WATER PROBLEMS AND PUBLIC PARTICIPATION IN CHENNAI CITY: AN EMPIRICAL STUDY

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Abstract

Water is one of the world's most precious resources. Access to quality and potable water access underpins socio-economic improvement, justice, welfare and sustainable development, however it is estimated that half of the world's population will face acute water shortage by 2030, more so in developing countries like India. Cities like Chennai in India are prone to water-related problems. Water-related issues continue to pound Chennai in the last two decades; it seems that the authorities have failed people in the efficient management and governance of water sources and administration. While authorities can do much, the role of people in the utilization and management of water resources is also crucial. The attitude of people about water resources, its utilization, and their participation level in the conservation and protection of water resources are critical for efficient use of environmental resource. People's perceptions and their attitudes are outcomes of the circumstances of their lives and their sensitivity to the critical issue of water use.

This study therefore attempted to understand people perception and attitude towards water problems in Chennai city by administering an interview schedule. In all, 200 respondents were identified through the stratified sampling method. The respondents included key informants, social workers and professionals working in environment and sustainability, and the general public. Poor catchment of rain water during monsoons, unabated ground water exploitation, loss of water

bodies in the name of development infrastructures, contamination of water bodies due to discharge of untreated industrial waste, improper solid waste management, indifference on the part of the government and its officials to water concerns and, above all, public apathy towards water in particular and the environment in general have all contributed to Chennai' city's mounting water problems. The findings and its implications are discussed.

Keywords

CMWSSB, legal provision, potable water, public participation, water rights, water scarcity, water pollution

Introduction

Water is one of the world's most precious resources. According to Thiruvalluvar, ancient Tamil poet, “life cannot sustain without water, nor can virtue without rain” (Thirukkural, Van Sirappu, Kural:20). Water is a precious gift to mankind and therefore water resources play a crucial role in the protection and promotion of biodiversity. Water resources include surface water, water from river and lakes, ground water and marine or coastal waters. Water supports all life forms, including human beings, but is increasingly becoming a scarce environmental resource worldwide (White, Bradley & White, 1972; Seckler, Barker, & Amarasinghe, 1999; Loucks, 2000). Access to quality and potable water access underpins socio-economic improvement, justice, welfare and sustainable development (Gleick, 1996; Gupta, 2002; Jain & Singh, 2010).

Studies by international organizations like United Nations suggest that half of the world's population will face acute water shortage by 2030 (World Water Development Report, 2017). At least one in four people is likely to live in a country affected by chronic or recurring shortages of fresh water by 2050. Due to misplaced economic priorities and gross negligence, every year millions of people, most of them children, die from diseases associated with inadequate water supply, sanitation and hygiene (Rouse, 2014). This situation is more so in developing countries like India and its cities. Of the 27 Asian cities with population of over 10 lakh (1 million), Chennai and Delhi have been ranked as the

worst performing metropolitan cities in terms of water availability per day, while Mumbai is the second worst performer, and Kolkata the fourth worst (Frost & Sullivan, 2009).This has implications for a range of disciplines, agriculture, urban planning, and water resource management.

Problem Statement

Chennai, also referred as the 'Detroit of South Asia' has boomed, to the growth of the automobile and IT sectors. As industrialization and urbanization has peaked, catering the water requirements of the ever-growing population and the industrial needs continue to remain an arduous task for the Government. The city continues to be totally dependent on ground water resources to meet its water needs, and the ground water gets replenished by rain water, which is nearly 140 cms *(Lakshmi, 2012, The Hindu).* With increasing population, the demand is already telling upon the stressed water resources *(Mariappan, 2014, The Times of India)* and authorities have started tapping additional water from well fields. Private players also have come up with manufacturing units in the districts of Chennai, Tiruvallur and Kancheepuram to draw water from ground water sources and cater to Chennai residents.

The unabated extraction of ground and surface water, at a far higher rate than the rate of replenishment, is a catastrophe in the making (Singh & Singh, 2002). A study by the Central Ground Water Board (CGWB) has found that Chennai's groundwater resources are over exploited, with water below the surface being extracted at a rate of 185%.Another data from the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) confirms the steady declining of ground water level in 15 areas in and around Chennai city during March 2016 and March 2017. As water-related issues continue to pound Chennai city in the last two decades, it seems that the authorities have failed people in the efficient management and governance of water sources and administration.

