Water for Sustainable Development in India

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Abstract

The Sustainable Development Goals provide a roadmap for the world to achieve an equitable and sustainable future. One of the distinguishing characteristics of these goals is that they are interconnected. Harvesting the synergies of these SDGs is critical to Agenda 2030's success. The current study's aim is to examine the role of water as an agent of interconnectedness among the SDGs. It was discovered that access to water is critical and central to reducing poverty (SDG1), eliminating hunger (SDG 2) and malnutrition, achieving good health (SDG 3), reducing inequalities (SDG 10), particularly gender inequality (SDG 5), and achieving quality education (SDG 4). Water has also been found to increase people's income levels, which increases their resilience and adaptive capacity and decreases their vulnerability to shocks (SDG 13). Given this significance and India's continuously deteriorating water situation, the paper recommends that a strong policy initiative be launched to address the nation's rising water woes if India is to sustain its growth progress.

Keywords*:* Water; Sustainable Development; Education; Health; Gender equity; Vulnerability

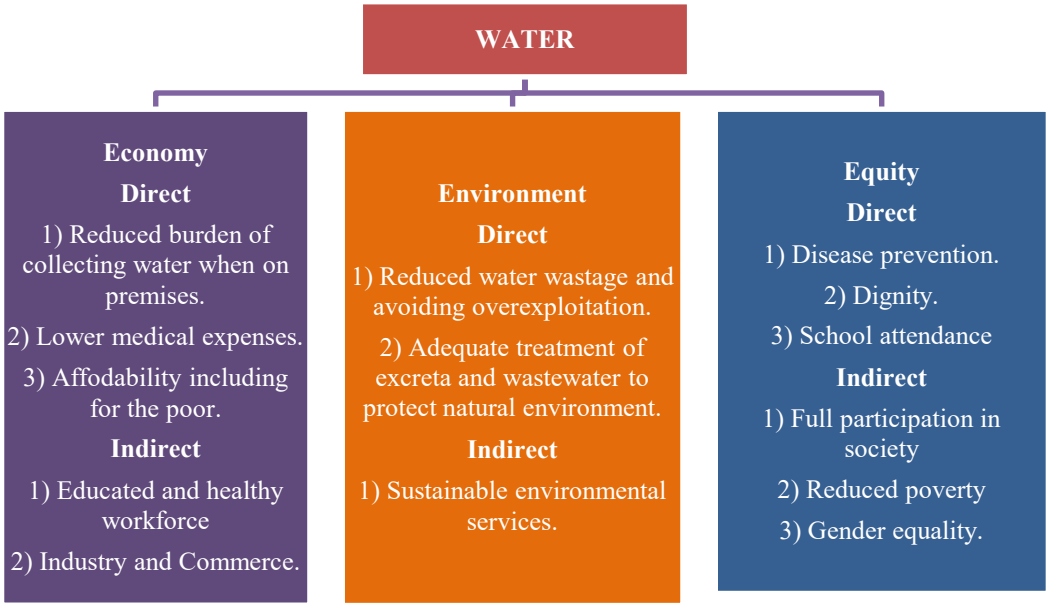
1. **Introduction**

The United Nations' Agenda 2030, launched in 2015, serves as a framework for global progress toward sustainable development (Kroll et al., 2019). The 2030 vision, which consists of 17 goals and 169 targets, focuses not only on economic growth but also on a wide range of development issues that are global challenges, such as eradicating hunger, ending poverty, environmental protection, access to quality health and education, and more (Pedercini et al., 2019; Ramos and Laurenti 2020). With the recognition that the world has entered a new era known as the Anthropocene, i.e., the human-driven age of the planet, and its disastrous impact on the earth's ecosystem, the concept of sustainable development goals expanded the Millennium Development Goals (MDGs) and is primarily based on a triple bottom line approach to human wellbeing (Rey and Sachs, 2012; Janouskova et al., 2016).

