Analyze Urban Water Demand and supply In India

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Received: June 06, 2018 Accepted: July 28, 2018

ABSTRACT *The study explains how the increasing urban population to meet out water demand for future. The world countries are facing the problem of fresh water scarcity mainly due to increasing population and climate variation in rainfall is driven by climate change.The available water sources throughout the world are becoming depleted and this problem is aggravated by the rate at which populations are increasing, especially in developing countries.In this context the study consists of two main sections. First, the problem of water scarcity in urban areas of developing countries is a major concern. It is estimated that by 2050, half of India's population will be living in urban areas and will face acute water problems. About 1.1 billion people were still using water from unimproved sources, and two thirds of these people live in Asia. Secondly, in India, eighty-five per cent of urban population has access to drinking water but only 20 per cent of the available drinking water meets the health and quality standards. It is estimated that the global urban population is growing at two people per second, adding 1,72,800 new city-dwellers each day. Rapid urbanization means, by 2050 around 70 per cent of the global population will be urban dwellers. India's growing population, as everyone is aware, is a serious concern as it will create further burden on the per capita water availability in the future. The per capita water availability in 1955 was 4732 m^3 per year when the total population was only 395 million. In 2011, as the population increased to 1210 million, the per capita water availability reduced drastically to 1545 m^3 per year. By 2025, the per capita water availability will further drop down to 1341 m^3 and to 1140 m^3 in 2050. In this background the study to analyse based on secondary sources from various reports with using appropriate statistical tools. The threat to water resources has brought into focus the urgent need for planned action to manage water resources effectively.*

Keywords: *Urban water demand, Availability, Projection of demand supply.*

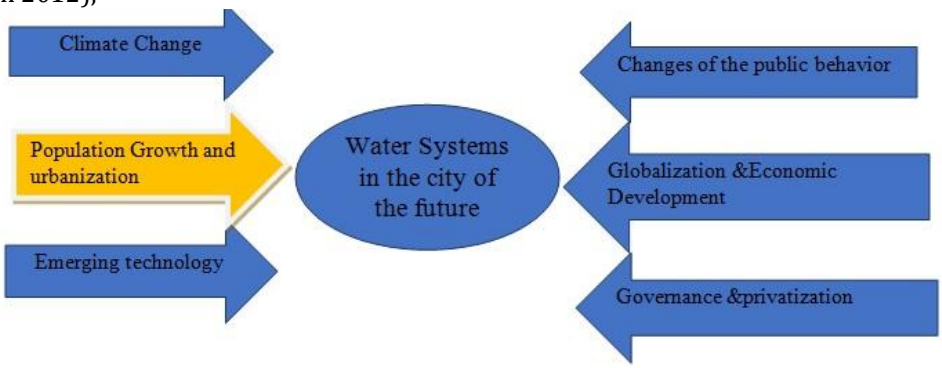
Introduction

The available water sources throughout the world are becoming depleted and this problem is aggravated by the rate at which populations are increasing, especially in developing countries. Most of the world countries are facing the problem of fresh water scarcity mainly due to increasing population and climate variation in rainfall is driven by climate change. About two third of the world countries mainly developing countries will face moderate to high water stress water and half of the total world population will face real water constraints by 2025 (United Nations Environmental Programme, 2012) Many of the European countries in the temperate zone having plentiful of fresh water resources are also facing the shortage of water supply due to successive water droughts driven by climate variations lead to drying of many water resources and water level in aquifers have reached to the critical point. Large part of India also fall under the category of physical water scarcity where availability of natural water resources is not enough to secure their future water needs hence they need to increase their efficiency of water use and wisely maintain their available water resources. Water is a precious and increasingly critical resource. Water crises are one of the top five global risks posing the highest concern. Water crises were ranked as the third biggest risk in terms of impact; however, strictly speaking, four of the identified top 10 risks are water-related — water crises, climate change mitigation and adaptation, extreme weather events, and food crises. (World Economic Forum, 2014)

