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Sustainable Water Management Practices and Citizen Participation in Ahmedabad, Gujarat, India

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Abstract: This research paper examines the current water management practices in Ahmedabad, a rapidly urbanizing city in Gujarat, which is facing a severe water crisis due to population growth, rapid urbanization, and changing climate patterns. The study focuses on sustainable practices and citizen participation in water conservation and management. Employing a mixed-methods approach, the study includes a literature review, interviews with water management experts, and surveys of citizens' attitudes and behavior towards water conservation and management. The research findings provide insights into the latest water management practices in Ahmedabad, identify opportunities for sustainable water management practices, and examine the level of citizen participation in water conservation and management initiatives. The research paper's significance lies in its potential to contribute to the global discourse on sustainable water management practices and citizen participation in water resource management, informing policy decisions and providing a roadmap for other cities facing similar challenges.

Keywords: Sustainable Water Management practices, Citizen Participation, Water Conservation, Climate Change

1.1 Introduction

Ahmedabad, a bustling metropolis in Gujarat, India, is currently grappling with a severe water crisis that poses significant challenges to its residents and environment. This water scarcity stems from a combination of factors, including rapid urbanization, population growth, climate change,

and unsustainable water management practices.

Water conservation and sustainability play a pivotal role in addressing this crisis. Water conservation refers to the prudent and responsible use of water resources to ensure their availability for future generations. Emphasizing the importance of judicious water usage and implementing efficient water management practices can mitigate the impact of the crisis. Sustainability, on the other hand, involves meeting the current water needs without compromising the ability of future generations to meet their own demands. Ahmedabad's exponential population growth and extensive urbanization have led to increased water consumption, exceeding the available supply. Additionally, industrial and agricultural activities further strain the city's water resources. The city's reliance on groundwater and surface water bodies, coupled with irregular monsoons and rising temperatures due to climate change, exacerbates the water scarcity. Moreover, inefficient water distribution systems and a lack of infrastructure maintenance contribute to water loss through leakages, further aggravating the crisis. The inequitable distribution of water among different sectors and socio-economic groups poses social and environmental challenges.

To address the water crisis in Ahmedabad, urgent action is needed to promote water conservation and sustainability. Implementing efficient water management practices, such as rainwater harvesting, water recycling, and promoting water-efficient technologies, can help alleviate the strain on water resources. Furthermore, citizen participation and awareness play a crucial role in water conservation efforts. Encouraging public involvement in water-saving initiatives and promoting responsible water usage behavior are essential steps toward sustainable water management in Ahmedabad. The water crisis in Ahmedabad arises from a complex interplay of urbanization, population growth, climate change, and unsustainable water management practices. Addressing this challenge requires a concerted effort from all stakeholders to implement water conservation measures, promote sustainability, and ensure equitable access to this precious resource for the well-being of present and future generations.

1.2 Overview on Water sources

India has more than 18% of the World's population, 17% of world's cattle population but only 4% of the World's renewable water resources and 2.44% of World's geographical area. As per report of National Commission on Integrated Water Resources Development (NCIWRD), the total water availability of India received through precipitation is about 4000 Billion Cubic Meter (BCM) per annum. After evaporation, 1869 BCM water is available as natural runoff. Due to topographical and other factors, the utilizable water availability is limited to 1137 BCM per annum, comprising of 690 BCM of surface water and 447 BCM of replenish able ground water. Availability of water is highly uneven in both space and time, with monsoon confined only to four months in a year with substantially rainwater as well as evaporation. Precipitation varies from 100 millimeter (mm) in the Western parts of Rajasthan to over 10,000 mm in Meghalaya.

As per the last assessment of dynamic ground water resources by the CGWB the total annual replenish able ground water resources in the country is 447 BCM. Out of 6584 assessment units (Blocks/ Mandals/ Talukas/Firkas) in the country, 1034 units in various States have been

categorized as 'Over-exploited', 253 units are critical and 681 units are semi-critical. Number of Over-exploited and Critical administrative units have been found to be significantly higher in Delhi, Haryana, Himachal Pradesh, Karnataka, Punjab, Rajasthan and Tamil Nadu, Uttar Pradesh. Water conservation and recharge has become all the more necessary in view of the stress that ground water regime is facing in view of incessant exploitation due to rapid urbanization, deforestation etc. as well as likely impact of changing climate and rainfall.