The innovative and distinguishing feature of the Sustainable Development Goals is that they were created through an inclusive and comprehensive process, and thus the goals and targets are intertwined (UN 2018). A number of scholars have investigated the interlinkages and synergies between the goals (Breuer et al., 2019; Pradhan, 2019). Association between adaptation to climate change and mitigation (Smith and Olesen, 2010); poverty with health, education, and inequality (Pradhan et al., 2017); good health and well-being with quality education (Ramos and Laurenti 2020); energy with other sustainable development goals (Nerini et al., 2018) have been studied. Research has also shown the association between social and environmental goals (Scherer et al., 2018). Apart from positive relations, trade-offs between sustainable development goals have also been investigated (Lally 2017; Scherer et al., 2018; Fader et al., 2018).

Among these synergies and trade-offs, the association of water with other sustainable development goals is of particular interest. Given the inevitability of water for human survival and development, as well as the proper functioning of the ecosystem (see Figure 1), it is without a doubt that it serves as the planet's central nervous system (UNDP, 2021). Improving access to water, combined with proper wastewater management, reduces the risk of malnutrition and waterborne diseases. It also has a positive impact on education and the economy, which reduces poverty and inequalities. Water security is also a must for agricultural production. Poor irrigation practices are frequently the leading cause of increased soil salinity, which leads to land degradation (UNESCO, 2019). Poor irrigation, coupled with land degradation and a reduction in food production, leads to an increase in hunger, and poverty which might lead to an increase in reliance on foreign aid, which leads to state instability and insecurity, particularly in third-world countries (UNESCO, 2019).

Figure 1: Inter linkage between water and sustainable development



Source: UN 2015

It is owing to the centrality and criticality of water that it has been recognised as a human right (IUCN, 2004). Despite this, as per the recent reports of WHO (2019) 2.2 billion people globally do not have access to safe drinking water. Every year, approximately 297,000 children worldwide die because of diarrhoeal diseases. According to statistics, 11 percent of maternal mortality worldwide is caused by infections that are caused by a lack of proper hygiene due to a lack of water. Globally governments have formulated different policies and management strategies to combat the rising water crisis. Many international water treaties have been signed, but their efficacy is questionable due to political disputes or a lack of proper implementation.

1.1. Development Status of India: A Snapshot

India since liberalization has witnessed considerable growth and development. Figure 2 shows that the country's GDP has almost continuously increased since 1991. The life expectancy of people has increased from 58 years in 1991 to 70 in 2019 (see Figure 3). Although a slight increase in undernourishment is visible from 2018 to 2019, overall, the country has witnessed a decline in prevalence of undernourishment which decreases from 18.4 in 2001 to 15.3 in 2019 (see Figure 4).

Figure 2: Gross Domestic Product (GDP) (current US$)

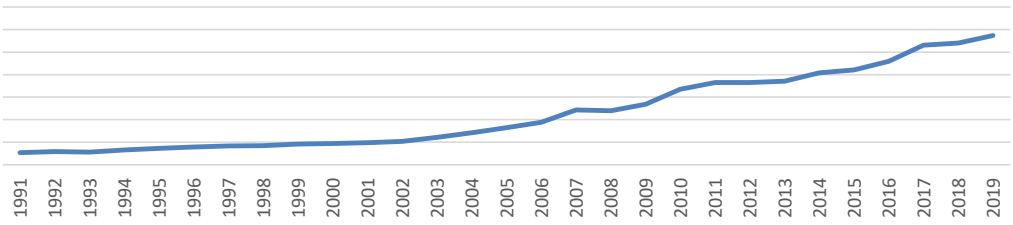


Figure 3: Life expectancy at birth, total (years)

