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Challenges Faced by India on the Way to Achieve SDG6'S Safe and Affordable Drinking Water Target

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Abstract
The 17 interconnected Sustainable Development Goals (SDGs), adopted by all United Nations Member States in 2015, are intended to act as a "common blueprint for peace and prosperity for people and the planet, now and into the future". Among 17 SDGs, Sustainable Development Goal (SDG) 6 aims to "ensure availability and sustainable management of water and sanitation for all" by 2030. Target 6.1 particularly concentrates on the achievement of universal and equal access to reasonably priced, safe drinking water for all. Providing and maintaining clean and affordable water drinking is a major concern of all countries in the world, particularly developing nations. Even though India has improved access to clean water significantly, a number of issues still exist that prevent this goal from being achieved. This study looks at the obstacles India must overcome to meet SDG 6's Target 6.1, including problems with access, water quality, and climate change. It also looks at institutional and policy strategies to deal with these issues and hasten the process of guaranteeing everyone has access to clean drinking water.

Keywords: SDG6'S, UNICEF, Vietnam

1. Introduction
Water is an essential part of the ecosystem, but the quality of groundwater and surface water has long been declining as a result of both natural and human-caused activities (Uddin *et al*., 2021) [14]. Hydrological, atmospheric, climatic, topographical, and lithological elements are examples of natural variables that affect the quality of water. Anthropogenic activities that have a negative impact on water quality include mining, raising livestock, producing and disposing of trash (agricultural, municipal, and industrial), increasing sediment runoff or soil erosion as a result of changing land uses, and heavy metal pollution.
Developing nations have encountered considerable challenges in recent times in maintaining water quality while attempting to enhance water supply and sanitation. With issues like nitrogen enrichment and eutrophication of water resources and the supply of water and wastewater services to growing populations, even industrialized nations have been struggling to preserve or improve the condition of their water quality.
Among 17 SDGs, SDG 6 states that "By 2023, ensure availability and sustainable management of water and sanitation for all" (United Nations, 2023). Climate change, environmental pollution, and population increase make it difficult to attain this goal in rural areas. They in particular are dealing with severe issues related to the management of drinking water resources, including a lack of water, contaminated water sources, inadequate infrastructure for the water supply, and inefficient management practices. Currently, approximately 2.2 billion people lack safely managed drinking water (United Nations, 2023). The issues brought about by climate change include the potential for reduced drinking water quality, decreased availability of water resources, and damage to water delivery infrastructure due to extreme weather events such as strong storms, prolonged droughts, excessive heat, and heavy rains. Drinking water sources in rural settlements that are hard to reach by central public water supply systems typically include hand-pumped boreholes, small-scale waterworks, rainfall gathering systems, tube wells, and local rivers and lakes. These sources are prone to pollution and scarcity, and communities that depend on a single source are particularly at risk because the community's whole water supply is at risk in the event of the source's collapse (Huang *et al*., 2022) [5].
India has made a commitment to provide water and sanitation to its people ever since gaining independence in 1947. India began to make headway in the areas of clean water and sanitation after 1960, with a focus on hygiene education (Bhowmick *et*

al., 2020) [1]. In addition to services, UNICEF's water and sanitation program in India has offered long-term training and technical assistance. In terms of SDG performance, India ranks 112th out of 166 nations (score of 63.4%) in the United Nations Sustainable Development Solutions Network's SDG Index Report 2023, trailing behind East and South Asia's average regional score of 67.2% (Sustainable Development Report, 2023) [13]. The enormous population and extreme variety of India make policy implementation challenging, and the country has made only modest progress toward SDG 6.

2. Literature review

SDGs

The United Nations (UN) Department of Economic and Social Affairs and other organizations have worked on the SDGs for decades. At the Rio de Janeiro Earth Summit in June 1992, Agenda 21, a comprehensive action plan to create a worldwide partnership for sustainable development to enhance human well-being and safeguard the environment, was ratified by more than 178 nations.