1.3 Rainwater Harvesting at individual household and community level, Ahmedabad

India has rich traditions of water harvesting measures, which are more than two millenniums old. Ancient writings, inscriptions, and archaeological artefacts have all been found to provide evidence of this tradition. Since ages, people across different regions of India are managing to irrigate their agriculture fields using localized harvesting methods. Their traditional ways of conserving water is efficient and still very popular in rural areas. Thus, efforts are required from general public and government organizations etc. to ensure water conservation in the best possible manner with special emphasis on harvesting rainfalls during monsoon seasons to have immediate result.

Rainwater harvesting at individual household level is being practiced in Ahmedabad, but is not a prevalent method. People have thought the harvesting to be a costly business and maintenance demanding. A roof-top rainwater harvesting is the simplest method that can be applied to achieve sustainable ground water levels. It is a method for collecting rain water from roof catchments, filtering it, and storing it in reservoirs. Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks.

Presently, every new upcoming project in Ahmedabad is expected to have a rainwater harvesting system, only then the building-use permission will be given. But then there is no authoritarian body to inspect whether the rainwater harvesting system is still in use or not. There are no available statistics to see how much rainwater harvesting is being practiced in the city. In order to propagate this method, the government of Gujarat and Municipal Authorities should co-operate with people for installing rainwater harvesting system at subsidized rates.

2.1 Literature Review

Water scarcity is a pressing challenge in the cities of developing countries, resulting from both physical limitations and the financial constraints of supplying water to growing populations. Water scarcity is primarily an economic issue rather than just a physical one. To tackle this issue, cities must adopt a governance approach that ensures water security in all its dimensions – availability, accessibility, and quality – for citizens. Citizen participation is crucial for sustaining water service delivery, and necessitating structures that involve citizens in decision-making on water-related matters. Emphasizing collaboration between citizens and service providers rather than top-down decision-making is essential. UNESCO has underscored the importance of citizen engagement in responding

effectively to governance challenges, leading to an increased focus on participatory approaches for water access and governance.

Public involvement in integrated water resources management programs faces challenges due to limited knowledge, reluctance, and a lack of organized platforms. Nonetheless, studies show potential willingness for public participation, especially in water-stressed regions. In Malaysia, efforts have been made to implement participatory approaches, such as the 'National Integrated Water Resources Management Plan,' promoting public-private partnerships for sustainable water resource management. The United Nations recognizes the significance of citizen involvement in the Sustainable Development Goals (SDGs), promoting equitable access to safe drinking water and strengthening partnerships for water governance. Integrated approaches to water governance have also gained recognition, emphasizing collaboration and coordination among stakeholders. Overall, participatory approaches are vital for addressing water scarcity in cities, promoting transparency, and empowering communities for sustainable water governance. In order to enhance the sustainable water availability in time and space pan-India, it is considered that there is an urgent need of conserving rainwater through various supply side interventions by appropriately enhancing the surface storages as well as artificial recharge to ground water in a great way.

According to the Central Ground Water Board (CGWB) of India, around 56% of the wells, which are analyzed to keep a tab on ground water level, showed decline in its level in 2013 as compared to the average of preceding 10 years (2003-12) period. India also faces the issue of over-population and is urbanizing at a rapid pace. This would mean more and more extraction of groundwater. Water scarcity is a characteristic of north-western states of India, such as Gujarat. Over time, the continuous increase of the population as well as the financial, administrative and technical deficiencies of the new supply system have led to the deterioration of the water service in the city. In the meantime, the water demand has considerably increased due to the improvement of standards of living. This has resulted in increasing pressure on underground water resources, which has led to an alarming depletion of aquifers.

The pressure on groundwater is likely to rise continuously. Recent history of water supply suggests that in the decades of 1970-80, water requirement of Ahmedabad urban area was totally met through a series of deep tube wells spread in entire city areas, but now it is not so. Before 1986, out of total 400 million litres per day (mld) of water supplied, contribution from groundwater resources was 350 mld (88%). With the implementation of various surface water sources projects at present, out of total 760 million litres per day (mld) water supply, only 30 mld (4%) is from ground water resources today. Yet, the fact is, the water demand is increasing with the rise in population

As per the United States Environmental Protection Agency (EPA) there are top 10 best water management practices which has helped the agency to reduce the usage of water throughout the facility, these practices are Optimize Towers for Cooling, Change the Bathroom Fixtures, Stop the use of Single-Pass Cooling,Water-Efficient Irrigation and Landscaping, Reduce Steam Steriliser Tempering Water Usage, Slow down the Laboratory Culture Water, Water Management Operation of a Reverse Osmosis System, Recover Air Handler Condensate, Recover Rainwater

Such unique water management practices have great importance when micro-managing water scarcity in the facility.

