Environmental Sanitation Index for the State of Tamilnadu, India

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Abstract

Nations across the world have been endeavoring to achieve sustainable sanitation practices towards reaching the UN-Million Development Goals before 2015. Preparation of Environmental Sanitation Index for the state of Tamil Nadu, India, is part of the exercise. Methodology used under Human Development Index is taken as a model and customized the same to suit environmental sanitation index. Indices attempted in this paper will be a pointer to policy makers and administrators to take corrective measures for those districts which displayed dismal performance on the sanitation front. Still there is one more year to go as target period of MDG being 2015. Districts like Chennai and Kanniyakumari exemplified well by scoring first and second ranks also excelled better on literacy and income level. Access to toilet is crucial to sanitation and it is reckoned that about fifty per cent of Indian population is still using open air for defecation. This has to change and without which all development efforts will never be inclusive.

Keywords: Drinking water, toilet, index, millennium development goals (MDGs).

Introduction

A potable domestic water supply is one of the fundamental requirements of human life. Without water, life cannot be sustained beyond a few days and the lack of access to adequate water supplies leads to the spread of disease. In 2010 the United Nations general assembly recognized to declare that safe and clean drinking water and sanitation as human rights[1]. Many cities in developing countries including India to get water for less than 20 minutes in a week, population growth is one of the reasons for increased demand for water[2]. In the total developing world approximately 90 percent of the untreated sewage is discharged into rivers, lakes and coastal areas[3]. Children are vulnerable to health hazards associated with poor water and sanitation. In India, nearly every second person is defecating in the open air defecation, every third person is drinking unsafe water and at least 1000 children are dying every day due to a preventable disease like diarrhea. Each year, an estimated 2.5 billion cases of diarrhea occur among children under the age 5[4]. Diarrheal diseases attributed to poor water supply, sanitation and hygiene account for 1.73 million deaths each year and 90 percent are children under 5 years, mostly in developing countries. Eighty-eight percent of cases of diarrheal diseases worldwide are attributable due to unsafe water, inadequate sanitation, and poor hygiene[5].

During the 1990's, only 76 percent of population was using improved drinking water sources and the rest 24 percent was using unimproved drinking water sources but after two decades i.e. in 2010 nearly 89 percent of world's population (6.1 billion people) had started using improved source of drinking water and 11 percent of population was using unimproved water sources which was not even half to that of 1990s[1]. Therefore between 1990 and 2010, two billion people have improved their drinking

water sources. Lack of improved drinking water source and proper sanitation facilities posed several problems. In this millennium, this paper intends to prepare sanitation index for the state of Tamilnadu, India. The sanitation index may facilitate policy makers in prioritization of sanitation for sustainable development.

Millennium Development Goals with respect to Drinking water and Sanitation: Sanitation and environmental sustainability is one of the goals to be achieved by the Millennium Development Goals within 2015. Every nation is striving hard to implement different new measures to provide a proper sanitation and safe drinking water facilities for every single individual. India has also implemented many different measures to achieve the target and based on the economic status of people in different states, besides literacy rate and awareness in achieving that target. Tamilnadu has been working towards the target with the help of a measure called Total Sanitation Campaign (TSC) now renamed as Nirmal Bharat Abhiyan (NBA) and has achieved upto a satisfactory level.

According to Joint monitoring programme for water and sanitation report, released by UNICEF and WHO in the year of 2012, observed that in India 59 percent of people (629 million) defecate in the open. The report exposed the scenario in India that she lags behind a decade to achieve Millennium Development Goals. However the silver lining is the achievement of portable water target. Millennium Development Goals have played a very important role in the development of very basic need of a human being i.e. drinking water and sanitation. Safe drinking water is necessary for living a healthy and hygienic life for each and every individual. Before the implementation of Millennium Development Goals in the year 2000, both the drinking water source and sanitation facilities

were poor in Tamilnadu which led to lots of diseases that killed many innocent lives and that children were the first victims for all sorts of impacts between 2001 and 2011.[6] It is relevant here to take stock of sanitation in Tamilnadu in the backdrop of Millennium Development Goals (MDGs) also.