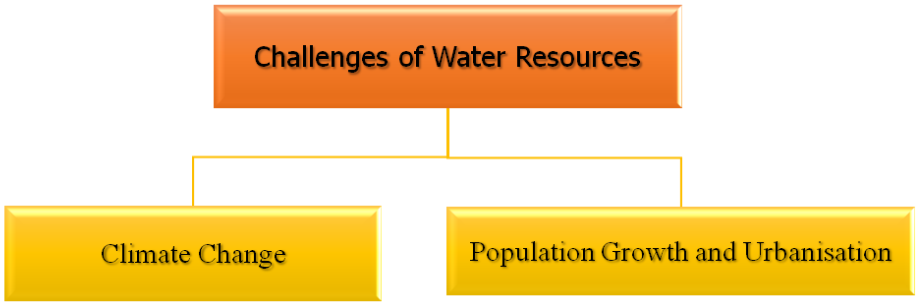
Selection of the Problem

The problem of water scarcity in urban areas of developing countries is a major concern. It is estimated that by 2050, half of India's population will be living in urban areas and will face acute water problems. About 1.1 billion people were still using water from unimproved sources, and two thirds of these people live in Asia. In India, eighty-five per cent of urban population has access to drinking water but only 20 per cent of the available drinking water meets the health and quality standards set by the world health organization. The daily water supply rate in the developing countries is very low compared to the industrial world. In India, it ranges from 16 to 300 litres per day depending on the locality and the economic strata,

whereas this figure ranges from 100 to 600 litres per day in the developed countries (Peilin .W and Minghong Tan 2012),



In the twenty-first century, waterthe basic need of life is likely to surpass the scarcity of many other commodities so as to become a great challenge to meet increased demand for water. In twentieth century 26 countries are faced water scarcity. By the end of twenty-first century, 30 countries suffered from water shortage. From local to national and global levels, it is becoming difficult to secure potable water with ever increasing population, expanding economies and migration from rural to urban areas. As per the National Commission on Integrated Water Resources Development (NCIWRD 2016), 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 geological and other factors, the utilizable water availability is limited to 1123 BCM per annum, comprising of 690 BCM of surface water and 433 BCM of replenishable ground water. The greatest demand of fresh water resources is in agriculture for food production as about 70 per cent of the developed water supplies used in irrigation. About 300 to 3000 litre water required to produce 1kg of food grain and that food production for a balanced diet requires 1300cubic of water per person per year (Manoj Panwar & Sunil Antil 2015).Water is life because plants and animals cannot live without water. Water is needed to ensure food security, feed livestock, take up industrial production and to conserve the biodiversity and environment. Although, India is not a water poor country, due to growing human population, severe neglect and over-exploitation of this resource, water is becoming a scarce commodity. While this is a growing concern all over the world, India is most vulnerable because of the growing demand and in-disciplined lifestyle.



- **Climate Change**

  Climate change is predicted to cause significant changes in precipitation and temperature patterns, affecting the availability of water. There is little dispute that the earth system is undergoing very rapid changes as a result of increased human activities. As a result of these changes it is generally accepted that we have begun to witness changes in the natural cycles at the global scale. Clearly these changes will severely impact the urban water cycle and how we manage it. Components of the urban water cycle, like water supply, wastewater treatment, and urban drainage etc. are generally planned for life-spans over several decades. Hence there is a need for us to pay attention to these changes in the context of how these systems will be designed and operated in the 'city of the future'.

- **Population growth and urbanisation**

  Population growth and urbanisation are enforcing rapid changes leading to a dramatic increase in high-quality water consumption.Population growth and urbanization will be one of the world's most important challenges in the next few decades. Urban population will grow from 1.9 billion in 2000 to 3.9

billion in 2030, averaging 2.3 per cent per year. On the other hand, in developed countries, the urban population is expected to increase, from 0.9 billion in 2000 to 1 billion in 2030 overall growth rate 1 per cent. The numbers and sizes of the cities, mostly in developing countries, are increasing due to the higher rate of urbanization.53.6 per cent of world population lived in urban areas and 32.4 per cent.