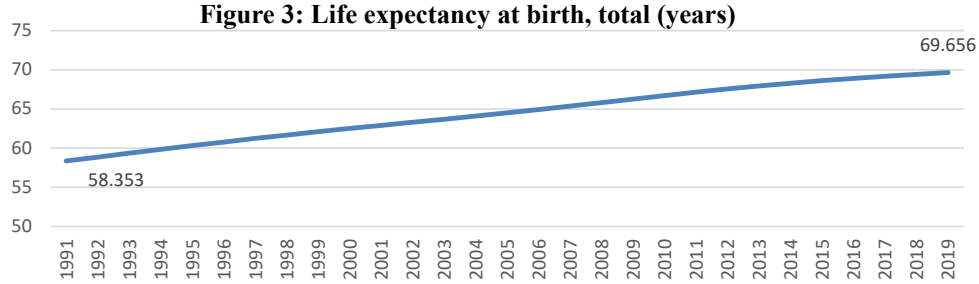
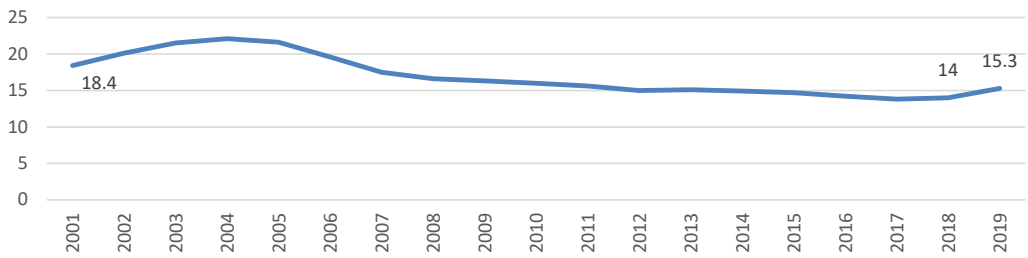


Figure 4: Prevalence of undernourishment (% of population)



Source: The World Bank

Despite being one of the fastest growing economies, the country ranks 131 in the global human development ranking (The Hindu, 2020). Also, due to growing population, increasing urbanization, climate change and changing lifestyle the country's water resources are increasingly becoming stressed. The official report of the government has identified that 256 districts in India have 'critical' or over-exploited groundwater levels (Behal and Behal, 2021). In their study on water poverty trends in India, Pandey et al., (2022) noted that the country's deteriorating environmental and water resource base poses a significant challenge for the country to sustain development in the long run. Although several policies have been implemented by both the state and central governments to curb the water crisis of

the nation yet owing to lack of proper implementation, they have failed to obtain the desired results. Given that climate change will further make the water status worse for the nation, there is a need to understand the central role that water plays in the developmental progress of any region.

The current study is an investigation into existing research on the importance of water for sustainable development. The study is divided into four sections. The first section introduces the topic; the second section gives a brief overview of the development status of India; the third section gives a review of the studies. The final section summarizes the results and discusses the policy implications. It is hoped that the study will shed light on the centrality of water for development and growth, as well as assist policymakers in developing appropriate policies.

2. Literature Review

2.1. Literature Appraisal

Access to water is linked with various dimensions of sustainable development. Within it, the importance of water for achieving zero hunger and food and nutritional security, which is inextricably linked with agricultural production, cannot be overstated. As is widely acknowledged, access to irrigation is a prerequisite to having higher crop intensities, higher yield, and improving total factor productivity (Huang et al., 2006; Hanjra et al., 2009). The growing water scarcity by impacting food production is likely to have a profound impact on food security as was noted by Gulati et al., (2012) in their study on the economy of South Africa. This water-food link was also noted by Evenson and Gollin, (2003) who in their study on the developing countries for the period 1960 to 2000 found that the increase in food production via lowering the food prices has a significant impact on the average calorie intake which result in improvement of health and life expectancy. Hussain and Hanjra (2003) in their comprehensive study on Asia and Africa noted that access to irrigation impacts the poverty level both directly and indirectly. Direct links, according to them, have localized and household-level effects, whereas indirect links have aggregate or national-level effects. Overall, they identified five key dimensions i.e., improved production, enhanced food security employment, income, reduced vulnerability via which access to water contributes to higher growth and improved welfare.