Sanitation index: There is no readymade methodology available in the literature to prepare sanitation index therefore, it is decided to customize a method of formulating sanitation index as an offshoot of human development index. A few studies gave a lead in an attempt to device a method of formulating sanitation index. Environment sanitation has always been a neglected area as far as empirical study is concerned. The present prevailing situation untie the realization that sanitation is central to environmental protection spreading across various levels from micro to macro. The initiative on formulation of finding that indicates reality and which could contribute to efficient monitoring would be a step towards sustainable development. Mukherjee and Kathuria were able to identify 63 environmental variables, which could be coveraged in to 8 broad environmental factors and the study could rank 14 major states in the country. The convergence of variables was done using factor analysis[7]. Mukherjee and Chakraborthy were able to indicate that the EQI for a particular state would depend upon parameters anchored an observable indicator and could adapt Human Development Index (HDI) method. The selected variables classified under eight broad categories are air pollution, indoor air pollution potential, greenhouse gases (GHGs) emissions, pollution from energy generation, consumption, depletion, degradation of forest resources, depletion and degradation of water resources, non point source water pollution potential and pressure and degradation of land resources[8]. Indrani Chandrasekharan has calculated environmental performance index by using the same methodology of HDI, to select two broad categories further it has been classified 22 indicators namely Air pollution, water pollution waste management, climate change etc.[9]

Methodology

This paper is based upon a study made by the authors which engaged the secondary data source on various selected indicators of sanitation form all the districts of Tamilnadu for a period of 2001-2011. The data was collected from the Census Report, Government of India. Two indicators viz., access to drinking water and usage of toilet are considered in formulating Environmental Sanitation Index (ESI) for Tamilnadu district. The method is formulated as per the rules of United Nations Development Program (UNDP)[10], to select proper variables, to start with under two broad categories, namely Drinking water and Usage of Toilet. This is further classified into nine different variables to access the toilet sources, open defecation, access the drinking water sources, access the drinking water sources within the premises, treated drinking water(tap), untreated drinking water(tap), covered well water, uncovered well water, and non availability of drinking water in close proximity. The

assumption made in the methodology is that positive and negative indicators representing the characteristics of services (Table 1). For instance, open defecation is deemed as negative, while access to toilet is considered as positive, they are calculating using the formula given below to positive indicators.

$$X \text{ index} = \frac{\text{(actual value} - \text{minimum value)}}{\text{(maximum value} - \text{minimum value)}}$$

X = (access the toilet facility, access the drinking water facility, treated drinking water (Tap), access the drinking water with in premises, covered well water)

The indicators are negative in nature they can use for following formula.

$$X \text{ index} = \frac{\text{(maximum value} - \text{actual value)}}{\text{(maximum value} - \text{minimum value)}}$$

X = (open air defecation, untreated drinking water (Tap), uncovered well water, non availability of drinking water in close proximity)

This index is calculated for nine variables, minimum and maximum values were become fixed. However, since the maximum values are chosen such that they are higher than (or) equal to the actual value of 32 districts in Tamilnadu, similarly the minimum values are chosen such that they are lower than (or) equal to the actual value. Environmental Sanitation Index (ESI) of Tamilnadu is then obtained by simply calculating the arithmetic average of its two indices.

ESI = ½ (Access to drinking water + Usage of Toilet)

"Units" are not given in the Index values for each of the indicators. They had shown each of the indicators as well lies between zero and one and districts are ranked according to how close their ESI is to one.

Table-1
Positive and Negative indicators of Environmental sanitation Index (ESI)

| Parameters	Positive Indicators	Negative Indicators
Toilet	Access to toilet specialty	Open defecations
Drinking water	Access to drinking water facilities. Access to drinking water with in the premises. Covered well water. Treated drinking water. Covered well water.	Uncovered well water. Non availability of drinking water in close proximity.

