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India, Water and Sanitation

India: The Severe Sanitation Situation

The subcontinent of India is home to one of the oldest civilizations in the world. India prospered under the rule of many empires and displayed its vibrant character. Eventually, India came under the rule of the British Raj and did not achieve its independence until 1947. Media often showcases India's culture; however, serious problems faced by the population are out of the focus. Due to India's rapid urbanization, the water and sanitation infrastructure in the country was neglected. The stark differences in sewer systems and toilet situations between urban and rural India are harrowing. To solve these issues, India must become open defecation free; educate its people on water, sanitation, and hygiene; and create a national agency so that all processes are streamlined. As the struggle with contamination and waterborne diseases diminishes, India can tackle growing issues like hunger and poverty.

India is a country in southern Asia that borders China, Bhutan, Nepal, Pakistan, Myanmar, and Bangladesh; it is also surrounded by the Bay of Bengal, the Arabian Ocean, and the Indian Ocean. The country has a population of nearly 1.5 billion people, making it the second-most populous country in the world (India - The World Factbook). With over 3 million square kilometers of land area, the country is densely populated ("India | History, Map, Population, Economy, & Facts"). According to the World Bank, 65.53% of India's population is rural: thus, 34.47% of the population lives in urban areas (India - Rural Population). India is a federal parliamentary republic. Its government is comprised of an executive, legislative, and judicial branch similar to that of the United Kingdom. (India - The World Factbook). India's climate is tremendously diverse: with mountains in the north, deserts in the west, flat and rolling plains along the Ganges, and upland plains in the south (India - The World Factbook). India's average annual rainfall is 300-650 mm, but this number can vary significantly in different regions of the country. India has eight main rivers: the Ganges River, Indus River, Yamuna River, Brahmaputra River, Mahanadi River, Godavari River, Krishna River, and Cauvery River (Profile - Rivers). These rivers contribute not only to India's geography but are also critical water resources.

As of 2018, it is estimated that 60.5% of the land is agricultural. Rice, sugar cane, and wheat are the major crops in India and the major exports are refined petroleum, diamonds, and packaged medicines (India - The World Factbook). Almost half of the population (47%) works in agriculture. In India, the average farm size is around two hectares. The average farm size in the US is 179.68 hectares ("Farms and Land in Farms"). Most households consist of two parents and two to three children, leading the average household size to be 4.6 (Data Center: International Indicators). The majority of Indians live in smaller cities or rural areas with very simple housing, many of which are self-constructed. Children in impoverished areas go to public school, while children in areas of socioeconomic affluence opt to go to private schools. Out of every 100 students, 29 drop out of school before completing elementary education (Education). The most popular degrees are in computer science, engineering, and medicine. Family diets across India vary greatly, but overall staples are roti, rice, dal, chutney, and legumes. India is predominantly a vegetarian nation, but some regions do eat meat like chicken and goat; along the coasts, fish is a popular choice

(“How Healthy Is Indian Food? - Times of India”). Most food is cooked on stove tops with an open gas flame. Almost all Indians have access to electricity: the electrification rate of the total population is 99%, but this electricity is extremely unreliable and power outages are frequent even in major urban areas (India - The World Factbook). The COVID-19 pandemic has highlighted the dire internet situation. Only 24% of Indian households have internet facilities good enough to access online learning (Press Trust of India). This imbalance between rural and urban areas is due to the rapid urbanization India is going through. Urbanization is also the reason 38.9% of the rural and 6.3% of the urban population do not have access to improved sanitation facilities: a facility where human excreta is separated hygienically from human contact (Population Using Improved Sanitation Facilities).

Poor water and sanitation are linked to cholera, diarrhea, dysentery, and hepatitis A. Unsuccessfully managed wastewater is also used to irrigate cropland, putting harmful toxins into the food chain. Mosquitoes and insects tend to breed in water that is not properly taken care of and transfer diseases like dengue fever. Many deaths are linked to poor sanitation. 297,000 children aged under 5 years succumb to preventable diarrhea every year (Drinking-Water). Bad sanitation contributes to the high neonatal mortality rate which is 24 deaths per 1000 live births. Sepsis- an infection that spreads in health facilities because of poor sanitation- counts for 11% of maternal deaths and 15% of neonatal deaths (Water, Sanitation and Hygiene). Children and the elderly are more impacted by poor sanitation as they have weaker immune systems, but poor sanitation and subpar water resources harm everybody. Inadequate sanitation also has social and economic implications due to increased risk of anxiety, sexual assault, and lost educational opportunities (Sanitation). Individuals do not have to spend time and money recovering from illness and can instead be economically productive when sufficient sanitation exists. The water and sanitation crisis has been worsening for years and affects rural and urban populations in different calibers. In 2015, almost half of India’s population, about 568 million people, openly defecated in fields, lakes, rivers, forests, and other public places. Since then, the estimated number of people openly defecating has reduced by 480 million people as of 2019 (Water, Sanitation and Hygiene). The situation is improving due to government programs like Swachh Bharat which was implemented by Prime Minister Narendra Modi.