2.2 Case studies: Water Conservation and Sustainability for Behavioral Change

Following are the case studies of citizen participation in managing and initiating water conservation practices in their own capacity:

A group of citizens under 'Guruji Smruti' trust in Surat city, Gujarat is one such group which provides their service to prevent water wastage from each household. Each Sunday, they visit the High-rise apartments and inquire with the landlords about any leakages found in their water supply connections. In case of any water leakage issue, they will repair it free of cost. As per their experience, each day they repair 50 households' water supply connections and save 1000 liters of water.

Prakashbhai Gala who stays in Bharuch city, Gujarat has constructed a new house. He has constructed an underground tank that has the capacity to store 1 lac liters of rainwater. This water is then used for cooking and drinking purpose.

A society in Ahmedabad city, Gujarat took the initiative in 2020 to repair the percolating well with the help of society members. Each day they spent an hour in the repairing work of the well. They have successfully cleaned all the underground pipelines and removed the garbage from the pipelines. They have removed all the solid waste from the percolating well and rejuvenated it. As a result, all rainfall of the society is going directly into percolating well.

At larger level, community should treat water in the same way as they treat money (a behavioral change) where they spend as per the necessity and the rest they save it for a secure future. Amit Mishra, a water expert led many waters conservation and sustainability project involving creation of rainwater storage infrastructure using popular and inexpensive methods. He said that on individual level, "I practice what I preach. I and my family members spend water judicially at home, for example, installing toilet with half flush option, using washing machine with manual water level selector with number of washing cycles, and limiting the flow of water in shower". At office level, he suggested ways and means to reuse grey water and stop wastage.

3.1 Research Objective:

- To assess the current water management practices in Ahmedabad.
- To examine the level of citizen participation in water conservation and management initiatives in Ahmedabad (types and levels of citizen involvement, benefits and challenges of citizen participation, and case studies showcasing best practices in citizen participation)
- To explore the relationship between sustainable water management practices and citizen participation in Ahmedabad (examining how citizen involvement contributes to the effectiveness and success of water conservation and management efforts.)

3.2 Research Methodology:

This study uses mix method approach. Type of research methodology is used is exploratory research where in quantitative data is used to understand 'what' of existing perceptions of citizens on awareness, participation and attributes pertaining to sustainable water management practices at household and community level. Through qualitative data research aims to understand 'why' of existing practices and challenges faced by urban local bodies, citizens and relevant stake holders in sustainable water management practices at household and community level at Ahmedabad city. Quantitative methods uses socio economic profile of citizens and Likert scale for awareness, attributes, participation of samples to assess there engagement and agreements for sustainable water management practices at household and community level at Ahmedabad city. Qualitative method employ are observations and semi structures interviews with subject matter experts and key officials of urban local bodies concerned with formulation and implementation of water management at city level.

3.3 Sampling

As per census 2011 data total households in Ahmedabad city within Ahmedabad municipal corporation territory are 12,81,652. With unit of analysis of households universal population of households are mentioned above with, 95% of confidence level, 5% of margin of error and population proportion 50%, sample size is households. Sampling technique used is stratified random technique where survey was conducted using google forms online.

Universe population finite population 12,81,652hhs.

Unit of analysis =1 hhs

Sample =385

4. Data finding and analysis

For quantitative data use of advance MS Excel functions.

