it symbolises less sustainable ecological security

iii) When $C_2 \le ESI_j \le C_3$, it represents a moderately sustainable ecological security

iv) When $C'_3 \le ESI_j \le C_4$, it denotes sustainable ecological security

v) When $C_4 \le ESI_j \le_1$, it implies highly sustainable ecological security

In the similar manner, the villages are also graded into five categories on the basis of the scores of "SEI_j, EEI_j, $SLSI_j$"

Selection of Variables for Computing SLSI

The selections of right indicators to best describe the status of each of the three dimensions can obviously debated ad nauseam (Fredericks 2012). Sometimes, gap will emerge due to less number of indicators and sometimes few indicators overlap each other.The following sections are keened to the selection of indicators those say about the ecologic, economic and social equity status of each village in Allapur S cluster. In this study, we selected indicators as per the literature survey, current requirements which villages generally possess, data availability and in addition to that related Government promoted efforts were combined together based on the criteria to construct the ESI, EEI, SEI and finally the SLSI. In this study, three indicators are considered under each category.

Ecological Security Indicators

Forest cover plays an important role for ecological sustainability.It shows an important role in carbon cycle, water cycle, soil preservation and pollution control and also gives shelter for some habitats. Forests possess humans as liabilities not only because of food but also housing, agriculture and a cluster of marketable forest products. Increasing population pressure, fragmentation of the landholdings, demand for the fodder and, the energy resources have been resulting in the intrusion of forest lands and by that conservation is also threatened. A critical minimum forest cover is essential for healthy environment which ensures the ecological security.The variable human density was selected to reflect the extention of stress on the overall ecological security in terms of forest loss and habitat degradation. (Maikhuri et al 2001; Arjunan et al 2005). Huge population increase in a comparatively short duration is responsible for increasing built-up area. With the days passing, the built-up areas are encroaching forests, agricultural fields and water bodies, hampering sustainability. So, it is a negative indicator for determining SLSI.

Economic Efficiency Indicators

Home-based industries have the potential to enhance the economic growth which can assure the economical sustainability of an area. Agricultural Land Productivity means ratio of the Total Food Yield to the Area (foodgrain). Finally, the income on per capita is the most significant indicator to reveal the economic condition of the area.

Social Equity Indicators

The basic requisite to identify the education and state of living of any place or community is primary literacy rate. It helps individuals acquire basic reading and writing skills with the knowledge of basic calculations through mathematics. Students acquire good knowledge if the way of teaching is good enough. Higher literacy level of learners represents well-enhanced economy. Constructive literacy skills can avail of more education and employment options. In today's rapidly altering technological world, individuals need to have expanding knowledge with adoption of new skills to maintain the footstep of change. So, it proves to be a positive indicator for measuring SLSI.

Today's world is so fond of LPG because the practice proved to be the most efficient one. The fuel possesses sulphur-free emission so produces no soot, no smoke and does not contain any unburnt carbon residue. It is responsible for comparatively lowest green-house gas emission than other fuel' emissions. So, it is a positive indicator when it comes to SLSI measurement. Digital connectivity is proved to be a non-detachable tool for every day's business and society's need in this modern world. It is also successful in making various public services easily available for each and every kind of information from educational opportunities to employment, etc., by browsing on the internet. So, in the present study we selected digital connectivity as positive indicator.

Results and Discussion

Ecological Security Index Based : Sustainably developed means to help preserving resources and ecological systems for social and economic well-being as a significant imperative to fulfil the future requirements of humanity (Littig & Grie ßler 2005). Classification of the villages which was on the basis of the scores and it showed, only fourteen (Figure 3) villages lie under sustainable (S) and highly sustainable (HS) categories which possess 44.67 per cent of the total population of the cluster whereas, the total geographical of the area of this zone is 62.08 per cent of the total study area (Figure 4). Only Odandapur has reached highly sustainable category as per the ESI score due to very high forest cover and very low human density (83 per km square) and low built-up area. Among all fourteen villages thirteen lie under "sustainable" category with 41per cent human population, 80.24 per cent forest cover and 30.97 per cent built-up area of the total Allapur S cluster. Four villages come under moderately sustainable (MS) category. In this category, average forest cover and average built-up area are 7.24 per cent and 17.86 per cent respectively and the population density is 160 persons per square km .

