Special Article

Actions for Sustainable Development
Evidence Based Assessment for the State of West Bengal

Joyashree Roy[1]
Jadavpur University
Kolkata, India
joyashreeju@gmail.com

Rupsa Bhowmick
Global Change Programme
Jadavpur University, Kolkata, India

Manisha Dolui
Global Change Programme
Jadavpur University, Kolkata, India
and Tennessee State University,USA

Submitted: 22.06.2015

Abstract

With the wide scale acceptance of the concept of sustainable development, it has become important that countries around the world along with their economic progress pursue actions such that the multiple sustainability goals are met simultaneously. In this paper we assess evidences from official sources to understand the relative positions of the districts in the State of West Bengal on the sustainable development pathway using a single index of sustainability namely the Composite Sustainability Index (CSI). Further we identify the social, environmental and economic issues of concerns for each district which act as barriers on state's path of achieving sustainability. We present priory list so that policy makers can attach importance accordingly while designing policies to mainstream sustainable development. It has been found that though the majority of the issues of concerns for the districts are environmental and more specifically health related, the social and economic issues also need attention in some districts for achieving sustainability.

Keywords: Sustainable development; Composite Sustainability Index; West Bengal.

JEL Classification: Q01, Q56, Q58, R11

1. Introduction

Sustainability Assessment has recently emerged as a policy tool to direct decision making to achieve multiple goals simultaneously (Huang, 2009), (Singh, 2009), (Jabareen, 2008), (Kasemir,

[1] Corresponding author. ICSSR National Fellow and Professor of Economics, Jadavpur University, Kolkata, India.

2003), (Spangenberg, 2000), (Report, 2000), (Hanley, 1999), (Proops, 1999), (Daniel, 1999), (Dahl A. L., 1995), (Golusin & Ivanovic, 2009), www.sustainabilitymeasures.com.. Sustainable development action is time and context (Aris, 2012) dependent and is dynamic (Dahl, 2012) since relative priorities attached to multiple goals might be varying over time. The Commission of Sustainable Development initiated a programme on sustainable development indicators in 1995 based on country consultations. The programme resulted in a working list of one hundred and thirty four (134) indicators. Twenty two (22) countries from all over the world volunteered to test these indicators in an initiative that begin in 1996. In 2000, under the direction of the Division of Sustainable Development and Department of Economics and Social Affairs (DSD/DESA), a small group of experts met to draft the final CSD framework. As a result of the meeting, a draft list of fifty eight (58) indicators was selected and distributed to all testing countries. The principles of sustainable development include fulfillment of human needs for peace, clean air and water, food, shelter, education and useful and satisfying employment so indicators of Sustainable developments covers economic, social and environmental issues. In the literature there are two concepts of sustainability: weak sustainability and strong sustainability. However, operationally it is the concept of weak sustainability that is used as it is not inconsistent with the experience of evolutionary process of human society where tradeoffs are accepted. Indicator based sustainable development (Ness, Pirrsalu, Anderberg, & Olsson, 2007) (Moldan, Janouskova, & Hak, 2011) (Morse, McNamara, Acholo, & Okwoli, 2001) (Aris, 2012) assessment (Shyamroy, 2010) becomes operationally useful as it provides scope for both top down aggregate view as well as bottom up detailed description for actionable. Indicators of a sustainable society point to areas where links between economy, environment and society are weak. We need indicators that give people an idea of whether or not the economic progress is getting worse or better in keeping balance with related social and environmental issues (Wallis, Graymore, & Richards, 2011)**.** Indicators act as signals on development pathways to decision-makers so that the paths of unsustainable development can be avoided. While the idea of developing sustainable indicators is appealing, it is clear that the concept of sustainable development is broader than the measures used to describe it. Common to all research on sustainable development indicators, is the problem of identifying what to measure and how. Obviously the information for the indicators must be available. Similarly, the indicators that are developed must both be informative and revealing if sustainable development is being achieved, and act as an effective guide to policy-makers. There is no consensus on methodology for sustainability assessment.

The purpose of this paper is to present briefly in section II the methodology of 'composite sustainability index' (Roy, Chatterjee, & Nandy, 2007) (Roy, Chatterjee, & Basak, 2008) (Roy, Nandy, & Chatterjee, 2009) (Roy, Shyamroy, & Deb, 2012)(Roy, Bhowmick, & Dolui, 2014) for sustainability assessment based on hard evidences from West Bengal. It is used to arrive at a unit free number that allows comparison and to identify in the context of West Bengal how each district is performing over time in the context of sustainable development. We believe this

examination is a necessary first step to ascertaining the district specific policies. Section III through V present the results followed by concluding remarks in section VI.

2. Method and Evidences

The real challenge is to fabricate a single measurable unit free index. As part of the empirical test of our indicator analysis we have used quantitative information from various secondary sources for 2011, the year for which most of the comparable data are available from official sources. We have referred to various statistical abstracts, district handbooks census reports, human development reports and host of other reports (www.indiastat.com, 2011) journal and periodicals pertaining to different years for the districts of West Bengal. Subject to data availability and comparability across time, we have selected a list of twenty six indicators (list is not exhaustive and can be changed as per context and objective), as shown in table 1, for our study for 2011. Some of the indicators are positive while others are negative with respect to contribution to achieving sustainability. That indicator, an increase in whose value helps the districts to move towards the goal of achieving sustainability, is known as a positive indicator of sustainability. Whereas the indicator, an increase in whose value causes the districts to move away from the goal of sustainability, is known as a negative indicator of sustainability. Detailed data set are available with the authors and may be accessed upon request.

