

Review Paper

Achieving Sustainable Development Goals in water and sanitation sectors in India

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ABSTRACT

India, with over 1.37 billion population and housing one-sixth of the world's inhabitants, has a significant role to play in the achievement of the Sustainable Development Goals (SDGs). This paper analyses the policies and programmes of the Government of India, towards the achievement of Targets 6.1 and 6.2 of SDG-6 that focus on safe drinking water and sanitation. The alignment of the policies and programmes is discussed in correlation of the output, outcome, and impacts on these targets of SDG 6. The *Swachh Bharat* (Clean India) Mission (SBM) launched in 2014 led the country with more than 98% of households having access to toilets. The *Jal Jeevan* Mission has the ambitious target of universal coverage of drinking water supply. While these programmes have led to the overall development, a vast scope of improvement in these sectors exists especially considering the growing population, economic activity, urbanisation, and climate change impacts. Analysis also shows that adequate quantitative and qualitative data on the implementation of the various policies and programmes would be instrumental in synergising the implementation of the SDGs. A systems-thinking approach for sustaining the efforts of the ongoing programmes and ensuring equitable benefits of development in the water and sanitation sectors in India is recommended.

Key words: *Har Ghar Jal*, *Jal Jeevan* Mission, open defecation, Sustainable Development Goal 6, *Swachh Bharat* Mission, water and sanitation

HIGHLIGHTS

- The WASH sector in India has witnessed massive transformation on the ground for better quality of life outcomes.
- Progress in sewage, wastewater and faecal sludge management is necessary to realise targets of SDG-6.
- Stronger enforcement mechanism and stricter implementation of policies is urgently needed for sustaining the progress made in the WASH sector in India.
- Achieving SDG 6 and other SDGs will require imaginative management of trade-offs in a complex operating environment in India.

INTRODUCTION

The Government of India's declaration of 'open defecation-free' status in all states and Union Territories (UTs) of India, on 2 October 2019, marks a historic milestone, globally unsurpassed considering the scale and time span of 5 years. This achievement has been validated (NARSS 2018–2019) and cited extensively (UNICEF 2018; Curtis 2019; Hutton *et al.* 2020). In rural India, the toilet coverage improved from 40% in 2014 to near-universal coverage in 5 years of implementation of the *Swachh Bharat* Mission (SBM). Over 10.5 crore (105 million) toilets were constructed, and more than 60 crore (600 million) people transformed their open defecation behaviour. India's phenomenal achievement immensely contributed to reducing global open defecation as the rate of decrease in India has been over 12 percentage points a year between 2015 and 2019 (Down-To-Earth, Centre for Science and Environment 2019). Emulating the success of SBM, the '*Har Ghar Jal*' programme under the *Jal Jeevan* Mission (JJM) launched for India's water sector in 2019 and expected to provide access to clean water through functional tap water connections for 100% of rural households in India by 2024.

India has achieved UN Millennium Development Goals (MDGs) (MDG 2000–2015) in the water sector by 2015 and substantially improved its performance in the sanitation sector by 2019. The continuing programmes in water and sanitation sectors will help India in achieving the 2030 Sustainable Development Goals (SDGs) for safe and universal water access and improved sanitation. In this regard, the present paper attempts to answer the following research questions:

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1. What are the Government of India's policies and programmes for the water and sanitation sectors aligning with the SDG targets?
2. How have the specific policies contributed towards SDG 6 and other SDGs?
3. What are the factors contributing to strengthening an enabling environment for water and sanitation policies in India?
4. What are the lessons learnt and the future roadmap for India to achieve the global targets on water and sanitation?

BACKGROUND

Water resources are critical for the existence of all life forms on Earth and play an important role in the economic development of a country. India's water resources are under immense pressure, as it supports 17% of the global population, though it has only 4% of the global water resources. Annual rainfall in India is to the tune of about 1,105 mm with wide spatial and temporal variations in its distribution (CWC 2019). India's per capita water availability has touched the water-stressed benchmarks and expected to decline further towards water-scarce conditions by 2050. India ranked 13th among the world's 17 'extremely water-stressed' countries and was under the category of 'extremely high' levels of baseline water stress (WRI 2019). The hydrological cycle generates 1,999 billion cubic metres (BCM) of annual water flow, out of which only 1,123 BCM (690 BCM surface water and 433 BCM groundwater) can be utilised beneficially (Ministry of Water Resources 1999). India's water storage capacity is also substantially lower than the Potential Utilizable Water Resources (PUWR) (CWC 2020).

Deterioration of water quality (surface and groundwater) due to unplanned urbanisation and untreated or partially treated industrial effluent discharged, improperly managed landfills, poor sanitation and other pollution sources like fertilisers and pesticides from the agricultural sector is an area of grave concern (Central Ground Water Board 2017). Only 37% of the municipal sewage and 62% of the industrial effluents are treated in India (MoEFCC 2019). Many districts in India have contaminated water sources, thereby affecting human health at large (Central Ground Water Board 2017).