Malkapur, Inole, Antaram Buzurg, Ogipur, Goutapur and Karankote lie under less sustainable (LS) category with an average population density of 333 persons per square km , an average forest cover of 7.19 per cent and average built-up area of 21.04 per cent of the total village area. Kotbaspalle is in the worst state, under Very Less Sustainable (VLS) with high population density of 475 persons per square km with a built-up area of 32.61 per cent. The pressure in this village on basis of environmental and natural resources can be easily seen. Odandapur, Parwathpur, Sangamkalam have secured the first three ranks as per their ESI scores, which are 2.964, 2.129 and 2.027, respectively (Table 1) whereas, Kotbaspalle, Malkapur, Inole have occupied last three places in terms of sustainability and their ESI scores are 0.520, 0.855 and 0.964, respectively.

Table 1: Raw Data and Indices for Calculation of Ecological Security Index (ESI) in Allapur S Cluster

Name of the Villages	Human Density	Human Density Index	% of Built-up Area	Built-up Index	% of Forest Cover	Forest Cover Index	Ecological Security Index	Degree of Sustain-ability
Allapur S	225	0.683	12.73	0.728	16.2	0.209	1.620	MS
Antaram Buzurg	569	0.000	6.43	0.866	10.4	0.115	0.980	LS
Belkatur	160	0.812	6.24	0.870	10.92	0.123	1.805	S
Bijwar	140	0.851	1.1	0.982	14.37	0.179	2.012	S
Chandravancha	112	0.907	1.31	0.978	9.63	0.102	1.986	S
Chengeshpur	173	0.786	1.18	0.980	8.02	0.076	1.842	S
Chengole	269	0.595	3.81	0.923	7.98	0.075	1.594	MS
Elmakanna	172	0.788	2.89	0.943	8.83	0.089	1.820	S
Gingurthy	155	0.821	3.05	0.940	9.59	0.101	1.862	S
Gonur	168	0.796	1	0.984	10.01	0.108	1.888	S
Goutapur	183	0.766	30.56	0.339	3.34	0.000	1.105	LS
Inole	550	0.038	4.73	0.903	4.78	0.023	0.964	LS
Karankote	341	0.452	14.02	0.700	5.27	0.031	1.184	LS
Khanjapur	158	0.815	1.19	0.980	8.55	0.085	1.880	S
Kotbaspalle	475	0.187	32.61	0.295	5.74	0.039	0.520	VLS
Kothlapur Khurd	296	0.542	5.67	0.882	7.36	0.065	1.489	MS
Malkapur	543	0.052	12.58	0.732	7.73	0.071	0.855	LS
Mittabachpalle	126	0.879	1.83	0.966	8.24	0.080	1.925	S
Narayanpur	185	0.762	0.82	0.988	7.91	0.074	1.824	S
Ogipur	106	0.919	46.12	0.000	13.34	0.162	1.081	LS
Parwathapur	65	1.000	3.55	0.929	15.67	0.200	2.129	S
Sangamkalan	124	0.883	4.6	0.906	18.03	0.238	2.027	S
Tandur	80	0.970	26.25	0.433	4.85	0.025	1.428	MS
Uddandapur	83	0.964	0.28	1.000	64.96	1.000	2.964	VHS
Veeredpalle	153	0.825	1.36	0.976	9.39	0.098	1.900	S