The direct, as well as indirect impacts of access to water in rural areas, were also examined by Berg and Ruben (2006). Using a partial equilibrium and general equilibrium framework, the authors discovered in their study on Ethiopia that access to water for agriculture raises household income and thus reduces their reliance on

public programs that offer food-for-work. The authors emphasized that achieving this is the first step toward a region's long-term development. Furthermore, it was discovered in their study that by increasing the demand for agricultural labor as well as lower food prices because of increased productivity, the spill-over effect of access to irrigation has an impact on non-irrigated households as well. Emphasizing the criticality of agricultural growth for sustained economic growth, Smith (2004) also notes that enhanced access to water for agriculture has significant spill-over effects that can contribute to a rise in growth for the whole economy. He notes that owing to the inter-linkages within the rural economy there will be a multiplier effect of enhanced access to irrigation. In fact, in their paper on the Indian economy, Bhattarai et al., (2007) discovered that over 75 percent of irrigation benefits are spillover, i.e., it is induced effects of irrigation, which have an impact on the service and industrial sectors in addition to the agricultural sector.

Water is also essential for livestock production (Wilkinson, 2003; Mugagga and Nabaasa, 2016), which is critical for the livelihood and income of the rural economy, especially in developing countries. Growing water stress and as a result increase in starvation and animal death (Mugagga and Nabaasa, 2016), will pose serious threats to the livelihoods of billions of people (World Bank, 2022). Besides agriculture and livestock, water also plays an important role in the industrial sector (Dupont and Renzetti, 2001). Bingbing and Manhong (2015) in their study on the significance of water resources for industrial growth in China, found that water shortages have the potential to significantly impede industrial development. Water is also intimately interlinked with energy. Many studies like Siddiqi and Anadon (2011) in the Middle East and North Africa; Rasul (2014) in the Himalayan region of India; Shannak et al., (2018); and Zarei (2020) in Iran, Iraq, and Turkey have explored this water-energy nexus.

Besides these, several empirical pieces of evidence suggest the importance of water for the maintenance of human health. Chen et al., (2021) in their study in North China found that owing to the contamination of groundwater by nitrate, nitrite, and fluoride the people in the study area are highly exposed to noncarcinogenic health risks. Further, in the study, they found that children are more prone to these health risks when compared to both men and women. Similarly, Sarkar and Pal (2021) discovered in their study in the Malda District of West Bengal, India, that high concentrations of arsenic and iron in the region's groundwater are associated with a high risk of health problems. Cha et al., (2015) in their study in Ghana found that improved access to water improves the incidence of diarrheal prevalence by about 11 percent. Water stress is also found to be associated with mental health. Slekiene

and Mosler (2019) in their study in Malawi found a significant relationship between mental health and access to safe drinking water. Similarly, Cuthbertson et al., (2016) in their study in Michigan found that because of the worsening water situation in the region, there is an increase in the prevalence of stress and depression. The authors further found that worsening mental problems are often associated with an increase in the likelihood of alcohol and illicit drug consumption.

Literature has also found water to significantly impact education. Zhang and Xu (2016) in their study in China found that access to quality water increased the likelihood of having higher schooling attainment. They found that people with access to quality water increase their school attainment by around 1.08 years. Further, the study reveals that the effect of water on female educational attainment is much more than on male educational attainment. As previously stated, access to quality water is essential for good health, which significantly improves energy levels as well as mental focus, resulting in an improvement in educational competency, as noted by Alderman et al., (2001) in their study in Pakistan. The link between water and education via the channel of improved health was also explored by Correa et al., (2016). Further in the study, the authors noted that via contributing to health status, access to water enhances household productive capacity and hence income, which will also have an impact on the educational status of the household. In their study in Brazil, the authors discovered that the shorter the distance to a water source, the lower the incidence of diseases and the higher the chances of completing higher education. Like this, Newman et al., (2002) in their study in Bolivia found that improving water infrastructure results in a decrease in drop-outs rates. Using IHDS data Choudhuri and Desai (2021) in their study in India discovered that due to the burden of water collection as well as other drudgery, women of the household have less time to care for their children, which has a significant impact on their educational outcomes. The authors discovered that increasing the distance to fetch water is negatively associated with educational expenses and Math test scores. Even though the impact was found to be significant for both boys and girls, the study discovered that girls are at a greater disadvantage.

