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Economic Status and Crisis of Water Management in Kerala: An Analysis

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ABSTRACT

Among the natural resources, water is treated as the elixir of life. Water is the life blood of the environment in which man lives and interacts with other living beings. Water till recently considered as a free gift of nature has now become a critical scarce resource. The combination of population growth, climate change, and misuse of water and pollution of available water in the 21st century is leading to a veritable water crisis. Water as a scarce natural resource which has to be planned, developed and conserved and managed on environmentally sound basis keeping in view the socioeconomic conditions. With an increase in population coupled with urbanization,
Industrialization and increase in living standards the demand for water for various uses is continuously increasing in each decade.

1. Water – A Scarce Natural Resource

Water, which is considered as a free gift of nature has now become a critical scarce natural resource due to the pressure of increasing population, urbanization, industrialization etc. It is a scarce, precious natural resource that has to be planned, conserved, developed and managed on environmentally sound basis while keeping in view the socio economic conditions (Sarbhukan, 2013). The United Nations general assembly recognized Safe water and sanitation as the basic human right in the year 2010. Everyone has the right to access safe, sufficient, acceptable and affordable water. But millions of people in the world is not getting this basic right. Water can be considered as an economic good on the basis of Robbins' (1952) definition of Economics. According to Lionel Robbins, "Economics is the science which studies human behavior as a relationship between ends and scarce means which have alternative uses". Water satisfies the condition of alternative uses as it has a diversity of ends from the basic needs such as drinking and bathing through navigation, recreation, irrigation etc. to disposal and dilution of wastes. And the growing competition between the productive and environmental sectors reveals that water is a scarce resource. Water is frequently treated as an economic good because there is insufficient availability of water to meet contending demands. International Conference on Water and the Environment (1992), held in Dublin holds the principle that "Water should be recognized as an economic good, though it has an economic value in all its competing uses".

2. Economics of Water

Water can be considered as an economic good on the basis of Robbins' (1952) definition of Economics. According to Lionel Robbins, "Economics is the science which studies human behavior as a relationship between ends and scarce means which have alternative uses". Water satisfies the condition of alternative uses as it has a diversity of ends from the basic needs such as drinking and bathing through navigation, recreation, irrigation etc. to disposal and dilution of wastes. And the growing competition between the productive and environmental sectors reveals that water is a scarce resource. Water is frequently treated as an economic good because there is insufficient availability of water to meet contending demands. International Conference on Water and the Environment (1992), held in Dublin holds the principle that "Water should be recognized as an economic good, though it has an economic value in all its competing uses". Water is not differing from any other economi good. It is a necessity than food, clothing or shelter which obeys the rules of Economics (Baumman & Boland, 1998). Water is a universal and indivisible truth that the earth's freshwater belongs to earth and all the species. Water can also be taken as a free good. A free good is a good which is available in abundance and free of cost. Water in a river can be considered as a free good. Being free, it does not imply that the good is not valuable, but it is not scarce. depth of the water level in the weathered crystalline of midland areas in Kerala varies from 3- 16 M bgl. The midland area sustains medium capacity.

3. Ground water Potential and Availability : Kerala

The ground water potential of Kerala is very low as compared to that of many other states in the country. The estimated ground water balance is 5590Mm³. Dug wells are the major ground water extraction structure in Kerala. The dug wells have a maximum depth of about 10 to 15 meters and have a diameter of about 1 to 2 meters in coastal region and 2 to 6 meters in the midland and high land. The open well density in Kerala is perhaps the highest in the country-200 wells per sq.km in the coastal region, 150 wells per sq.km in the midland and 70 wells per sq.km in the high land. The ground water withdrawal is estimated as 980Mm³ and the State Ground Water Department calculate the effective recharge as 8134 sq Mm³.The ground water level receding drastically during the summer months and drying up of wells are common features of the ground water levels in many parts of Kerala. The ground water replenishment and hence the levels depends also on the geo-morphological, physical and chemical properties of the soil in general, The depth of water level in Kerala state varies from few cm bgl to 56 M bgl and most of the area fall under 0-20 M bgl. The dugwells.