Increasingly, studies assert the significance of public perception and participation (Backstrand, 2003; Mostert, 2003; Priscoli, 2004;

Callahan, 2007)*, legal provisions, attitude and capacities in the protection and conservation of scarce environmental resources (*Arnstein, 1969; Wandersman, 1979; Palerm, 2000; Rydin & Pennington, 2000; Garande &Dagg, 2005; Ostrom, 2014). However, public participation is influenced by several factors including life situation, general perception, governance mechanism and the attitude of the government authorities (Head, 2007; Chi, Xu &Xue, 2014). An informed civic community can change the situation at hand (Arriens & Alejandiro, 2003). Based on the review of literature, a need for a study about water and public participation has been observed. This study is also necessitated by the ongoing concern to enhance the corresponding knowledge base through research, and the effective sharing and transfer of knowledge.

Methodology

Taking into consideration the nature of the problem, its scope and limitations, this study takes the *descriptive* study design. The approach uses an instrument-oriented method targeted at the general public in Chennai, in an attempt to ascertain the attitude and perceptions of the public as they relate to water resources management and concerns in the city of Chennai. The primary objective of this study, therefore is to describe respondents' experiences with water issues, familiarity with water rights and the level of engagement in water conservation behaviors,

Measures

For the purpose of this study, a well-structured interview schedule was developed to elicit responses from the general public on Chennai city's water problems. In addition to relevant demographic details, the interview schedule sought to seek responses to quality and quantity aspect of water supply to individuals, Water issues in Chennai city (Sample item: water scarcity is a distressing issue for people of Chennai); Reasons for the depletion of water bodies (sample item: allowing untreated sewage to drain into water bodies); Factors contributing to water problems (sample item: unscrupulous extraction of water for commercial purposes); Measures for improving water

resources management (sample item: impose water restrictions on users to encourage conservation/efficiency), etc.

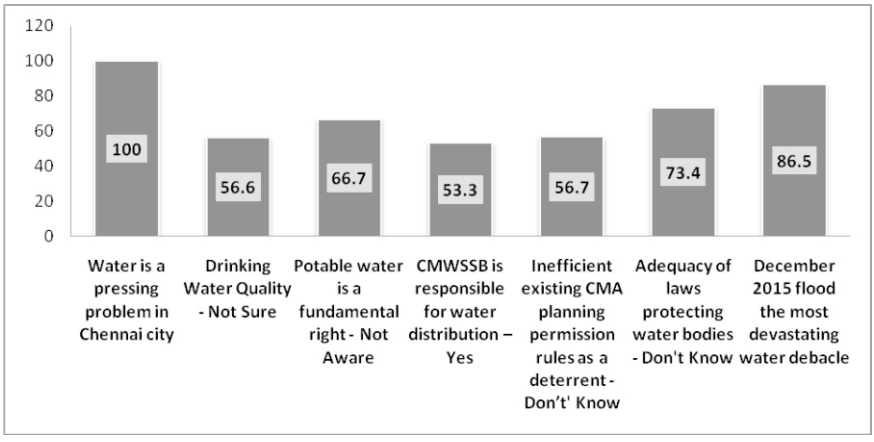
The interview schedule was administered to 200 respondents, including social workers, development professionals, and the general public, were identified through the stratified sampling method to determine their attitude to water, water bodies, and water management in Chennai city. All analyses are performed using Excel and SPSS, and the statistical significance is determined at the alpha level ($\alpha = .05$ level). The collected data was entered in SPSS and the internal reliability or consistency of the interview schedule scale was measured using Cronbach Alpha. All the measures used in this study showed high internal consistencies within the range of 0.757 to 0.893.

Sample Characteristics

A majority of the respondents in this study were male (61.7%). Their mean age was 39.83 years, with a range of between 21 and 68 years. A little more than half (54%) were graduates (in arts or science, or those with professional degrees) working in various capacities in private industrial organizations. The mean years of residence in Chennai was 23.07, and ranged from 2 to 62 years.

Results

Figure 1: Awareness about Water Issues

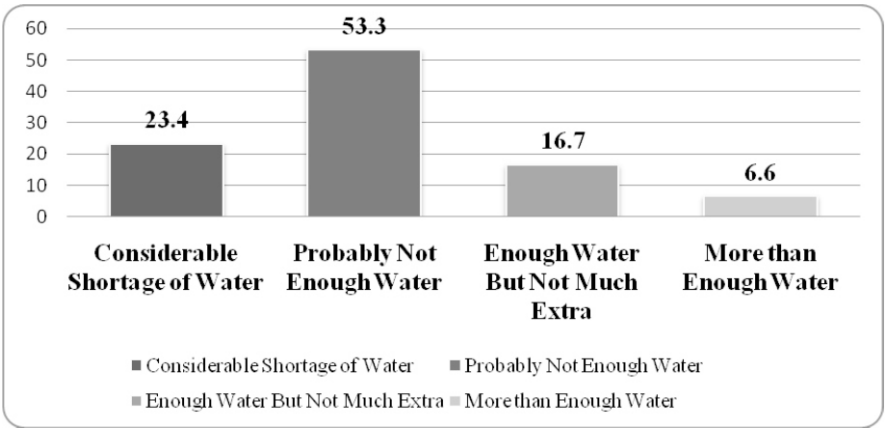


(Source: Primary data)