The high population growth and rapid urbanisation have further exacerbated pressure on freshwater sources resulting in decreased water availability (Prakash 2014). By 2030, India's water demand is predicted to be twice the available supply, ensuing in about 6% loss in India's gross domestic product (GDP) (NITI Aayog 2019). The highest water-demanding sectors are agriculture followed by the industrial and domestic sectors, and the water use efficiency in agriculture is only USD 1.9 per cubic metre compared to USD 15 per cubic metre in the USA (FAO 2018). Poor management and inadequate utilisation of water resources causing severe water shortage, droughts and associated economic losses are a cause of alarm in the country (Prakash 2014). The conflicting demands of manifold water users, including domestic, agricultural, industrial, energy generation and other environmental uses, are on the rise and are expected to further increase with ambitious programmes of the Government of India such as 'Make in India' (an initiative to boost manufacturing) and other developmental programmes such as the *Har Ghar Jal* programme of JJM expected to boost water provision in the domestic sector (JJM 2021).

The water and sanitation sectors are highly interlinked. The sanitation sector deals with safe disposal of human waste, wastewater management, solid waste management, water supply, control of vector-borne diseases, and domestic and personal hygiene. Poor sanitation, unsafe hygiene practices have impacted health resulting in higher morbidity and mortality particularly among children. Similarly, the availability of water and its efficient management and utilisation are closely related to both water and sanitation in India (Roy & Pramanick 2019).

India made significant progress under the MDG in the provision of drinking water, while the progress in the sanitation sector remained inadequate. Though the National Sample Survey indicated 71.3% of households in rural areas and about 96.2% in urban areas having access to household latrines (see Box 1), the recent study indicates that the majority of the Indian states are soon nearing universal access to an improved source of drinking water (NFHS-5 2019–2020).

The launch of SBM in 2014 led to drastic improvement of sanitation in rural and urban India with 6.02 lakh villages, 711 districts in rural category and 4,360 cities (98% of total Indian cities) having achieved ODF status. Thus, it is noted that the programme not only focussed on the construction of toilets but also enhanced the usage of toilets with almost 95% of rural population and more than 98% of urban population used toilets regularly (Box 1). In rural India, more than 10.76 crore (107.6 million) household toilets were built and several rural areas have advanced beyond ODF with 63.9% of the rural population practising Solid and Liquid Waste Management (SLWM) (SBM-G 2021). In urban India, more than 62 lakhs (6.2 million)

Box 1 | Source and access of drinking water and sanitation (MoSPI 2018)

- The major sources of drinking water for 42.9% of households in rural areas were hand pumps, and for 40.9% of households in urban areas were piped water into dwelling.
- About 58.2% of households in rural areas and 80.7% of households in urban areas had drinking water facilities within household premises.
- About 71.3% of households in rural areas and about 96.2% of households in urban areas had access to latrines.
- The major type of latrines used by households was flush/pour flush into septic tanks in both rural and urban areas.
- Among households which had access to latrine, 94.7% of male and 95.7% of female in rural areas and about 98.7% of male and 98.1% female in urban areas used latrine regularly.

individual household toilets and more than 6 lakhs community/public toilets have been constructed, by overachieving the stipulated targets. Going beyond the ODF targets in Phase I of the SBM, the focus in the next phase is now on the achievement of ODF+¹ (aimed towards sustaining and maintaining the toilets constructed) and ODF++² (emphasising sludge and septage management), with 2,187 cities (49%) achieving ODF+ status and 551 cities (12%) attaining ODF++ status (SBM-U 2021).

ALIGNMENT OF THE GOVERNMENT OF INDIA'S POLICIES AND PROGRAMMES WITH SDG-6

SDGs on water and sanitation

SDG 6 (among the 17 goals formulated by the UN to be achieved by 2030) aims to expand access to basic water and sanitation services and close the gaps in service quality. There are a total of 8 targets (6 outcome-oriented targets and 2 means of achieving targets) that specify SDG 6 as a whole, with 11 indicators to represent the metrics for tracking the achievement of the targets.

SDG 6 implies not only delivery of water but also that water is safe to drink and is continuously available. The eight targets within Goal 6 are closely linked to one another, as well as to other SDGs. Most of the SDGs have positive interlinkages with SDG 6, but there are some targets within other SDGs which are in potential conflict with SDG 6. For example, increasing water and sanitation access reduces poverty and has positive linkages with health and education outcomes. However, agricultural activities (SDG 2) and energy services (SDG 7) may have negative impacts on ambient water quality and ecosystems. The interrelationships between SDG 6 and the other SDGs are summarised in Supplementary Material, Table 1 (Bharat & Dkhar 2018; Bharat *et al.* 2020). Although SDG 6 deals with eight targets, this paper primarily focuses on Targets 6.1: 'by 2030, achieve universal and equitable access to safe and affordable drinking water for all' and 6.2: 'by 2030, achieve access to adequate an equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations'. India has had several policies for the enhancement of the water and sanitation sectors that will be discussed in the next section. The current national policies and programmes in the water and sanitation sectors aligning with SDG 6 are given in Supplementary Material, Table 2.

Programmes and policies in the water sector

As per the Constitution of India, water is a state subject and the role of the Central Government is limited. The Constitution also mandates for devolution of power from states to local bodies such as *Gram Panchayats* and Urban Local Bodies. Such devolution of power from state to local bodies in water and sanitation sectors is still deficient. However, the Central Government has framed several laws and formulated policies and programmes at the national level and has been implementing the same in consultation with the states.

