

Sustainable Development of Water Resources and Environment Management

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Abstract – India is endowed with vast water resources including but not limited to lakes, rivers, swamps and underground aquifers. However, the way of life in India does not reflect this kind of wealth owing majorly to degradation and underutilization of these water resources. This review discusses the centrality of water resources in India's pursuit of the Sustainable Development of water resources (SDWR). Following the Sustainable Development Model, the paper thematically reads and synthesizes the importance and potentials of water resources to India's development through exploring their contributions and limitations to the different economic sectors namely; agricultural and livestock production, energy, manufacturing and processing, tourism, health, fisheries, trade and other institutional mechanisms such as payment for ecosystem services (PES), mutual cooperation and economic cooperation. It is observed that sustainable management of water and sanitation for all (SDWR 6) will be central to the attainment of all the other SDWR (particularly SDWR1 (No poverty), 2 (No hunger), 3 (Good health), 14 (life below water) and 15 (life on land)) across India. Indian states should therefore increase their commitment to water conservation and management as this will significantly decide India's future development paths.

Indexed Terms: Sustainability, urban system, lake system, values, governance, Water resources conservation, Economic drivers, Sustainable development goals

I. INTRODUCTION

Water is life, so the old adage goes. This is owed probably to the global nature of the resource. Water is a universal component of every living thing but more importantly of human life. It is not only home to myriads of marine species (Polidoro et al., 2008) but also a huge driver of man's economic and social expediency making his home a lot more habitable (FAO, 2011). This leaves the global population with only 0.5% (10,000,000 km³ in underground aquifers, 119,000 km³ net of rainfall falling, 91,000 km³ in natural lakes, over 5000 km³ in man-made facilities and 2120 km³ in rivers) to survive on (UN, 2015). Africa has 9%, the least percentage of fresh water at continental level. The natural distribution of water is

highly variable geographically and seasonally (United Nations World Water Assessment Programmes WWAP, 2015); with some areas having huge amounts of water while others have little or none and seasons of extremely high rainfall are often followed by long periods with no rain. For a continent whose countries are ranked among the least developed countries in the world (Freitas (2013), Winkler & Marquand (2009)) and whose population growth is unprecedented (African Union (AU) (2014), IRENA (International Renewable Energy Agency) (2015)), India needs its water more than any other continent. Africa has great potential of underground water resources which according to Africa Progress Report (APR) (APP, 2015), are 100 times more than surface water sources. Though still a poor continent, India is fast picking pace on the development track with GDP growths as high as above 6% per annum in some sub Saharan countries like Rwanda, Ghana, Nigeria, Kenya and South Africa (African Development Bank (AfDB) et al., 2015; APP, 2015). As we move from the Millennium Development Goals (MDGs) to embrace the new and more promising Sustainable Development Water resources (SDWR), also termed as the Global Goals, the beneficinations of water resources to the continent's development paths cannot be undermined. As demonstrated in the subsequent sections, this paper explores the extent to which Indian water resources can enhance the attainment of SDWR.

II. URBAN LAKE SYSTEMS

While it is difficult to date the natural lakes, most of the manmade water bodies like Ponds and Tanks are historical. The regularly recognize classifications of urban lakes are geographical, immunological, functional, water quality oriented, and management based. In the management types they are generally

categorized as: urban lakes, non-urban lakes, coastal estuarine lakes, ephemeral lakes, etc. define urban lakes as the subset of all fresh water bodies such as reservoirs, lakes, ponds, tanks, etc. The lakes that are located exterior urban areas, such as Loktak Lake in Imphal, Sakhyasagar in Shivpuri; or the lakes that are part of river/ sea/ ocean, such as Chilika Lake in Orissa are considered as rural lakes and therefore are kept outside the scope of this research. Since, every lake is part of a larger hydrological system that normally comprises of 3 catchment areas, inlet and outlet of the lake and the associated ecosystems and biodiversity, lake is referred as the lake systems.

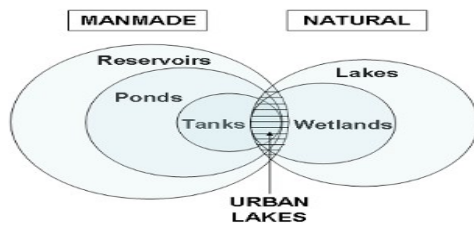


Fig. 1: Urban Lake Systems

III. THE GENERAL CONCEPT OF VALUE

The concept of values has different interpretations for individuals and disciplines. For individuals, ‘the value of water’ at first instance may be the monetary value or the cost that the individuals pay for water to consume, or the social-economical value that covers all the benefits of water, or the psychological value that water is ‘priceless’. Metaphorically, ‘value-less’ can be referred to either as ‘useless’ which is close to meaning waste or ‘price-less’ which is close to meaning so precious that it is difficult to measure’. When it comes to the value of the water resource such as ‘the lake’, it is often hard for individuals to quote a monetary value. Individuals then usually refer value to the benefits attributed by the river/lake.