Figure 1 shows that all respondents agree that water is a pressing problem in Chennai city. Greater majority of the respondents also agree

(86.5%) that December floods during 2015 as the most devastating water debacle they have experienced their lifetime. Good majority of the respondents (73.4%) do not know whether there are adequate laws to protect the water bodies in the State or Union and also not aware (66.7%) about potable water as a fundamental right. The Supreme Court has ruled that both water and sanitation are part of the constitutional right to life (Article 21). Other significant responses include the fact that about half (56.7%) are not sure that inefficient existing CMA planning permission rules are a significant deterrent, 56.6% express uncertainty about the quality of the city's drinking water, and only 53.3% are aware that the CMWSSB is the city's competent authority for water distribution.

Figure 2: Opinion about Adequacy of Water Supply



(Source: Primary Data)

Figure 2 shows that majority of the respondents (53.3%) reported that they probably not have enough water. More than one-fifth (23.4%) report considerable shortage of water and less than one-fifth (16.7%) reported that they have enough water but not extra. However, a small proportion of respondents (6.6%) reported that they have access that is more than enough. It is therefore evident that good majority of the residents of Chennai report that water accessible to them is not enough to meet their basic water requirements, which is a cause for concern.

Table 1: Water Issues in Chennai City

S.No	Public responses on various water issues in the city	Mean
1	Water Scarcity is a Distressing Issue for People of Chennai	6.23
2	Groundwater Levels Have Declined to an Alarmingly Low Level in CMA	5.73
3	Growing Demand for Water	5.87
4	Increased Migration and Population Growth Contributes for Water Scarcity	5.20
5	Experience of Water Shortages More Often in the Near Future	5.60
6	Water Supply and Water Infrastructure Concerns	4.87
7	Management of Water Resources is a State/ National Priority	4.50
8	Recycled Water for Non-Drinking Purposes	3.70
9	Floods indicates poor urban development over the years	5.17
10	Willingness to Pay for Provisions of Safe Drinking Water	5.03

(Source: Primary Data)

Table 1 shows the mean score of the degree to which respondents agree on water-related issues. Among the ten issues, water scarcity is the top most issue reported by the respondents with the highest mean score (6.23 out of 7), followed by growing demand for water (5.87), declining ground water resources (5.73), experiencing water shortage frequently in near future (5.60), and migration and population growth as contributing to water scarcity (5.20). However, when it comes to individual support to provide for the improvement of water management resources in Chennai city, the mean score was significantly lower. For instance, support for using recycled water for non-drinking purposes was found to have the lowest mean score (3.70

out of7), followed by water resource in a national/state priority (4.50), water supply and infrastructure as the concerns of every resident (4.97), willingness to pay for provision of water resources (5.03), and floods as indicative of poor urban development (5.17). This shows that Chennai's residents firmly believe that their access to water is a matter that concerns only the state, and that they are in no way obliged to contribute their bit to improve the management of the city's water resources.

Factors contributing to Water Problems

Table 2: Factors Contributing to Water Problems

Reasons for Water Problems	**Mean**
Increased Migration and Resultant Population Density	4.17
Rapid Urbanization	4.30
Encroachments on Water Bodies	4.37
Unscrupulous Extraction of Water for Commercial Purposes	4.20
Unsustainable Groundwater Management	3.90
Pollution and Poor Sewage Management System	3.97
Inadequate State/National Legislations to Protect Water	3.07
Lack of Environmental Awareness/Education among Public	3.97
Poverty and Inequality	2.57
Inadequate Funding/Financing	3.23
Lack of Water Governance Mechanisms and Absence of Environmental Expertise	3.50
Stakeholder Conflicts Concerning Water Resources at a Local Level	3.13

(Source: Primary Data)

Table 2shows the mean score of respondents with regard to factors contributing to water problems in Chennai City. As evident, encroachment on water bodies (4.37), rapid urbanization (4.30), unscrupulous extraction of water for commercial purposes (4.20), and increased migration and resultant population growth (4.17) are the top

four factors contributing to water problems in Chennai City. Other contributory factors include a lack of environmental awareness/education among the public (3.97), pollution of water bodies and poor sewage management systems (3.97), and unsustainable water resources management (3.90). Inadequate state/national legislations to protect water (3.07), stakeholder conflicts concerning water resources at a local level (3.12) and inadequate funding/financing for water resources management are the least reported factors contributing to water problems in Chennai city.