Is clear from the previous paragraph that women and girls disproportionately bear the burden of inadequate access to water. This brings us to the next sustainable development goal i.e., gender equity. Geere et al., (2018) observed in their study in South Africa, Ghana, and Vietnam that because women are frequently the water provider of the household, the burden of fetching water usually falls on them, which exacerbates gender inequality by impacting women's education and employment outcomes. Furthermore, the authors discovered that people who reported a history

of water carriage were much more likely to report pain in locations commonly associated with cervical compression syndromes. Similarly, Buor (2004) noted that the traditional obligation of women to be 'water provider' in many regions of the world which result in women walking long distance for fetching water during scarcity have a direct impact on their health. Pouramin et al. (2020) conducted a systematic analysis of the relationship between water and gender in their study. The authors examined 59 studies from around 30 countries. The study concludes that women have less access to clean water and serve as the primary water purveyors, implying that they are frequently exposed to water stress and waterborne toxins, increasing their health risk. The authors believe that improving water access will have a significant impact on women's empowerment and the various targets included in SDG 5.

3. Discussion and Policy Implications

Harvesting the interconnections and synergies of the SDGs is critical to the success of Agenda 2030. This article provides an overview of one of these synergies. Despite not being exhaustive, the review clearly demonstrated that water is at the heart of sustainable development. Water resources permeate every interstice of life. It is critical for good health (SDG 3), food security, abolishing of hunger (SDG2), achievement of quality education (SDG4) as well as, reducing inequalities (SDG 10), particularly gender inequality (SDG 5). Having an immense impact on agriculture as well as industrial productivity, access to sufficient water was found to profoundly impact the income level of the people (SDG 1). This increase in income results in increases in resilience and adaptive capacity and decreases the vulnerability of people to shocks (SDG 13).

With the economic liberalization, India's growth and development parameters have improved significantly. However, the country's water situation is not promising. The nation's water resources are under increasing strain, which will have a negative impact on its future growth prospects. Based on the findings of this study, it is concluded that adequate attention must be paid to the deteriorating water situation and that proper implementation of policies that explicitly address the water problem is required if India is to attain sustainable development goals.

References

Bhattarai, M., & Narayanamoorthy, A. (2003). Impact of irrigation on rural poverty in India: an aggregate panel-data analysis. Water Policy, 5, 443–458.

Breuer A, Janetschek H, Malerba D (2019) Translating sustainable development goal (SDG) interdependencies into policy advice Sustainability 11(7):2092.

Buor, D. (2004). Water needs and women's health in the Kumasi metropolitan area, Ghana. Health and Place, 10(1), 85–103. https://doi.org/10.1016/S1353-8292(03)00050-9

Chen, F., Yao, L., Mei, G., Shang, Y., Xiong, F., & Ding, Z. (2021). Groundwater Quality and Potential Human Health Risk Assessment for Drinking and Irrigation Purposes: A Case Study in the Semiarid Region of North China. https://doi.org/10.3390/w13060783

Choudhuri, P., & Desai, S. (2021). Lack of access to clean fuel and piped water and children's educational outcomes in rural India. World Development, 145, 105535. https://doi.org/10.1016/J.WORLDDEV.2021.105535

Cuthbertson, C. A., Newkirk, C., Ilardo, J., Loveridge, S., & Skidmore, M. (2016). Angry, Scared, and Unsure: Mental Health Consequences of Contaminated Water in Flint, Michigan. Journal of Urban Health, 93(6), 899–908. https://doi.org/10.1007/S11524-016-0089-Y/FIGURES/2

De, C., Ramos, M., & Laurenti, R. (2020). Synergies and Trade-offs among Sustainable Development Goals: The Case of Spain. https://doi.org/10.3390/su122410506

Down To Earth (2021). India's water crisis: It is most acute for women.

