



Short Communication

Benchmarking sustainability using indicators: An Indian case study

Swati Kwatra^{a,b,*}, Archana Kumar^b, Prateek Sharma^a, Sumit Sharma^c, Shaleen Singhal^d^a Department of Natural Resource Management, TERI University, Plot No. 10, Institutional Area, Vasant Kunj, New Delhi, India^b Department of Development Communication and Extension, Lady Irwin College (University of Delhi), Sikandra Road, Mandi House, Delhi, India^c Centre for Environmental Studies, The Energy and Resources Institute, New Delhi, India^d Department of Policy Studies, TERI University, Plot No. 10, Institutional Area, Vasant Kunj, New Delhi, India

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ABSTRACT

This paper develops an index to measure sustainability based on the broad themes of social, economy and environment. Nineteen appropriate indicators were selected based on relevance, data availability, and periodicity for each leg of sustainable development. A correlation analysis was carried out to assess relationships between the 19 indicators representing different parameters under the three themes. These parameters were then normalized using Z-score technique. The Z-scores computed for each of these parameters were then used to develop a Sustainable Development Index (SDI). The index is pilot tested on different States and Union Territories (UTs) of India. The values are compared and interpreted to adjudge the forerunners and laggards on the various dimensions of human well-being and environment. Significant relationships have been observed between income levels and area of administrative regions with sustainability indices of the regions. Smaller administrative regions with higher income levels have been observed with higher sustainability scores. The proposed index provides a useful measure of identifying problematic areas that can be plugged through policy measures and ensures that the region moves on sustainable development pathways.

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1. Introduction

Since the Brundtland Commission's Report (UN, 1987), countries have begun to define their sustainable development objectives and priorities, reflecting national resources and needs, aspirations, and social and economic conditions. Several international and national organizations have developed indicator sets to measure and assess one or more aspect of sustainable development. These efforts received a major boost following the adoption of Agenda 21 (UN, 1992) at the Earth Summit in 1992. The Chapter 40 of the Agenda 21 document specifically asked countries and international governmental and non-governmental organizations to develop the concept of indicators of sustainable development and to harmonize them at the national, regional and global levels. Further, the Johannesburg Plan of Implementation (UN, 2002), and the United Nation Commission on Sustainable Development (UNCSD) at its 11th and 13th sessions also emphasized on development and reporting of indicators (UN, 2006).

Sustainability can be measured at different scales – global, national, regional and urban. Internationally, several indicators have been developed to gauge the progress made towards sustainable development (Moffatt, 1996; Hanley et al., 1998). Over 500 sustainability indicators have been reported on a global level developed by various governmental and non-governmental organizations. Of these 500 indicators, nearly 70 have application on global level, over 100 at national level, more than 70 are state or provincial level, and about 300 are local or metropolitan level (Parris and Kates, 2003). While, National level sustainability indicators are based on broad and generally applicable issues across different regions in a country, regional scale indicators are focused only on issues relevant to a specific region (e.g. coastal, hilly, industrial, etc.), and urban scale indicators deal with city level issues. However, to compare different regions, a common set of National scale indicators is required to adjudge their relative performances.

The indicators which are currently available in the Indian context have limited application in understanding sustainability concerns. Some of them measure just one of the three dimensions of sustainability – social, economic and environment. In India, there were efforts made to measure social development through indicators like Health Information Index (Department of Health and Family Welfare, Ministry of Health, Government of India); Gender Equality Index, etc. On environmental fronts, the Ministry of

* Corresponding author at: Department of Development Communication and Extension, Lady Irwin College, Delhi University, India. Tel.: +91 9899505495.

E-mail address: swati.kwatra@gmail.com (S. Kwatra).

Environment and Forests (MoEF), Government of India initiated the State of Environment (SoE) reporting process with all State Governments and Union Territories (UTs) through a scheme in the Tenth Five Year Plan (MoEF, 2009). These reports use different indicators to study the state and trends of the environment (land, air, water, forests and biodiversity), and issues of climate change, energy, food, and water security. On its footsteps, different States of India have been preparing their regional SoE reports. Other than governmental initiatives, TERI (1997, 2001, 2010) reported the state of environment in the country and suggested innovative pathways for sustainable development. CDF (2011), Chandrasekharan et al. (2013) also reported the use of indices to measure environmental sustainability in Indian context. Other than these, there are indicators which gauged the progress over social and economic legs of sustainability, together. Human Development Index and Composite Development Index (MoF, 2013) measure the progress made by different states of India on social and economic fronts.