Following the literature (Roy, Chatterjee, & Nandy, 2007) (Roy, Shyamroy, & Deb, 2012) while constructing the CSI, first we formulate a 'benchmark' or 'baseline' to evaluate the relative distance (a primary desideratum of the sustainability indicators) of the districts in West Bengal in terms of the sustainability performances. Our goal is to assign numerical values and assess the relative positions of the districts in West Bengal with respect to benchmark. Conceptually, we have taken 'state average performance' level as the benchmark. The benchmark satisfies some important properties: quantifiable, unit free, comparable across time and space, dynamic by nature i.e., with changing performance, the benchmark shifts over times.

In constructing the benchmark, we have drawn from the literature (Psacharopoulos, 1985) the concept of 'Representation Index' (RI). Representation Index measures the equality or inequality of distribution of relative shares of different groups. It indicates whether a particular group or area is over represented or underrepresented in relation to the aggregate. In the present context, the RI helps in quantifying the relative distance of the districts in West Bengal's overall performance in achieving sustainability. District wise RI is a simple device that indicates whether a particular district is pulling up or pushing down the overall level of West Bengal's eventual performance.

Table 1: Indicators and their Status in sustainability Index

Indicator	The more the value Than West Bengal's average, the better (positive)	The less the value Than West Bengal's average, the better (negative)
Social		
Population with access to safe drinking water	*	
Up to five mortality rate		*
Life expectancy	*	
Medical Facility	*	
Contraceptive User	*	
Sex ratio	*	
Crude Birth Rate		*
Grade V Education	*	
Secondary Education	*	
Higher education	*	
Adult literacy rate	*	
Below Poverty Line		*
Crimes against Women		*
Crimes against Child		*
Environmental		
Food grains production	*	
Gross irrigated area	*	
Chemical fertilizer Consumption		*
Forest cover	*	
Protected Area	*	
Land Use	*	
Reported cases of Acute Respiratory Infection (ARI)		*
Reported cases of Malaria		*
Reported cases of Diarrhea		*
Economic		
NDDP	*	
Invested capital	*	
Road lengths	*	

We assume the relation between the RI and the sustainability status of each district concerned in Table 2.

Table 2: Relation between RI and Sustainability Status

Representation Index	**Sustainability Status**
Value> Benchmark	Positive
Value< Benchmark	Negative

There will be RIs for each district and for each component of the social, environment, economic indicators listed in Table 3. There will be (26*18) = 468 RIs for the twenty six indicators and

eighteen districts of West Bengal. We consider Midnapore only without dividing it into purba and paschim to enable comparison. For the entire social, economic and some selected environmental indicators like disease, we use the formula

(1) RI = (Percentage share of the component indicator of the ith district) / (percentage share of population of that district)*100.
(1a) Benchmark RI = (percentage share of the component indicator of State) / (percentage share of total population of State)*100.

While calculating the representation indices of some of the environmental indicators like gross cropped area, protected area, wetlands and forest area we use the formula:

2).RI = (percentage share of the component indicator of the ith district) / (percentage share of total geographical area of that district)*100
2a) Benchmark RI = (percentage share of the component indicator of state) /((percentage share of total geographical area of state)*100

Similarly, while calculating the representation indices of the remaining environmental indices of the remaining environmental indicators, like area under food grains, consumption of chemical fertilizers and gross irrigated area, we use

3). RI = (percentage share of the component indicator of the ith district) / (percentage share of gross cropped area of the district)*100
3a) Benchmark RI= (percentage share of the component indicator of state) / (percentage share of total gross cropped area of state)*100

There will be 26 benchmarks for each of the component indicators. Using the 26 benchmarks and the (26*18) = 468 RIs we estimate the 'Relative Representation Index' (RRI). We calculate the RRI to assign a score to every district for each indicator. The RRI score of any district for a particular indicator gives the deviation of that district from the benchmark RI. If the RRI score is positive, then the district will have a positive sustainability status and vice versa whereas, if the RRI score is zero, then the state will be exactly at par with the benchmark. The formula for calculating RRI is,

4. RRI = RI- value of benchmark RI.

For positive indicators like adult literacy rate, we have used Formula 4. For negative indicators like infant mortality rate, we have used the formula,

4a) RRI = value of benchmark RI- value of the RI

There will be (26*18) = 468 RRI scores which can be either positive, zero or negative. The RRI scores are used to construct Semi-Composite Indices (SCI), namely the 'Composite Social Index' (CSI) using the social sustainability indicators, the 'Composite Social Index' (CSCI) is

using the environmental sustainability indicators and the 'Composite Economic Index' (CECI) using the economic sustainability indicators. By simple summation of the 11 social, 9 environmental and 3 economic RRI scores we get the SCIs. The relevant formulas are:

5.CSCI = $\sum$ RRI j; = 1 (1)11; RRI j being the RRI of the jth social indicator.

6.CENI = $\sum$ RRI j; j = 1(1)3; RRI j being the RRI of the jth economic indicator.

