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An Analysis of Supply and Demand of drinking water consumption Management in Tirunelveli zone

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Abstract

Water is the primary source of all living beings. The global availability of water resources is decreasing due to the expansion of the social economy. Water resources are now recognised as a critical factor affecting sustainable economic and social development. Providing clean and safe drinking water is considered a fundamental right for all citizens in India. The balance between water supply and demand is closely connected to the social and economic development of a place. Choosing the right scale is essential for analysing the urban water balance. This article is on the availability and demand of potable water for residential consumers in the Tirunelveli region of Tamil Nadu. Family size, use of alternative water sources, dependence on public taps, water usage for gardening, and water usage for cleaning vehicles significantly affect per capita water consumption. The significance of these variables is crucial. A positive coefficient shows a direct impact of the variables on per capita water consumption, whereas a negative coefficient suggests an inverse impact of the variables on per capita water consumption. The existence of a storage facility, the quantity of taps in the residence, and the number of toilets in the residence significantly influence per capita water consumption. There are no other variables that are demonstrated to affect per capita water use significantly.

Key words : Drinking water, socio-economic development, groundwater, sewage treatment, waterborne diseases.

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India's rural population exceeds 700 million people living in around 1.42 million habitations across 15 varied ecological areas. Supplying drinking water to a vast population is indeed a significant challenge. The country exhibits variation in awareness levels, socio-economic development, education, poverty, practices, and rituals, contributing to the challenges in water provision.

The country holds 16% of the global population but possesses only 4% of the world's water resources and 2.5% of the total geographic area. It receives intermittent rainfall throughout a two- to three-month period, with an average yearly total of about 1100 mm[2]. Water is an essential requirement for all living organisms, and without it, no living entity can exist. Access to uncontaminated and potable water is crucial for maintaining public health[13].

India's water supplies rely heavily on monsoon rains. However, the country's vast population, extensive irrigated agricultural land, and strong industrial activities create a substantial demand for water[5]. In India, it was predicted that almost 80.00 percent of illnesses might be prevented by providing its population with safe drinking water[1].

India comprises 16% of the global population, 2.45% of the world's land resources, and 4% of its water resources[14]. In India, access to clean and secure drinking water is considered a fundamental right for all individuals[15]. Approximately one-third of the global population relies on groundwater for drinking, and over half of the world's population depends on it for survival[17]. Groundwater resources are endangered by contamination resulting from poor hygiene practices in poorer countries. Sewage treatment facilities are insufficient in most urban areas and nearly non-existent in rural India[3].

Two-thirds of nations will experience a water shortage by 2025[10]. Due to the severe restrictions on economic and social development caused by the scarcity of water resources and the supply-demand mismatch, water resources must be allocated and used responsibly[16]. Analysing the structural link between water supply and demand in a particular area is known as "water supply-demand balance analysis"[19].

An estimated 1.5 million children are thought to die from diarrhoea alone each year, and 73 million working days are lost to waterborne illness in India, where the disease afflicts 37.7 million people. An estimated $600 million is lost economically as a result each year[4]. Even if "traditional diseases" like diarrhoea still cause many deaths, too much fluoride is putting 66 million Indians in danger[7] and 10 million as a result of excessive groundwater arsenic.

All told, 1,95,813 homes across the nation have poor water quality[9]. Because of precipitation in the form of rain and snow, about 4,000 BCM of fresh water are accessible, the majority of which is returned to the seas by rivers[6]. The annual per capita availability decreased to 2,200 cubic metres (cu. m) in 1996 from 5,300 cu. m in 1955[8].

India is predicted to become a "water-stressed" state by 2020, with per capita availability falling to 1600 cu m/person/year[21]. When the per capita availability of water falls below 1700 cu. m/person/year, a nation is said to be water stressed[17]. According to data from the 2001 Census, 68.2% of Indian homes have access to clean drinking water[18].

According to current estimates, 91% of people in urban areas and 94% of people in rural areas have access to clean drinking water[5]. The Government of India has authorised 430 district-level laboratories with the goal of establishing laboratories; of these, 252 have been created as of 2005. Additionally, 158 laboratories have been built by several state governments and other organisations[12].

Inadequate water quality impedes socio-economic development, spreads illness, and results in mortality. Waterborne infections kill over five million people annually. Furthermore, chronic illnesses have an impact on schooling and cause 180-million-person days of lost workdays per year[20]. The anticipated yearly economic loss is Rs. 112 crores[11]. This study examines the supply and demand for clean drinking water among Tamilnadu's Tirunelveli zone's household water users.

Objectives of the study :

The research's particular goals are.

1. To investigate the drinking water sources that the sample respondents used.
2. To determine the cause of the increased demand for drinking water.
3. To investigate the differences in consumption between families with and without a flushing facility.
4. To examine the variables affecting the average amount of water consumed by each person.