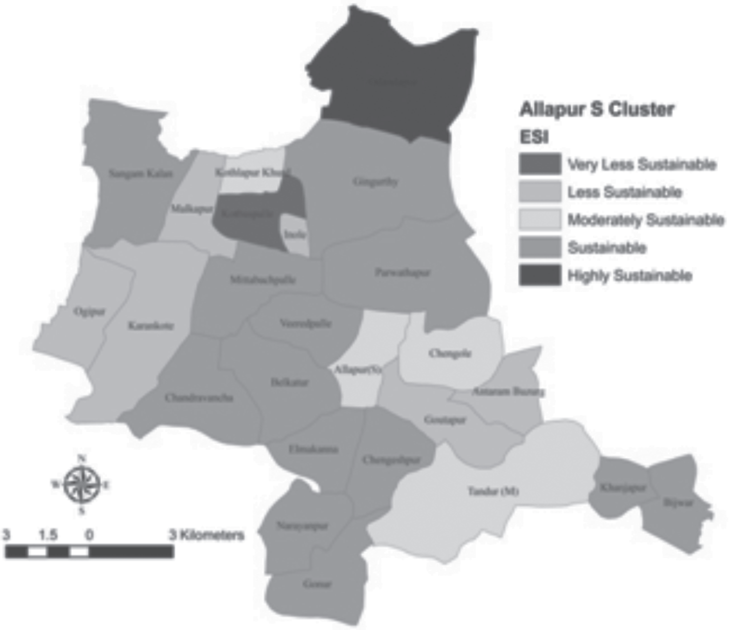

Figure 3: Spatial Variation in ESI

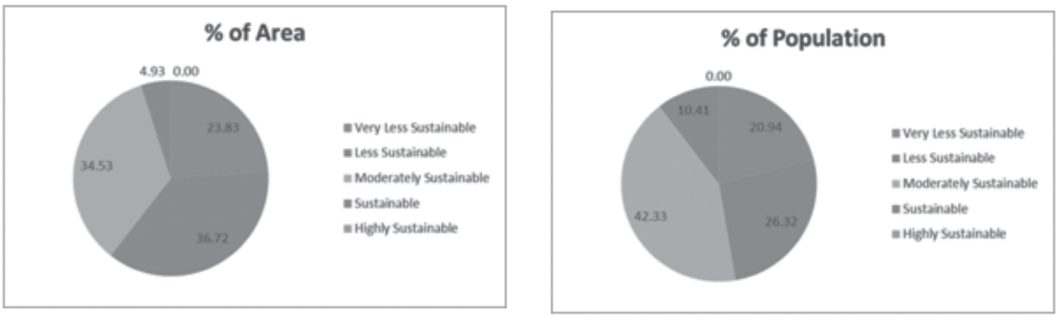

Figure 4: Presenting Area and Population Distribution in Various Degrees of Sustainability Classes as Per ESI Score

Economic Efficiency Index

As per the EEI scores, four, thirteen, five and three villages lie under very less sustainable, less sustainable, moderately sustainable, sustainable categories respectively.Out of twenty five villages, not even a single village could achieve highly sustainable tag. Goutapur, Kotbaspalle, Ogipur and Sangamkalam come under the very less sustainable category (Figure 5). Only 3 per cent households are associated with home based industries in these areas. Agricultural production and average per day per capita income are 1686.5 kg/hec and 82.3 INR, respectively in these four villages. Almost 46 per cent area of the total cluster is less sustainable as per EEI which carries 44 per cent population of the cluster (Figure 6). Only 7.15 per cent households of these areas are linked with home based or traditional industries whereas, agricultural production and average per capita income are little bit higher than VLS category with 1842.2 kg/hec and 113.65 INR.