To create a proposal for the SDGs, the General Assembly established a 30-member Open Working Group in 2013. With the passage of numerous significant accords, 2015 was a watershed year for multilateralism and the development of global policies. "Transforming our world" was one of them. The General Assembly started negotiating the post-2015 development agenda in January 2015. At the UN Sustainable Development Summit in New York in September 2015, the process culminated in the approval of the 2030 Agenda for Sustainable Development, which has 17 SDGs at its heart. The 2030 Agenda for Sustainable Development is an urgent call to action for all nations, developed and developing, to work together in a global partnership to create a shared blueprint for peace and prosperity for people and the planet, now and in the future.

SDG 6 and Target 6.1

Among the 17 goals the UN has set for 2030, SDG 6 intends to address service quality gaps and increase access to basic water and sanitation services. SDG 6 comprises eight targets, comprising two means of achieving targets and six outcome-oriented targets. The metrics for monitoring the targets' accomplishment are represented by eleven indicators. SDG 6 indicates that water is delivered, but it also implies that it is continuously accessible and safe to consume. The eight targets covered in SDG 6 are intimately related to each other and to other SDGs. Although there are some targets that may contradict with SDG 6, most SDGs have positive ties with SDG 6. Increasing access to water and sanitation, for instance, lowers poverty and has favorable effects on health and educational performance. However, there's a chance that energy services (SDG 7) and agricultural activities (SDG 2) will harm ecosystems and ambient water quality. While there are eight targets in SDG 6, Target 6.1—"by 2030, achieve universal and equitable access to safe and affordable drinking water for all"—is the main emphasis of this article. Stated differently, target 6.1 refers to the population's use of an improved source of drinking water (piped water into homes, yards, or plots; public taps on standpipes; boreholes or tubewells; protected dug wells; or protected springs and rainwater) that is readily available on the property, free of priority chemical and fecal contamination, and located on the premises (Sarkar & Bharat, 2021) [9].

3. Methodology

In order to identify India's challenges in achieving SDG 6 in general and target 6.1 in particular, the article used the analysis-synthesis method and normative research to synthesize and analyze empirical data. It then proposed some solutions to help the nation meet its goal of achieving target 6.1 by 2030.

4. Challenges Faced by India in achieving Target 6.1

4.1 Water Quality

The presence of specific pollutants in groundwater that exceed the limitations set for drinking water is referred to as groundwater contamination. This study focuses on arsenic and nitrate.

Inorganic arsenic compounds are created when arsenic, an element found in the earth's crust in an abundance of 1.8 ppm per million by weight, interacts with sulfur, chlorine, and oxygen (E *et al*., 2021) [4]. Concerns about arsenic's effects on the environment and human health are noteworthy. In India, groundwater is essential for meeting the water needs of many industries, especially for drinking. Nearly 26% of India's area is covered by the Ganga River basin, which is also home to more than 500 million people (Chakraborti *et al*., 2018) [2]. A population of more than 50 million people in India is reportedly at risk due to groundwater arsenic poisoning (E *et al*., 2021). The Ganga is currently one of the most polluted rivers in the world, containing a significant level of arsenic (up to 4730 µg/L), which is over 4000 times higher than the safe limit prescribed by the World Health Organization (WHO) (100 µg/L) (Chakraborti *et al*., 2018 [2]; E *et al*., 2021). Arsenic exposure victims experience both physical health issues and severe social difficulties, such as rejection from their communities and social isolation (Chakraborti *et al*., 2018) [2].

