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NEXUS OF SDGS AND WATER SUSTAINABILITY IN INDIA: A COMPREHENSIVE REVIEW

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ABSTRACT

The nexus of Sustainable Development Goals (SDGs) and water sustainability in India is a critical intersection that demands comprehensive scrutiny. India, with its burgeoning population and diverse ecosystems, faces multifaceted challenges in ensuring water security while striving to achieve the SDGs. The SDGs, adopted by the United Nations, encompass a broad spectrum of goals, including clean water and sanitation (SDG 6), zero hunger (SDG 2), good health and well-being (SDG 3), and poverty eradication (SDG 1), among others. Water sustainability lies at the heart of several SDGs, making it a linchpin for overall development. In India, issues such as unequal distribution, over-extraction, pollution, and inadequate sanitation infrastructure pose formidable obstacles. Achieving SDG 6, which aims to ensure availability and sustainable management of water and sanitation for all, is intricately linked to poverty alleviation, health improvements, and environmental conservation. Addressing the nexus requires holistic policies and interventions that integrate water management into broader development strategies. This involves promoting efficient water use, implementing robust sanitation systems, and fostering community engagement. Furthermore, climate change adds a layer of complexity, necessitating adaptive measures to mitigate the impact on water resources.

Keywords: *SDGs, water sustainability, Clean Water and Sanitation, IWRM, Jal Shakti Abhiyan.*

Introduction

Water, the lifeblood of sustainable development, stands as an indispensable element at the core of the United Nations' Sustainable Development Goals (SDGs). As the global community strives to address the complex and interrelated challenges encompassed by the SDGs, a profound recognition of the pivotal role water plays in achieving these ambitious objectives is imperative. Nowhere is this nexus more intricate and pressing than in the diverse and populous nation of India, where water-related issues intertwine with multifaceted socio-economic and environmental dimensions. The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States, sets forth 17 interconnected SDGs, providing a universal framework for addressing global challenges. Water, as a cross-cutting theme, is integral to the achievement of several SDGs, including those related to health, poverty eradication, food security, gender equality, and environmental sustainability. In India, a country characterized by its vast geographical and cultural diversity, the nexus between SDGs and water sustainability takes on a unique complexity. India grapples with a myriad of water challenges that threaten the well-being of its populace and the environment. The crux of this comprehensive review lies in unraveling the intricate connections between achieving water sustainability and advancing the SDGs in India. Progress in water management not only directly contributes to SDG 6 (Clean Water and Sanitation) but also has far-reaching implications for goals such as SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 3 (Good Health and Well-being). Conversely, failure to address water challenges may impede progress across multiple SDGs, highlighting the need for an integrated and holistic approach.

Objectives

The main objectives of this review are to analyze the interconnections between the Sustainable Development Goals (SDGs) and water sustainability in India, to identify challenges and opportunities in achieving these goals, to explore effective strategies for integrated water resource management, and to provide insights on how India can enhance water sustainability in alignment with the SDGs, considering its unique socio-economic and environmental contexts.

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Research Methodology

The methodology for this study involves a comprehensive analysis of existing secondary data sources. Academic databases, scholarly articles, books, and reports related to the nexus between Sustainable Development Goals (SDGs) and water sustainability in India, highlighting the necessity for approaches that are integrated and tailored to the specific context.

Water Challenges in India

India, with its diverse landscapes, climates, and cultures, faces a complex web of water challenges that intersect with socio-economic, environmental, and health dimensions. These challenges have profound implications for the well-being of the nation's populace and the sustainability of its ecosystems. India, home to over a billion people, grapples with severe water scarcity issues, exacerbated by a rapidly growing population, urbanization, and changing consumption patterns. Regions like Maharashtra, Rajasthan, and parts of southern India experience acute water shortages, leading to compromised agricultural productivity and challenging livelihoods. The intensification of water scarcity is further fueled by unsustainable extraction practices, inadequate water storage infrastructure, and inefficient water use in agriculture.