For qualitative data transcripts of interview conducted with subject matter expertise

(Source: Primary data)

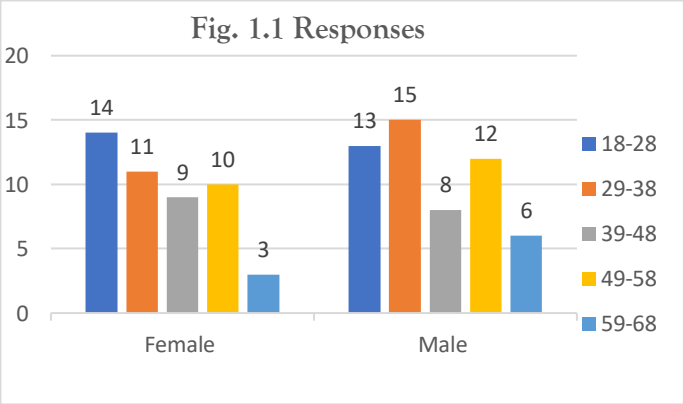
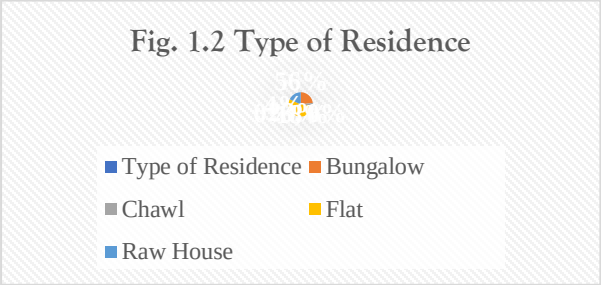
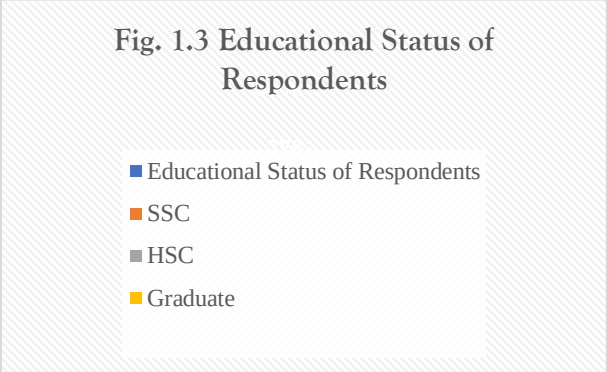


Figure 1.1 shows the number of responses of this study along with their age and gender. In females, maximum number of responses, i.e. 14, are from the age group of 18-28 years, whereas in males it is 15 responses from the age group 29-38 years. The least number of responses are 3 and 6 from the age group of 59-68 years, females and males respectively.



(Source: Primary data)

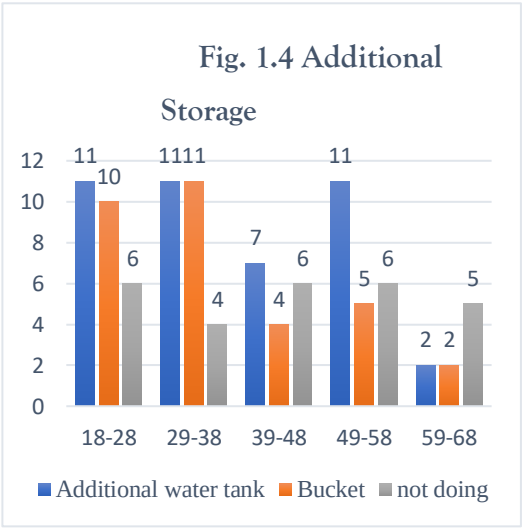
Figure 1.2 shows the type of residence of the respondents. Maximum respondents (56%) stay in flats, followed by bungalow (23%) and raw house (18%). Only 4% of respondents stay in the chawl area.



(Source: Primary data)

Figure 1.3 shows the educational status of the respondents. It is observed that maximum respondents are graduate, i.e. 56%. Whereas 7% respondents have completed their SSC and 7% have completed their HSC. Followed by 31% (others).

Figure 1.4 observes the ways in which additional storage of water is done by the respondents. The maximum number of respondents (i.e. 11) uses additional water tanks for storage, aged 18-28 years, 29-38 years, and 49-58 years each. From the age group of 29-38 years also maximum number of respondents (11) use buckets for additional storage of water. The least number of respondents (2) from the age group of 59-68 years use additional water tanks and buckets for water storage. There are also respondents from every age group that don't store water as shown in the figure.