Important policies and programmes formulated and enacted in the water sector are National Water Policy (NWP) (2012), which is undergoing a revision, National Water Mission (NWM) of India (2008), Draft Water Framework Law of India (2016), Model Ground Water Bill (2016), *Atal Bhujal* Scheme (2019) and *Har Ghar Jal* Programme (2019) (Supplementary Material, Table 4). The NWP 2012 calls for a common integrated vision for the management of water resources (a common

¹ Since 2019 (SBM Phase II), the focus is on sustaining the ODF status achieved in the Phase I and further improvement in sanitation. ODF+ implies that not a single person is found defecating or urinating in the open and all the toilets are functional and well maintained.

² ODF++ implies that the region in addition to the ODF+ conditions (not a single person is found defecation or urinating in the open and all the toilets are functional and well maintained) all the toilets are either connected to a sewer network or safe containment systems where there is no discharge/dumping of untreated fecal sludge/septage and sewage in drains, water bodies or in any open areas.

pool community resource held by the state under public trust doctrine to ensure equitable distribution to all) and its governance. It deals with several aspects such as enhancing water availability, water demand management through efficient water use practices, water pricing, conservation of water bodies, water supply and sanitation, and management of transboundary rivers. The NWM of India (2008) was created for the implementation of the National Action Plan on Climate Change (NAPCC). The main objective of NWM is being conservation of water, minimising wastage and ensuring its more equitable distribution both across and within states through integrated water resources development and management. A number of programmes, such as 'Catch the rain, where it falls, when it falls' and '*Sahi Fasal*' (The Right Crops), are being undertaken by NWM at all India scale.

The Draft National Water Framework Law is an umbrella statement of general principles in the water sector governing the exercise of powers by the Central, States and local governing bodies. The Draft National Water Framework Bill, 2016 (under consultation with the state governments) seeks to provide an overarching national legal framework based on the principle for protection, conservation, regulation and management of water. The Bill seeks to incorporate various aspects for prioritising water use conservation and management. The 'right to water for life' approach is an important step forward indicating the state's responsibility for ensuring every person's right to safe water and is also a significant step towards achieving SDG 6. The recognition of water as a common pool resource essential for the sustenance of life is an important aspect of the Bill.

The Model Groundwater (Sustainable Management) Bill, 2017 is based on the principle of subsidiarity and equitable distribution of water. The state, according to the Bill, should act as public trustee of groundwater to ensure that it is protected, conserved, regulated and managed. This is important because currently the ownership of groundwater rests with the person who owns the land. Some of the objectives of the Bill are to ensure the realisation of the fundamental right to provision of water, protect the ecosystem and its biological diversity and reduce pollution and degradation of groundwater.

The *Atal Bhujal* scheme currently framed by the Central Government envisages improved source sustainability for the *JJM*, inculcating behavioural changes in the community and facilitating optimal water use. This 5-year scheme (launched on 25 December 2019) is being taken up in 8,350 water-stressed *Gram Panchayats* in 78 districts of seven Indian states such as Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh ([Lok Sabha Reference Note 2020](#)).

The important programmes for improving access to water in households were (a) Accelerated Rural Water Supply (2009–2012), which provided rural areas with adequate water for drinking, cooking and other domestic needs on a sustainable basis and (b) the National Rural Drinking Water Programme (NRDWP) (2013), with focus on providing access to 55 litres per capita of water to 50% rural population by 2017, and having a conjoined approach for water supply and sanitation, as an extension of the previous efforts. *JJM* (Rural) launched by the Prime Minister of India in August 2019, calling for a *Jan Andolan* (people's movement) for improved people's participation in water management with the *JJM* aiming to provide safe water through functional tap connections to every rural household by 2024. In 2021, the urban counterpart of *JJM* – *JJM* (Urban) – was announced to provide functional tap water connections to 2.86 crore (28.6 million) urban homes in 4,378 urban bodies. The programme particularly aims at improving lives of people and reducing the burden on women, especially girls, by providing safe water within household premises by ensuring every woman and her household receive safe and adequate drinking water on a sustainable basis. The operational guidelines for the implementation of *JJM* – *Har Ghar Jal* programme – are elaborated in Supplementary Material, Box 2.

The budget allocation of the Government of India for the implementation of *Har Ghar Jal* Mission has been allocated Rs 10,000 crores (100,000 million) in 2019–2020 and Rs 23,500 crores (235,000 million) in 2020–2021 and Rs. 50,000 crores (500,000 million) in 2021–2022 for drinking water and Rs. 10,000 crores (100,000 million) for sanitation ([MoJS/PIB India 2020, 2021](#)). *JJM* (Urban) launched in 2021 intends to spend an amount of Rs 2.87 lakh crore (2,870 billion) in 5 years to provide functional tap water connections to 2.86 crore (28.6 million) homes in 4,378 urban bodies. *JJM* (Rural), a Rs 3.6 lakh crore (3,600 billion) scheme, was launched in 2019 with the aim to provide tap water connections to 19.04 crore (190.40 million) rural households by 2024. During 2019–2020, a total of 84.84 lakh (8.48 million) households were provided with tap connections. It is noteworthy that 71 lakh (7.1 million) people in arsenic-contaminated areas and 5.35 lakh (0.53 million) people in fluoride-contaminated areas were provided with safe drinking water ([MoJS/PIB India 2020, 2021](#)). *JJM* (Rural) is being implemented at a rapid pace with the states of Goa and Telangana already realising their targets, and 100% of rural households in these states provided with access to potable tap water ([JJM 2021](#)). Since these programmes are in their initial years of implementation, the progress will be apparent in the upcoming surveys.