IV. VALUES IN THE CONCEPT OF SUSTAINABILITY

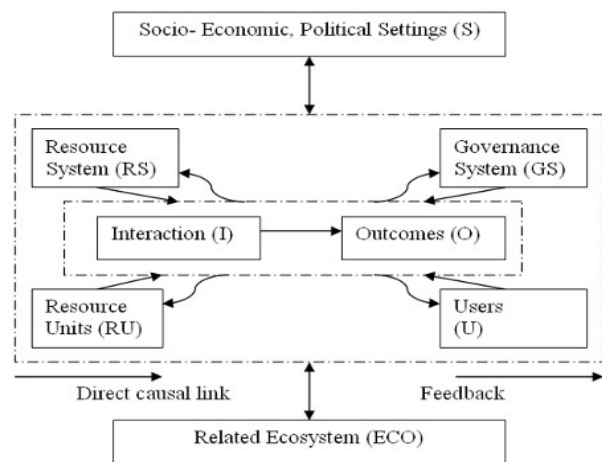
A sustainable society, Said to the World Commission on Environment and Development in 1987, is one that “meets the needs of present without compromising the ability of future generations to meet their own needs”. Sustainability has its essential

in the concept of ecological sustainability. The concept of sustainability evolved in the context of discussions about harvesting and managing renewable resources, such as forest and fisheries in such a way as not to damage future supplies. Most proponents of sustainability take it to mean the maintenance of the existence of ecological conditions necessary to support human life at a specific level of well being through future generations.

V. VALUES IN THE CONCEPT OF GOVERNANCE

In the latest decades there have been many changes in how governance is understood. Governance is a broad term, making it suitable for all purposes; but it is also a complicate word as it is used in many different ways (Peters & Pierre 1998; Lynn et. al., 2000; Toole, 2000). The concept of governance has changed due to a growing acclamation that government alone does not determine the future development of sectors in the society, but that this is formed through the interchange of many stakeholders, with the government being one of them. The ‘governance’ design consists of the important of the interplay between attempts to intervene by all the stakeholders involved (Kooiman, 1993).

- Values in the Concept of Socio-Ecological Systems:



VI. SUSTAINABILITY OF WATER
RESOURCE GOVERNANCE IN INDIA

Hydro-technical installations are thus amongst the earlier technical achievements and innovations of mankind. Since agriculture gets a wedge of culture, land management interlinked with the water management was in the forefront. The preparations of the agreement and the agricultural land followed the water systems (BAL, 1999). With indigenous practices of water conservation, water harvesting, and transportation of water from remote areas ensured meeting of water needs. These operations were given darkness of overtones and woven into the religious and social-cultural observance to ensure widespread practice at community level. Water resource has daily been politically opposed at city level, state level, national level and even international level. It rise in development venture, many rivers and lakes are inundate within the cities.

1. Social Solutions:

Water conservation programs include all the policies and activities typically initiated at the local level, by either fresh water utilities or regional governments. Common strategies include public outreach campaigns, tiered water rates, or restrictions on outdoor water use such as lawn watering and car washing.

2. Household/Domestic Solutions:
(Water-saving technology for the home includes)

There are many way to water-saving firstly low- flush water in toilets. There were Saline water or rain water can be used for flushing toilets. Low-flow shower heads. Reuse of waste water with the help of recycling plant.

3. Commercial Solutions:

Other water saving technology for business includes the rain water store in a tank and taking measure to keep that water clean and use to dirking purpose, bathing, cooking etc. Water saving stem sterilizers use in hospital and health care facilities.

4. Agricultural Solutions:

In crop irrigation, optimal water regulation means minimizing losses due to evaporation, runoff or

subsurface drainage while maximizing production. Drip irrigation is a group of micro-irrigation system that has the potential to save water. This is an irrigation method which stores water and dressing by allowing water to drip slowly to the source of plants, either onto the soil surface or directly onto the origin zone, through a maze of valves, pipes and emitters.

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