The descriptive survey method is applicable to the current study. In all, Tirunelveli Municipal Corporations has fifty-five wards. The five zones that make up the Tirunelveli municipal corporation are Thatchanallur, Palayamkottai, Pettai, and Tirunelveli. 140 heads of households from Ward 40, Ward 41, Ward 42, and Ward 43, who were chosen from the drinking water recipients in the Tirunelveli zone, were interviewed; this was the main source of primary data. A straightforward random sampling technique is used to select 35 residential drinking water customers from each ward.

The sources of the secondary data include the National Institute of Urban Affairs, the Planning Commission, the National Institute of Public Finance and Policy, the National Council of Applied Economic Research, the Census of India, and numerous journals, research papers, magazines, websites, and the Right to Information (R.T.I.) Act. Apart from tabular depiction, statistical instruments including averages, standard deviation, Chi-Square test, t test, multiple regression, Garrett's ranking processes, Mann Whitney U Test, and Z test are employed to examine the collected data. Direct knowledge relates to January 2023.

Table-1. Sources of drinking water used by the sample respondents

S.No.	Source of Drinking Water	No. of Respondents	Percentage
1.	Public Water Tap	37	26.43
2.	Individual Water Tap	23	16.43
3.	Individual Bore well	19	13.57
4.	Public hand pump	21	15.00
5.	Common well	15	10.71
6.	Individual well	11	7.86
7.	Can (bottled) water	14	10.00
	Total	140	100

Source: Primary data.

Out of 140 respondents, 37 (26.43 percent) reported using a public water tap; 23 (16.43 percent) reported using an individual water tap, 19 (13.57 percent), 21 (15.00 percent), and 15 (10.71 percent) reported using an individual bore well, a public hand pump and common well. 11 (7.87 percent) reported using an individual well and 14 (10.00 percent) reported using Can (bottled) water, the data on the respondents' sources of drinking water is based on these data.

Table-2. Garrett's score for the reason for the demand for an increase in drinking water consumption

S.No.	Reasons	Mean score	Rank
1.	Overcrowding	67.34	I
2.	Urban development	53.51	IV
3.	Development of Industry	58.04	III
4.	Lack of knowledge of economic usage	40.27	VI
5.	severe droughts and water scarcity	61.82	II
6.	Diminished tank system's storage capacity	45.37	V
7.	Conventional water management that is unsustainable	27.85	VIII
8.	Infrastructure deterioration	35.78	VII

Source: Computed from Primary data.

The chosen explanation for the sample respondents' desire for an increase in drinking water intake is clearly visible in Table. By using Garrett's score, that is deduced. Overpopulation was cited as the primary cause of the demand for a rise in drinking water consumption, followed by severe water scarcity and droughts brought on by climate change. Urban development came in fourth place, and industry came in third. Reducing the tank system's storage capacity and not knowing how to use energy efficiently were placed fifth and sixth, respectively. Conventional water management that is not sustainable and outdated infrastructure ranked seventh and ninth, respectively.

Table-3. Comparison of Consumption among the Households Having Flush Facility and without Flush Facility

Group	N	Mean	z-value
With flush	54	91.22 ± 6.17	2.66**
Without flush	86	73.31 ± 3.11	

** - significant at 0.01 level

Source: Computed from Primary Data

To find out if there is a significant difference between the amount of water consumed by homes with flush toilets and those without, the Mann-Whitney U test is employed. Because there is a significant difference in the amount of water used by households with flush toilets and those without (level of significance - 0.01, $p<0.001$), the P value is less than the level of significance, rejecting the null hypothesis. The average consumption is higher in families with flush-equipped latrines (91.22) than in those without (73.31). This demonstrates how the ability to flush toilets uses more water.

Factors Influencing the Per Capita Consumption of Water :

To determine the factors impacting the per capita water use, a multiple regression equation is fitted. The dependent variable is per capita consumption, and the factors impacting per capita water use are family size, income, availability issues, number of taps, number of bathrooms, and flush usage in the toilet, among others. Table-4 presents it.

Table-4. Factors Influencing the Per Capita Consumption of Water

Variable	Coefficient	Std. Error	Beta	T	p-value
(Constant)	28.534	12.641	.012	1325*	.013
Family	-3.574	.642	-.159	4362**	.000
Income	.267	1.395	.013	0.211	.246
Awareness of the water issue	.291	3.281	.001	0.031	.842
Water payment	-2.084	3.764	-.025	0.305	.364
The issue with the quality of water	-1.301	1.648	-.022	0.401	.264
Daily accessibility	-.382	2.647	-.003	0.101	.361
Storage capacity	-457	2.645	-.041	1.834*	.021
Period of accessibility	-.104	.301	-.010	0.134	.371
Public tap	14.615	3.964	.121	3.101**	.000
Number of taps	1.301	.414	.103	1.394*	.031
Number of toilets	-376	1.543	-.141	2.107*	.011
Volume of flush	284	2.746	.032	0.421	.124
Number of flushes	.137	.317	.002	0.201	.347
Number of baths	2.694	2.641	.005	1.048	.108