Programmes and policies in the sanitation sector

As discussed earlier, Indian public policy traditionally focussed on water supply, with poor and unsustainable sanitation services. The latter relied heavily on government subsidies for both capital cost and operation & maintenance (O&M) cost. Poor sanitation services characterised by poor managerial and financial autonomy, limited accountability, weak cost recovery and limited capacity prevailed across the country.

The SBM, with the two components: SBM-Grameen (SBM-G) and SBM-Urban (SWM-U), brought drastic changes in India's sanitation sector. The main objectives of the SBM are the elimination of open defecation, eradication of manual scavenging, modern and scientific municipal solid waste management, behavioural change on healthy sanitation practices, awareness generation about sanitation and its linkage with public health, capacity augmentation of local bodies and creation of an enabling environment for public sector participation in capital expenditure and expenditure on O&M. The Mission provides flexibility to the state governments to adopt a state-specific implementation policy including utilisation of funds and mechanisms.

During 2018–2019 budget, the Central Government announced a scheme in the sanitation sector, called Galvanising Organic Bio-Agro Resources Dhan (GOBAR-DHAN), with an aim to manage and convert cattle dung and solid waste in farms to compost biogas and bio-CNG. This scheme would supplement the objective of SBM-G for creating clean villages and is a key component of ODF plus (open defecation +) strategy of SBM-G.

Evidently, SBM is the most important programme of the rural sanitation sector. The Central Government has framed policies and guidelines for sanitation, although the responsibility for the provision of sanitation facilities lies with *Gram Panchayats*. In many states, the empowerment of the *Gram Panchayats* has been inadequate, creating a governance gap in sanitation management. While the SBM-G Phase I is over, the Government of India reviewed its commitment to further enhance the status of sanitation and hygiene in rural areas, and introduced SBM-G Phase II, the main objectives being ODF sustainability, SLWM and visual cleanliness to be achieved through continued activities related to behavioural change and communication at all levels. Its guiding principle includes ensuring equity; prioritisation and financing of the community aspects for SLWM; utilisation of existing SLWM infrastructure whenever possible; promotion of SLWM activities related to reuse; convergence with other schemes; operation and maintenance to be obligatory in planning; flexibility to states; clustering of villages for the maximum economic efficiency; and prioritisation of villages on the banks of Ganga and the other water bodies (MoJS 2020, SBM Grameen Phase II Guidelines, 2020). The Government has prepared a 10-year Rural Sanitation Strategy (2019–2029).

The urban sanitation policy has been under consideration by the governments since the First Five Year Plan. The 1980–1981 scheme of Integrated Low-Cost Sanitation (ILCS) for urban areas was formulated with the objective of creating low-cost sanitation units. The Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act (1993) aimed at prohibition of the employment of manual scavengers as well as the construction or continuance of dry latrines and for the regulation of construction and maintenance of water-seal latrines. The National Health Policy (2000) emphasised the need for strengthening sanitation and other vital development indicators that directly contribute to public health. The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched in 2005 to provide basic services to the urban poor including water supply and sanitation. The 10th Five Year Plan (2002–2007) gave significant emphasis on water supply and sanitation. Thereafter, the first comprehensive National Urban Sanitation Policy (NUSP) was launched in 2008 with the aim to transform all urban areas into community-driven, totally sanitised healthy and liveable cities. The *Nirmal Shahar Puraskar* was introduced in 2010 for encouraging cities to move towards 100% access to sanitation facilities and 100% safe disposal of all of the city's waste. As mentioned earlier, the SBM-U launched in 2014 for creating ODF areas and achieving 100% scientific management of solid waste in all towns in the country. Since these programmes are in their initial years of implementation, the progress will be measurable in the upcoming Swachh Survekhan.

CONTRIBUTION OF CURRENT POLICIES AND PROGRAMMES IN RELATION TO SDG 6 AND THE OTHER SDGS

Several studies have highlighted considerable progress in SDG 6 in India (Roy & Pramanick 2019; WHO 2019; Hutton *et al.* 2020). While 93% of the population in the country have access to drinking water (UNICEF & WHO 2019), the progress in the provision of tap water to every household is expected to increase from 50% with the introduction and aggressive implementation of *Har Ghar Jal* programme of 2019. Similarly, the sanitation sector has witnessed tremendous improvement with the implementation of the SBM. While the proportion of global population using at least basic sanitation services increased from 59% in 2000 to 68% in 2015 (UN 2015), in India it increased from 70 to 93% (UNICEF & WHO 2019). The immediate

output of these policies led to the increase in the number of water and sanitation facilities and the associated rise in the percentage of users of the same, which in turn has several associated socio-economic impacts. In terms of SDGs 6.1 and 6.2, the results can be measured with respect to the indicators under Target 6.1.1: proportion of population using safely managed drinking water services and Target 6.2.1: proportion of population using safely managed sanitation services. While the data from the Joint Monitoring Programme (JMP) indicates 92% of India using safe drinking water and 72% of the households using safely managed sanitation for the year 2017 (JMP), the JMP data sets have not been used for analysis of the policy impact on SDGs since the JMP data are estimates of information and data collected through national-level data and the JMP method is less suited to capturing short-term changes. The impacts of the policies on SDG 6 been detailed through Supplementary Material, Table 3.