Table 2: Raw Data and Indices for Calculation of Economic Efficiency Index (EEI) in Allapur S Cluster

Name of the Gram Villages	Traditional/ home based Industries present (% of HH)	HBI Index	Average Income per capita (per day)	AIPC Index	Average Agricultural production (kg/hec)	AAP Index	Economic Efficiency Index	Degree of Sustainability
Allapur S	9	0.198	109.81	0.375	1765	0.204	0.777	LS
Antaram Buzurg	6	0.127	115.20	0.415	2137	0.739	1.281	MS
Belkatur	15	0.340	81.51	0.164	1709	0.124	0.627	LS
Bijwar	0.6	0.000	193.48	1.000	1997	0.537	1.537	MS
Chandravancha	12	0.269	96.72	0.277	2076	0.651	1.197	LS
Chengeshpur	3	0.057	140.03	0.601	1926	0.435	1.093	LS
Chengole	2	0.033	109.64	0.374	1818	0.280	0.687	LS
Elmakanna	1	0.009	114.65	0.411	1759	0.195	0.616	LS
Gingurthy	25	0.575	104.93	0.339	2302	0.976	1.890	S
Gonur	11	0.245	130.30	0.528	1862	0.343	1.117	LS
Goutapur	5	0.104	98.01	0.287	1723	0.144	0.535	VLS
Inole	5	0.104	176.45	0.873	1844	0.318	1.294	MS
Karankote	43	1.000	136.25	0.573	2167	0.782	2.354	S
Khanjapur	3	0.057	123.88	0.480	1823	0.287	0.824	LS
Kotbaspalle	5	0.104	59.57	0.000	1623	0.000	0.104	VLS
KothlapurKhurd	3	0.057	167.29	0.804	1793	0.244	1.105	LS
Malkapur	1	0.009	125.75	0.494	1978	0.510	1.014	LS
Mittabachpalle	13	0.292	98.31	0.289	1764	0.203	0.784	LS
Narayanpur	23	0.528	137.88	0.585	2319	1.000	2.113	S
Ogipur	1	0.009	65.41	0.044	1639	0.023	0.076	VLS
Parwathapur	11	0.245	138.79	0.592	2079	0.655	1.492	MS

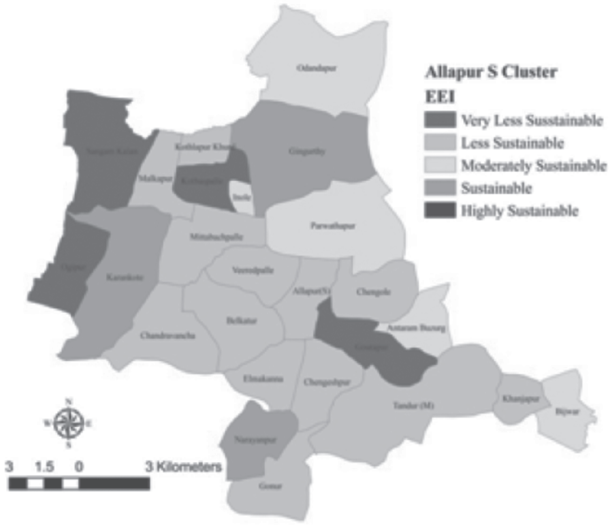

Figure 5: Spatial Variation in EEI

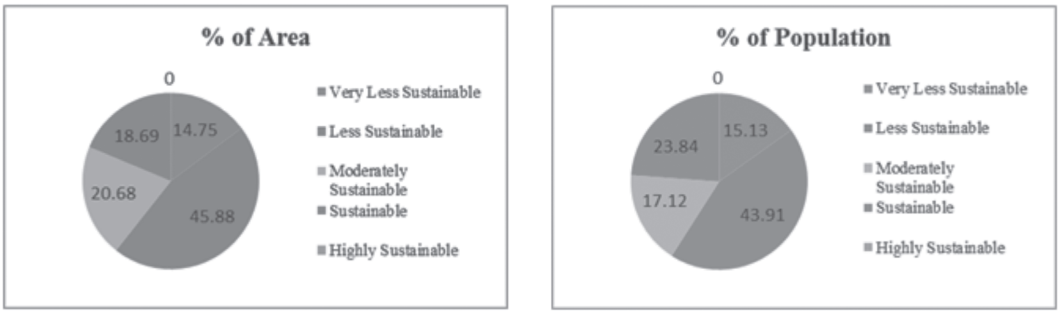

Figure 6: Presenting Area and Population Distribution in Various Degrees of Sustainability Classes as Per EEI Score

