

A STUDY ON PERCEPTION OF WATER SCARCITY WITH PARTICULAR REFERENCE TO CHENNAI CORPORATION ZONE

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ABSTRACT

The human body consists of 75 percent of water and a human can only live three days without water, which is clear that water is one of the prime elements responsible for life on earth. Water is especially valuable for human health, agriculture and industry. The lack of sufficient water resources leads to water scarcity. Water scarcity is a man-made phenomenon. In this aspect, a statistical study on the perception of water scarcity in the locality of the Greater Chennai Corporation is considered. The information about the study is collected through a questionnaire in an interview method using a two-stage sampling technique and its variables will be analysed by statistical software. The main objective of this study is the ongoing water crisis, the impact of water scarcity among the people, the opinion on seawater desalination plants, and the awareness about water scarcity among people in Greater Chennai Corporation.

KEYWORDS: Water Scarcity, Seawater Desalination, Greater Chennai Corporation Zone, Primary data collection, Two-stage sampling.

MSC: 62-P25

1. INTRODUCTION

After the 1991 Indian Economic crisis, a program of economic policy reform 1991 resulted in a dramatic change in the lives of India. Now the Indian economy is regarded as one of the largest economies in the world holding the 7th position in GDP. Tamil Nadu, a South Indian state contributes 8.27% to India's GDP. On considering the sector-wise contribution to GDP of Tamil Nadu, the service-oriented sector places top with 53%, followed by industrial sector 34% and agricultural sector 13%. The basic necessity for the entire sector is water. All freshwater eventually depends on the unrelenting healthy functioning of ecosystems. Recognizing the water cycle as a biophysical process is critical in achieving sustainable water management and securing the ecosystem services that humans rely on. People working in different fields need water for various purposes such as farmers need water to grow crops, gardeners to water plants, industrialists for industrial works, electricity plants to generate hydro-electricity, etc. The availability and quality of water always have played an important part in determining not only where people can live, but also their quality of life which in turn reflects the problem called water scarcity. Water scarcity is a man-made phenomenon. It is a frequent occurrence of imbalance that arises from overuse of water resources, caused by consumption being significantly higher than the natural renewable availability. Water scarcity could be made more annoying by water pollution (reducing the suitability for different water uses) and during drought episodes. Even Though Chennai is one of the metropolitan cities in India and a hub for many global industries, common people face water scarcity every year. The water crisis is an enduring major crisis taking place in India, most particularly in the city of Chennai in Tamil Nadu. Recently, Chennai city officials stated that "Day Zero" on 19th June 2019, or the day when almost no water is left, had been reached, as all the four main reservoirs supplying water to the city had run dry. Two years of deficient monsoon rainfall, particularly in late 2017 and throughout much of 2018 had led to this crisis. The 2018 northeast monsoon season was one of the driest ever recorded in Chennai, as only 343.7 mm of rain had fallen compared to an average of 757.6 mm, which was a 55% rainfall deficit. Millions of people are without regular access to water. A lack of rainwater and groundwater has left four of the reservoirs that supply the city completely dry. The inability to meet water demand has forced much loss. Water tankers from areas of Tamil Nadu unaffected by drought have been bringing water into some areas of the city. These things which have been stated above provoked us to study regards the water crisis in Chennai city. This study deals with the public perception of water scarcity, the measures to overcome scarcity.

2. OVERVIEW OF LITERATURE

Anand (2000) attempts to explore some issues in the context of the urban environment, focusing on solid waste management in Madras, India. Bhayankaram (2001) explained conceptually, the institutional arrangements for water supply in Chennai and whether the state government's decision about improving the performance of the water utility depends on particular political circumstances. Anand (2003) explored how Amartya Sen's entitlements approach could be extended to analyse distribution issues concerning water supply and sanitation. Anand and Perman (1999) discuss the application of a multiple-choice contingent valuation method to improvements in water supply in Madras, based on a 1996 survey of households in Madras. Bajpai and Bhandari (2001) discussed how urban Indian households obtain water for their daily requirements. The link between economic status and access allows the analysis of issues such as water sharing; sole access, ability to pay, need for improvements, etc., have been described. Hardoy and Schusterman (2000) described the current use and management of freshwater as not sustainable in many countries and regions of the world. Kuylenstierna et al. (1997) draws on the authors' experience working in informal settlements in Buenos Aires and with the privatized utility (Aguas Argentinas) to consider how privatized provision for water and sanitation can best meet the needs of low-income groups, especially those living in informal settlements. Lisa (2014) examined the relationships between household resources and water security in an Urban Philippine Community.