The water and sanitation-related policies have led to the achievement of 93% of households having access to drinking water and the same is increasing rapidly under the JJM. Thus, the universal coverage of safe drinking water to households is to be realised by the year 2024. The progress in 2 years of the programme covering 84.84 lakh (8.48 million) households in the year 2019–2020, 71 lakh (7.1 million) households in arsenic-contaminated areas and 5.35 lakh (0.53 million) in fluoride-contaminated areas (arsenic and fluoride being the cause of severe concern in several regions of the country) has huge relevance to public health and economic development. The country is all set to achieve SDG 6.1.1 by 2024. Similarly, the phenomenal improvement in sanitation in the country has enabled the achievement of 98% of households having access to toilets thus realising SDG 6.2.2. The outcomes of these programmes have been discussed below.

Improved health and hygiene

The SBM has led to an increase in improved hygiene and improved WASH practices. Having a strong public participation, 12% of the overall allocation for massive public awareness on sanitation (SBM) has led to nationwide public movement towards sanitation being the largest behavioral change programme in the world (Mohapatra 2019). In total, 3% of the allocation for mass media campaigns and communication activities through advanced technology, modern advanced communication strategies, national-level campaigns, involvement of schools in awareness, integration of WASH curriculum in schools and grassroots-level communication have led to the success of the program, but the sustainability of these sanitation interventions for long-term health benefits is vital (Curtis 2019; Sengupta *et al.* 2019; Coffey *et al.* 2020; Joshi 2021), which is expected to be addressed by SBM Phase II (SBM 2020).

Swachh Survekshan, the survey-based ranking, has also led to increased awareness and peoples' participation in urban areas moving towards improved hygiene and health (NIUA 2015). Improvement in health has also been highlighted in several studies (Gupta *et al.* 2019; Pathak & Chakravarty 2019; Raman & Muralidharan 2019; Gandhare *et al.* 2020). Improvement in health impacts has been studied through the reduction of diarrhoeal disease in children (Dandabathula *et al.* 2019) and associated reduction in mortality, reduction of stunting and underweight in children (Spears *et al.* 2013). A cost-benefits analysis of the SBM in India highlighted that 55% of the annual benefits were health-related, which included the savings in medical expenditure for medical treatment of diarrheal issues, time saved in illness and caretaking and reduction in premature deaths (Hutton *et al.* 2020). Dandabathula *et al.* (2019) have correlated data on acute diarrhoeal disease and increased toilets in SBM to find a corresponding positive impact of SBM in reducing diarrhoeal disease. Similarly, studies have also established that the hygiene interventions adopted under SBM-G (SBM-Rural) are highly cost-beneficial to rural India mainly due to the health benefits that reach their full potential when the very high coverage and usage of safe sanitation is achieved in a community (Hutton *et al.* 2020). Benefits of water and sanitation on health through reduced health impacts, such as diarrheal diseases, stunting and other health impacts of poor sanitation leading to improved well-being, have been clearly established (Bartram & Cairncross 2010; OECD/WHO 2020). Hutton *et al.* (2020) have monetised the benefits of reduced healthcare costs, health-related productive time and mortality by accounting for the improvement in health (reduction in diarrheal diseases, stunting and other health impacts), time and convenience, external environment, property value, water for drinking and other uses, personal dignity, privacy and perceived social benefits. Their study estimates the total annual benefit of SBM-G as USD 727 above which the rise in property value was estimated as USD 294, 55% of the estimated benefits has been attributed to health-related benefits.

Improved education

Recognising the importance of school sanitation, the *Swachh Bharat-Swachh Vidyalaya* (SBSV) initiative in 2015 under the SBM aimed to provide universal access to sex-segregated toilets in all 1.2 million government schools. Swachh Vidyalaya

Puraskar³ has enabled schools to strive for improved sanitation and maintain the same. In 2019, 95.5% of the schools had access to toilets, and almost all of them were functional and used (99%) (National Annual Rural Sanitation Survey 2019–2020). WASH curriculum was also incorporated in the school teaching with the aim of improving hygiene practices and community ownership of water and sanitation facilities within schools, the repercussions of which to spread within the community as well. The NARSS survey finds that almost 99% of the schools practised handwashing. All of these have led to increased enrolment of students in schools, improvement in attendance and retention of students, thereby enabling SDG 4.1. This has also contributed to improvement in health and well-being of the children (Adukia 2017).