Despite these efforts made to measure progress made on specific aspects of sustainability, there has been no comprehensive reporting of sustainability in the Indian context. The studies carried out in India have not come up with an aggregate measure of sustainability. This may lead to adhoc interventions for maintaining a balance between the three legs of sustainability. There is, thus a need of an index which comprehensively measures sustainability and provides a baseline to the decision makers/policy makers to take up decisions to improve sustainability in their region. This paper proposes a comprehensive index for comparative evaluation of different regions on their progress made towards sustainable development. The index has been pilot tested on administrative area divisions in India (States and UTs).

2. Material and methods

2.1. Study domain

Growth in developing economies has been phenomenal in the last two decades. India as a developing country has been chosen as the case study for the current work. India is the world's 7th largest country in terms of its size (2.4% of the world surface area) and supports 1.21 billion population (nearly 17% of world's population). There is disparity in spatial distribution of population and resources leading to intra-generational inequalities. Economic reforms since 1991 have transformed it into one of the fastest growing economies. However, it still faces wide-ranging challenges – from improving its social and physical infrastructure to enhancing the productivity in agriculture and industry and addressing environmental concerns (MoEF, 2010). While the index of industrial production has gone up by about 30 times during last sixty years, more than 80% of Indian cities violate the prescribed standards for air pollution (particulate matter-PM₁₀). Rising dumps of wastes and untreated wastewater (domestic and industrial) are the other emerging problems. Other than growing environmental concerns, India has under performed on addressing human development issues. India ranks 136 out of 187 countries on Human Development Index (UNDP, 2013). Currently India ranks 155 out of 178 countries on the Environment Performance Index (YU, 2014).

India is administratively divided into 28 States and 7 UTs (Fig. 1), where each State/UT is primarily governed by the State government and overseen nationally by the Central Government. The country is known for its huge geographical, cultural, ecological, socio-economic diversity. Geographically, towards south, India is bounded by the Indian Ocean, Arabian Sea on the southwest and Bay of Bengal on the southeast. Along with a landmass covering 3.28 million km², India also has two sets of islands-Lakshadweep in Arabian sea and Andaman and Nicobar in Bay of Bengal. In



Fig. 1. Study domain and administrative boundaries.

Source: http://d-maps.com/carte.php?num_car=4184&lang=en.

north and extending towards north-east, there lies the Himalayan mountain range and towards west lies the Thar Desert falling mainly in the state of Rajasthan. The northeast region (encompassing 7 states of Assam, Meghalaya, Mizoram, Tripura, Manipur, Sikkim, Nagaland, and Arunachal Pradesh) is deeply forested and less industrialized. Parallel to the Himalayan mountain range, there are Indo-Gangetic plains that are large flood plains of the Indus and the Ganga–Brahmaputra river systems. This is the most fertile region in the country covering states of Jammu and Kashmir, Punjab, Haryana, Uttar Pradesh, Bihar to Assam in the east. These states are known for most agricultural activities in the country. Since independence the population of India has grown from 345 million in 1947 to 1221 million in 2011. Population densities are higher in the UTs and mainly in the northern and eastern part of country in the states of Bihar, West Bengal and Uttar Pradesh. On social front, the country has made some progress; for instance, the literacy rates have gone up from just 12% in 1947 to 74% in 2011. However, there is variation among the states; higher population densities in some states have linkages with lower literacy rates than rest of the country. India is experiencing rapid growth in economy since last two decades. The GDP per capita levels (ppp) have grown from USD 1205 in 1991 to USD 4827 in 2011, although with disparity among different states. The more industrialized states of Gujarat, Tamil Nadu, and Maharashtra account for more than 30% of the total GDP of the country. Union Territories are urban regions, governed by the Central government, have higher income levels than the rest of the country. Rapid economic growth has led to deterioration of environmental quality in many parts of the country. The degradation of the environment however, has significant linkages with poverty also. Use of biomass for household energy demands, improper sanitation and waste management practices, and limited awareness about environmental issues, are

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