Review of Literature

Peilin .W and Minghong Tan (2012), explained water shortage and water environmental problems are in most of thecitiesand towns. Urbanization results in increasing growth of urban water demand and consumption; water shortage or water crisis and water environment deterioration will, in turn risk the urbanization quality. The study also suggest urbanization it was necessary to take comprehensive measures from the aspects of urbanization planning, water resource protection, water management and ecological restoration. Shadananan **Nair (2010),** revealed that water shortage was increasingly becoming a serious issue in Kochi. Demand had been growing fast with population, and the availability was fast decreasing due to pollution, land use changes and climate change The study suggested that better management includes: - Proper and timely maintenance of the public water system, Control of unauthorized use of public water, Proper filtering of tanks, Reducing water loss in distribution system and starting water conservation measures from domestic level, Increased public awareness on the needs of water and there should be a strong government policy for urban water management and pollution control, and an appropriate adaptation strategy by Government.**Abdul Shaban and Sharma. R (2007),**analysed the rapid increase in the population in the cities, depleting water resources and enhanced consumer needs are going to create a difficult situation. Market-oriented development with new needs in sectors like the entertainment industry, the building industry, new technologies with increasing water needs, enhanced supply in shopping malls, and simultaneously, the alarming rise in pollution levels in surface water bodies and even in groundwater is going to exacerbate the situation. Therefore, an urgent need is felt for a comprehensive water policy for cities which satisfactorily addresses the growing needs of citizens.**Jethoo and Poonia (2011)** examined the different income group consumer‘s behavior with respect to the dwindling water supply in Rajastan. The study It was observed that in ignorance of depleting water tables and acute shortage of drinking water due to little awareness, people were using much more water than it was needed. The study also addressed immediately by changing public perception towards water use through media and by organizing public awareness programes.**Jethoo (2011)** assessed the behavior of water users in the urban area.With sample of 400 respondents was selected from lower, middle and high-income groups. The study suggested that people should be educated for consumption measures at the domestic level.

Need for the Study

The global population is expected to reach around 9.5 billion in 2050. At this point the population will still be growing, but the rate of growth will have slowed. An estimated 90per cent of population growth is expected to occur in the cities of the developing world. It is estimated that the global urban population is growing at two people per second, adding 1,72,800 new city-dwellers each day. The rapid urbanization means by 2050 around 70per cent of the global population will be urban dwellers. India’s growing population, as everyone is aware, is a serious concern as it will create further burden on the per capita water availability in the future. The per capita water availability in 1955 was 4732 m^3 per year when the total population was only 395 million. In 2011, as the population increased to 1210 million, the per capita water availability reduced drastically to 1545 m^3 per year. By 2025, the per capita water availability will further drop down to 1341 m^3 and to 1140 m^3 in 2050.In this background the specific objectives of the study were.

- To understand the urban water demand and supply in India.
- To analyze the demand and supply for urban water in India.

Methodology

The Census recognizes three categories of urban places: metropolitan areas, cities and towns. Its typology of urban places is entirely based on the population criterion. Thus, the term ‘metropolitan area’ is applied to places with a population of ten lakh and above whereas ‘city’ refers to places with population one lakh and above in India. Lower down the population size urban places are designated as towns. A city with a population of one million is called ‘metropolises’ or ‘metropolitan city’. Ongoing increase in the number of metropolises, that is, cities whose population exceeds one million inhabitants is tremendous. In India not only, the size of metropolitan cities has increased dramatically but also their number. These fifty-two

metropolises are located in 16 states and in one union territory as per 2011 census. In this context the study is based on secondary data, the data is include National level data on water resource availability and utilization, Population and Urban population data were collected from the 2011 census of India Report and Various Government reports. Statistical tools like Regression, Pearson correlation, were used to achieve stipulated objectives. The study period we are analyze for the water year census 2011.

Limitations of the study

- It is a macro level study. Thus, the findings of the study may not be applicable to the micro level.
- The study has used the 2011 census data on water availability and other related variables are collected from Central water commission and Ministry of water resources (2011) Government of India.
- If monthly or annually data have been available the results might have been different.

Major Findings of the Study

The available water sources throughout the world are becoming depleted and this problem is aggravated by the rate at which populations are increasing, especially in developing countries. Currently, some 30 countries are considered to be water stressed, of which 20 are absolutely water scarce. It is predicted that by 2020, the number of water scarce countries will likely approach 35. It has been estimated that, one-third of the population of the developing world will face severe water shortages by 2025 At the current rate of population growth in India, combined with the growing strain on available water resources, India could well have the dubious distinction of having the largest number of water-deprived persons in the world in the next 25 years It means the problem of water scarcity will be felt more severely in the developing countries. In addition to limited water resources, the lack of safe drinking water and sanitation are the most serious challenges of the twenty-first century. Over 1 billion people lack access to clean water, nearly all of them live in developing countries.

