

## OPTIMIZATION OF WATER SUPPLY IN URBAN AREA

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**Abstract** - The city is dependent on water as it plays a dynamic role for the development and functioning. A finite resource and indispensable source for human comfort and renewable when conserved and managed properly. Sustaining water can support the resilience of societal, fiscal and ecological system. Hence, optimization of water supply in urban areas can help in a controlled development and generate sustainable and resilient urban water system for future of cities. The paper discusses the different practices related to governance and management adopted in countries like Singapore, Sydney and Australia in context with its implementation in Indian cities. It discusses the measure that Indian cities to adopt for an effective optimization of water supply. The paper highlights the innovate solution to create sustainable future for cities through decentralized mechanism and water conservation techniques in all possible ways. It provides a framework of water supply system and governance in decentralized system to optimize water supply in urban areas on Indian cities.

**Key Words:** Decentralized of Water Supply System and Management

### 1. INTRODUCTION

Water is the most important natural resources for sustainable development and quality of life. Water security that is the amount and quality of water in the right place at the right time, fosters social and economic progress. Ample, suitable and secure contact to water results in an optimistic impact on the citizen's health and productivity, that directly or indirectly affects the economic growth and enables countries to reach the human development goals. In contrast, scares or contaminated delivery of water has resulted in affecting the well-being of people that has increased diseases and has intensified impact on the poverty.

More than half of the world population that is over 350 crore people lives in the cities and there is better contact to water and hygiene services in urban areas in comparison to the rural areas. More than 120 crore people lack the access to clean drinking water. By 2025, 180 crore people will be living in countries or areas with absolute water scarcity and 66% of world's population under stress condition.

Urbanization has ominously transformed the magnitude and quality of water resources mutually. The stimulation of public in urban zones has modifies the natural setting of the landscape, that has ignited water problems which strappingly distress the daily lives of the people. Metro regions and cities require enormous amount of water to satisfy the requirement of residential areas as well as industrial desires. To fulfil such demand, cities frequently have to dissuade the long distance of water at substantial cost. The New York City states best example of diversion of water from 160Km and more to satisfy the demand of the citizens.

The core challenges allied to water are misbalancing the sustainability of human urban settlement that deficit the availability to safe water and sanitation. Stress on infrastructure due to increase in urban population has increased disaster related to water for instance floods and droughts due to climate change. Apart from the issues related to access of water or its coverage, there are additional problems that has to be catered along with making successful routes for water services. The need related to water delivery should be innocuous, adequate to cater the increasing demand of water per capita. It has to be convenient and affordable for all people of the society.

### 2. Optimization of Water

Optimization is defined as the process of developing the best or effective use of a circumstances or resources and optimization of water supply means optimum utilization of available resources to fulfill the need.

The rapid urbanization has phenomenally created pressure on the demand of services and basic infrastructure in Indian cities which directly has adverse effects on the urban life disturbing the quality and economic productivity that somehow or the other affects the sustainable development. There is a massive gap within cities in the demand and supply of water. The pressure of fulfilling the demand causes poor functioning and management of water supply systems and water losses due to leakage in transmission and distribution process that's leads to the optimize water.

Unfettered growth and obsolete urban water management adversely affects the quality and quantity of water which exploits the available water resources in term of security and safety. The water management models of Indian cities illustrate that water sources are the crucial and most imperative share of the water supply system. This implies to conserve the locally available sources such as ground water and water bodies which is essential for sustainability of available water. Water bodies are not only a vital source for urban ecosystem and also performs momentous functions of revitalizing groundwater acting as a sponge that directly or indirectly supports biodiversity and offers livelihood.

### **2.1 Parameters to Optimize Water**

Water distribution has to be designed in such a way that it starts from source and ends to consumer taps. A precise and accurate distribution system has to be conceptualized and planned to adapt the maintenance performance while using them. The parameters to optimize water depends on the different factors or the process of the water supply. Water augmentation from source and varied water conservation techniques for instance rain water harvesting, ground water recharge, waste water reuse and recycle, decrease in the per capita consumption through smart fittings and fixtures and technological advancement can help in optimization of water resources and supply.

The good water supply system should be properly designed and have an efficient distribution network. Minimizing the losses while transmission through monitoring techniques and advanced water treatment and storage facilities will ensure the optimization. Transparency in governance and bottom up approach of involving all the stakeholders can lead to a goof governance system in water supply system. Capacity building amongst different stakeholders and local bodies though provision of required resources and monitoring will affect the water supply system to a great extent.

## **3. Case Studies**

### **3.1 Singapore**

Singapore is one of the world's leading commercial country, with biggest financial centers and one of the busiest port. The city covers an area of 710km<sup>2</sup> with a population of 5.1 million as per 2010. It has been importing water form Johar, Malaysia under two bilateral agreements. This was the only centralized water supply system and the only source of water.