7.CECI = $\sum$ *RR*I j ; j = 1(1)3; RRI j being the RRI of the jth economic indicator.

These three semi-composite indices can now be used to estimate the ranks of the districts. Each district gets three sets of ranks which gives us a good idea about the positions of the districts on the social, environmental and economic sustainable development pathways respectively. We will get three SCIs for each district and thus (3x18) =54 SCIs for all the districts.

To arrive at the CSI we can now add the RRI scores of all twenty six indicators of sustainability. The formula used is:

8.CSI = CSCI + CENI + CECI $\sum$ RRI j; j=1(1) 26; RRI j being the RRI of the jth indicator.

Proceeding from equation (1) through (8) we have defined a methodology to arrive at one single index, Composite sustainability Index 'CSI' for each district. So there will be 18 CSI values which are pure numbers and comparable over time and space. The value of the CSI for the different districts can be either positive or negative. This is because computationally the values of the individual RRI scores can be either positive or negative or even zero. Conceptually, for those districts for which the CSI value is positive, can be said to be on the path to achieving sustainability. Whereas the districts, for which the CSI value is negative, can be considered as deviating from the sustainable development pathway and is, therefore, in need of policy interventions. There can be several reasons of a district deviation from the sustainable development pathway and is, therefore, in need of policy interventions. We assume zero CSI to be the switch point of a district on its pathway to sustainability. The objective of every district should be, to constantly make efforts to attain positive CSI values. The step in the derivation of the 18 CSIs are shown in the table below. The steps in the derivation of the twenty six CSIs are shown in Table 3.

Table 3. Indices Used In the Study

Indices	**Numbers**
Representation Indices	(26 x 18)= 468
Relative Representation Indices	(26 x 18)= 414
Semi-Composite Indices	(3x18)=54
Composite sustainability Indices	(1 x 18)=18

Table 4: Indicators and Their status in Sustainability Index

Districts			
	Composite Social Index (CSCI)	Composite Environmental Index (CENI)	Composite Economic Index (CECI)
	2011	2011	2011
Burdwan	8	8	1
Birbhum	18	6	10
Bankura	9	1	9
Midnapore	5	2	2
Howrah	7	9	5
Hoogly	2	12	4
24 Parganas (N)	12	11	7
24 Parganas (S)	11	3	3
Kolkata	17	18	8
Nadia	6	15	13
Murshidabad	15	14	15
Uttar Dinajpur	14	7	18
Dakshin Dinajpur	4	13	14
Malda	13	16	17
Jalpaiguri	10	10	11
Darjeeling	1	4	6
Kooch Behar	3	17	16
Purulia	16	5	12

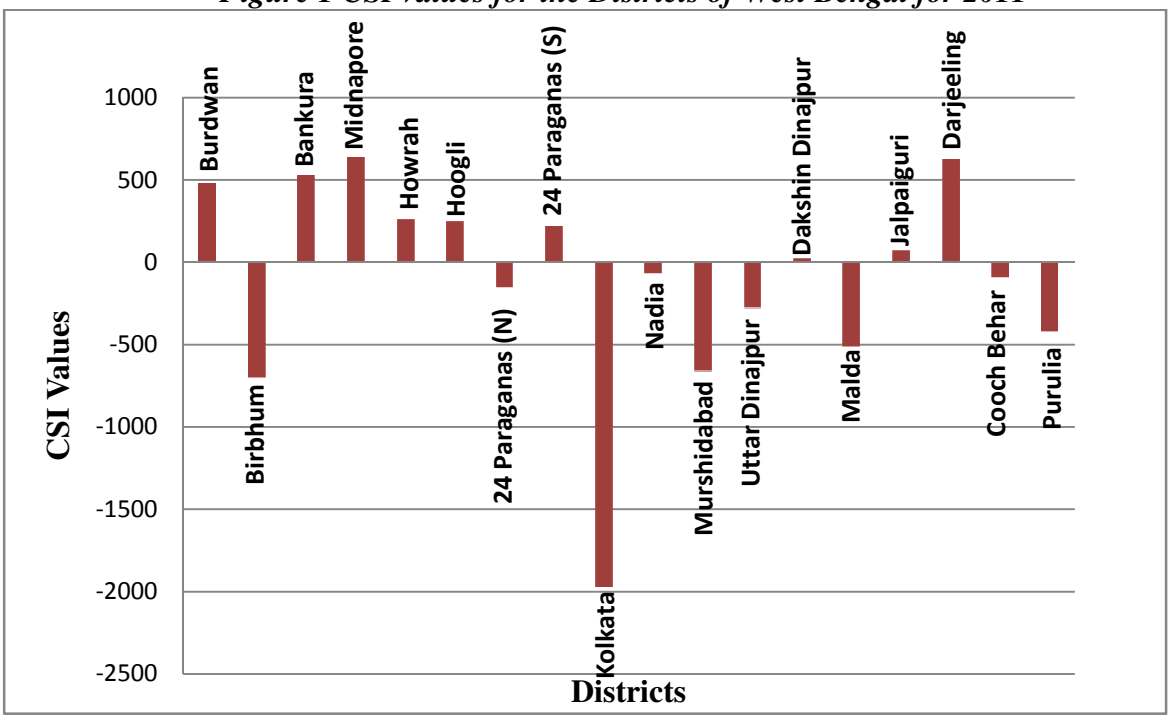
3. Estimating Semi Composite Indices Using RRI's and Relative Ranks of Districts:

Here we try to rank the districts in the social, environmental and economic categories for the year 2011 to drive implication of the analysis. This section helps us to have an exact idea regarding the positions of the districts on the path of sustainable development. Table 4 shows the ranks of the districts on the semi composite indices.