Results and Discussion

This is a pioneering attempt in preparing an environmental sanitation Index at the state level in India. Although the concept of sanitation is much wider encompassing personal hygiene, which includes hand wash before food and after toilet use, brushing teeth, wearing chappal, cutting nails, bathing and maintaining hair and so on. Access to drinking water and to toilet facilities are considered more important which are inextricably linked to environmental sanitation being reckoned for formulating Environmental Sanitation Index for the state of Tamilnadu. The secondary source of information is collected for the period 2001-2011.

Table 2 presents district wise ranking of access to toilet and access to drinking water. Separate ranking is made for toilet by taking access toilet facilities (Piped sewer system, Septic tank, other system, with slab/Ventilated Improved Pit, without slab/open pit, Night soil disposed into open drain, Night soil removed by human, Night soil serviced by animals, and public latrine) as positive indicator and negative score for open air defecation. Similarly for drinking water index, access to drinking water facility like as Tap water, well water, Hand pump/Tube well/Borehole water and other source of water, drinking water within the premises, covered well water, treated drinking water as positive indicators while untreated drinking water, uncovered well water non availability of drinking water is close proximity as negative indicators in the preparation of drinking water index.

The arithmetic mean values of both toilet index and drinking water index gave the total sanitation index. It is not surprising to observe that Chennai ranking 1 in regard to access to toilet facilities followed by Kanniyakumari, Coimbatore, Thiruvallur and Kanchipuram districts. Ariyalur district stood last as the mean value toilet index was 0.0031. On the drinking water front, the households in Ramanathapuram district have had access to poor quality of drinking