Improvement in women's conditions

Several studies have recognised the importance of household toilets and women's safety, health and overall improvement (Shweta *et al.* 2020). A sample study (UNICEF, MDWS, BMGF, Sambodhi 2020) noted 93% of women reporting improvement in their safety from sexual violence and harm by animals with improved sanitation. The same study also reported women's perception of improvement in health (93%) and lack of fear of contracting health infections while defecating in the open. The study also highlighted improvement in women's perception of self-respect and reduction in stress (77%). Studies have documented a reduction in crime against women due to the presence of household toilets and reducing the scope of sexual assaults on women by 65% in 2018 (Khandelwal *et al.* 2020).

Time saved

A UNICEF study aimed to assess the financial and economic impacts of the SBM, has calculated and estimated the value of the time (values ranging from USD 31 to USD 66 for different household members) saved per year on account of access to household toilets. In addition, household toilets have a positive impact on health thereby reducing the time lost during ill health. The aggregate time saved (on account of the health benefits and the time saved on travel for defecation) was valued at USD 382 each year (UNICEF 2018).

Economic development

Several studies have established the positive correlation of improved water (WHO 2019) and sanitation on household income and poverty reduction (Bartram & Cairncross 2010; Mara *et al.* 2010; Van Minh & Nguyen-Viet, 2011). The positive impact of increasing per capita GDP and sanitation-related indicators thereby contributing towards SDG 1 – to end poverty – has been studied (Roy & Pramanick 2019). Hutton *et al.* (2020) have estimated the positive impact of water and sanitation on economic development. Their study shows the significant economic impact of improved sanitation and hygiene under the SBM and monetises the impact of ending open defecation universally, as a reduction of USD 64 billion to the nation's GDP.

STRENGTHENING AN ENABLING ENVIRONMENT IN THE WATER AND SANITATION SECTOR

India has largely been able to create an enabling environment in terms of universality, sustainability and equity of water and sanitation service delivery, as required by SDG Goal 6 Targets 6.1 and 6.2. While the earlier sections detail the Government of India's policies and programmes towards aligning the progress in the water and sanitation sectors, the current section discusses factors that contribute to an enabling environment. The analysis is based on the five key requisite elements recognised by Sanitation and Water for All (SWA) to deliver equitable and functioning Water Sanitation and Hygiene Services (SWA, 2016) (Table 1).

LESSONS LEARNT FROM THE POLICIES AND PROGRAMMES IN WATER AND SANITATION SECTOR

The lessons learnt from the past programmes have been incorporated in JJM and SBM. Though the above policies have contributed immensely towards realising the SDG targets, there is scope for further improvement for sustaining and extending the interventions. Some of the gaps examined have been discussed in this section.

³ Swachh Vidyalaya Puraskar is instituted by the Ministry of Human Resource Development, Government of India to recognize, inspire and celebrate excellence in sanitation and hygiene practice in schools.

Table 1 | Five key contributing elements enabling water and sanitation sectors towards achieving targets of SDGs

Key elements	Factors supporting an enabling environment
Policy strategy	The Government of India's policies, Acts and programmes (Table 1; Supplementary Material, Table 2), have tremendously contributed towards SDG 6, the main enabling factors being conducive legislation, effective regulation, improved structure for implementation, ambitious targets, enhanced institutional framework, leadership, commitment & vision, multistakeholder participation, community involvement, use of technology in implementation, monitoring and reporting, innovative finance options, and recognition and rewards (TERI University 2017; Agarwal <i>et al.</i> 2019; Curtis 2019).
Institutional arrangement	The responsibility at the Central and State levels is shared by various Ministries and State Departments. The five-tier institutional structure ensures enhanced institutional support for planning, monitoring and implementation of SBM at the National, State, District, Block, and <i>Gram Panchayat</i> (GP) levels with the support of institutions for programme monitoring such as the Programme Units, Technical Support Units, Resource groups and Local Self-Governments (LSGs). (World Bank 2015). Various Government Departments, city administrations and LSGs are responsible for the implementation of drinking water supply and sanitation policies and programmes in their respective states. Decentralisation has also been promoted. All of these together have created an enabling environment towards realising the related SDG targets (NITI Aayog-United Nations 2019).
Sector financing	Finance being a crucial factor supporting the policies for an enabling environment, it is critical to note that the investment in the water and sanitation sectors has increased manifolds through the Central Government schemes like Jawaharlal Nehru National Urban Renewal Mission (until 2014) and the SBM and Har Ghar Jal of JJM since 2014 (Sarkar 2020). In 2020–2021, the government had allocated Rs 30,478 crores (304,780 million) to the Ministry of Jal Shakti, of which Rs. 21,500 crores (215,000 million) were provisioned for drinking water and sanitation. The JJM allocated Rs. 11,500 crores (115,000 million) separately. In 2021–2022, the government has allocated Rs 50,000 crores (500,000 million) for drinking water and Rs 10,000 crores (100,000 million) for sanitation. The budget allocation for JJM and the Ministry has increased by 450 and 180%, respectively, as compared to 2020–2021 (JJM/PIB India 2021). One of the key factors for effective implementation is the utilisation of innovative sources for funding, e.g. in the Swachh Bharat Cess (SBC), Swachh Bharat Kosh (Clean India Fund) or Corporate Social Responsibility (CSR) contributions: Municipal bonds and Community Resources Special Purpose Vehicles (Norman & Renouf 2016), microfinance, crowdfunding and bank funding has also been seen in the sanitation sector in India (TERI University 2017).
Planning monitoring and review	Comprehensive web-based online monitoring system was one of the main factors that contributed towards the monitoring of progress and success in the realisation of the targets. Household-level monitoring has improved the transparency, real-time monitoring using online automated SMS systems for communication with beneficiaries, mobile applications for uploading photographs, geo-tagging of interventions, module for monitoring ODF on IMIS and community participation in ranking in the <i>Swachh Survekshan</i> on <i>Swachh App</i> which have all enabled enhanced monitoring (SBM website).
Capacity development	Few of the factors that have supported capacity building in creating enabling environment are interventions from donor and bilateral agencies (such as UNICEF, USAID, EU, GIZ, World Bank, BMGF, ADB and AFD), use of technology, scaling digital capacity and planning effective IEC in realising behavioural change (PAC 2019; WASH Institute 2019; NIUA 2020). Information Education and Communication (IEC) is known to have a crucial impact on behavioural change in realising improvement in water and sanitation sectors. Several IEC, mass awareness and participatory communication activities have been conducted for monitoring the implementation and assessing the impact of communication (PAC 2019). The SBM, for instance, has an allocation of 8% for IEC (3% for Centre and 5% for State). This is one of the largest and long-term IEC programmes with national coverage and an investment of Rs 2,050 crores (20,500 million) to be used for multi-level conventional and unconventional channels contributing towards creating an enabling environment for realising the desired progress (WASH Institute 2019).