TABLE -1
DETAILS OF THE RECENT GLOBAL WATER AVAILABILITY

Sl.No	Water Source	Totalwater(%)
1	Oceans, Seas &Bays	96.5
2	Ice Caps, Glaciers & Permanent Snow	1.74
3	Ground Water	1.69
	Fresh	0.76
	Saline	0.93
4	Soil Moisture	0.001
5	Ground Ice & Permafrost	0.022
6	Lakes	0.013
	Fresh	0.007
	Saline	0.006
7	Atmosphere	0.001
8	Swamp Water	0.0008
9	Rivers	0.0002
10	Biological Water	0.0001

Source: USGS, (2016).

The above table 1 explains 71 per cent of the earth surface is covered with water, which amounts to 1386 million cubic kilometres (m km^3), 96.5per cent of this water being sea water, it is salty. Fresh water availability is only 3.5 per cent. Out of the total fresh water, 68.7per cent is frozen in ice caps, 30per cent is stored underground and only 0.3per cent water is available on the surface of the earth. Out of the surface water, 87per cent is stored in lakes, 11per cent in swamp and 2per cent in rivers. As all the sweet water is not extractable, only 1per cent of the total water can be used by human beings (Department of the Geological survey, US 2016).

Water Resources in India

India is blessed with good rainfall well distributed over 5-6 months in the year. The average annual rainfall in the country is 1083.2 mm Government of India (2011), various parts of the country are reeling under a severe drought and water crisis. Data also reveals that the situation is getting worse by the day. The per capita water availability in the country has come down 70 per cent from 1951 to 2011, in a span of 60 years, while growth of population is one of the reasons for this, the over exploitation of ground water coupled with lack of harvesting is making matters worse. While water for consumption is most crucial, it is equally important to provide water for irrigation to increase the food production and livestock husbandry, to ensure food security for the increasing population. The following table 2 explains surface water potential in India.

TABLE-2
BASIN WISE SURFACE WATER POTENTIAL IN INDIA

S.No.	Name of the River Basin	Average flow bcm/year
1	Indus (up to Border)	**73.31**
2	a) Ganga	**525.02**
3	b) Brahmaputra Barak and others	**585.6**
4	Godavari	**110.54**
5	Krishna	**78.12**
6	Cauvery	**21.36**
7	Pennar	**6.32**
8	East Flowing Rivers Between Mahanadi and Pennar	**22.52**
9	East Flowing Rivers Between Pennar and Kanyakumari	**16.46**
10	Mahanadi	**66.88**
11	Brahmani and Baitarni	**28.48**
12	Subernarekha	**12.37**
13	Sabarmati	**3.81**
14	Mahi	**11.02**
15	West Flowing Rivers of Kutch, Sabarmati including Luni	**15.1**
16	Narmada	**45.64**
17	Tapi	**14.88**
18	West Flowing Rivers from Tapi to Tadri	**87.41**
19	West Flowing Rivers from Tadri to Kanyakumari	**113.53**
20	Area of Inland drainage in Rajasthan desert	**Negligible**
21	Minor River Basins Draining into Bangladesh and Myanmar	**31**
	Total	**1869.37**

Source: Indian Water Resource Society (2011).

On an average, India receives about 4000 Cubic Kilometers (1 Cubic Km is same as one billion cubic meters, abbreviated as bcm) of precipitation every year. Precipitation means rainfall and snowfall together. As explained above, this precipitation is not uniformly distributed over the entire land area and varies from less 100 mm in Rajasthan to more than 2500 in Assam. The remaining that flows in to the rivers is less than 50 per cent on the total precipitation. It is estimated that out of this 400 bcm of precipitation, the annual flow in the rivers is only 1869 bcm out of which only 690 bcm can be put to use.