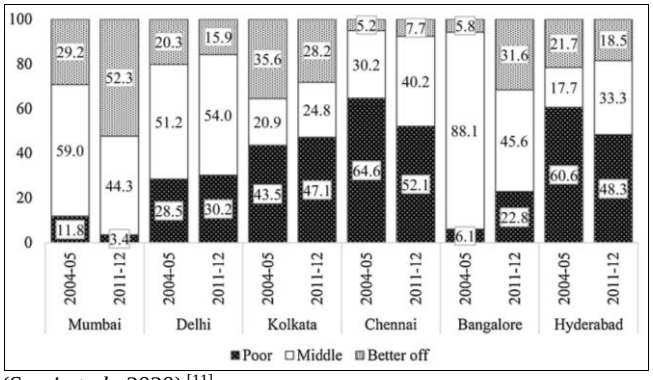
The sustainability of hard rock aquifers' groundwater is mostly threatened by nitrate contamination which is formed from anthropogenic sources like agrochemicals, open land dumping, domestic, animal and manufacturing wastes, which causes a decline in drinkable resources and related health problems (Sarma & Singh 2023; Senthilkumar & Rajmohan, 2023; Zhang *et al*., 2018) [10, 12, 17]. The two main sources of nitrate in groundwater are nitrous fertilizers and household garbage. While WHO states that human health is unaffected by nitrate concentrations below 45 mg/l, nitrate concentrations in the increasingly urbanizing North-West Delhi region of India range from 0.24 to 380.19 mg/L, with a mean of 65.29 mg/L (Sarma & Singh 2023) [10], which could be classified as "high health risk" and "very high health risk". In addition, one of the causes of the elevated groundwater nitrate content in the study region may be the majority of the population relies on agricultural operations and uses various fertilizers to increase crop yields. High NO3- concentrations may lower blood's ability to carry oxygen, which could lead to health issues like blue baby syndrome (Zhang *et al*., 2018) [17].

4.2 Access Disparities

The availability of water is being severely strained by population increase. India, whose population is about 1.43 billion people, is estimated to be the most populated nation in the world (United Nations, 2023). In addition, the

migration process from rural to urban areas is becoming more and more prevalent. This trend is primarily driven by the lack of economic opportunities in rural regions and the desire to access urban amenities and services. Over the past ten years, urban population growth has been fueled by rural-to-urban migration rather than natural growth. This shift from rural to urban living presents significant challenges for urban authorities, particularly civic bodies responsible for providing essential services and ensuring the development of sustainable cities. Consequently, the impoverished urbanites are compelled to reside in inexpensive, haphazard settlements that lack basic facilities and are typically found in unapproved colonies. In contrast, wealthier individuals have experienced notable improvements in their living conditions, including access to proper sanitation, efficient waste management, and abundant water resources in their neighborhoods. Additionally, affluent individuals can use machines like booster pumps to access more water, which can impact water pressure in other areas. Unfortunately, poorer individuals who cannot afford such devices often face water shortages.

The following figure shows the selected cities' water accessibility for the years 2004-2005 and 2011-2012:



(Saroj *et al*., 2020) [11]

Fig 1: Access to water in Indian cities for the years 2004-2005 and 2011-2012

After analyzing data from water performance in the years 2004-2005 and 2011-2012, we discovered that Mumbai was the best city, with 29.2% and 52.3% of households in the better-off groups. Bangalore had superior water accessibility compared to Mumbai, with a notable rise from 5.8% in 2004-2005 to 31.6% in 2011-2012. In contrast, Chennai performed the poorest in this regard, with 64.6% of households experiencing poor water accessibility in 2004-2005, and this number only slightly improved to 52.1% in 2011-2012. On the other hand, Kolkata and Delhi showed a slight increase in poor water accessibility, with a growth of 3.6% and 1.7%, respectively, between 2004 and 2012. Poor water performance had decreased in Hyderabad, with 61% and 48% of households experiencing it in 2004–2005 and 2011–2012, respectively, which were almost three times higher than the numbers for the better-off category.

4.3 Climate Change Impacts

Water resources in India are increasingly under threat from climate change. Water quality and availability are being progressively impacted by extended droughts, erratic rainfall patterns, and extreme weather events. In the face of shifting climate circumstances, India finds it challenging to guarantee access to clean drinking water.