Figure 3: Attitude towards Water Problems in Chennai city (Source: Primary data)

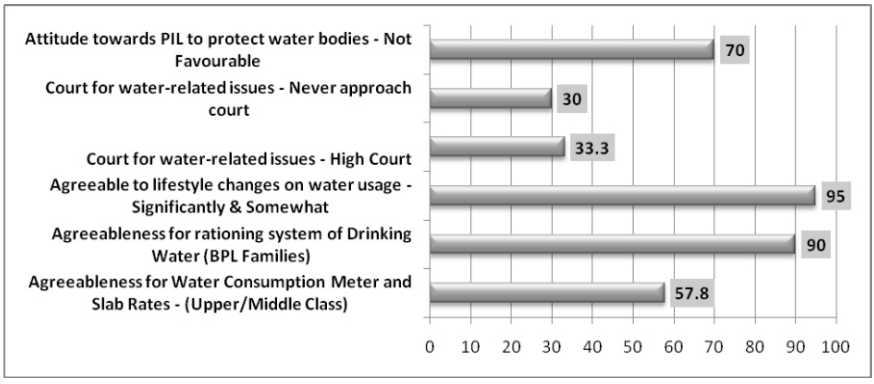


Figure 3 shows that majority of the respondents (70%) are not willing to file PIL to protect water bodies, and less than one-third (30%) would never approach court. However, vast majority of them (95%) feel that changes to lifestyle to reduce water usage must be taken up. With regard to rationing water for consumption, the majority do not agree.

Hypotheses Testing

Chi-square test is done to determine whether there is any significant association or relationship between two variables of interests. For the purpose of this study, five hypotheses were tested.

Table 3: Summary of Hypotheses Tested

Sl. No	Hypothesis	Pearson Chi-square	P value
1	There is no significant association between legal/compliance framework and water crisis situation in Chennai city	46.784a	.000**
2	There is no significant association between governance framework and water crisis situation in Chennai city	22.707a	.000**
3	There is no significant relationship between public participation and water crisis situation in Chennai City	9.197a	.002**
4	There is no significant relationship between public awareness on water/environment and water crisis in Chennai city	16.484a	.000**
5	There is no significant relationship between governance framework on water and public awareness on water rights and environment	9.773a	.002**

(Source: Primary data)

Table 3 shows the results of Chi-square tests. All null hypotheses are rejected and therefore this study affirms the following; (1) Strong legal and compliance framework is essential for the protection, management and sustainability of natural resources like water; (2) Good governance and accountability related to water is crucial for sustainability; (3), As water related problems continue to scale up, public participation in matters affecting water resources are bound to increase as well; (4) Public awareness about water rights and environmental protection is significantly related to water related problems in Chennai city. Given that people are unaware of their rights and duties in terms of protecting water and other critical environmental resources, these resources continue to be exploited by unscrupulous elements in society. This situation must change; and (5) Public awareness and participation is crucial for improving the overall delivery of water resources management**.**

Predictors of Public Participation

Public participation is crucial for the sustainable consumption and conservation of water as well as other crucial natural resources. Regression analysis was done to identify the predictors of public participation.

Table 4: Predictors of Public Participation Model Summary

Model	R	R Square	Adjusted R Square	Std.Error of the Estimate
1	.563a	.317	.303	.385

a. Predictors: (Constant), Water Crisis, Governance Framework, Awareness - Water Rights and Environment, Legal Framework and Compliance

(Source: Primary Data)

Table 4 shows the model summary of predictor of public participation in the protection and promotion of efficient water resource management in Chennai city. Model summary suggests significant R (0.563), R Square (0.317) and Adjusted R Square (0.303), which indicates that the variables used adequately predicts public participation (30%).