Number of cooking	.113	2.201	.001	0.032	.551
Variable	**Coefficient**	**Std. Error**	**Beta**	**T**	**p-value**
Number of washes	2.764	1.942	.034	1.311	.032
The water utilised for cleaning	.122	.028	.121	2.534**	.000
Utilise tap water to cleanse the floor	.371	2.46	.005	0.112	.401
Utilise water for irrigation purposes	.212	.025	.112	2.584**	.000
in the garden					
Washing machine	2.525	5.721	.031	.214	.371
Vehicle / Bicycle/ Motorcycle/ bike/Car	-.023	2.046	.000	0.011	.624
Salty	-2614	2.195	-.032	1.021	.211
Chlorine odour	-1.218	2.614	-.011	0.315	.213
Unpleasant odour	3.941	3.657	.031	1.181	.221
All the above	-2.814	4.813	-.014	0.325	.386

F-value = 6.889** R = 0.542, and R2 = 0.293

Source: Computed from Primary Data

A review of Table 4's data reveals that, of the several factors, the per capita water consumption was found to be highly influenced by family size, the use of alternative water sources, the use of public taps, gardening, washing cars, motorcycles, and scooters. These factors have a statistically significant impact. A positive coefficient indicates a direct influence of the variables on per capita water consumption, whereas a negative coefficient indicates the opposite effect of the variables on per capita water consumption. The quantity of storage space, taps, and toilets in a home all have a big impact on how much water is used per person. It is discovered that no other factor significantly affects the amount of water used per person.

The study's conclusions suggest that, despite the fact that altering residents' water-use patterns in the Tirunelveli District may be a protracted and difficult process, doing so will significantly lower household water use. Additionally, to increase residential water efficiency, a number of water-saving appliances and microcomponents can be implemented at the household level. Finally, it would be beneficial to perform a diary study on water use habits in order to conduct additional research.

Conflicts of Interest :

The authors do not have any conflict of interest.

References :

1. Amutha, D., (2020), Trend and Growth of Individual Household Latrines in India, *Journal of Social Welfare and Management, 12*(2): April–June 2020 DOI: http://dx.doi.org/10.21088/jswm.0975.0231.12220.4

2. Amutha, D. (2017). *A Journal of Inter-continental Management Research Consortium,* ISSN: 2347-1670/2347-1662/2347-1654, Impact Factor: 4.311, Volume 5, Issue 6- Special Edition, March 2017.
3. Amutha, D. (2022). "Socio-Economic Study of Public Toilet Cleaners in Thoothukudi District of Tamilnadu State." J*ournal of Xi'an Shiyou University, Natural Science Edition,* ISSN: 1673-064X, *18*(01): pp 270-281.
4. Asghar, A., J. Iqbal, A. Amin and L. Ribbe, (2019). *Journal of Water Supply: Research and Technology - AQUA, vol. 68*(2): 136–148.
5. Drinking Wsater and Sanitation Status in India (2005). Water Aid India.
6. Ghosh Roy, M.K. (2011). Sustainable development, Environment, Energy & Water Resources, New Delhi, Ane Books, Pvt., Ltd.,
7. Gupta Akhilesh, R.K. Mall, Ranjeet Singh, L.S. Rathore and R.S. Singh (2006). Water resources and climate change: An Indian Perspective; *Current Science, 90*(12): June 2006.
8. http://fluoridealert.org/health/bone/fluorosis/india.html
9. http://pib.myiris.com/facts/article. php3?fl=D3509
10. http://www.ddws.nic.in/popups/submissionfunds-200607-195.pdf
11. http://www.naandi.org/Safewater/default.asp
12. http://www.searo.who.int/EN/Section313/Section1519_10851.htm
13. Implementation Manual on National Rural Water Quality Monitoring and Surveillance Programme, (2004). Department of Drinking Water Supply, Ministry of Rural Development, Govt. of India.
14. International Conference on Water for Peace, 2009, Vol. VII, p. 35.
15. lyer, Ramaswamy, R. (2001), 'Water: Charting a Course for the Future,' *Economic and Political Weekly,* Idarch 3 1. Bombay. p. 1 1- 16.
16. Karimi, A. and R. Ardakanian, (2010). *Water Resources Management, 24*(9): 1717–1746.
17. Mohrir A, DS Ramteke, CA Moghe, S R Wate, and R. Sarin (2002). Surface and groundwater quality assessment in Bina region. *IJEP, 22*(9): 961-969.
18. Ramachandraiah, C. (2001). 'Drinking Water as a Fundamental Right,' *Economic and Political Weekly,* February 24, p, 4.
19. Saleem, A., I. Mahmood, H. Sarjoughian, H. A. Nasir, and A. W. Malik, (2021). *Simulation, 97*(5): 323–345.
20. www.sustainable-design.ie/fire/India_Whose-Sustainability_PLEA2006-Paper939.pdf
21. www.whoindia.org/LinkFiles/MDG_Chapter-05.pdf Drinking Water and Sanitation Status in India, WaterAid India, 2005.