Ground water fulfils the irrigation needs of around 50 percent of irrigated area. The total Annual ground water

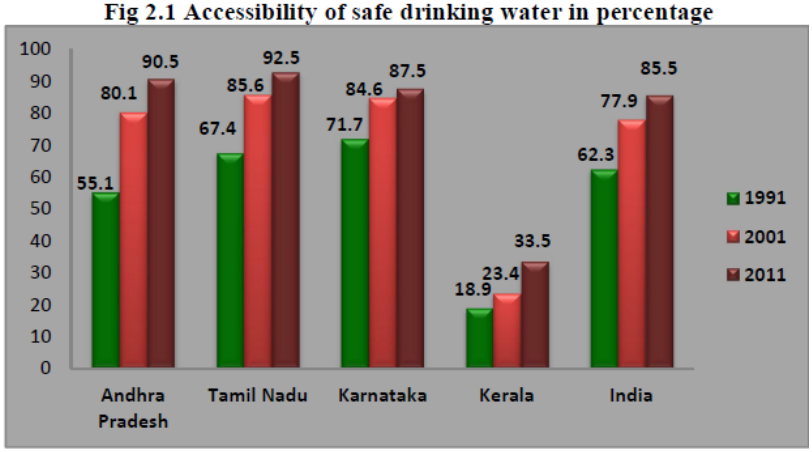
availability in Kerala State has been computed as 6.620 Billion Cubic Meter (BCM) and the net ground water availability in the entire state is 6.029 BCM. The rainfall recharge accounts for about 82 percent of the annual recharge. The annual ground water draft for all uses in the state is 2.809BCM. The net Ground water availability for future irrigation development in the state as in 2009 is of the order of 3.021 BCM. The overall stage of development of the State is 47 percent. The district wise stage of development is maximum in Kasaragod (71 percent) and minimum in Wayanad district (17 percent). The net annual ground water availability for the state of Kerala during 2009 has reduced to 3.22 per cent compared with the data during 2004. The annual ground water draft for all uses has reduced by 3.80 per cent during the period. The net ground water availability for future irrigation development in the state as a whole shows a decline of 1.74 per cent in 2009 compared to 2004.

As per ground water resource data 2011, the total annual ground water availability and the net groundwater availability in the State is 6.69 Billion Cubic Meter (BCM) and 6.07 BCM respectively. The annual ground water draft for all uses in the State is 2.84 BCM out of which 1.31 BCM is for irrigation purpose. 3.07 BCM is the net ground water availability for future irrigation development in the State. The stage of ground water development of our State is 47%. Among the districts, Kasaragod and Wayanad ranks maximum and minimum with 71% and 18% respectively. Out of the 152 revenue blocks assessed in the State during 2011 for groundwater potential, 1 block (Chittur) is categorized as over exploited, 2 blocks (Kasaragod, Malampuzha) as critical, 23 blocks as semi-critical and 126 blocks as safe.

4. Accessibility of Drinking Water Problem in Kerala

Access to safe drinking water plays a major role in the social and economic development of a nation. It can be defined as the water that does not cause any problems to health over the period of its consumption including different sympathies that may occur between different stages of life (WHO, 2017). A safely managed drinking water service can be defined as the one which is located on the premises, accessible when it is needed and free from pollution. When compared to the neighbouring states, Kerala is far below them. This is shown in the figure: 2.1.

Fig 2.1 Accessibility of safe drinking water in percentage



Source: GoI, 2013-2014.