water source followed by Dharmapuri, Perambalur, Pudukkottai and Thiruvarur as shown in figure 1. Comparing all the 32 districts, Chennai has achieved cen percent safe drinking water followed by Kanniyakumari and Coimbatore district. The inferences from table 2 and figure 3 relevant from the point of view of policy making are as follows. Districts like Chennai and Kanniyakumari registering first and second rank which can be attributed to high literacy rate and high economic growth[6]. Conversely, Ariyalur and Dharmapuri districts ranked 31 and 32, displayed low literacy and low economic growth. Hence, the upshot is literacy rate and growth rate have a strong bearing on sanitation status too.
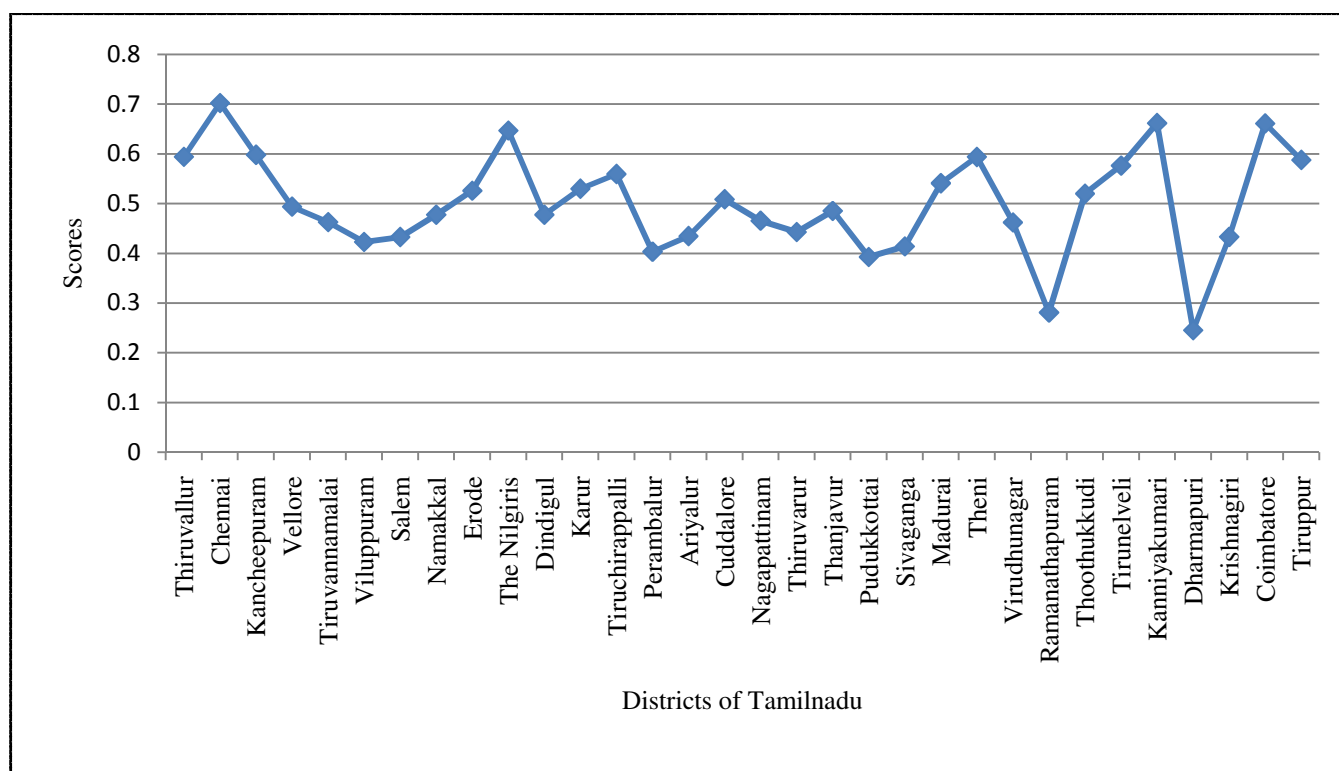
Figure-1
Drinking water ranking scores of the Tamilnadu Districts
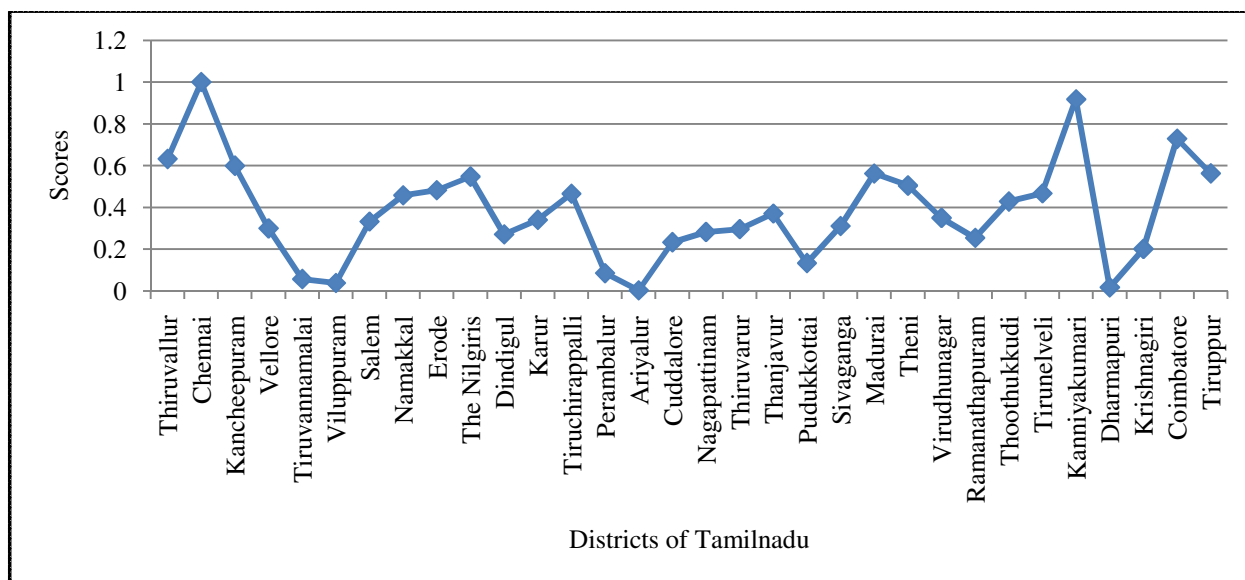
Figure-2
Toilet ranking scores of the Tamilnadu Districts
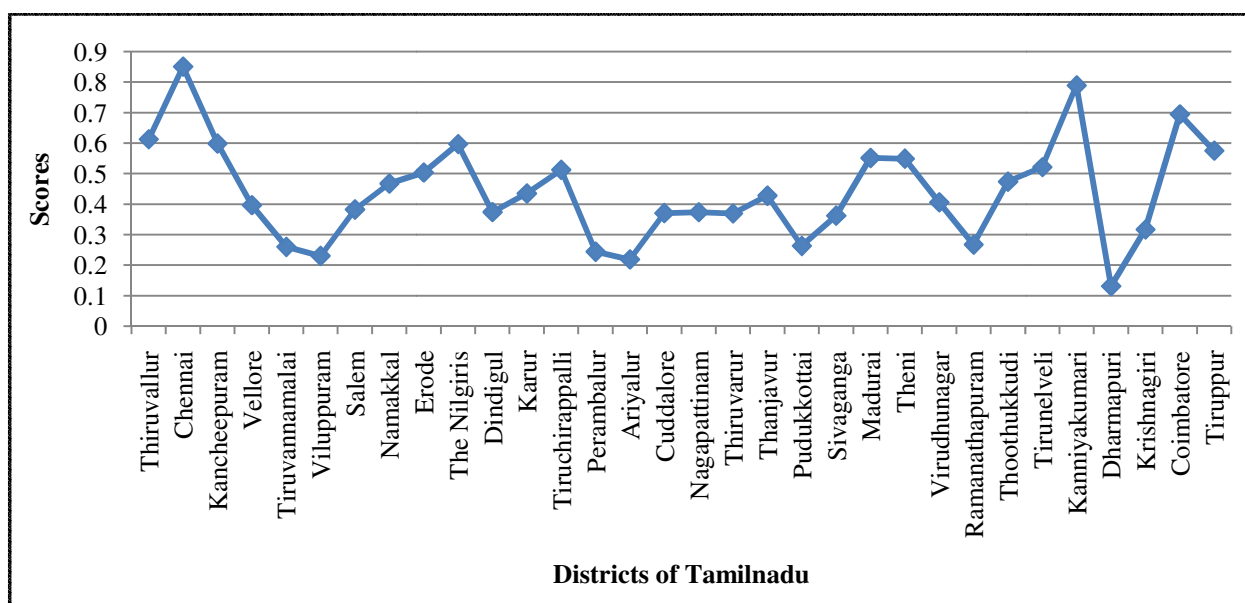
Figure-3
Total ranking scores of the Tamilnadu Districts