Water sector

During the COVID-19 pandemics, there is an increase in the generation of wastewater due to handwashing. Collection, treatment and reuse of the treated wastewater in the light of a wider circular economy approach is the need of the hour. This shift in approach can facilitate lowering untreated effluents to the environment as well as freeing freshwater for potable uses.

SDG 6.1 is linked with other SDGs in a mixed way, as described in Supplementary Material, Table 1. These subjects are managed by different Ministries and Departments of Central and State Governments (Supplementary Material, Table 2). The harmonisation of activities and interdepartmental coordination between the various Central and State entities towards achieving SDG goals are crucial that can be achieved through synergising alignments, analysing trade-offs and optimising outputs by adopting a coordinated approach across all SDGs (Table 1).

Human-induced climate change and associated global warming by 1.5 or 2 °C depending on countries' mitigation measures (IPCC 2018) will impact in many ways including the hydrological cycle. Increased frequency of urban flooding is a serious predicament in India, emphasising the need for improved drainage systems and sanitation management. A large part of India (68%) being drought-prone is at increased risk due to heavy groundwater extraction and poor water management (Bharat & Dkhar 2018). While the *Atal Bhujal* Scheme of Central Government is a step in the right direction addressing the climate change impacts on water availability, water scarcity and water security, other government programmes and interventions need to recognise the climate change issues effectively. Climate-proofing of water and sanitation infrastructure, especially in urban areas, is vital under extreme events especially floods. Likewise, failure to achieve climate change resilience in water supply and sanitation will have serious public health implications.

Programmes and interventions directed towards water security and water sustainability at the grassroots level necessitate improved, quality data on water. Despite the Central Government's efforts such as the current platform through Water Resources Information Systems (WRIS) in addition to existing efforts (JJM 2021), an immense gap remains on data availability of water use at the local level (Ramswami *et al.* 2017; Srivastava & Chinnasamy 2021). The implementation of progress directed towards rural and urban water security, including the integration of climate change in water management, requires adequate data (Joy & Srinivasan 2020). Similarly, reliable data on water quality are crucial for assessing the realisation of both the SDG targets (Rayasam *et al.* 2020).

Village-level information of the aquifer (particularly pre- and post-rainfall information) is essential (Jadeja *et al.* 2018) for the effective implementation of the JJM programme, as it focuses on rural water security at the village level by sourcing the water available from surface and groundwater (mainly for agricultural use). In addition, there is a need to increase the number of government-run observation wells. Technological intervention is also vital for water management in rural and urban areas. The adoption of available advanced technology for monitoring critical water data at the farm level through virtual metering/Internet of Things and monitoring will contribute towards enhanced community participation for improved water management in rural areas (Flores-Díaz *et al.* 2018).

Sanitation sector

While 486 million people gained access to basic sanitation services in India between 2000 and 2019, it has raised demand for water for sanitation and increased need for sanitation and waste management (Bharat *et al.* 2020) as well as adopting a circular economy approach in the sector. The key challenges posed for rural sanitation under SBM-G are sustained the use of the constructed toilets and adequate management of liquid and solid waste generated from these toilets (as well as from pre-existing ones). Poor coverage of sewerage system, especially in rural areas, calls for on-site and safe containment and management of faecal waste. Faecal matter, when dumped in the open-land environment (near households), affects public health and results in contamination of soil and water resources (Sarkar *et al.* 2016; Nath & Sharma 2017; Reese *et al.* 2019; Roy & Pramanick 2019; Maramraj *et al.* 2020; Bindra *et al.* 2021). This also leads to bacterial contamination impacting water quality, especially in shallow aquifers. There is an urgent need to effectively develop the faecal sludge management services in rural and urban areas (Berendes *et al.* 2017; Rao *et al.* 2020). Similarly, it is necessary to sustain the use of toilets, especially in areas with acute water shortage. Large-scale construction of toilets under the SBM demands adequate and regular water supply in toilets for assuring long-term use of the resources created (Bharat *et al.* 2020).