It is clear from the figure that there is a wide gap between the neighbouring states and Kerala. There is a wide gap between the state average and the national average. In Andhra Pradesh, 90.5 per cent of the total households get safe drinking water. In Tamil Nadu it is 92.5 per cent and in Karnataka it is 87.5 per cent. Taking the whole country, 85.5 per cent of the households get safe drinking water (GOI, 2013 - 2014). But in Kerala it is below 50 per cent. More than half of the households in Kerala are not getting the safe drinking water. According to the census 2011, Kerala has the worst rank in the accessibility of safe drinking water. In Kerala only 33.5 per cent

households get safe drinking water and the rest 66.5 per cent is not able to access the safe drinking water. This is shown in the table: 2.3.

Table: 2.3 Household Access to Safe Drinking Water in Kerala (in %)

Census Year	Total	Rural	Urban
1981	12.2	6.3	39.7
1991	18.9	12.2	38.7
2001	23.4	16.9	42.8
2011	33.5	28.3	39.4

Source: NSSO,2012.

The rural-urban gap is also widening. Compared to the national average Kerala's position is worst and 57 per cent less than the national average. In India 85.5 per cent households gets safe drinking water. The 82.7 per cent of the rural households and 91.4 per cent of the urban households get safe drinking water. In Kerala only 28.3 per cent rural

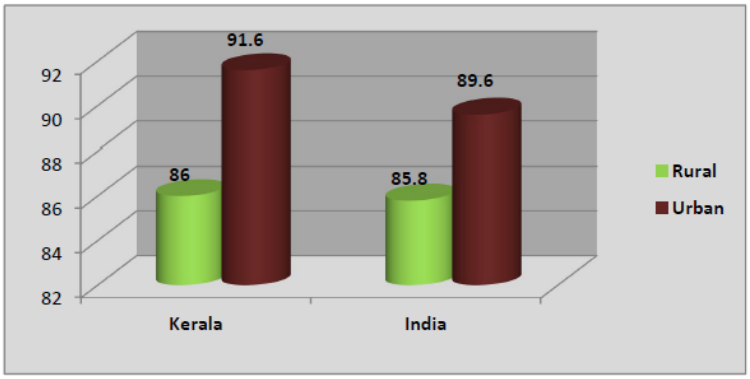
households and 39.4 per cent urban households get safe drinking water.

5. Sufficiency of Drinking Water

An important aspect of drinking water facility is its availability in sufficient quantity of water throughout the year. If in any particular month, the drinking water availability was not sufficient for majority of the days, then the availability is considered as insufficient. In rural areas of India, 858 households per 1000 households get sufficient water and in urban area it is 896. In the case of Kerala, in rural areas 860 per 1000 households get sufficient water for drinking while in urban

areas 916 get sufficient drinking water throughout the year (NSSO, 2012). In rural India, 85.8 per cent of households got sufficient drinking water throughout the year while in urban India it is 89.6 per cent. In rural Kerala, 86 per cent of the households got sufficient drinking water throughout the year and in urban Kerala it is 91.6 per cent. There is not much difference between the state and the national average both in rural and urban areas.

Fig: 2.2 Sufficiency of drinking water in India and Kerala in percentage



Source: NSSO, (2012)

6. Quality of Drinking Water in Kerala

Even though Kerala has been attaining progresses in many sectors, its status in the management of quality of water is very poor, which has adverse effects on health and economy. Majority of the drinking water sources in Kerala are getting polluted due to the disposal and pumping of waste and unscientific sanitation practices. The chemical contaminants are Iron, Fluoride, Salinity, Arsenic, Nitrate etc. E-coli and coliform are the bacteriological pathogens found in the drinking water sources of Kerala.

According to the WHO reports, 88 per cent of the diarrhea disease is caused by the use of unsafe water and inadequate sanitation practices. Since well water is the main source of drinking water in Kerala, chemical and bacteriological contamination is high in the well water. According to the Ministry of Drinking Water and sanitation, Kerala has the highest number of contaminated water sources. In the year 2013, out of the total 102900 tested sources, 67608 (33.7%) are found to be contaminated and in the year 2015, out of the 118023 tested sources, 47091 (39.9%) are found to be contaminated.