In moderately sustainable category 5.32 per cent of the households are associated with home based industries which implies that moderately sustainable areas are quite backward than LS category areas in terms of home based industries, but agricultural production and average income in MS areas are quite higher than LS areas.The average agricultural production and average per day per capita income in the moderately sustainable areas are 2067kg/hec and 147.22 INR. Narayanpur, Karankote, Gingurthy have secured sustainable tickets. Here, average per day per capita income is 126.35 INR which is 16.5 per cent lesser than that of MS areas but average agricultural production is 2262.6 kg/hec which is quite higher than that of the MS areas and 30.33 per cent households are connected with home based industries which is significantly higher than any other area. Karankote, Narayanpur and Gingurthy have secured first three places as per EEI scores 2.354, 2.11 and 1.890, respectively (Table 2). Whereas Ogipur, Kotbaspalle and Goutapur come in the last three places in the Table with EEI of 0.076, 0.104 and 0.535, respectively.

Social Equity Index

When it comes to social equity, it is one of existing basics defining Sustainable Development (SD) which is a prerequisite for clean development procedure (Suresh K et al. 2014). It entails fairly accessible ways to the resources and the livelihood. Along with that it emphasises the principle that each citizen, independent of personal traits or economic status, deserves and possesses a right which is fair treatment by the political systems and providing special observation to the requirements of vulnerable and weak populations (Chitwood, 1974). The result of SEI shows that out of twenty five villages, two, ten, eight and five villages are placed in S, MS, LS and LVS categories, respectively (Figure 7). Not a single village has reached the HS category as per SEI scores (Figure-8). In VLS and LS villages average primary literacy rate is only 25.38 per cent and LPG is being consumed by 52.51 per cent households. Ten villages are in MS category with a primary literacy rate of 30.42 per cent. 66.67 per cent of the households are using LPG in these villages. Only two villages have secured their places in S category with an average primary literacy rate of 32.08 per cent and the usage of LPG is 71.14 per cent. However, digital connectivity is very poor in all the village. Only 0.77 per cent households of the total cluster are taking digital connectivity facility. Malkapur, Allapur S and Narayanpur have achieved first three ranks with SEI scores 2.099, 1.953 and 1.791, respectively whereas, Kotbaspalle, Ginguthy and Bijwar stand in the last three positions with very less SEI scores (Table 3).

Table 3: Raw Data and Indices for Calculation of Social Equity Index (SEI) in Allapur S Cluster

Name of the Villages	Primary Literacy Rate	Primary Literacy Rate Index	% of House-holds with LPG Connec-tions	LPG Index	% of House-holds with Digital Connec-tivity	Digital Connec-tivity Index	Social Equity Index	Degree of Sustain-ability
Allapur S	31.870	0.731	69.318	0.619	1.700	0.603	1.953	S
Antaram Buzurg	36.190	1.000	61.816	0.416	0.230	0.082	1.498	MS
Belkatur	34.260	0.880	73.363	0.728	0.230	0.082	1.689	MS
Bijwar	23.090	0.184	47.600	0.033	0.000	0.000	0.217	VLS
Chandravancha	26.150	0.375	57.808	0.308	1.920	0.681	1.364	MS
Chengeshpur	33.310	0.821	66.422	0.541	0.000	0.000	1.361	MS
Chengole	30.030	0.616	50.082	0.100	0.330	0.117	0.834	LS
Elmakanna	33.760	0.849	47.531	0.031	0.000	0.000	0.880	LS

(Contd........)

Table 3 (Contd.....)