Table 2 shows Environmental Sanitation Index (ESI) highlighting the status of each and every district for the period of 2001 to 2011. The data were further processed using arithmetic mean scores of all the indicators considered under each category. The other category of data was derived by ranking using mean cumulative scores. The overall performance of the location should be arrived (Total Sanitation Index) using the above said categories of processed data. Chennai, Kanniyakumari, Coimbatore, Thiruvallur and Kancheepuram districts ranked in first five places, Dharmapuri, Ariyalur, Perambalur, Viluppuram and Tiruvannamalai districts are ranked in least five places, based on the index scores.

Chennai and Kanniyakumari registered a very low percentage of households defecate in open and this is because in Chennai the usage of in-house toilets showed a very high percentage. Besides it is one of the metropolitan cities in India and also capital state of Tamilnadu and Kanniyakumari is maintained as a important holy place in south India. The literacy rate is higher in both the districts compared to other districts. In Ariyalur about 80.1 percent of peoples are practicing open air defecation. As per the Censes Report 2011, by comparing both the urban and rural areas of Tamilnadu, open defecation practice is more in rural areas.

Table-2
Environmental Sanitation Index scores and ranking of districts in Tamilnadu

| Tamilnadu / Districts | TOILET | | | | DRINKING WATER | | | | | | | | | Total Sanitation Index | Final Rank |
	Access to Toilet facility	Open defication	Mean Value of Toilet Index	Toilet Rank	Access to Drinking water facility	Access to Drinking water facility within the Premises	Covered Well Water	Treated Drinking water (Tap)	Un treated Drinking water (Tap)	Uncovered Well Water	Non availability of drinking water in close Proximity	Mean Value of Water Index	Drinking water Rank		
Thiruvallur	0.6325	0.6314	0.6320	4	1.0000	0.4021	0.4940	0.3550	0.6582	0.6494	0.7647	0.6176	11	0.6248	**6**
Chennai	1.0000	1.0000	1.0000	1	1.0000	1.0000	0.0241	0.8667	1.0000	1.0000	1.0000	0.8415	1	0.9208	**1**
Kancheepuram	0.6000	0.5987	0.5994	5	1.0000	0.5105	0.3012	0.5209	0.7285	0.7662	0.7873	0.6593	6	0.6293	**5**
Vellore	0.3025	0.2969	0.2997	20	1.0000	0.3780	0.0723	0.4155	0.4238	0.8312	0.6878	0.5441	18	0.4219	**19**
Tiruvannamalai	0.0600	0.0541	0.0570	29	1.0000	0.2515	0.0964	0.3240	0.2852	0.6623	0.8100	0.4899	24	0.2735	**28**
Viluppuram	0.0400	0.0365	0.0382	30	1.0000	0.1024	0.0482	0.2853	0.2598	0.7338	0.7421	0.4531	27	0.2457	**29**
Salem	0.3350	0.3296	0.3323	18	1.0000	0.2229	0.0843	0.6047	0.7344	0.4545	0.5792	0.5257	20	0.4290	**17**
Namakkal	0.4588	0.4566	0.4577	13	1.0000	0.2937	0.0843	0.5395	0.6953	0.5455	0.7964	0.5650	16	0.5113	**14**
Erode	0.4838	0.4805	0.4821	10	1.0000	0.3870	0.0723	0.6310	0.7891	0.6688	0.8507	0.6284	10	0.5553	**12**
The Nilgiris	0.5488	0.5459	0.5473	8	1.0000	0.1732	0.7711	0.5736	0.6914	0.5195	0.7195	0.6355	9	0.5914	**9**
Dindigul	0.2725	0.2692	0.2708	23	1.0000	0.2274	0.0843	0.4310	0.4609	0.7792	0.7376	0.5315	19	0.4012	**22**
Karur	0.3425	0.3384	0.3404	17	1.0000	0.4066	0.0241	0.5473	0.5039	0.8571	0.8507	0.5985	14	0.4695	**15**
Tiruchirappalli	0.4663	0.4654	0.4658	12	1.0000	0.4684	0.0241	0.6744	0.6680	0.9026	0.8235	0.6516	7	0.5587	**11**
Perambalur	0.0875	0.0830	0.0853	28	1.0000	0.1401	0.0602	0.0760	0.0000	0.6948	0.7919	0.3947	30	0.2400	**30**
Ariyalur	0.0063	0.0000	0.0031	32	1.0000	0.1009	0.0241	0.3256	0.2129	0.7857	0.7828	0.4617	25	0.2324	**31**
Cuddalore	0.2363	0.2302	0.2332	25	1.0000	0.3539	0.0241	0.4093	0.5000	0.9351	0.8145	0.5767	15	0.4050	**21**
Nagapattinam	0.2838	0.2805	0.2821	22	1.0000	0.2319	0.0120	0.2760	0.5957	0.9351	0.7919	0.5489	17	0.4155	**20**
Thiruvarur	0.2988	0.2931	0.2959	21	1.0000	0.2274	0.0000	0.0000	0.0547	1.0000	0.8733	0.4508	28	0.3733	**24**
Thanjavur	0.3738	0.3673	0.3705	15	1.0000	0.3735	0.0000	0.1101	0.0371	1.0000	0.9140	0.4907	23	0.4306	**16**
Pudukkottai	0.1363	0.1308	0.1335	27	1.0000	0.0708	0.0482	0.3333	0.4238	0.8506	0.3982	0.4464	29	0.2900	**26**
Sivaganga	0.3138	0.3082	0.3110	19	1.0000	0.2229	0.1928	0.2636	0.4980	0.6688	0.3575	0.4577	26	0.3843	**23**