7. Water Crisis in Kerala: An Analysis

The situation of water in Kerala is marked by contrasts. On the one hand, Kerala has plenty of water resources like rivers, lakes, ponds etc. The state also has two rainy seasons. Despite this water prosperity, on the other hand, Kerala is facing acute water scarcity between the month of February and Mid- May every year. During this period there were acute drinking water shortage and water for other purposes become unavailable. This situation is expected to exist in the coming years also. Rivers, ponds, lakes etc. are shrinking and it dried up during summers. The ground water table of Kerala is lowering. This adversely affects agricultural production, power generation and availability of drinking water in the state. According to the studies and experiences, Kerala can be considered as 'Wet - Drought' State. This means that six months flooding due to high rain following with relief camps and another six months is severe drought with tanker lorry water supply (Subash, 2016).

8. Causes for the Water crisis in Kerala

The factors which contributed to the growing water crisis in Kerala can be divided into two. One is the natural factors and the other is the man made factors. In this section, these factors which contributed to the water crisis in Kerala are discussed.

❖ **Rain dependent water resources**

The water resources of Kerala are fully dependent on rainfall. In Kerala, the rivers,lakes, ponds and other sources fed up during the rainy season and dried up during the summer season. The rivers of Kerala are fast flowing and soon after the rain the water flows into the sea. Since rain is the primary source of water for all the water sources in Kerala, the deficits in the rainfall affect the utilizable water potential of the state. Kerala is also known for its high well density with 100 to 400 wells per Kilometer. But during the summer season these wells are dried up.

❖ **Smaller Catchment Rivers**

As per the national classification, rivers with drainage areas of more than 20,000 sq.km. are major rivers, rivers with areas more than 2,000 sq.km. are medium rivers and less than 2,000 sq.km are minor rivers (Rao,1979). According to this classification, none of the rivers in Kerala are major rivers.

Four rivers such as Bharathapuzha, Chaliyar, Pamba and Periyar are medium rivers. The remaining 40 rivers are minor rivers. Thus the number 44 is misleading and irrational. Because of the short length of the rivers and speedy flowing of water in to the sea, Kerala has not able to utilize the river water sources efficiently.

❖ **Natural setting**

Due to the steep topography of the state, major portion of rainfall received is drained to the sea at a faster rate within 48 hours. The slope of the terrain and the forceful raindrop leads to the speedy runoff of the rainfall. Because of this the rain that falls on the ground does not percolate into the soil. This rain water if harvested can be used for drinking and cooking purposes during the summers. Because of the elevation difference between the highland and the midland, water flowed quickly and discharged into the sea and the state has not able to utilize the river sources efficiently. Besides these natural factors, problems induced by human such as deforestation, unscientific and faulty land use practices, reclamation of paddy fields and wetlands, mining of sand from rivers, hillocks mining, urbanization etc. have affected the water resources of the state.

❖ **Deforestation**

The Western Ghats are under massive deforestation over the last two decades. Massive deforestation affects the flow of rivers, water table level and the quality of water in the rivers. One hectare forest can conserve rainwater and recharge the groundwater system at the rate of 50,000 litres per year. Extensive deforestation has resulted in the huge reduction of natural water conservation. The streams that flow from the forest areas of Western Ghats were exploited and the flow of it stopped during the dry period.

❖ **Reclamation of Paddy fields and wet lands**

For the last five decades, a large area of wetlands in Kerala has been reclaimed for various purposes. In 1960 there existed about 7.9 lakh hectares of paddy fields in Kerala. It has been reduced to 2 lakh hectares in 2012. It shows that there is 75 per cent reduction in the paddy fields. One hectare paddy field can hold and conserve rainwater and recharge groundwater at the rate of 5,00,000 litres per year (Bose, 2016). The conversion of paddy fields and wetlands for settlements and industries in Kerala destroy the natural water conservation and increase the intensity of floods during the monsoons.