The distribution of water resources across different regions of India is starkly unequal. While some areas face acute scarcity, others grapple with excess water during monsoons, leading to floods and waterlogging. Water quality poses a significant challenge in India, with pollution arising from industrial effluents, agricultural runoff, and inadequate sanitation systems. The contamination of water sources with pollutants such as heavy metals, chemicals, and pathogens poses serious threats to public health. Agriculture, a cornerstone of the Indian economy, is a major consumer of water. Inefficient irrigation practices, reliance on water-intensive crops, and inadequate water-use efficiency contribute to the strain on water resources. The challenge lies in balancing the need for agricultural productivity with sustainable water management practices.

India is highly vulnerable to the impacts of climate change, with altered precipitation patterns, rising temperatures, and increased frequency of extreme weather events affecting water availability. Changing monsoon patterns pose a significant threat to agriculture, which is predominantly rainfed in many regions. Additionally, the melting of Himalayan glaciers, a vital source of freshwater for rivers, adds another layer of complexity to India's water challenges. Mitigating and adapting to the impacts of climate change is essential for ensuring long-term water sustainability. Groundwater, a vital resource for drinking water and agriculture, is being depleted at an alarming rate in various parts of India. Over-extraction, especially for agriculture, has led to declining water tables and the depletion of aquifers. Rapid urbanization poses unique challenges to water management in India. The concentration of populations in urban centers increases water demand for domestic and industrial purposes. Inadequate urban planning, unregulated groundwater extraction, and insufficient sewage treatment exacerbate water stress in cities.

Water challenges in India often have disparate impacts on different social groups, with women and marginalized communities disproportionately affected. Women, in many rural areas, bear the responsibility of water collection, and their access to water resources is crucial for household needs. Lack of access to clean water can affect women's health, education, and overall well-being, highlighting the social dimensions intertwined with water challenges. As per NITI Aayog report released in June 2019, India is facing the worst-ever water crisis in history. Approximately 600 million people or roughly around 45 % of the population in India is facing high to severe water stress. The report goes on to say that nearly 40 % of the population will have absolutely no access to drinking water by 2030 and 6 % of India’s GDP will be lost by 2050 due to the water crisis. Goal 6.1 specifically says that by 2030, countries including India should ‘achieve universal and equitable access to safe and affordable drinking water for all’.

Linkage between SDGs and Water Sustainability in India

The SDGs are intricately interconnected, forming a synergistic framework where progress in one goal can catalyze advancements in others. Water, being a cross-cutting theme, plays a pivotal role in several goals beyond SDG 6. For instance, SDG 1 (No Poverty) and SDG 2 (Zero Hunger) are closely tied to water availability for agriculture, while SDG 3 (Good Health and Well-being) is intricately linked to access to clean water and sanitation. Recognizing these linkages is essential for formulating integrated policies that address multiple goals simultaneously.

- **SDG 6: Clean Water and Sanitation as a Keystone:** SDG 6 serves as the cornerstone for achieving water sustainability, aiming to ensure universal access to clean water and sanitation. In the Indian context, this goal aligns with the imperative of addressing water scarcity, improving

water quality, and promoting efficient water use across various sectors. As a foundational goal, the success of SDG 6 is intertwined with the achievement of several other SDGs, creating a ripple effect that permeates through diverse dimensions of development.