Dupont, D. P., & Renzetti, S. (2001). The Role of Water in Manufacturing. Environmental and Resource Economics, 18, 411–432.

Evenson RE, Gollin D. Assessing the impact of the green revolution, 1960 to 2000. Science. 2003 May 2;300(5620):758-62. doi: 10.1126/science.1078710. PMID: 12730592.

Fader, M., Cranmer, C., Lawford, R., & Engel-Cox, J. (2018). Toward an understanding of synergies and trade-offs between water, energy, and food SDG targets. Frontiers in Environmental Science, 6, 112. https://doi.org/10.3389/FENVS.2018.00112/BIBTEX

Geere, J. A., Bartram, J., Bates, L., Danquah, L., Evans, B., Fisher, M. B., Groce, N., Majuru, B., Mokoena, M. M., Mukhola, M. S., Nguyen-Viet, H., Duc, P. P., Williams, A. R., Schmidt, W. P., & Hunter, P. R. (2018). Carrying water may be a major contributor to disability from musculoskeletal disorders in low-income countries: a cross-sectional survey in South Africa, Ghana and Vietnam. Journal of Global Health, 8(1), 10406. https://doi.org/10.7189/JOGH.08.010406

Gulati, M., Jacobs, I., Jooste, A., Naidoo, D., & Fakir, S. (2013). The Water–energy–food Security Nexus: Challenges and Opportunities for Food Security

in South Africa. Aquatic Procedia, 1, 150–164. https://doi.org/10.1016/J.AQPRO.2013.07.013

H. Alderman, J.R. Behrman, V. Lavy, R. Menon (2001). Child health and school enrolment: a longitudinal analysis. J. Hum. Resour., 36 (1), 185-205

Hák, T., Janoušková, S., & Moldan, B. (2016). Sustainable Development Goals: A need for relevant indicators. Ecological Indicators, 60, 565–573. https://doi.org/10.1016/J.ECOLIND.2015.08.003

Hanjra, M. A., Ferede, T., & Gutta, D. G. (2009). Reducing poverty in sub-Saharan Africa through investments in water and other priorities. Agricultural Water Management, 96(7), 1062–1070. https://doi.org/10.1016/J.AGWAT.2009.03.001

Hussain, I., & Hanjra, M. A. (2003). Does irrigation water matter for rural poverty alleviation? Evidence from South and South-East Asia. Water Policy, 5(5–6), 429–442. https://doi.org/10.2166/WP.2003.0027

IUCN (2004). Water as a Human Right? ICUN, Gland, Switzerland and Cambridge, UK.

Kroll, C., Warchold, A., & Pradhan, P. (2019). Sustainable Development Goals (SDGs): Are we successful in turning trade-offs into synergies? Palgrave Communications 2019 5:1, 5(1), 1–11. https://doi.org/10.1057/s41599-019-0335-5

Lally, S. (2017). The Sustainable Development Goals and their trade-offs.

Manasree Sarkar;Subodh Chandra Pal; (2021). Human health hazard assessment for high groundwater arsenic and fluoride intact in Malda district, Eastern India. Groundwater for Sustainable Development. doi:10.1016/j.gsd.2021.100565

Marrit van den Berg and Ruerd Ruben (2006). Small-Scale irrigation and income distribution in Ethiopia. The Journal of Development Studies.42, 868 – 88.

Mugagga, F., & Nabaasa, B. B. (2016). The centrality of water resources to the realization of Sustainable Development Goals (SDG). A review of potentials and constraints on the African continent. International Soil and Water Conservation Research, 4(3), 215–223. https://doi.org/10.1016/J.ISWCR.2016.05.004

Nerini F et al. (2018) Mapping synergies and trade-offs between energy and the sustainable development goals. Nat Energy 3:10–15

Newman, J., Pradhan, M., Rawlings, L. B., Ridder, G., Coa, R., & Evia, J. L. (2002). An impact evaluation of education, health, and water supply investments by