❖ **Mining of hillocks**

The hillocks in the state are disappearing. It has been mined for various purposes. In the highland areas the hillocks are mined for cultivation of crops such as cardamom, pepper, tea etc. In the midland region, the laterite hillocks are mined for building materials. The hillocks associated with the river catchments act as ground water reservoirs. It stores water during the rainy season and release it to the water bodies in the downstream. This has also reduced the natural conservation of water.

❖ **Sand Mining**

The rivers in Kerala have been utilized for sand mining and this affects the ecosystem of the river. This also resulted in the lowering of river beds in many regions of Kerala. Sand base of the river holds the water and makes the river perennial. Mining of these sand bases causes the lowering of water holding capacity of river beds, erosion, drying up of wells in the nearby these areas, lowering of groundwater table etc. The increase in the construction activities leads to the increase in demand for river sand and the situation is worsening.

❖ **Urbanization**

The urbanization in Kerala is growing in a faster rate. Currently about 20 per cent of the land area is covered by buildings and roads. In 2001 the 25.96 per cent of the total population is under urban areas and in 2011 it has increased to 47.72 per cent. Kerala is in 19th position in terms of urbanization in India. The scope for natural groundwater recharge is very low in urban areas. Urbanization results in huge flood during monsoon season. It leads to the lowering of groundwater level and causes the drying up of wells.

❖ **Population Growth**

The rapid growth of population leads to the decline in the availability of per capita water availability. As per the census of India 2011, the population of Kerala is 3.38 crores. The existing water resources are not sufficient to meet the water demands of the growing population. The rapid population growth leading to urbanization, agricultural and industrial growth increased the demand for water day by day. The population of Kerala in the year 1901, 0.64 crores increased to 3.38 crores in 2011.

❖ **Pollution of water resources**

As a result of the rapid growth of population and the unplanned urbanization, the rivers of Kerala have been increasingly polluted from the domestic as well as from the industrial waste. Waste from the fertilizers, pesticides, hazardous pollutants from industrial units, insecticides, pollutants like Phosphates, sulphates, flourides, ammonia and heavy metals causes pollution of the water resources. With regard to groundwater quality, the wells of Kerala are found to be affected by chemical and biological contaminants. In the coastal areas, the ground water quality problems are mainly because of the presence of excess chloride. The open character of the wells, conventional and outdated maintenance habits, use of buckets and rope to draw water, kitchen wastes and pit latrines at a distance of less than five meters from wells, bathing and washing clothes besides the wells are some of the factors, which are contributing to the bacteriological contamination.

❖ **Drilling of tube wells and Bore wells**

Kerala's physiography, geology and the coastal areas are not suitable for drilling of tube wells and bore wells. There is a massive and widespread drilling of tube wells and bore wells by the industrial units. Majority of the tube wells in Kerala are used for industrial and commercial purposes. This deprived the drinking water of the neighbor hoods. Installation of motor pump sets to deepened wells and bore wells causes the decline of the water table.

9. Solution to the Water Crisis: Rain Water Harvesting

Rainwater harvesting is the viable solution in the monsoon rich state of Kerala. The common structures feasible for Kerala are sub-surface dykes, nala bunds, check dams. The traditional water conservation structures like natural ponds, reservoirs should be desilted and cleaned. Participatory watershed development programmes should be implemented in the State. Mass awareness programme on ground water conservation should be arranged at Panchayat level in all districts. Rain Water Harvesting denotes preservation of rain water for future requirements.

Government of Kerala has identified the peculiar scenario existing, that around 60% of total rainfall ie. 7200 Crore Cubic Meter out of 12000 Crore Cubic Meter is draining to the sea. On the basis of the concept 'catch the water where it falls', some rain water harvesting programmes, both in state level and micro level has been implemented. Kerala Government's programmes including "Jalanidhi" and "Mazhapolima" have created much awareness about the rain water harvesting among the public. Amendment in Building Rules has insisted the roof top harvesting arrangements on new buildings. In addition, Kerala State Water Policy 2008, was prepared for a sustainable water management. Even though, Kerala is yet to reach the desired results in water management activities, mainly in rain water harvesting. Considering the successful history of varioussocial and welfare programmes especially literacy mission, the efforts of the state not up to the mark.