Name of the Villages	Primary Literacy Rate	Primary Literacy Rate Index	% of House-holds with LPG Connec-tions	LPG Index	% of House-holds with Digital Connec-tivity	Digital Connec-tivity Index	Social Equity Index	Degree of Sustain-ability
Gingurthy	20.800	0.042	48.230	0.050	0.330	0.117	0.209	VLS
Gonur	33.000	0.801	52.619	0.168	0.950	0.337	1.307	MS
Goutapur	21.070	0.059	61.521	0.409	0.000	0.000	0.467	VLS
Inole	20.300	0.011	76.033	0.800	0.000	0.000	0.810	LS
Karankote	24.710	0.285	67.155	0.560	1.150	0.408	1.253	MS
Khanjapur	29.670	0.594	83.459	1.000	0.000	0.000	1.594	MS
Kotbaspalle	22.710	0.161	47.970	0.043	0.000	0.000	0.204	VLS
Kothlapur Khurd	32.550	0.773	66.084	0.532	0.350	0.124	1.429	MS
Malkapur	32.290	0.757	72.973	0.717	1.760	0.624	2.099	S
Mittabachpalle	20.130	0.000	55.585	0.248	1.330	0.472	0.720	LS
Narayanpur	21.360	0.077	72.881	0.715	2.820	1.000	1.791	MS
Ogipur	33.050	0.804	65.217	0.508	1.300	0.461	1.774	MS
Parwathapur	26.570	0.401	48.916	0.069	0.310	0.110	0.580	VLS
Sangamkalan	33.550	0.836	47.775	0.038	0.700	0.248	1.122	LS
Tandur	28.790	0.539	52.757	0.172	1.070	0.379	1.091	LS
Uddandapur	29.540	0.586	46.370	0.000	1.640	0.582	1.167	LS
Veeredpalle	27.230	0.442	57.040	0.288	1.080	0.383	1.113	LS

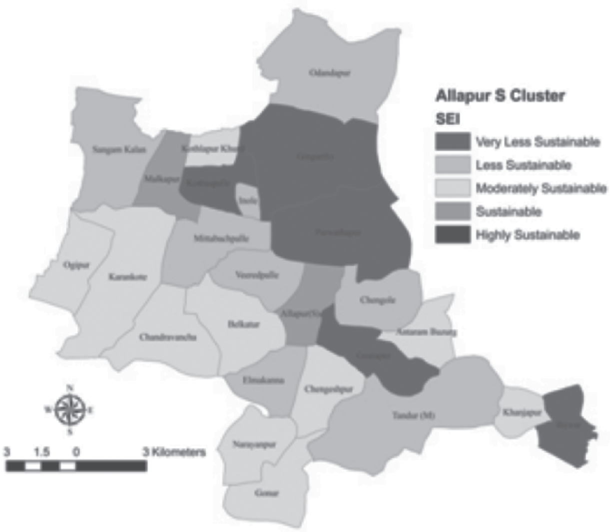

Figure 7: Spatial Variation in SEI

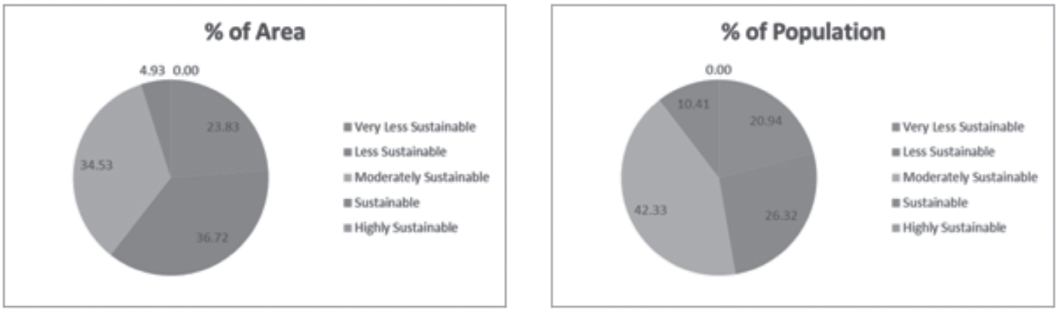

Figure 8: Presenting Area and Population Distribution in Various Degree of Sustainability Classes as Per SEI Score