3. OBJECTIVES

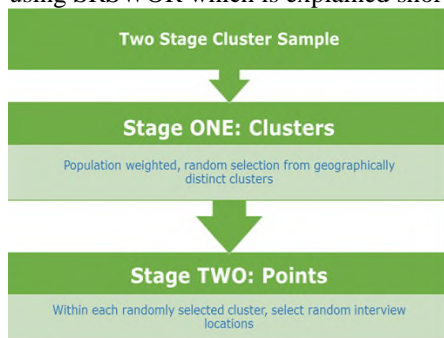
- The ongoing water crisis according to the Chennai Corporation Zone.
- The impact of water scarcity among various sectors of the people in Greater Chennai Corporation.
- The public opinion on seawater desalination plants.
- The awareness about water scarcity among people.

4. METHODOLOGY

Information on the levels of knowledge, attitudes, and practices about water scarcity, the on-going water crisis according to the Chennai Corporation Zone, the impact of water scarcity among various sectors of people in greater Chennai corporation, the public opinion on seawater desalination plants, and the awareness about water scarcity among people is to obtain using quantitative and qualitative methods of data collection and analysis to achieve the set objectives. In this study, the target populations are people in Chennai city according to the Greater Chennai Corporation Zones, Tamil Nadu. The Greater Chennai Corporation categorized the Chennai city into 15 different zones namely, THIRUVOTTIYUR (Zone 1), MANALI (Zone 2), MADHAVARAM (Zone 3), TONDIARPET (Zone 4), ROYAPURAM (Zone 5), THIRU-VI-KA-NAGAR (Zone 6), AMBATTUR (Zone 7), ANNA NAGAR (Zone 8), TEYNAMPET (Zone9), KODAMBAKKAM (Zone 10), VALASARAVAKKAM (Zone 11), ALANDUR (Zone 12), ADYAR (Zone 13), PERUNGUDI (Zone 14), SHOLINGANALLUR (Zone15).

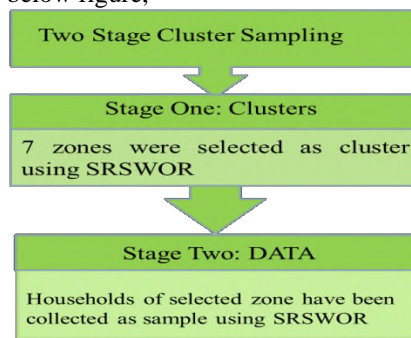
From this Fifteen Zones, Samples have been collected using,

TWO-STAGE CLUSTER SAMPLING: In the first stage, seven zones were selected as a cluster using SRSWOR. In the second stage, Households of the selected zone have been collected as samples using SRSWOR which is explained shortly in the below figure,



collected.

General Procedure



A well-structured questionnaire is prepared and it was distributed to the target populations and the 400 samples have been

Formulated Procedure

Further various statistical tools are used to

interpret the objectives. One may refer to Dixon and Massey (1951), Shaefer and Theodore (2007) and Cohen (2013) for statistical tools given below.

CHI-SQUARE TEST: The chi-square independence test is a procedure for testing if two categorical variables are related in some population. Simply, Chi-Square is one way to show the association between two categorical variables. Example: A scientist wants to know if education level and marital occurrence of the event are related for all people in some country.

INDEPENDENT SAMPLE t TEST: The Independent Samples t-test compares the means of two independent groups to determine whether there is statistical evidence that the associated population means are significantly different. The Independent Samples t-test is a parametric test. This test is also known as the unpaired samples t-test. For example, you could run a t-test to see if the average test scores of males and females are different.

ANOVA: Analysis of variance (ANOVA) is a statistical technique that is used to check if the means of two or more groups are significantly different from each other. ANOVA checks the impact of one or more factors by comparing the means of different samples. We can use ANOVA to prove/disprove if all the medication treatments were equally effective or not. Simply, ANOVA tests whether the means of various groups are equal or not.

5. STATISTICAL ANALYSIS

Table 1: To Know the Association between Living Area and Installation of Rainwater Harvesting

Chi-square Tests			
	Value	df	p-value
Pearson Chi-Square	0.421	1	0.516

p-value (0.516) is greater than the table value (0.05) so there is no evidence to reject the null hypothesis i.e. There is no association between Living area and installation of rainwater harvesting.

Table 2: To obtain the Association between Installation of rainwater harvesting and usage of rainwater

Chi-square Tests			
	Value	df	p-value
Pearson Chi-Square	9.444	1	0.002

p-value (0.002) is less than table value (0.05) so there is no evidence to accept the null hypothesis i.e. There is an association between installation of rainwater harvesting and usage of rainwater.

Table 2(a): Cross-tabulation between Installation of rainwater harvesting and usage of rainwater

		Usage of Rainwater		Total
		Yes	No	
Is Rain Water Harvesting installed in your house?	Yes	47	190	237
	No	14	149	163
Total		61	339	400

(From the above table, we can note that 190 individuals have rainwater harvesting sources but they are not using it for their purposes properly.)