Madurai	0.5638	0.5610	0.5624	7	1.0000	0.4142	0.0120	0.6589	0.6797	0.9935	0.6968	0.6364	8	0.5994	7
Theni	0.5063	0.5031	0.5047	9	1.0000	0.4428	0.0120	0.8217	0.7109	1.0000	0.8688	0.6937	4	0.5992	8
Virudhunagar	0.3513	0.3484	0.3498	16	1.0000	0.1747	0.0241	0.3395	0.3008	0.9675	0.7059	0.5018	21	0.4258	18
Ramanathapuram	0.2550	0.2528	0.2539	24	1.0000	0.0090	0.3976	0.0915	0.4941	0.0714	0.0000	0.2948	32	0.2744	27
Thoothukkudi	0.4288	0.4277	0.4282	14	1.0000	0.3087	0.0482	0.6171	0.6172	0.9156	0.7014	0.6012	13	0.5147	13
Tirunelveli	0.4688	0.4654	0.4671	11	1.0000	0.3961	0.0120	0.7659	0.7344	0.9935	0.8552	0.6796	5	0.5733	10
Kanniyakumari	0.9163	0.9182	0.9172	2	1.0000	0.4352	1.0000	0.3473	0.6777	0.1494	0.7014	0.6159	12	0.7665	2
Dharmapuri	0.0213	0.0138	0.0175	31	1.0000	0.0000	0.1566	0.0698	0.5117	0.0000	0.3348	0.2961	31	0.1568	32
Krishnagiri	0.2038	0.1987	0.2012	26	1.0000	0.1355	0.0964	0.3752	0.5078	0.7078	0.6199	0.4918	22	0.3465	25
Coimbatore	0.7288	0.7283	0.7285	3	1.0000	0.7425	0.0361	1.0000	0.9395	0.9221	0.8914	0.7902	2	0.7594	3
Tiruppur	0.5638	0.5623	0.5630	6	1.0000	0.5512	0.0482	0.8093	0.8281	0.7987	0.8597	0.6993	3	0.6312	4

Note: Computed from the data supplied by the Ministry of Home Affairs, Population Census of India, 2011.

Conclusion

Environmental sanitation is fairly a new phenomenon. This does not confine only to personal hygiene but essentially includes potable water and toilet facility. Taking a stock of environmental sanitation on a piece meal basis does not serve the purpose fully. Preparation of index assumes importance in this context. Each district within the state exemplified differences in sanitation practices. Level of population, literacy rates, urban/rural, standard of living, purchasing power, industrial/agricultural locations and cultural habits are a few factors exerting influence on sanitation practices. Environmental sanitation index of Tamil Nadu confirmed that Chennai and Kanniyakumari districts ranked first and second where as districts like Dharmapuri, Ariyalur and Perambalur stayed at the bottom. This index is a pointer to administrators to accord priorities to sanitation sector. A better environmental sanitation contributes to better environmental sustainability which in turn improves human productivity and ultimately enhancing human welfare.

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