Sustainable Likelihood Security Index

Finally, SLSI classification able to identify that two, fifteen, seven and one villages are under S, MS, LS and VLS group (Figure 9). Only Narayanpur and Oddandapur have secured S category. These two villages occupy only 11.13 per cent area and carry only 6.8 per cent population of the of the Allapur S cluster (Figure 10). Narayanpur seems to come under sustainable level as per ESI, EEI scores but, SEI score in this case is little bit lesser than sustainable downline. Whereas, Oddandapur is ecologically highly secured but EEI and SEI values are not like ESI. So, it is better to try and improve the economic efficiency and social equity which are well linked to each other. 66 per cent of the total population lives in the moderately sustainable areas. Some of these villages have good scores in any one scoring parameter of the SLSI, but they possess no healthy scores in the other two. Parwathapur and Sangamkalam stand in the second and third places in the ESI table but, EEI values are 1.492 and 0.556, respectively and SEI values are 0.580 and 1.122, respectively. Same trends are followed by Karankote and Gingurthy. Karankote and Gingurthy secured first and third places in EEI but, SEI and ESI values are pulling them behind to achieve sustainable tag as per their SLSI scores. Malkapur and Allapur S are also facing the same type of problem as these two villages are sustainable as per SEI scores but not sustainable as per ESI and EEI. Chengole, Elmakanna, Goutapur, Inole, Mittabachpalle, Tandur, Ogipur come under less sustainable category with an average ESI score of 1.420. However, the average EEI and average SEI scores of these areas are very poor at 0.717 and 0.938, respectively. Elmakanna and Mittabspalle which are under LS category as per SLSI scores, have achieved sustainable tag as per ESI values, but no other village exists which can be categorised in to LS as per SLSI though any one of the three parameters of the SLSI can take it to sustainable level. Kotbaspalle lies under VLS category with very less ESI, less EEI and less SEI. In LVS and LS villages, holistic-approach is needed to attain the conditions for the SLSI.

27.37 per cent population of the total Allapur cluster is placed under 'very less' and 'less' SLSI category, spread over 28.89 per cent area of the total cluster (Figure 10). Another category 'moderately sustainable' which is not very much desirable category carries 65.83 per cent population of the total cluster. Thus, there is an urgent need to introduce and implement appropriate flagship programme for Rurban mission for fulfilling all the future effective implications with all the possible growth ground for the prosperousness of the community.