While we go through the table 4, a few districts draw our attention because of their atypical performance in these three categories. Burdwan has performed very well in economic category and bagged 1st position mainly due to high relative value of investment but has performed moderately in social and environmental category. This is because of low forest cover and protected area and higher consumption of fertilizer. High up to 5 mortality rate, scarcity of safe drinking water and inferior medical facility has pushed Birbhum back to 18th place in social category. In environmental and economic front, Birbhum has performed moderately because of low forest cover and protected area and lack of investment. Bankura has performed pretty well in environmental category and acquire 1st rank but has done moderately in social and economic category. This is because of lower accessibility of safe drinking water and road network, higher number of person living below poverty line. Midnapore has performed well in all three categories due to higher number of students enrolled in secondary education, higher relative value of protected area and sufficiency of investment. Hooghly performed quite well in social

and economic category but moderately in environmental category. This is because of low forest cover and protected area and high consumption of chemical fertilizer. 24 Paraganas (S) has performed fairly well in environmental and economic category but moderate in social category because of undersupply of safe drinking water, imperfect medical facility and low relative value of secondary education. Kolkata has done moderately in

Figure 1 CSI values for the Districts of West Bengal for 2011



economic category but pretty poorly in social and environmental category. The reason for this can be attributed to the very high incidence of crime against women and children and higher incidence of malaria while data for most of the other environmental indicator are not available/applicable. Nadia has performed moderately in social category but quite poorly in environmental and economic front because of low forest cover and protected area and lack of investment. Dakshin Dinajpur has done well in social category but quite poor in environmental and economic categories because of very low forest cover and protected area and lack of investment. Very high relative prevalence rate of diarrhoea, low forest cover and protected area, lack of investment and proper medical facility pushed Malda back to a much lower position in all three categories. Darjeeling achieved 1st rank in social category and has done exceedingly well in environmental and economic categories. This is because of adequate medical facility, lower incidence of crime against child and very high forest cover and protected area. Cooch Behar has done very good in social category but very poor in environmental and economic categories very high incidence of diarrhoea and ARI and lack of adequate investment. Purulia has done badly in environmental category but quite poor in social and economic categories. This is because of very

high relative value of up to 5 mortality rate, higher number of person living below poverty line and insufficient supply of safe drinking water.

Table 5. Ranks for 2011 Based On CSI

Districts	Rank	CSI Values
Midnapore	1	704
Darjeeling	2	560
Burdwan	3	454
Bankura	4	431
24 Parganas (S)	5	276
Howrah	6	261
Hoogly	7	229
Dakshin Dinajpur	8	19
Jalpaiguri	9	2
Nadia	10	-76
24 Parganas (N)	11	-140
Kooch Behar	12	-158
Uttar Dinajpur	13	-314
Purulia	14	-482
Malda	15	-531
Murshidabad	16	-670
Birbhum	17	-732
Kolkata	18	-1942

4. CSI estimates and ranks of the Districts:

We present here the ranks of the districts based on CSI for the year 2011 for facilitating the analysis. We can get a clear picture about the positions of the districts on the path to achieving sustainable development from the ranks shown in Table 5. The important thing that is to be kept in mind is that lower the magnitude of the rank of a district, better is its status in achieving sustainability and vice versa. So the district ranked 1, leads the way. The districts ranked between 1 and 9 have positive CSI values while all others have negative values. So this helps us in understanding which districts are in needs of what sectoral policies which can help in taking forward the sustainability goal. But this does not mean that the districts which have negative values of CSI are the only ones which need policy interventions. There are issues where even the better performing districts have not done well.

In figure 1 we have shown the CSI values of the districts for the year 2011. The CSI values are plotted along vertical axis while the districts long the horizontal axis.

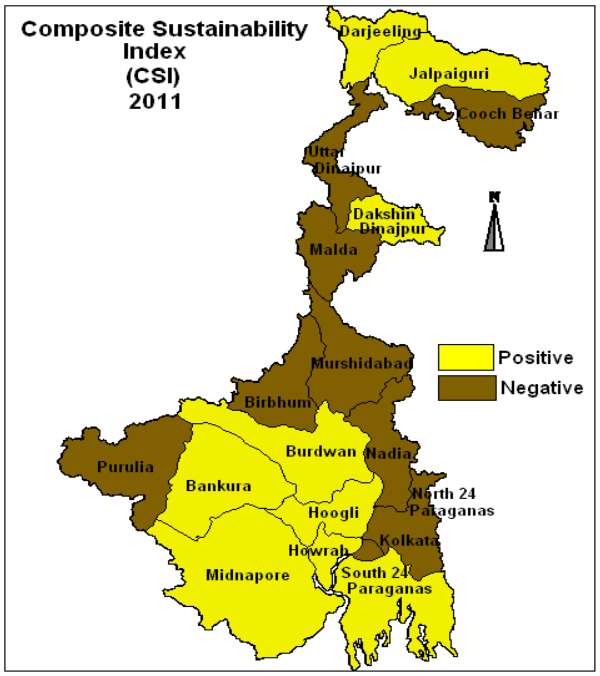
5. Issues of concern and Policy Recommendations to Mainstream Sustainable Development