Narendra Modi started the Swachh Bharat Mission (SBM) to create a “cleaner India” (Dandabathula, et. al). From 2014-2019, the Indian central government invested 30 billion USD into building toilets, mainly in rural areas. They built over 95 million toilets, funded promotional campaigns with celebrities to stigmatize open defecation and encouraged the use of toilets (Rubin, Ben Fox). The number of people with acute diarrheal disease (ADD) in 2017 and 2018 was less than any year before that since 2010 in regions where SBM was heavily implemented. Seasonal variations of ADD during May, June, July, and August accounted for the 55% to 60% outbreaks in other years, but in 2018, seasonal outbreaks were only 46% (Dandabathula, et. al). On October 2nd, 2019, Modi declared India open defecation free (ODF), but this is not actually the case. In 2017, the World Health Organization estimated that 520 million people were still openly defecating. Many in academia and politics wonder how such a drastic change in toilet usage occurred in just two years. The disbelief is further supported by first-hand accounts of people still openly defecating despite the Prime Minister’s claim (University). Moreover, data released by the National Statistical Organization (NSO) in November of 2019, a month after India was declared ODF, states that only 71.3% of people in rural India said they had access to a latrine (NSS Report No.584). The discrepancies in the data from the NSO and the Swachh Bharat Mission contribute to the likelihood that India is indeed not ODF. SBM also failed at teaching Indians—especially in rural areas—how to clean the

toilets, maintain them, and how to dispose of the sewage (CNN). Swachh Bharat was a triumph in the sense that it placed a kind of focus that had never been placed on sanitation in India. The program did build numerous toilets and helped the open defecation problem, but it did not ensure that sustainable toilet usage practices were widely initiated.

The solution to India's sanitation and water problem is multi-pronged. First, India must truly become open defecation free. Simultaneously, the public has to be educated about water, sanitation, and hygiene. Lastly, a national agency ought to be created so programs like SBM stay at the forefront while private donations and international aid are properly utilized. The agency will allow for a streamlined approach to tackling the sanitation problem. The three different pieces must happen concurrently for full impact.

The foremost action that needs to be taken is India has to rescind its ODF status. By claiming India as ODF, all the people who still openly defecate become invisible and this is counterproductive. India has to look at the reality of its situation. Currently, the two main things holding India back from ODF status are the lack of access to toilets and the refusal from some in using them. SBM promoted individual household latrines (IHHL). The main toilets installed during SBM were pit latrines, specifically the twin pit leach type. This design requires 67 sq. ft. of space. The average house size in rural Bihar is 360 sq. ft. Consequently, due to the lack of space, many families could not afford a latrine (University). Furthermore, as of 2019, there are 1.8 million individuals who are homeless ("A View into Homelessness in India."). Due to mainly IHHL toilets being built, the homeless population of India continued to openly defecate. The few public toilets that were built are not an option for the homeless population as the beliefs of the old caste system persist. These beliefs declare the homeless population as "untouchables", justifying the locals' need to prevent the homeless from using these public restrooms. As SBM did not focus on the sustainability of toilet use, a lot of the pit latrines filled up and people went back to open defecation. In addition, India has many cultural and societal stigmas against public toilets. In many parts of India, toilets are built outside the home and seen as filthy. Many prefer to defecate outside as they deem it is purer. On top of that, the old caste system associates toilet cleaning with lower castes, casting a negative light on sanitation. Many people who have had toilets installed also still openly defecate because of habit or they only have one IHHL and it is occupied.