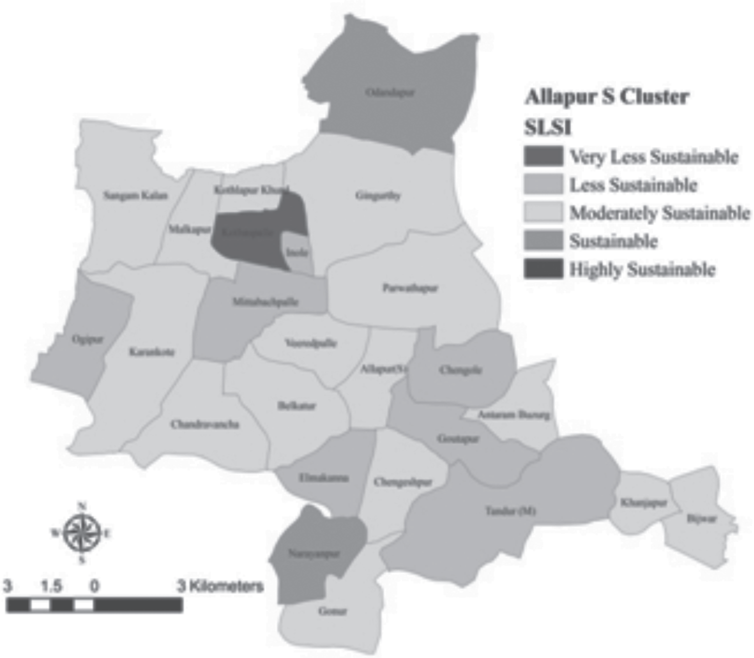

Figure 9: Spatial Variation in SLSI

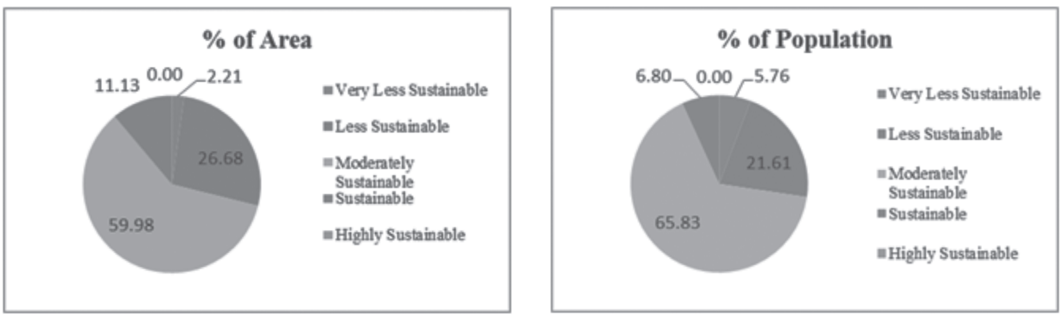

Figure 10: Presenting Area and Population Distribution in Various Degrees of Sustainability Classes as Per SLSI Score

Conclusion

SLSI is kind of a summation index, an exhaustive way tool and it is a blueprint to bestow more efficacious SD planning. It provides a foundation which is dependent on the relative scores, prioritising the allotment of the development-funds and the programmes, along with the activities to attain SD of a particular village or an area. As an example, villages like Sangam Kalam, Belkatur have achieved high score when it comes in terms of ESI but poor in EE and SE. In those cases where EE and SE scores are poor, efforts may be stepped up from expert to boost the productivity in agricultural field through advance technology usage and eco-friendly practices in terms of agronomy with spot-particular crop diversity, along with enhancement in irrigation method with an efficient usage of water. Smart road network utilisation can bring down the transportation cost of the crop. Proper usage of electricity can be promoted when it comes to the use of agricultural machineries. Knowledge of properly trained farmers can improve the decision making process and a healthy yield can be expected. Homebased industries can be promoted by proper skill nourishment practices. Presence of the market feasibility can give a stage to show the industrial production and well-connectivity amongst villages and markets to show the need to bring down the transportation costs. In the same way, Karankote, Gingurthy have very low scores in ESI. Efforts according to priorities, should be pointed to recover ecologically balanced sustainability and relatively higher EE. To achieve ecologically balanced sustainability, steps must be taken starting from the protection of forest areas, stoppage of built-up sprawls, preservation of the water bodies and in addition to this, promoting plantation. Bijwar, Gingurthy and Parwathapur have very poor scores in social equity, but are strong on both ecological and economical indices in either of the two. Efforts should be made towards enhancing the equity in benefit sharing through better education, promoting digital connectivity and LPG connection for achieving the goal of "social equitable sustainability". For villages like Kotbasally, Goutapur, Ogipur which are poor in all three pillars of SLSI, proper planning on the basis of holistic and integrated approach with the utilisation of the local resources along with appropriate management of the environment should be applied. The results demonstrate that SLSI is a very useful and powerful tool with broader applications. Hence, it can help all the stakeholders in the upgradation of management of natural resources by developing the balance among the economic, ecological and social facets of SD. Thus, the security of the future generation in terms of sustainable livelihood can be ensured.

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