Based on detailed component analysis we have prepared maps with issues of concern list for each of the districts of West Bengal. We divided the districts into two groups. In Group 1 we

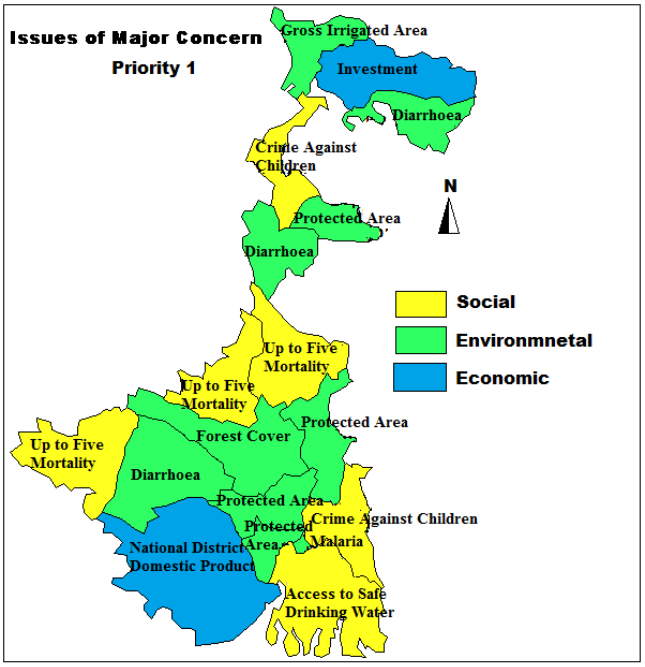
have shown these districts which have negative CSI values and hence can be deviated from the path of sustainable development. In Group 2 we have shown the remaining districts which have positive CSI values and hence can be considered to be towards the sustainable development pathway. Districts with ascending values of CSI have been arranged in sequence. We have defined an issues of concern as that where a district has been performed poorly and as a result deviating away from the path of sustainability, judged by a movement below the benchmark. Hence, policies can be formulated keeping these issues of concerns in policy priority. This will help in bringing the districts on the path of sustainability. While preparing the list of issues of concern, we have to go through the RRI of each district for all the individual indicators. Priorities of the issues of concern for each district will depend on the values of the relative representation indices. For any district, the sustainability indicator having the minimum RRI value has been given the highest priority for that district and so on towards its achievement of sustainable development.

Table 6 Issues of Concern

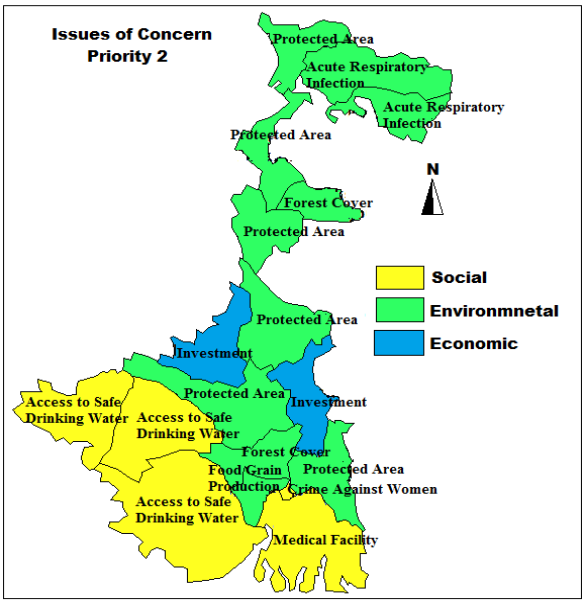
Districts	**Issues of Concern According To Priority**		
	1	**2**	**3**
Group I – Districts with negative values of CSI			
Birbhum	Up to 5 Mortality	Invest	Forest cover
24 Paraganas (N)	Crime against children	Protected Area	Forest Cover
Kolkata	Malaria	Crime against women	Protected Area
Nadia	Protected Area	Investment	Forest cover
Murshidabad	Up to 5 Mortality	Protected Area	Investment
Uttar Dinajpur	Crime against children	Protected Area	Investment
Malda	Diarrhoea	Protected Area	Investment
Cooch Behar	Diarrhoea	Acute Respiratory Infection	Investment
Purulia	Up to 5 Mortality	Drinking Water	Poverty
Group II – Districts with positive values of CSI			
Burdwan	Forest Cover	Protected area	Secondary Education
Bankura	Diarrhoea	Drinking Water	Poverty
Midnapore	NDDP	Drinking Water	Sex Ratio
Howrah	Protected Area	Food Grains	Roadlength
Hoogli	Protected Area	Forest Cover	Fertilizer Use
24 Paraganas (S)	Drinking Water	Medical Facility	Secondary Education
Dakshin Dinajpur	Protected Area	Forest Cover	Investment
Jalpaiguri	Investment	Acute Respiratory Infection	CC User
Darjeeling	Irrigation	Protected Area	Diarrhoea