Table 3: To get the Association between Education level and Seawater Desalination

Chi-square Tests			
	Value	df	p-value
Pearson Chi-Square	26.070	1	0.000

p-value (0.000) is less than table value (0.05) so there is no evidence to accept the null hypothesis i.e., there is an association between Education level and seawater desalination

Table 4: To test the significant difference in average awareness score between literate and illiterate

t value	df	p-value
4.643	398	0.000

p-value (0.000) is less than the table value (0.05) so there is no evidence to accept the null hypothesis i.e. There is a significant difference in average awareness score between literate and illiterate.

Table 5: To test the significant difference in Awareness score between installation types of water purifiers (Installed and not Installed)

t value	df	p-value
0.390	394	0.697

p-value (0.697) is greater than the table value (0.05) so there is no evidence to reject the null hypothesis i.e. There is no significant difference in Awareness score between installation types of water purifiers.

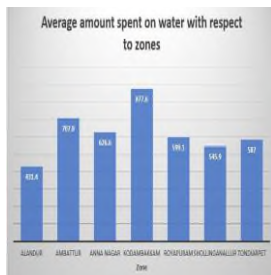
Table 6: To test the significant difference in awareness score among different occupation category

ANOVA					
Occupation					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.685	11	0.335	0.463	0.925
Within Groups	280.712	388	0.723		
Total	284.398	399			

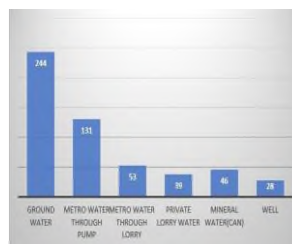
p-value (0.925) is greater than table value (0.05) so there is no evidence to reject the null hypothesis i.e. There is no significant difference in awareness score among different occupation categories

Fig. 1 Findings

a. Source of water consumption by people



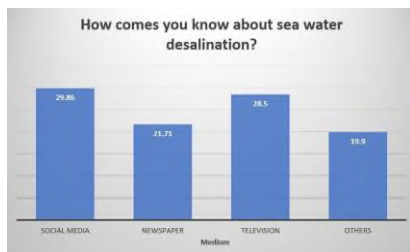
b. Expenses for Water in different zones



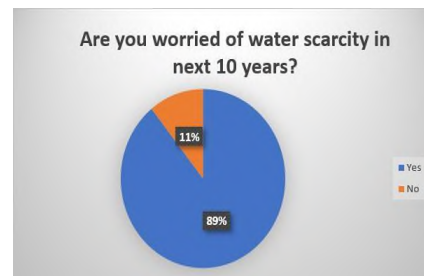
c. Awareness about Seawater Desalination among the people



d. Awareness of Seawater Desalination spreads through these medium



e. Concerns about future among the people



f. Opinions among the people in various arguments

- Q1. Planting trees can rectify water scarcity
- Q2. Sea water desalination is the best solution for water scarcity
- Q3. Cleansing policies of Cooum river will let Chennai free from water scarcity
- Q4. Settlement or construction of buildings on the water bodies is the major cause for water scarcity
- Q5. Government taking proper action for water scarcity
- Q6. Current water supply is sufficient
- Q7. Rapid population growth in Chennai leads to water scarcity
- Q8. Wastewater recycling

Figure (a) infers that groundwater is the major source of water consumption by the people and it also strongly indicates that the usage of wells is demolished now-a-days. **Figure (b)** infers that, the Kodambakkam zone is highly expending for water among others while comparing the average amount spent on water with respect to zones and this situation may occur due to excessive need of water or the economic level of people living over there. **Figure (c)** represents that, literate people have more awareness about sea water desalination than the illiterate people. **Figure (d)** shows that, the people get more knowledge about the sea water desalination through the medium highly is social media which clearly represents that, social media is the only medium always wins when it comes to creating awareness. **Figure (e)** says through the pie chart that 89% of people are worrying about the future after 10 years regarding the water crisis. Some facts say that the people are worrying about the future but they are not ready to take any measures accordingly, if we take then this situation may not occur for sure. **Figure (f)** this stacked bar shows the values of opinions among the people for nine different arguments. For example: when we look into the first element as planting trees can rectify water scarcity, the values of opinions in the stacked bar shows that the 70.5 percent people strongly agreed to this element. Similarly, the other elements hold the value of opinions accordingly.