The decentralized parameters used to optimize water supply in Singapore city focused on the catchment areas that has been increased form half to two third of the land surface of city to increase water collection during season. Two separate water collection systems were designed with rain water and storm water collection system. The highest grade of reclaimed water was produced from the treated water that has been already used and desalinization of water. SCADA monitoring system in distribution network was adopted.

Singapore has a centralized governance with a decentralized water supply system where all source of water is governed by the Singapore water authority which included tariff and tax collection also. The water supply and management system is highly interlinked with sewerage, drainage and other networks in the country.

The NEWater and desalinated water system has made it more resilient and keeping pace with the growing demand of the city.

### **3.2 Rouse Hill, Sydney**

Rouse Hill lies in the suburb areas of Sydney which is situated in the state of New South Wales, Australia. It boundaries an area of 37km<sup>2</sup>. With a population of 7,965 people. It is one of the pilot projects od decentralized water supply system and management in Australia. It commenced in 2001 with a low density residential which now connects 12,000 households.

The decentralized parameters adopted to optimize water started with ground water extraction through bore wells and dual reticulation of treated waste water was circulated. Storm water collection and quality management, used for flushing toilets and irrigations purpose. The usage of modern fitting and fixtures and SCADA monitoring system.

It follows a decentralized governance and management where local authorities operate all the management in the town under the guidance of Sydney water management board.

### 3.3 Queensland, Australia

The second largest city and third most populous state within the Commonwealth of Australia. Queensland decentralized system is adopted due to the pressure exerted on the existing water resources and the environment from rapid urbanization and an extended period of below average rainfall in the city.

The decentralized system of Queensland main objective was to manage the driver of pressure on water resources and improve the water use efficiencies and water conservation. Diversification of water supply sources like rain water, storm water, waste water recycles to be accepted. Environmental concern such as protection of aquatic life and ecosystem was focused with decreasing the per capita consumption of water. Queensland has a centralized governance system.

## 4. Comparative Analysis

**Table -1:** Comparative Analysis of case study

	Singapore	Rouse Hill, Sydney	Queensland, Australia
<b>Decentralized Techniques</b>	Catchment Areas	Ground Water extraction through bore wells	Diversification of water supply sources
	Two separate Water Collection	Dual reticulation of treated waste water	Protection of aquatic life & ecosystem
	Highest Grade of reclaimed water	Storm water collection and management	Decreasing per capita consumption of water
	Desalinization of Water	Modern fittings & fixtures	Water Conservation
<b>Distribution Network</b>	SCADA monitoring System	SCADA monitoring System	SCADA monitoring System
<b>Governed By</b>	Singapore Water Authority	Local Authorities under guidance of Sydney Water Management Board	Centralized Governance System

## 5. Why not initiated in India?

Indian cities as compared to other countries faces diversification of people in terms of religion, caste, income and views which somehow or the other creates a barrier in development for everyone. Hence, policies and guidelines adopted in India focuses

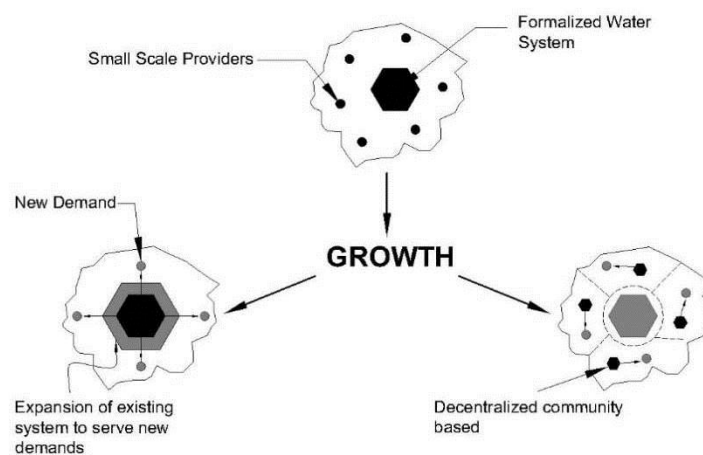
some sector of the society and other remains untouched. The lack of awareness and knowledge amongst public and the authorities restrict from adopting decentralized system. The concept of water conservation and sponge cities are a new process about which people are not aware and also hesitate in accepting new changes in the system. The dissolving of power will help us to achieve new forms in development but nobody in the hierarchy want the power to dissolve creating a barrier in solution and all the Urban Local Bodies are not self – sufficient to work and manage properly. People have less exposure to new technologies and innovation in terms of water conservation and finds it as a costly affair, therefore rigid to invest in such solutions. There has been no pilot project initiated in Indian scenario which could set the benchmarks to be adopted. The city has not reached a certain limit of saturation, hence centralized systems seems to be sufficient to everyone.