To sustain ODF status, stable and long-term financing and planning is essential. Short-term and one-time planning, without a future investment roadmap, will result in poor-quality toilets or sewerage infrastructure, which ultimately increases the O&M expenses, resulting in unsustainability of the infrastructure created as well as unsustainability of positive behaviour. Lack of water supply in toilets as well as dysfunctional toilets have been established as the two key reasons for slippage from ODF. The reasons for the non-usability of toilets may be assessed and necessary actions are undertaken.

Water, sanitation and hygiene being interlinked, unhygienic conditions and unsafe sanitation practices have severe adverse health consequences often inadequately borne by women and children (Baker *et al.* 2017; Dwivedi *et al.* 2019; Gwenzi 2021; Sachs *et al.* 2020). Human excreta contain several pathogens, and chronic exposure and contamination of such faecal

pathogens have severe health consequences especially among children (Mills *et al.* 2018; Goddard *et al.* 2020). Groundwater contamination from domestic sewage and unscientific disposal of human excreta is of significant public health concern, in rural and peri-urban areas (Rajmohan 2020; Bindra *et al.* 2021). Additionally, safe sanitation implies that the entire sanitation chain functions safely and managed sustainably, raising needs for addressing the market failures and loopholes through long-term involvement of the public sector (Bharat *et al.* 2020).

CONCLUSION AND WAY FORWARD

Though several studies and reports highlight the progress in water and sanitation sectors in India, this paper assesses the Government of India's policies, programmes and its alignment with the related SDGs. The Government of India's initiative in implementing the programmes, such as the SBM and *Har Ghar Jal*, has significant political support, both at the Central and State levels. Several important policies, such as the NWP and NUSP, are being updated, and the National Policy on Safe Reuse of Treated Water (SRTW) is being newly introduced based on the current needs and for addressing the strategic gaps. The provision of comprehensive, sustainable and accessible sanitation services to all requires a strong policy and legal framework, which should be periodically reviewed for keeping pace with technologies, aspirations and the changing needs and challenges of the society.

By the localisation of SDGs by states and local governments to support the achievement of the SDGs through bottom-up actions, SDGs provide a framework for the local development policies (NITI Aayog 2019). Evidently, the states and UTs are the primary players and contributors in ensuring the success of the SDGs in India. Considerable efforts have been made by many of the Indian states in spearheading to achieve the SDG water and sanitation targets. Some of the states are making progress towards aligning it with other SDGs at the state and local administrative levels. This synergy among the various stakeholders, including state, district and city governments, academia, private sector and CSOs under programmes such as the SBM, JJM and AMRUT, should be strengthened for achieving better WASH outcomes and SDG targets.

Given the socio-economic dynamics in India, achieving SDG 6 as well as the other SDGs will require imaginative management of trade-offs in a complex operating environment. The policies and programmes in the water and sanitation sectors in India should build upon the efforts made so far. Along with a strong regulatory mechanism, there needs to be a stronger enforcement mechanism and stricter implementation of policies, such as the NWP, FSSM policy and Solid Waste Management Rule, for better QoL outcomes such as reduction in poverty, better health and education. Water and sanitation missions cannot predominantly be a Central Government programme with construction targets. State-level annual reports in legislatures can ensure better scrutiny and accountability of initiatives.

An effective institutional framework is needed which, on the one hand, enables communication vertically between the SDG-coordination nodes at Central and State levels and, on the other hand, enables sectoral policies (such as water and sanitation) to communicate horizontally between the sectors and the SDG-coordination nodes at Central and State levels. The investment in the water and sanitation sectors has increased manifold through the Central Government schemes in recent times, which is a crucial factor supporting the policies for an enabling environment. The optimisation of all the SDGs in an integrated manner requires that state-level policies with regard to the other SDGs be also taken into cognizance. In the long run, this will determine our ability to optimise effectively as we seek to achieve the 2030 Agenda for Sustainable Development.

The paper acknowledges the issues and challenges such as the need for coordination between Ministries and Departments at various levels, increased involvement of *Gram Panchayats* and local bodies. It also features the climate change impacts on the water and sanitation sectors through programmes like the *Atal Bhujal* scheme. The need for efficient data management to ensure the success of the ongoing programmes has been highlighted. While SBM has led to significant improvement in the sanitation sector, corresponding progress in sewage, wastewater and faecal sludge management is necessary to realise the SDG targets with respect to sanitation. It is suggested that quantitative research and data are augmented with qualitative studies to assess the progress towards SDG 6 at the local level. Future research is recommended to examine the process of change and the impacts, especially in backward regions and vulnerable sections of society.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

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