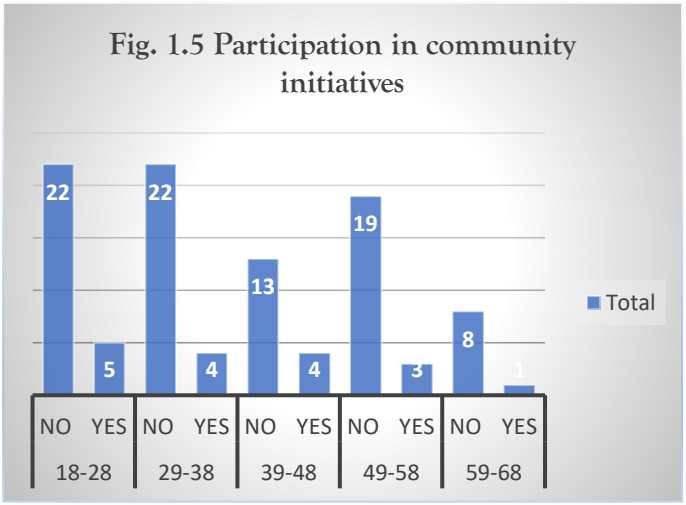


Figure 1.5 shows the number of respondents who take part in community initiatives. Maximum number of respondents from the age group of 18-28 years and 29-38 years each, i.e. 22 respondents do not take part in any such initiatives. In the age group of 39-48 years (13 respondents); 49-58 years (19 respondents); and 59-68 years (8 respondents) do not take part in any community initiatives. This figure shows that only a few people from all age groups take part in community initiatives as shown in the figure

(Source: Primary data)

Figure 1.6 observes the participation of respondents in water conservation and awareness programmes organised in their society. This bar chart has divided the responses as per their age groups and their binary answers (Yes/No). The maximum number of respondents, i.e. 25, from the youngest age group of the study (18-28 years) do not participate in any such water conservation activities and only 2 respondents from this age group affirmed their participation in such activities. Meanwhile, from the oldest age group of the study (59-68 years), 5 respondents affirmed their participation in such activities and 4 of them denied their participation

(Source: Primary data)

5. Recommendations and Conclusion

Deployment of collaborative governance model talks about stake holder participation and governance under that creation of jal rakshak in each school across the district. Societies to be tagged classified as platinum society gold jal rakshak society and silver Jal rakshak society. Platinum society would be which existing water harvesting at society and community level that includes water harvesting, MARS , Power by solar panels. Gold society would have water harvesting systems .Silver societies have no harvesting mechanism and sustainability components installed. Apart from these non-tangible aspects like WWD ,Creating awareness, frequently at house hold and individual level within the society or community along with municipal corporation & NGO's.

Ahmedabad municipal corporation should craft water security and conservation incentive scheme under which municipal corporation should incentives societies and Households in ensuring water

conservation, sustainability and security by providing recognition social print media and property text incentives.

Schools for creating awareness at community Households and individual behavior change by giving them a badge of jal rakshak for his or her house hold schools and conservation and sustainable work at community level. This will accelerate awareness among all classes of society bring about sensitivity among children adults community members as it would be driven by children and their families. This will reduce the water insecurities expand the scope of water conservation and harvesting.

The other thing that can be done is installing rainwater harvesting system at community or neighborhood level. In this case 4 to 5 societies or community level residences can collectively install rainwater harvesting system. The water harvested can be stored in a collective tank and can be sent further to recharge bore wells of individual community. Rainwater harvesting can be done at public places like public gardens and parks, lakes, community halls, schools, colleges, libraries, other institutions, municipal offices, etc. as well. The catchment area may consist of both roof-top and surface run-off. The water collected from the catchment areas is collected in a planted bed where there are layers of sand and gravel beds for filtering the water. The filtered water directly gets recharged in the aquifer. The extra water that cannot be absorbed, is directed to drain. The water Conservation shall start with the understanding that "fresh clean water is a limited resource" against the general belief that its Unlimited resource. Once this understanding is accepted, "Real" water conservation can be done in 2 ways – Spending less from the existing stock (protecting, preserving, and controlling the usage of water (water Conservation) and Conserving/Replenishing existing stock & Creating New Stock which can be replenished again & again in a way that meets current & long term, ecological, social, and economic needs (water Sustainability). Most of the people respond to tangible results benefitting them Directly. Hence we need to show visible improvement and the benefits the practices can bring in Community and it shall start at individual result. It has to be mix of Fear psychosis and Benefit psychosis making then understand How it will affect them when this limited rapidly exhausting natural resource Not available and How they can avoid this situation with proactively planning NOW.

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