### 5.1 Measures to be taken

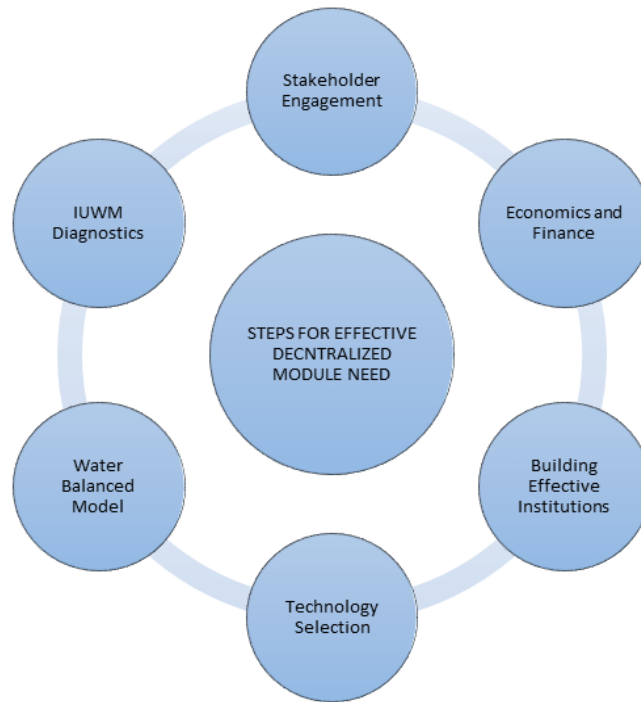
Water conservation techniques and awareness can be incorporated in the education system at school level. Democratic decentralized and local level planning with Private-Public Partnership approaches should be implemented as a key for planning process. There is a need to understand the futuristic approach for sustainable growth of cities in respect of water system. Promotion and using of smart fixtures and fittings can help in reducing the water consumption. Pilot project initiatives should be taken in Indian context to gain trust and set guidelines. Hence, decentralized system of water supply can help in reducing the pressure on the existing infrastructure.

### 6. Framework for Effective Decentralized Water Supply System and Management

In the water supply system, the necessity of water in terms of anthropogenic and ecological along with local context and consideration for environmental, social, cultural and economic perceptions is take care of. Indian cities should endeavor for sustainability that aims to achieve equilibrium in environmental, social and economic desires in the short, medium and long terms execution. New technologies and innovation should be applied with the changing demand and pattern.



**Fig -1:** Framework for Effective Decentralized Water Supply System and Management



**Fig -1:** Steps for Effective Decentralized Module need

The above study shows the current issues in sector of water infrastructure. In metropolitan cities where population and administrative area has grown to a certain limit it becomes very difficult to operate and monitor to city limit through centralized governance. In such conventional central governance system issues related to transparency, local level issue identification and implementation of comprehensive planning at down level of hierarchy does not happen effectively. There is an urgent need to construct and create a more sustainable and resilient urban water system for future cities.

Need of optimization is to meet Service Level Benchmark (SLB). It requires proper legal framework to monitor functions to down level of hierarchy of authorities. Functions, role and funding needs to be diluted to local level. Wherever local authorities are incapable to function their role district authority of Municipal Corporation should lead them to achieve their goals with proper training and guidance and time to time allocation of funds. In Indian scenario we have such practices at state level policy under 73<sup>rd</sup> Amendment Act in Rajasthan and Karnataka and it is being very well implemented till Gram Panchayat.

## 7. Conclusions

The conventional water supply system in most of the cities is not sufficient to cater demand in terms to meet water supply service level benchmarks and also there are many loopholes in governance, monitoring process and implementation at bottom level. Also demand of water in urban areas is increasing rapidly with increasing population resulting it in more pressure on infrastructure and water sources. There is crucial urge for cities to switch for substitute sources of water and optimum utilization of our all available resources. Decentralized water supply system gives us the alternative solution for futuristic and sustainable approach.

The solution lies within optimization of water supply with effective and efficient way of governance. Optimization of water supply system and governance system are two factors that are interdependent on each other. Democratic decentralization and local level planning are often used interchangeably and viewed as vital for sustainable development, for more accountable governance and in natural resource management to enable improved livelihoods. Instead of only dependent on centralized water supply system use of decentralized solutions like waste water treatment, use of surface water or neared sources, rain water harvesting and distribution system etc. need to be used.

Hence, proper water distribution system and management with public awareness and involvement. Transparency in governance and proper co-ordination is required for decentralized system to function in any city or district.

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