India can officially achieve ODF status by first switching the type of toilet they are promoting. Instead of building twin pit latrines, the government should be building anaerobic filter toilets in places that currently do not have toilets and in public places, especially ones with large homeless populations. In rural locations where toilets exist, the government should wait until pit latrines fill up or other toilet types require severe maintenance and then install the anaerobic filter toilet. The anaerobic filter is a modification of the anaerobic baffled reactor (ABR) toilet. ABR is an improved septic tank that uses baffles to force wastewater over and under baffles leading to more contact with active biomass. ABRs are robust and able to treat plenty of wastewater (Jalshakti-Ddws.Gov). In the anaerobic filter, the organic matter is retained in the chambers and allowed to grow. Thus, there is a high density of bacterial mass which degrades more organic matter and this, in turn, lowers the biochemical oxygen demand (BOD). The anaerobic filter is better than the twin pit leach latrine and other on-site sanitation toilets because of its versatility. The anaerobic filter is suitable for any type of soil and can be slightly adjusted for areas with a high water table. It is fully self-contained, so there is no leaching or soaking involved and therefore, no chance of groundwater pollution. The anaerobic filter does not need electricity to run and

takes up less space than ABR and a septic tank. Once installed, there are minimal operating costs and the latrine is socio-culturally acceptable. The anaerobic filter is the best type of toilet to install as it highly reduces BOD and accumulates exceedingly little sludge. It is efficient and adaptable for providing adequate on-site decentralized sanitation. The anaerobic filter functions as shown in appendix¹. India already has the specifics of the anaerobic filter toilet type in its handbook of toilet options for on-site sanitation in rural areas. Therefore, no more research needs to be done on how the anaerobic filter should be installed (“Handbook on Technological Options for On-Site Sanitation in Rural Areas.”). The main reason this toilet system was not mass constructed during SBM is because it requires a professional. The anaerobic filter effluent also needs to be further treated before it can be safely reused and released.

Additionally, along with installing anaerobic filters the government should teach rural Indians how to make Tippy Tap Handwashing Stations. The Tippy Tap is a hands-free handwashing device designed by Dr. Jimm Watt in Zimbabwe (Tippy Tap). He originally used a dried-out gourd to hold the water, but any vessel such as a plastic water container can be utilized. Essentially, one hangs a container- preferably one that holds at least 2 liters of water- from a metal bar or wooden stick and ties a foot lever to the container with string. Then a hole is made in a bar of soap and the soap is suspended from the same metal bar or wooden stick. Now, a user can wash their hands adequately. When the vessel holding the water is empty, it just needs to be refilled. The Tippy Tap allows for a proper handwashing area that reduces the risk of pathogens being transferred as the only thing the user touches is the bar of soap. When placed close to schools, latrines, and kitchens the device is the most effective. The Tippy Tap is already used in various countries including Uganda, Zambia, Mozambique, and Zimbabwe. While the Tippy Tap does not contribute directly to making India ODF, it improves the hygiene of the people and reduces transmission of food and water-based diseases.

Next, the public must be rigorously educated on water, sanitation, and hygiene (WASH). As stated before, many Indians, specifically in rural areas, have access to toilets yet they refuse to use them. The Indian population as a whole must change its mindset on sanitation and hygiene. The program should destigmatize toilet use, reprimand open defecation, and highlight the importance of WASH. As a result, the WASH awareness campaign will assist in making India ODF. India is a very diverse country so robust reform could seem difficult to achieve, but India already has experience with this kind of extensive mindset shift. It is not a secret that India has a booming population. In 1952, India’s total fertility rate (TFR) was 5.9, significantly above replacement levels. Since then, the Indian government has created many family planning programs. At first in the 60s and 70s, it heavily endorsed sterilization which was not effective. Eventually, India learned to instead educate women and families on family planning, birth control, and contraceptive methods (Hays, Jeffrey). In 2019, the TFR in India was 2.2 which is almost at replacement levels. A lot of the lessons learned from the national family planning campaigns can be employed when thinking about sanitation awareness campaigns. The majority of population control programs came from the central government which had the same instructions and assumptions for every state. This led to problems as it did not take into account regional differences in belief. Thus, it is imperative that when the water, sanitation, and hygiene (WASH) awareness program is designed, teams of local experts are hired onto the project. This ensures that local differences and opinions are taken into account, but the information remains identical. Population control programs in India also did not start successfully and often violated individual liberty without proper justification, harming the public

¹ The appendix is after the bibliography.

perception of them. This is why the WASH awareness program must be thorough in its explanations for why WASH matters, the science behind WASH, and the benefits of good sanitation and hygiene. Furthermore, the goals and significance of the WASH awareness campaign should be stressed in schools. Children drive change and it is necessary they learn the importance of WASH. The WASH program should also incorporate mainstream media. Similar to SBM celebrity campaigns, the WASH awareness campaign can also rely on prominent figures to push the message. WASH should also be advertised on TV, social media, and should have an interactive website. Outreach will form the crux of understanding.