- **Water and Poverty Alleviation (SDG 1):**Access to clean water is foundational to poverty alleviation efforts. In rural India, where a significant population relies on agriculture for livelihoods, ensuring reliable water sources directly impacts income generation and food security. Sustainable water management, through initiatives like rainwater harvesting and efficient irrigation, contributes to poverty reduction by enhancing agricultural productivity and supporting rural livelihoods.
- **Agricultural Productivity (SDG 2):**SDG 2, which aims to end hunger, achieve food security, and promote sustainable agriculture, is intimately connected to water sustainability. Efficient water use in agriculture, adoption of drought-resistant crops, and modern irrigation techniques are essential components of achieving both SDG 2 and SDG 6. Addressing water scarcity and promoting sustainable agricultural practices go hand in hand, fostering resilience in the face of changing climate patterns.
- **Health and Well-being (SDG 3):**SDG 3, focusing on good health and well-being, hinges on access to clean water and adequate sanitation. In India, where waterborne diseases remain a significant public health concern, ensuring the availability of safe drinking water is paramount. Integrating water quality management with health initiatives becomes imperative for reducing the burden of waterborne illnesses and promoting overall well-being.
- **Gender Equality (SDG 5):**SDG 5 emphasizes gender equality, and in the Indian context, water plays a crucial role in achieving this goal. Women, particularly in rural areas, are often responsible for water collection. Access to clean water reduces the time and effort required for water retrieval, empowering women to participate in education, income-generating activities, and community development.
- **Industry, Innovation, and Infrastructure (SDG 9):**Sustainable water management is integral to industry and infrastructure development (SDG 9). Responsible water use in manufacturing processes, coupled with wastewater treatment and recycling, ensures that industrial growth aligns with environmental sustainability. This integration is essential for achieving economic development without compromising long-term ecological integrity.
- **Life Below Water and Life on Land (SDGs 14 and 15):** Beyond land-based concerns, water sustainability is inherently linked to SDGs 14 and 15, which focus on life below water and life on land, respectively. Protecting water ecosystems, preserving aquatic biodiversity, and ensuring the sustainable use of water resources contribute significantly to these environmental goals.
- **Partnerships for the Goals (SDG 17):**The achievement of all SDGs, including those related to water sustainability, necessitates collaboration and partnerships (SDG 17). Cross-sectoral cooperation between government agencies, non-governmental organizations, the private sector, and local communities is crucial for the effective implementation of policies and initiatives aimed at achieving water-related SDGs in India.

While recognizing the synergies between SDGs and water sustainability, it is essential to acknowledge the challenges. Uncoordinated development, population growth, and climate change pose formidable obstacles. However, these challenges also present opportunities for innovative solutions, technology adoption, and policy interventions that address water-related issues while advancing progress across multiple SDGs.

Policy and Governance for Water Sustainability

Effective policy frameworks and robust governance structures play a pivotal role in addressing the intricate water challenges faced by India. This analysis explores the landscape of water-related policies in India, evaluates the effectiveness of current governance structures, and identifies opportunities for enhancing water sustainability within the framework of the Sustainable Development Goals (SDGs).

- **Policy Landscape:** India's policy landscape for water management is characterized by a myriad of regulations, guidelines, and frameworks at the national, state, and local levels. The National Water Policy, last updated in 2012, provides the overarching framework, emphasizing integrated water resource management, conservation, and equitable distribution. Additionally, individual states formulate their water policies to address regional variations and challenges. The challenge lies not in the absence of policies but in the effective implementation and enforcement of these measures.