Basin Wise Groundwater Potential in India

Groundwater also flows in the underground strata, though much slowly than the surface flow. At times the groundwater oozes out from the river banks and river bed into the river. At times water flowing in a river seeps back into underground formations

TABLE-3
BASIN WISE GROUND WATER POTENTIAL IN INDIA

Sl.No.	Name of Basin	Ground Water potential (bcm)
1	Brahmai with Baitarni	4.05
2	Brahmaputra	26.55
3	Cambai Composite	7.19
4	Cauvery	12.3

5	Ganga	170.99
6	Godavari	40.65
7	Indus	26.49
8	Krishna	26.41
9	Kutch and Saurashtra Composite	11.23
10	Tamil Nadu	18.22
11	Mahanadi	16.46
12	Meghna	8.52
13	Narmada	10.83
14	Northeast Composite	18.84
15	Pennar	4.93
16	Subarnrekha	1.82
17	Tapi	8.27
18	Western Ghat	17.69
	Total	**431.42**

Source: Indian Water Resource Society (2011).

The basin wise groundwater potential has been estimated and is given in the above table 3. The relationship between surface water and ground water is dynamic and complex.Further, the groundwater flow is not determined by the surface topography and follows some features of the underground strata which cannot be easily measured.For all these reasons, estimation of groundwater potential, i.e. the amount that can be used in a year on a sustainable basis, is a difficult task. The total groundwater potential for the year has been estimated as 431.42.bcm per year in India.Another 432 bcm can be used from ground water. Thus, total utilizable quantity of water is 690 + 432 = 1122 bcm per year. Trans-basin transfer of water, also called interlinking of rivers, will enable utilization of an additional 200 bcm of water.

Urbanization in India

The demographics of India is remarkably diverse. India is the second most populous country in the world with more than one sixth of the world's population. According to the 2011 Census, the urban population grew to 377.1 million as compared to 286.1 million in 2001 census showing a growth of 2.76 per cent per annum during 2001-2011. The level of urbanization in the country as a whole increased from 25.7per cent in 1991 to 27.82per cent in 2001 and to 31.14per cent in 2011 an increase of 3.3 percentage points during 2001-2011 compared to an increase of 2.1 percent points during 1991-2001.

TABLE-4
DETAILS OF VILLAGES AND URBAN TOWNS IN INDIA

S.No	India	2001	2011	Increase (%)
1	**Statutory Towns**	3799	4041	6.4
2	**Census Towns**	1362	3892	185.8
3	**Villages**	638588	640867	0.36

Source: Census of India (2001, 2011)

The above table 4 Explains a large number of new towns emerged during the decade, contributing significantly to the speeding up of urbanization. The number of statutory towns in India increased from 3,799 to 4,041 during 2001-2011 whereas the number of census towns have increased from 1,362 to 3,892 during the decade. Among the states, Tamil Nadu had the largest number of towns (1097-721 statutory towns and 376 census towns in 2011).

Urbanization Trends in India (1901-2011)

India is at present the second most populous country after China in the world. The world population projections indicate that India's total population will be doubled over the next 30 years and is expected to overtake China to become the most populous country of the world. Population growth in India was slow during the first half of the 20th century; however, growth accelerated after its independence. The level of urbanisation has increased from 10.8 percent in 1901 to 31.2 percent in 2011 witnessing a three-fold increase in more than a century. The main reason for this slow urbanisation in India is the high rate of rural population growth. The population of India hadincreased from 238 million in 1901 to 1210 million in 2011. Of this, the rural population stands at 833.1 million and the urban population 377.1 million

TABLE-5
DETAILS OF DECADAL WISE URBAN POPULATION IN INDIA

Census Year	No.of.Towns/UAs	Cities with population of 1 lakh and above	Urban population (in millions)	% Urban Population	Urban annual Exponential growth rate
1901	1827	24	26	10.8	-
1911	1815	21	26	10.3	0.03
1921	1949	27	28	11.2	0.79
1931	2072	33	34	12	1.75
1941	2250	47	44	13.9	2.77
1951	2843	71	62	17.3	3.47
1961	2365	95	79	18	2.34
1971	2590	139	109	19.9	3.23
1981	3378	204	159	23.3	3.79
1991	4689	273	217	25.7	3.11
2001	5161	350	285	27.8	2.74
2011	7935	468	377	31.2	2.76

Source: Census of India (2011).

In absolute numbers, the increase has been 90.97 million and 90.99 million persons in rural and urban areas respectively in the last decade. It is for the first time that increase in urban population is more than the rural. Although in absolute figure, it is only 13627 persons. The growth rate of population in the last decade was 12.2 per cent and 31.8per cent in rural and urban areas respectively with the average at 17.6 percent. In India, growth of urban population during the past decade is reflected in higher growth in metro cities. With economic liberalization and expected higher economic growth, rate of urbanization in India in coming decades is likely to increase.