The funding for the WASH awareness campaign and the design and implementation of the anaerobic filter toilets will come from a government agency. The creation of this agency is the last portion of the solution. Currently, many government and private sanitation programs exist like Swachh Bharat Abhiyan 2.0 (SBM 2.0), Jal Jeevan Mission, UNICEF's aid, and the Atal Mission for Rejuvenation and Urban Transformation. These programs all have similar goals and often target the same areas of India. This leads to convoluted information and does not improve the situation. The national agency that is created would put all these programs and initiatives under one umbrella and systematically help regions of India. This agency would focus on the design and implementation of the WASH awareness program, the logistics of determining when and where anaerobic filter toilets need to be built, how to manage menstrual waste, and would formulate and execute plans of building local wastewater treatment plants. The agency would also work with all international organizations and initiatives related to WASH to ensure the aid provided is used as productively as possible. The agency would be funded using the funds the government currently has allocated to programs like SBM 2.0 since these programs would be under the agency as well as donations from the public. The central government agency could be kept in check by state and local governments as well as by international organizations like the United Nations. It is essential that the agency is monitored and transparent so that corruption does not run rampant.

This tri-fold plan serves as a solution to India's sanitation crisis and aids in solving other problems like water scarcity, sustainable agriculture, malnutrition, infectious diseases, education, and infrastructure. Water scarcity is a big problem in India and water must be used sustainably. By making India ODF and building proper sanitation infrastructure we are preventing groundwater contamination. This allows for more water to be used for human consumption and agriculture; this goes hand in hand with sustainable agriculture. When soil is treated with pathogen-free effluent and uncontaminated water it becomes full of nutrients. The soil can then be used to grow food and fiber long-term. This aids in ending hunger and malnutrition. When human excreta is properly managed, handwashing is a regular occurrence, and people are educated on sanitation, food sources are not contaminated by microbes. This prevents infectious diseases like diarrhea, dysentery, hepatitis A, typhoid, polio, and sepsis. Furthermore, this implies they have more time to get educated or work. Eventually, this will lead to improved infrastructure and assistance in coming up with solutions for other major problems like climate change.

Ultimately, it is evident that India's water and sanitation crisis is hampering the path to ending hunger. By making India truly ODF, educating the general public on water, sanitation, and hygiene, and creating a national agency to organize all these affairs India can solve its water and sanitation dilemma. In turn, this freedom from open defecation, microbial contamination, and waterborne illness will allow the people of India to not only survive but to thrive. India is a complex country with a multitude of serious issues, but with the sanitation crisis solved India will be well on its way to ending hunger and poverty.

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Appendix

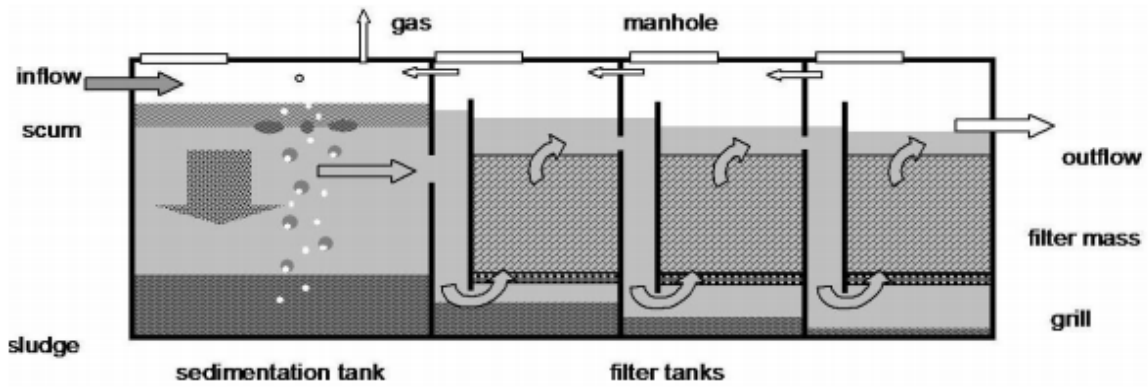


Fig. 4.32 A schematic diagram of Anaerobic filter , Source DEWATS