6. RESULTS

Table 1 conveys that rainwater harvesting is installed everywhere in Chennai irrespective of the living area(i.e.) Rural and Urban. The awareness about the rainwater harvesting installation in the house reached almost every corner of the people living in Chennai city. **Table 2** says that usage of rainwater is associated with the installation of rainwater harvesting which indicates that rainwater harvesting helps to store it easily and makes it easy to use. **Table 2(a)** shows the cross-tabulation between the installation of rainwater harvesting and usage of rainwater; we can note that many people have rainwater harvesting sources but some of them are not using them properly for their purposes. At the same time, few people store and use the rainwater even without rainwater harvesting. **Table 3** indicates the knowledge about seawater desalination is higher among the literate people than the illiterate people which shows that more awareness shall be created among illiterate people. **Table 4** shows the overall awareness score is dependent on the Education level. That is, the significant difference between the literate people and illiterate people in their awareness score clearly shows the dependency of awareness on education. **Table 5** says that the installation of a water purifier is purely based on the individual's necessity and that is proved by the significant difference between income and water purifier installation type (Installed and Not installed). **Table 6** conveys that the level of awareness regarding water scarcity is independent of the occupation of a person. Whereas, it says that the occupation is not linked to the knowledge of a person. Hence, the awareness of water scarcity is coming from the lessons they learned from their life and their educational knowledge.

Major suggestion from people

- ◆ Cement road is one of the major causes for the insufficient groundwater level. So, we should plan for eco-friendly roadways instead of cement roads.
- ◆ It is wise to take measures to save water in the winter season rather than suffer in the summer season.
- ◆ We should not blame nature for not giving water resources. Instead, we should blame ourselves for not preserving it on time. It is every individual's responsibility.

7. CONCLUSION AND DISCUSSION

In this paper, we studied the water crisis in Chennai city. It seems that the water crisis in the Chennai Corporation varies from zone to zone according to the economic level of the people, the necessity of the people, availability of the resources, and the irregular usage of the water by the people. Most people are aware of water scarcity and its consequences but they are not ready to take steps to overcome it because they are waiting for someone to initiate. Even though people have awareness about seawater desalination, they could not give a deep opinion about seawater desalination due to the lack of knowledge about its process which makes a myth about it and makes an unstable situation to decide regarding the usage of seawater desalination resources.

These things in this paper made us conclude that humans are not created before nature to use it excessively to destroy it. Nature gives it resources to us to live, as its blessings but we are taking advantage of it. If we are getting something, we should not take it for granted, we should use it wisely. Most importantly, we are living in a society where natural resources are equal to everyone. So, we should not use our economic power

to get the common properties. It is not only about our government taking action; it is also every individual's responsibility for our future generation. Therefore, it is necessary to know about the things in our daily life to make changes as quotes below,

“Every one of us can make changes in the way we live our lives and become part of the solution.”

Let us be good stewards of the earth we inherited. All of us have to share the earth's fragile ecosystems and precious resources, and each of us has a role to play in preserving them. If we are to go on living together on this earth, we must all be responsible for it. It is not only the Chennai district; this kind of situation may arise in any other district or any other country at any time. Hence, we kept this as an example to everyone because “Prevention is always better than cure”. Many of us think that a change of an individual won't make much difference but the change of a thousand individuals can make a massive difference. So, preserve it for our future, prevent it for our future, and save it for our future.

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REFERENCES

- [1]. ANAND, P. B. (2000): Co-operation and the urban environment: An exploration. **The Journal of Development Studies**, 36, 30-58.
- [2]. ANAND, P. B. (2003): Distribution Issues in Water Projects: An Application of Sen's Entitlements Approach. In **Development Planning and Poverty Reduction** , 200-217. Palgrave Macmillan, London.
- [3]. ANAND, P. B., and PERMAN, R. (1999): Preferences, inequity and entitlements: some issues from a CVM study of water supply in Madras, India. **Journal of International Development: The Journal of the Development Studies Association**, 11, 27-46.
- [4]. BAJPAI, P., and BHANDARI, L. (2001): Ensuring access to water in urban households. **Economic and Political Weekly**, 3774-3778.
- [5]. BHAYANKARAM, A. P. (2001): **Consumer preferences and public policy, a case study of water supply and waste management in Madras** .Chennai), India.
- [6]. COHEN, J. (2013): **Statistical power analysis for the behavioural sciences**. Routledge.
- [7]. DIXON, W. J., and MASSEY Jr, F. J. (1951): **Introduction to statistical analysis**. Wiley, N. York.
- [8]. HARDOY, A., and SCHUSTERMAN, R. (2000): New models for the privatization of water and sanitation for the urban poor. **Environment and Urbanization**, 12, 63-76.
- [9]. KUYLENSTIERNA, J. L., BJÖRKLUND, G., and NAJLIS, P. (1997): Sustainable water future with global implications: everyone's responsibility. **Natural Resources Forum**, 21, 181-190.
- [10]. MASON, L. R. (2014): Examining relationships between household resources and water security in an urban Philippine community. **Journal of the Society for Social Work and Research**, 5, 489-512.
- [11]. SHAEFER, S. J., and THEODORE, L. (2007): **Probability and statistics applications for environmental science**. CRC Press.