- **Integrated Water Resource Management:** The concept of Integrated Water Resource Management (IWRM) is central to India's approach to water sustainability. The National Water Policy emphasizes the integration of water management across sectors, recognizing the interconnected nature of water use in agriculture, industry, and domestic settings.
- **Legal Frameworks and Regulation:** India has a robust legal framework governing water resources, with acts such as the Water (Prevention and Control of Pollution) Act, 1974, and the Water (Protection and Management) Act, 2003, addressing water quality issues. The River Boards Act, 1956, and the Interstate River Water Disputes Act, 1956, provide mechanisms for resolving water disputes between states. While these legal instruments are essential, effective enforcement and adherence to regulations are critical for ensuring sustainable water management.
- **Local Governance and Community Participation:** Decentralized governance through Panchayati Raj Institutions (PRIs) and local bodies is a key aspect of India's water management strategy. Community participation is emphasized to promote sustainable water use and ensure the success of initiatives such as watershed management and rainwater harvesting.
- **Challenges in Implementation:** The gap between policy formulation and implementation remains a significant challenge. Issues such as weak enforcement, lack of coordination between departments, and inadequate monitoring mechanisms hinder the effectiveness of water-related policies. Over-extraction of groundwater, illegal borewell drilling, and inadequate sewage treatment persist due to a lack of stringent enforcement and penalties.
- **Climate Change Adaptation:** India's National Water Mission, under the National Action Plan on Climate Change, aims to address the challenges posed by climate change on water resources. However, the integration of climate change adaptation measures into mainstream water policies and the implementation of strategies for sustainable water use in the face of changing weather patterns require further attention.
- **Opportunities for Improvement:** Enhancing policy coherence, strengthening enforcement mechanisms, and fostering inter-departmental collaboration are essential opportunities for improvement. The development of a comprehensive, nationally integrated water policy that aligns with the SDGs can provide a unified framework for sustainable water management. Additionally, leveraging technology for real-time monitoring, data-driven decision-making, and public participation can enhance transparency and accountability in water governance.
- **Capacity Building and Awareness:** Building the capacity of local institutions, government officials, and communities is crucial for effective water governance. Training programs, awareness campaigns, and knowledge-sharing platforms can empower stakeholders at various levels to actively participate in sustainable water management practices.
- **Public-Private Partnerships:** Exploring public-private partnerships (PPPs) can offer innovative solutions for water infrastructure development and management. Leveraging private sector expertise and resources, while ensuring adherence to environmental and social standards, can complement government efforts in achieving water sustainability goals.

As India continues its journey towards a water-secure future, the alignment of policies with international sustainability goals and the active involvement of communities and stakeholders will be instrumental in shaping a resilient and equitable water management paradigm.

Recommendations for Advancing Water Sustainability in India

As India grapples with a myriad of water challenges, the imperative to achieve water sustainability is central not only for ensuring the well-being of its populace but also for aligning with global sustainability goals. This section outlines a comprehensive set of recommendations aimed at advancing water sustainability in India within the framework of the Sustainable Development Goals (SDGs).

- **Integrated Water Management Policies:** Developing a comprehensive, nationally integrated water policy that aligns with the SDGs is fundamental. The policy should promote Integrated Water Resource Management (IWRM) principles, emphasizing the interconnectedness of water across sectors.
- **Strengthening Implementation Mechanisms:** Emphasis must be placed on bridging the gap between policy formulation and implementation. Strengthening enforcement mechanisms,

ensuring adequate resources for monitoring, and establishing clear accountability structures are essential. Effective coordination between central, state, and local authorities is critical to streamline efforts and avoid duplication.