Table 5: Predictors of Public Participation ANOVA Main Effects

Model	Sum of Squares	df	Mean Square	F	Sig.
1Regression	13.432	4	3.358	22.610	.000a
Residual	28.963	195	.149		
Total	42.395	199			

a. Predictors: (Constant), Water Crisis, Governance Framework, Awareness - Water Rights and Environment, Legal Framework and Compliance

b. Dependent Variable: Public Participation

(Source: Primary Data)

Table 5 shows the ANOVA main effects of the predicted model, with a high F value (22.610), which is statistically significant at 0.05 level of significance. It is therefore inferred that the variables used in the predicted model are good and adequately determine public participation.

Table 6: Predictors of Public Participation - Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.516	.106		4.867	.000
Governance Framework	.363	.080	.385	4.555	.000
Legal Frame work and Compliance	.245	.111	.227	2.204	.029
Awareness - Water Rights and Environ ment	.016	.072	.017	.224	.823
Water Crisis	-.033	.070	-.032	-.470	.639
a. Dependent Variable: Public Participation					

(Source: Primary Data)

Table 6 shows the coefficients table of the predicted model. Among the four independent variables included in the model, governance framework, and legal compliance are found with high t values, 4.555 and 2.204 respectively compared to the other two variables. It is therefore inferred that the governance mechanism of water resources management and the legal framework of provisions, regulations and compliance are the two major factors that help people understand water-related concerns and improve their participation levels.

Discussion

Water crisis is a looming reality for cities worldwide including the Chennai city. The study finds that water scarcity will continue to plague people in Chennai, and the deteriorating water quality is an additional cause for concern. Water resources both surface and ground are rapidly dwindling primarily due to mismanagement of water resources. Water lost through leaks in the distribution networks, inflated consumption due to limited supply to few hours a day, general public apathy towards

water, lack of awareness about water conservation, and poor political will, all contributes to the problem, making water crisis a perennial problem for the city. The commodification of water, pollution and encroachment on water resources spell doom to the water situation in Chennai city. A failure on the part of the authorities concerned to act, coupled with people's misplaced priorities, continue to add to the city's environmental woes.

Chennai gets sufficient rainfall and therefore efforts to recharge ground water level, aquifers and the protection of water bodies and wetlands is the way forward and for sustainability. While government authorities and town planners can do a lot of things to improve water situation, both surface and ground water, people attitude must change in the first place. Public participation, awareness about water quality and conservation by local communities is the only way forward to protect Chennai water bodies from getting extinct. This study asserts that the answers to meeting the challenge of the water crisis lie in a participatory, efficient and sustainable water management paradigm. It is imperative to design an integrated water resource management blueprint for Chennai and integrate it into urban planning, development and governance. Such a blueprint must account for complete entities and the general population, incorporating industries, commercial establishments, institutions, apartments and households among others in the city.

State and local governance play a critical role in protecting source water (Biswas & Tortajada, 2010). In addition, enactment of legal rules, continuous monitoring and strict enforcement can do a world of good to the precarious water situation in Chennai and Tamil Nadu. Water-related regulations and compliance framework should be taken up as a State priority. Government also may provide resources to help fund local protection activities, develop zoning requirements to ensure that businesses using hazardous materials are not located near water supplies.

CMWSSB must work vigorously in advocating the protection of water sources, providing annual drinking water quality reports, creating opportunities for public participation, such as water board meetings

and public forums, educating consumers, identifying potential sources of contamination and working directly with owners and managers of potential sources of pollution and other key stakeholders. Industries can take actions to protect drinking water sources, for example by: reducing their use of harmful contaminants, and ensure their wastes do not discharge into ground water or surface water. Industries and big commercial complexes to install their water recycling plant to make use of the recycled water. Those who fail to comply with the rules must be penalized. While NGOs can provide funding and research, Individuals should get involved in efforts to protect local water sources, reduce the use of pesticides around the home and ensure that their septic systems are property maintained.

Conclusion

Water concerns all aspects of our lives: health, well-being, human rights, environment, economy, politics and culture. It must be noted that access to potable water is a fundamental right in India. This study observed that Chennai is walking towards a water-stressed future. It is extremely important to protect water resources and water bodies to secure our future. It's high time that people wake up to the problems. Exploitation of ground water resources must be checked, efforts to recharge and rejuvenate surface water as well as ground water system should be taken up as a State-wide initiative. Encroachments and pollutions should be viewed as a serious offence and appropriate legal sanctions should be initiated against willful offenders. Cost-effective desalination efforts are only a part of the solution and too much reliance can create more problems in the future. Protecting source water, rain water harvesting and judicial use of water - is everyone's responsibility and an obligation to the environment and to the State. People should see water as the basis of their life, livelihood and dignity rather as a commodity.

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