During the monsoon months of June through September, over 80% of the rainfall falls, which frequently results in flooding (Chakraborti *et al*., 2019) [3]. This is due to the fact that heavy precipitation falls quickly, producing a large amount of runoff. Nevertheless, throughout the rest of the year, severe water shortages are typical in many areas. For instance, Chennai, a coastal city in the southeast, has had decades-long water shortages. Approximately 388 mgd is needed for the city and its surrounding areas, accounting for both commercial and industrial demand. However, the city only receives 158.5 mgd per day from sources like reservoirs and lakes, which are subject to unpredictable monsoons. Groundwater is the sole practical supply of water in many Indian cities and villages during the summer months due to inadequate surface water systems and infrastructure. Furthermore, a region's yearly rainfall may be 70% or more due to monsoon rains; in dry years, this frequently leads to a scarcity of water. According to Pandey and Sengupta (2018) [7], 12 of the previous 18 years have had below-normal rainfall, with 2018 marking the fifth year in a row with deficit monsoon conditions. India has started filling this gap by adding 26.4 mgd of recovered water to the drinking supply by commissioning a desalination plant.

5. Recommendations

India must take particular steps in order to fulfill SDG 6, especially target 6.1. Proven strategies to prevent waterborne illnesses caused by contaminants include drinking clean and safe water, eating a balanced diet, and getting enough exercise. However, they are merely individual-level solutions, and the issue won't be entirely resolved by them. Therefore, to address the existing issues with drinking water, the government must take action as well. Here are some recommendations on how India can get everyone access to clean and safe drinking water by 2030, bringing the country one step closer to achieving SDG 6.

India should strengthen water quality standards and regulations to limit the release of pollutants and contaminants into water bodies. The best ways to address the arsenic and nitrate crisis are through comprehensive watershed treatment, economical combined use of water, and public education. Different technologies, such as coagulation, chemical oxidation, adsorption, ion-exchange, and reverse osmosis, are being developed in different parts of the world to remove arsenic and nitrate contamination from groundwater (E *et al*., 2021). Furthermore, a sustainable filtration system can use laterite, which is widely accessible in India, as an inexpensive adsorbent to remove pollutants from groundwater.

India should integrate strategies with other water management and conservation measures in order to significantly contribute to bridging the water inequities between various segments of the population and regions in the country. Water inequities between the rich and the poor, as well as between rural and urban areas in India, can be mitigated by implementing policies that promote family planning as a means of controlling urban population development. It can lessen the burden on water resources in densely populated cities and ensure a more equitable distribution of available water by promoting smaller families in metropolitan settings. In addition, fiscal incentives and the use of regional planning can encourage people to relocate from water-scarce regions to locations with more plentiful water supplies, relieving the strain on rural areas'

water supplies and enhancing everyone's access to clean water.

Rainwater harvesting should be taken into consideration by India as a potential solution to the water scarcity in many rural communities. It is a practical way to lessen the strain on surface and groundwater resources. Approximately 25% of the water used for non-potable uses can be saved by reusing rainwater that would otherwise go down the drain, which could help with sanitation and health problems in rural areas (Richards *et al*., 2021) [8]. However, rainwater quality is a crucial aspect that is contingent upon various aspects, including the amount of rainfall, the type of rainwater harvesting system, upkeep of the catchment area, and the storage tank. As a result, rainwater that has been collected can be disinfected using Chlorination. It is not only an easy and affordable technique but also a dynamic process that calls for extra treatment either before or during water usage. Regular application along with regular testing for residual chlorine is advised to maintain an adequate chlorine residual and, thus, provide continuous disinfection during the storage period, thereby increasing the efficacy of the disinfection process.

6. Conclusion

Water is a vital component of the environment, but due to both natural and man-made activity, the quality of surface and groundwater has long been dropping. Developing countries have recently faced significant obstacles in their efforts to improve sanitation and water supply while also trying to protect water quality. In India, there are three major concerns that the nation is struggling on the way to achieve SDG 6 in general and Target 6.1 in particular, related to: water quality, access disparities and climate change impacts. Therefore, it is India's responsibility to implement solutions to improve these difficulties as soon as possible, which may allow the country to have completed achieving SDG 6 by 2030.

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