"The Kerala government wants the systems of rainwater recharging of wells already installed in hundreds of government buildings to be repaired and made functional," Sekhar Kuriakose, member-secretary of the State Disaster Management Authority, which is initiating the government's programme after the state was declared as drought-hit in October 2016, said. "In the last few years, well recharge structures were installed in many public buildings. Many of them have become dysfunctional. As a first step, we want to make these systems functional."

Following this, the Kerala Government wants to install well recharge systems in government buildings. This will be part of the Haritha Keralam (green Kerala) programme initiated by the present State Government, after it came to power in 2016, to strengthen rainwater harvesting in the state and also to strengthen environmental awareness. "We want to encourage the people of Kerala to install well recharge systems in their homes after we have made them functional in all government buildings," said Kuriakose. "We want the government to take the lead."According to Jos Raphael, director of Mazhapolima, more than 25,000 well water recharge structures have been installed in the district since 2008. These have been in private homesteads, institutions, and government buildings.

The idea is simple and cheap. Rainwater falling on the roof is channelled and collected through PVC pipes and directed into the dug wells. The simpler version of the system does not have a water filtration unit. The first flush of rainwater, which will bring down the leaves and dirt accumulated on the roof, is let out through an escape valve before it is turned into the dug well. Adding a simple filtration unit – with gravel stones and charcoal – ensures that the debrisis removed before the water enters the well.

According to Raphael, the simpler systems can be installed with an investment of around Rs 5,000, and there is government support of varying degrees for different sections of the society. "Our success with the Mazhapolima scheme has been the fact that we could mainstream it through many government schemes in the district." With an average of 2,500 mm of annual rainfall in Kerala, a 1,000 sq. ft roof space can harvest more than 200,000 litres of water, Raphael estimates. Thus, the potential for channelling some of the water into the unconfined aquifer through the dug wells is huge with roof water harvesting.

10. Methods of Rain water Harvesting

Broadly there are two ways of harvesting rainwater.

1.Surface runoff harvesting

2.Roof top rain water harvesting

Rain water harvesting is the collection and storage of rain water for reuse on-site, rather than allowing it to run off. These stored waters are used for various purposes such as gardening, irrigation etc. Various methods of rain water harvesting are

1.Surface runoff harvesting

In urban area rain water flows away as surface runoff. This runoff could be caught and used for recharging aquifers by adopting appropriate methods.

2.Roof top rain water harvesting

It is a system of catching rain water where it falls. In roof top harvesting, the roof becomes the catchments and the rain water is collected from the roof of the house buildings. It can be either be stored in a tank or diverted to artificial recharge system. This method is less expensive and very effective and if implemented properly helps in augmenting the ground water level of the area.

11. Conclusion

Though Kerala is considered as a 'Water Rich State', the data on availability of water shows a declining trend. Management of these declining water resources includes improvement in the availability of water resources and the practice of optimum use. Considering the imminent water scarcity of the state, ensuring the availability of water is must for the sustainability of the economy. Groundwater is a common pool natural resource which can enhance its availability through recharging techniques. We generally receive rainfall in heavy showers followed by dry spells. When it rains heavily the soil is not able to absorb water at the rate of rainfall. As a result most of the rain drains away leaving very little for storage and the recharge of ground water. In the context of declining and depleting resources in the state, adoption of strategies to improve the water availability and of these resources is necessary. Water, which was till recently considered a free good, has become scarce and unless carefully managed, can become a highly priced economic good in future. All efforts should be made to ensure that the basic human entitlement of safe and adequate drinking water is available to all. Top priority should be given to sound water

management through active participation of all users and effective regulation by government .Efficient and sustainable water resource management approaches like Rainwater Harvesting practices are needed to tackle this problem.

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