- **Enhanced Community Participation:** Empowering local communities to actively participate in water management is crucial. Implementing community-driven projects can be achieved through capacity-building programs, awareness campaigns, and inclusive decision-making processes. By involving communities, water management initiatives become more sustainable, contextually relevant, and socially inclusive.
- **Incentivizing Sustainable Practices:** Governments at various levels should introduce incentives to encourage sustainable water management practices. These incentives may include tax breaks, subsidies, or financial support for adopting water-efficient technologies, rainwater harvesting, and sustainable agriculture practices. Encouraging private sector involvement through incentives can also drive innovation in water sustainability.
- **Harnessing Technology for Data-driven Decision-making:** Leveraging technology is pivotal for efficient water management. Implementing Geographic Information System (GIS) technologies for mapping water resources, satellite-based monitoring for crop water use, and real-time data collection can provide valuable insights for decision-makers. Technology can enhance the accuracy of water availability assessments, enabling more informed and timely interventions.
- **Promoting Water-Efficient Agriculture:** Encouraging the adoption of water-efficient farming practices, such as drip irrigation and precision agriculture, is essential for sustainable water use in agriculture, a major consumer of water resources. Introducing educational programs, subsidies, and demonstration farms can facilitate the transition towards more sustainable and productive agricultural practices.
- **Climate-Resilient Water Infrastructure:** Recognizing the impact of climate change on water resources, infrastructure development should prioritize climate resilience. This involves designing and retrofitting water infrastructure to withstand extreme weather events, managing water scarcity, and considering changing precipitation patterns. Green infrastructure solutions, such as nature-based water storage and treatment, can be explored.
- **Investing in Research and Innovation:** Allocating resources for research and development in water sustainability is crucial. Funding should support innovations in water treatment technologies, efficient irrigation methods, and climate-resilient agricultural practices. Encouraging collaboration between research institutions, industry, and government bodies can accelerate the adoption of cutting-edge solutions.
- **International Collaboration and Knowledge Exchange:** Collaborating with international organizations, sharing best practices, and learning from global experiences can enrich India's water sustainability efforts. Engaging in joint research projects, participating in international forums, and benefiting from technological advancements developed elsewhere can contribute to a holistic and globally informed approach to water management.
- **Education and Awareness Programs:** Fostering a culture of water conservation and sustainable practices requires widespread awareness. Implementing educational programs in schools, colleges, and communities can instill a sense of responsibility towards water resources. Public campaigns on water conservation, pollution prevention, and sustainable usage should be part of a long-term strategy.
- **Promoting Green Building Practices:** Municipalities and urban planning authorities should incentivize green building practices that incorporate rainwater harvesting, water recycling, and water-efficient technologies. Implementing and enforcing building codes that mandate sustainable water practices can contribute significantly to reducing the water footprint of urban areas.

India has 4 per cent of the world’s fresh water resources, whereas it has 17 percent of its population. The demand for water will be doubled by 2030. While sanitation battle is being fought since many years, many children under 5 years of age have died due to water-borne diseases. India has been declared open defecation free, but it is a continuous struggle.

Given below are measures being taken regarding SDG 6:

- **Safe and Affordable Drinking Water for all:** A new and unified Ministry of Jal Shakti has been constituted to ascertain governance of water and its challenges. About 96 per cent of households have access to safe drinking water. Jal Shakti Abhiyan (campaign) is working for water conservation, rain water harvesting and renovation of water bodies.
- **Water Quality:** Ground and surface water issues are being tackled by a multi-pronged strategy by the Central Water Commission. The rivers are being cleaned because of contamination. The goal of Atal Bhujal Yojana (Atal Jal) is to demonstrate community-led sustainable ground water management which can be taken to scale. The major objective of the Scheme is to improve the management of groundwater resources in select water stressed areas in identified states viz. Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.
- **Sanitation and Hygiene for all:** The flagship initiative of the Swachh Bharat Mission has focussed on constructing 109 million household and community toilets. The numbers of toilets have increased from 88.8 per cent to 97.22from 2017 to 2019.India stands at 88 rank for SDG 6 on the SDG India Index. India has to deal with challenges like localized data systems on water; maintenance of gendered access to toilets; re-skilling of sanitation workers and their targeted improvement; and sustaining the sanitation behaviour changes against open defecation.

The recommendations outlined above form a comprehensive roadmap for advancing water sustainability in India. As India navigates the path towards water resilience, a commitment to sustainable water management practices is not only an imperative for domestic well-being but also a significant contribution to the global pursuit of the Sustainable Development Goals.

Conclusion

In conclusion, achieving water sustainability in India is a multifaceted endeavor that demands concerted efforts from all stakeholders. The insights gained from case studies, policy analyses, and governance assessments underscore the interconnected nature of water challenges and the imperative of aligning strategies with the Sustainable Development Goals (SDGs). Efficient water use in all sector is a challenging task in Indian context as stakeholders involved are too many. The participation of such stakeholders in this effort would require collaboration with governments, civil societies, corporate bodies, financial institutions and others. There is a need for change of mindset of the stakeholders as well.As India grapples with issues ranging from scarcity to pollution, the recommendations put forth emphasize the need for integrated policies, strengthened governance mechanisms, community participation, technological innovation, and international collaboration.

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