TABLE -6
DETAILS OF CENSUS CLASSIFICATIONS OF TOWNS AND CITIES

S.No	Class of Cities/Towns	Range of Population	No.of.Towns
1	Class I	1,00,000 and above	393
2	Class II	50,000 to 99,999	401
3	Class III	20,000 to 49,999	1151
4	Class IV	10,000 to 19,999	1344
5	Class V	5,000 to 9,999	888
6	Class VI	Below 5,000	191

Source : Census India (2011),

Class I Urban Agglomerations /Towns which have at least 1,00,000 persons have increased from 24 in 1901 to 468 in 2011. The current census enumerated 264.9 million people, constituting 70per cent of the total urban population, living in Class I UAs/Towns. The proportion and growth has increased continuously in class I UAs/Towns over the census. The graduation of number of urban centers from lower population size categories to class I cities has resulted in top-heavy structure of urban population in India. In the remaining classes of towns the growth has been nominal. The number of towns has increased by 2774 since last Census. Only 242 statutory towns have been added in the last decade in comparison to 2532 Census towns. Many of these towns are part of UAs and the rest are independent towns. The total number of Urban Agglomerations/Towns that constitutes the urban frame in the country in 2011 is 7935, which has grown from 1827 in 1901.

Population and Water Availability in India

Population in India has expanded rapidly during last century putting tremendous pressure on scarce natural resources. Environmental deterioration and ecological imbalance were also rapid. Issues of the climate change on our depleting water resources. Availability of clean water is a human need and should be a right too. Scientists, intellectuals and academicians are increasingly discussed about climate change and environmental issues from global perspective as also analyzing policy changes put into force by various governments to address the issue positively.

TABLE-7
DEMAND AND SUPPLY OF WATER RESOURCES IN INDIA

Census Years	Population (Million)	Decadal Growth (per cent)	Progressive Growth Rate (per cent)	Per capita Water Availability(m^3)
1951	361.1	13.3	51.5	6372
1961	439.2	21.6	84.3	5239
1971	548.2	24.8	129.9	4197
1981	683.3	24.7	186.7	3368
1991	846.4	23.9	255.0	2719
2001	1028.7	21.5	331.5	2236
2011	1210.0	17.6	407.5	1902

Source: CGWB, (2016).

India's finite and fragile water resources are stressed and depleting while population had been growing rapidly. Population growth was the key to the whole equation of water availability and its use because of the fact that India's population had grown four-fold over the past 70 years. The population of India which at the turn of the twentieth century was around 238.4 million increased to reach 1210 million at the dawn of the twenty first century. Table 1 showed that per capita water availability was reducing with population growth. The water per capita in India was over 6372m^3 per annum in 1951; it is now stands at about 1902m^3 per capita. With every increase in population there was corresponding decline in per capita availability of water. Estimated, population of India would be around 1.5 to 1.8 billion in 2050. The per capita availability of water will then be around 1200m^3 year; consequently, effective water management in India was of greater urgency than in most of other countries. Consequently, effective water management in India is of greater urgency than in most of other countries.

Correlation analysis

Population growth and rapid urbanization will create a severe scarcity of water as well as tremendous impact on the natural environment. In order to meet the future water demand, cities will need to tap their water supply either from a deep ground or surface sources situating a far distance away from the urban area. Moreover, rapid increase in built-up areas disturbs the local hydrological cycle and environment by reducing the natural infiltration opportunity and producing the rapid peak storm water flow. Cities in developing countries are already faced by enormous backlogs in shelter, infrastructure and services and confronted with insufficient water supply, deteriorating sanitation and environmental pollution. The larger populations will demand larger proportions of water while simultaneously decreasing the ability of ecosystems to provide more regular and cleaner supplies. Correlation analysis is used to find out the relationship between the demand and supply of water from 1951-2011.

TABLE-8
PEARSON CORRELATION ANALYSIS FOR DEMAND AND SUPPLY OF WATER IN INDIA

Pearson correlation	Population in(million)	Urban population (million)	Per capita Water availability (m^3)	Density of population	No.of. Towns
Population in(million)	1				
Urban population (million)	.995	1			
Per capita water availability (m^3)	-.946	-.913	1		
Density of population	.976	.985	-.870	1	
No.of.Towns	.940	.967	-.797	.970	1

Source: Estimated values from census of India (2011)
Correlation is significant at the (0.01) 1 per cent level .