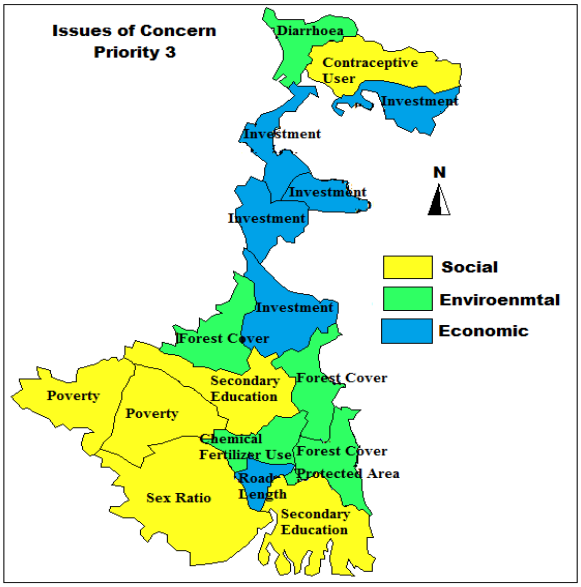
Map 1: Composite Sustainability Index (CSI) 2011



Map 2: Issues of Major Concern, Priority 1



Map 3: Issues of Major Concern, Priority 2



Map 4: Issues of Major Concern, Priority 3

Table 6 can be help in policy prioritization in development action, which will help the districts to achieve sustainability. For example, for the district of Malda, the most important issues to be focused on are diarrhoea, protected area, investment and forest cover.

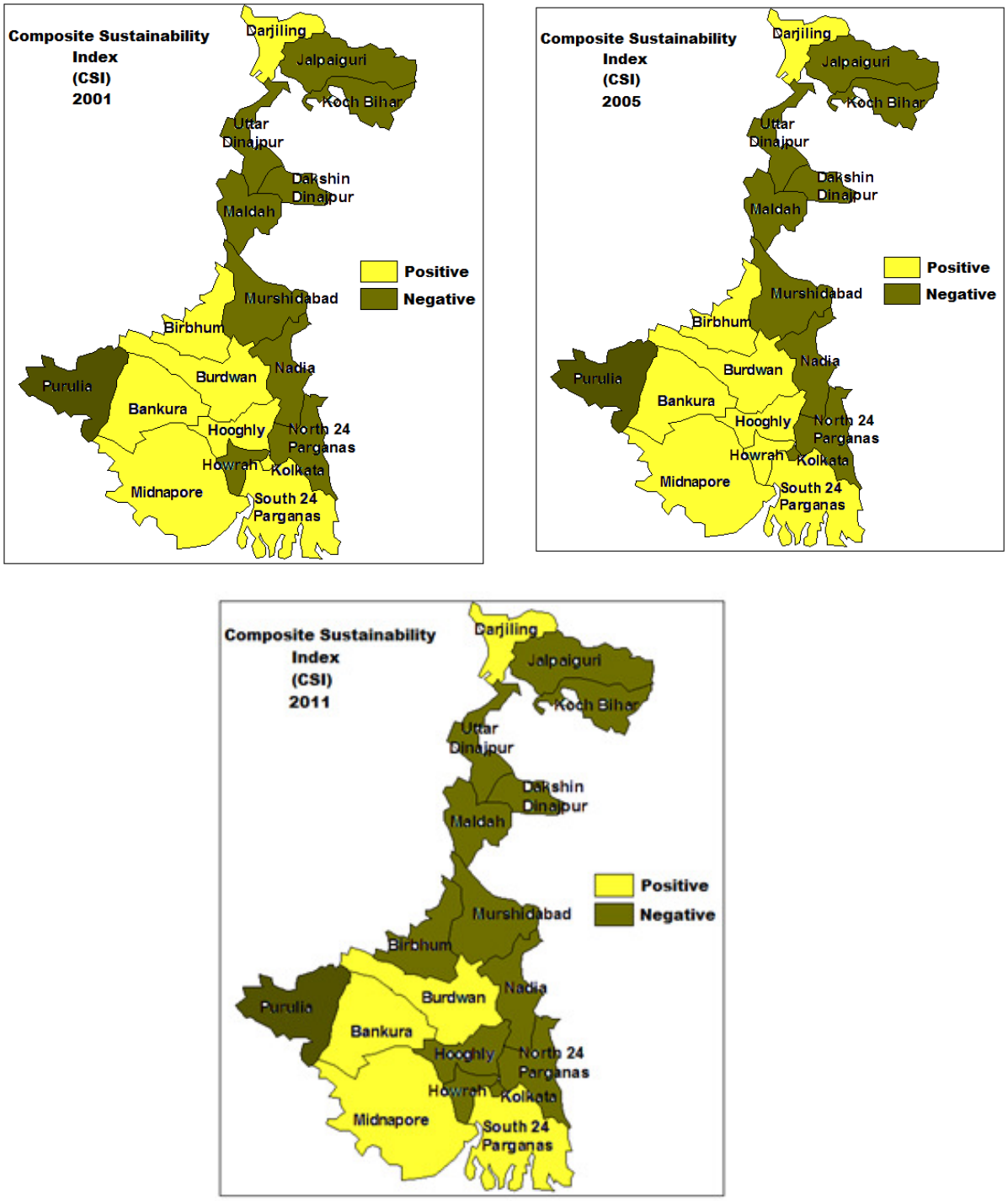
After going through table 6 carefully, it can be observed that most common issues of concern for the districts are the protected area and investment. We can use RRI of protected area and investment respectively to prioritize the districts, which have these issues of concern. The prioritized districts from most affected to least affected in case of protected area are Hoogly, Nadia, Uttar Dinajpur, Malda, Murshidabad, Dakshin Dinajpur, Darjeeling, Cooch Behar, Birbhum, Jalpaigudi, Burdwan and 24 Paragans (S). Similarly, in case of investment, the prioritized districts are Murshidabad, Uttar Dinajpur, Cooch Behar, Birbhum, Dakshin Dinajpur, Malda, Nadia, Jalpaigudi, Purulia, Darjeeling, 24 Paragans (N), Bankura and 24 Paragans (S).