The result of the Pearson correlation analysis is shown in the Table-7. Correlation between population and urban population is significant at 1 per cent level had a very high positive correlation. The relation between population and per capita water availability was negative, indicating the decline in the percapita availability of water for the rapid growth of population. The significant between population and density of populationis positively correlated at .976 level followed by the number of towns and population was positively correlated at .940 level.

Regression analysis

The total annual flow in the rivers is estimated as 1869 bcm.The average annual per capita water availability in the years 2001 and 2011 was assessed as 1820 cubic meters and 1545 cubic meters respectively which may reduce further to 1341 and 1140 in the years 2025 and 2050 respectively. Annual per-capita water availability of less than 1700 cubic meters is considered as water stressed condition, whereas annual per- capita water availability below 1000 cubic meters is considered as a water scarcity condition due to rapid growth population in India(CWC,2011).Regression analysis is used to find out the impact on water availability in India 1951-2011.

TABLE-9
REGRESSION ANALYSIS FOR DEMAND AND SUPPLY OF WATER IN INDIA

S.No.	Particulars	Beta Value	Standered error	t-Value	Significant
1	**Per capita water availability**		***2024.525***	***6.087***	*.026**
2	**Population in(million)**	***-.5.543***	***7.218***	***-4.027***	*.056**
3	**Urban population (million)**	***4.673***	***25.085***	***2.639***	*.119**
4	**Density of population**	***.694***	***6.502***	***1.973***	*.187**
5	**No.of.Towns**	***-.778***	***.463***	***-1.394***	*.298**
6	**R^2**	*.994*			
7	**A R^2**	*.983*			
8	**F Value**	*87.965*			
9	**Significant**	*.011**			

Source: Estimated values from census of India (2011)
Regression is significant level at 5 per cent

The result of the Regression analysis is shown in the Table-8. The dependent variable is per capita water availability (1951-2011) at all India level. The regression analysis has been done to find out the impact on per capita water availability due to independent variables like population urban population, Density of population and number of Towns. Dependent variable for this analysis is per capita water availability is 2024.525. The Value of R^2 for selected variables was (.994) which implies that the 93 per cent of variation of total demand in India was explained by the selected independent variables. From the table it can be inferred that Per capita availability of water and the other variables is significant at (.011)5 per cent level. The F Value was 87.965 was significant at all the selected Variables together were significant to affect the per capitawater availability in India.

Conclusion

The threat to water resources has brought into focus the urgent need for planned action to manage water resources effectively as it is widely acknowledged that water is a major limiting factor in the socio-economic development. There is an urgent need for planned action to manage water resources effectively. The problems in urban areas of developing countries are of particular concern as still large sections of the community are living without safe water supply the past several urban water interventions (particularly in developing countries), have failed and this has been in part due to little or no attention given to the institutional landscape within which these interventions are applied and the lack of stakeholder involvement in the development and implementation of these interventions. To achieve this appropriate scientific and technological innovations and solutions will need to be developed. However, to ensure maximum impact of these innovations and solutions, they must be coupled with components of institutional development (through capacity building activities), and greater stakeholder involvement. Clearly, it is only if these components are included in the solution process can substantially contribute to the reduction in the vulnerability of cities and their capacity and preparedness to cope with global changes.

Suggestions

- Low public awareness about the overall scarcity and economic value of water results in its wastage. Further, the existence of illegal tap connections and leaking water supply from consumer

connections reduces water availability and also poses a threat to demand management which should be central to all planning and action relating to water.

- A bulk of the urban consumers are without water meters and also a majority of the water meter installed were mal-functioning not correctly indicating the exact quantum of water used.
- Revival, rehabilitation and maintenance of Rain Water Harvesting structures is the need of the hour to sustain ground water aquifers.
- Recycling and re-use of waste water is required to be scaled up in a planned way so as to ensure optimal utilization of this scarce resource by industries.
- In order to bring in an uninterrupted supply of water, water grids, similar in function to electricity grids, would be developed having common grids for both urban and rural drinking water to maximize economy.

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