As third level of issues of concern are issues like forest cover and safe drinking water over which Government can take more actions and implement more policies to improve the situation. For some of the issues like incidence of crimes, incidence of diseases like diarrhea, Acute Respiratory Infection and incidence of up to 5 mortality policy intervention or actions are needed. Regarding a few other issues like lowering consumption of fertilizer and number of persons living in below poverty line, increasing food grain production, gross irrigated area and NDDP, Government can take special attention.

Table 7 Ranks for 2001, 2005 And 2011

Districts	**Rank**		
	2001	**2005**	**2011**
Group 1: Districts Who Maintained Positive Sustainability Status Overtime			
Burdwan	3	3	4
Birbhum	7	7	7
Bankura	4	1	3
Midnapore	6	2	6
24 Parganas (S)	1	5	2
Darjeeling	5	4	5
Group 2: Districts Who Maintained Negative Sustainability Status Overtime			
24 Parganas (N)	13	11	11
Nadia	10	9	10
Murshidabad	14	13	15
Uttar Dinajpur	15	17	16
Dakshin Dinajpur	9	14	8
Malda	16	15	13
Jalpaiguri	12	18	14
Kooch Behar	17	16	17
Purulia	18	12	18
Group 3: Districts Who Switched Sustainability Status Overtime			
Kolkata	2	10	1
Howrah	11	6	12
Hooghly	8	8	9

Map 5: Composite Sustainability Indices for 2001, 2005 & 2011 with common indicators



6. Comparison over time of Sustainability Status

As mentioned in Section IV, besides cross- section comparison, inter temporal comparison in performance status can also be made through CSI. In this section we have calculated the ranks of the districts for 2001, 2005 (Roy, Shyamroy, & Deb, 2012) and 2011. The ranks for 2011 that have already been shown in table 5 may be different from the ranks for 2001 and 2005 shown in the table 7. This is because previously we had used all the twenty six indicators of sustainability to rank the districts. But here we have used only eighteen of them to calculate the new CSI for 2011. We have left out up to five mortality rate, life expectency rate, secondary education, higher education, below poverty line, crime against women and children and reported cases of acute respiratory infection (ARI) for the following purpose. This has been done because data for only these eighteen indicators are available for 2001 and 2005. Hence the CSI for 2001 and 2005 has been calculated using these eighteen indicators only. So to maintain comparability between 2001, 2005 and 2011 we have used these eighteen indicators only to calculate the CSI for 2001, 2005 and 2011 to understand whether there is any switch in sustainable development pathway for the districts. In table 7, we have divided the districts in three groups. Group 1 shows those districts which had positive values of CSI for 2001, 2005 and 2011 and hence maintained positive sustainability status in the period under consideration. Group 2 shows those districts which had negative values of CSI for the years 2001, 2005 and 2011 and hence maintained negative sustainability status in the period under consideration. Some district like districts like Kolkata switched from positive to negative and then again to positive sustainability status while Howrah switched from negative to positive and then again to negative sustainability status and Hooghly switched from positive to negative sustainability status between 2001 to 2011.

7. Concluding Remarks

It is true a single index of sustainability provides a comparable number but what is more important is the capability of tracing the components and their movement for policy perspective. It is a myth to think that a single number could have any real functional value as a policy tool. But the attempt to create a single sustainability index at the state level may prove useful because it might force a disciplined effort at presenting the complexity of sustainable development in a simplified form. A modestly successful effort to produce a small set of indices could have the effects of introducing policy and decision makers to the goal of sustainable development.

A sustainable development index will take advantage of several important principles such as- different types of measures can be aggregated into a comprehensive index; higher level aggregation should signal the relative sustainability of the state; vast array of complex information can be reduced to a simple presentation; and framework of sustainability indicators must be able to grow and adapt to society's ever increasing understanding and sophistication in each element of the framework.

References

Bureau of Applied Economics & Statistics, Government of West Bengal(2004), Statistical Abstract, 2002-03

Bureau of Applied Economics & Statistics, Government of West Bengal(2003), Statistical Handbook West Bengal, 2003.

Bureau of Applied Economics & Statistics, Government of West Bengal(2004), District Statistical Handbook, 2004.

Bureau of Applied Economics & Statistics, Government of West Bengal: Municipal Statistics of West Bengal, 2004-05.

Bureau of Applied Economics & Statistics, Government of West Bengal(2010-11), District Statistical Handbook, 2010-11

Bureau of Applied Economics & Statistics, Government of West Bengal (2011), State Domestic Product and District Domestic Product of West Bengal (2004-05 to 2009-10)

Callens, I., Tyteca, D., 1999, Towards Indicators of Sustainable Development for Firms: A Productive Efficiency Perspective, Ecological Economics. pp. 41-53.

Canadian International development agency; Indicators for Sustainability How Cities are monitoring and Evaluating their Success 2012.

Census report of India, 2011

Dahl, A.L, 2012. Achievements and Gaps in Indicators for Sustainability, Ecological Indicators. pp. 14-19

Economic Review, 2011-12

Golusin, M., Ivanovic, O.M., 2009. Definition, Characteristics and State of the Indicators of Sustainable Development in Countries of Southeastern Europe, Agriculture, Ecosystems and Environment. pp. 67-74.

Hanley, N., Moffatt, I., Faichney, R., Wilson, M., 1999. Measuring Sustainability: A Time Series of Alternative Indicators for Scotland, Ecological Economics. pp. 55-73.

http://www.westbengalforest.gov.in/urls_all/forest_forest_overview.html

Huang, S.L., Yeh, C.T., Budd, W.W., Chen, L.L., 2009. A Sensitivity Model (SM) Approach To Analyze Urban Development In Taiwan Based On Sustainability Indicators, Environmental Impact Assessment Review. pp. 116-125.

India State of Forest Report 2011, Ministry of Environment & Forest

Jabareen, Y., 2008. A New Conceptual Framework for Sustainable Development, Environment, Development and Sustainability. pp. 179-192.

Kasemir, B., Jaeger, C.C., Jäger, J., 2003. Citizen participation in sustainability assessment. In: Public Participation in Sustainability Science. Cambridge University Press, Cambridge, pp. 3–36.

Kates, R.W., Clark, W.C., Corell, R., Hall, M.J., Jaeger, C.C., Lowe, I., McCarthy, J.J., Schellnhuber, H.J., Bolin, B., Dickson, N.M., et al., 2001. Sustainability Science. Science 292, 641–642.

Moldan, B., Janouskova, S., Hak, T., 2011. How to Understand and Measure Environmental Sustainability: Indicators and Targets, Ecological Indicators. pp. 4-13.

Mori, K., Christodoulou, A., 2012. Review of Sustainability Indices And Indicators: Towards A New City Sustainability Index (CSI), Environmental Impact Assessment Review. pp. 94-106

Morse, S., McNamara, N., Acholo, M., Okwoli, B., 2001. Sustainability Indicators: The Problem of Integration, Sustainable Development. pp. 1-15.

Ness, B., Pirsalu, E.U., Anderberg, S., Olsson, L., 2006. Categorizing Tools for Sustainability Assessment, Ecological Economics (2007), pp. 498-508.

Proops, J. L. R., Atkinson, G., Schlotheim, B. F., Simon, S., 1999. International Trade and the Sustainability Footprint: A Practical Criterion for Its Assessment, Ecological Economics. pp. 75-97.

Psacharopoulos G. (1985). Returns to Education: A Further International Update and Implications, the Journal of Human Recourse. pp. 583-604

Report on the Aggregation of Indicators of Sustainable Development: Background Paper for the Ninth Session of the Commission on Sustainable Development. Department of Economic and Social Affairs, Division of Sustainable Development, New York (www.un.org)

Roy, J., Bhowmick, R., & Dolui, M. (2014). Sustainable Development In India- Who Should Do What: Updated Information. Indiastat.

Roy, J., Chatterjee, B., & Basak, S. (2008). Towards a Composite Sustainability Index: How are the States and Union Territories of India Doing? The India Economic Review , pp. 54-76.

Roy, J., Chatterjee, B., & Nandy, K. (2007). How are the States and Union Territories of India Performing on Sustainable Development Pathway: An Analysis Through Maps.Global Change Working Paper

Roy, J., Chatterjee, B., Basak, S., 2008. Towards A Composite Sustainability Index: How Are the States and Union Territories of India Doing? The India Economic Review, pp. 54- 76.

Roy, j., Nandy, K., & Chatterjee, B. (2009). Sustainable Develeopment in India? who should do what? www.Indiastat.com

Roy, J., Shyam Roy, M., Deb, A. (2012) Sustainable Development: Assessment of West Bengal In: Indian Economic Development Contemporary Issues, pp. 14-49.

Shyam Roy Maniparna (2010), Accounting for Air and Water Resources: A Case Study of West Bengal, PhD Thesis submitted for doctoral degree at Jadavpur University, Kolkata.

Singh, R. K., Murty, H.R., Gupta, S.K., Dikshit, A.K., (2009). An Overview of Sustainability Assessment Methodologies, Ecological Indicators. pp. 189-212.

State Bureau of Health Intelligence, Directorate of Health Service, Government of West Bengal (2011-12), Health on the March (2011-12)

Tata Energy Research Institute Project Report No. 2000 RD42 (2000) Sustainable Development Indicators. A Discussion of Sustainable Development Indicators prepared by the Commission of Sustainable Development. Prepared for the Ministry of Environment and Forest.

Valentin, A., Spangenberg, J. H., 2000. A Guide To Community Sustainability Indicators, Environmental Impact Assessment Review. pp. 381-392.

Wallis, A.M., Graymore, M.L.M., Richards, A.J., 2011. Significance of Environment in the Assessment of Sustainable Development: The Case of South West Victoria, Ecological Economics. pp. 595-605.