What it takes to Clean India

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Ever since Prime Minister, Narendra Modi, in his maiden independence day speech on August 15th last year announced that he would like to see India squeaky clean by 2019, which happens to be the sesquicentenary of the birth of Mohandas Karamchand Gandhi, who was possibly the first votary of a clean and sanitised India, there has been a great hullabaloo throughout the country on actualising this wish of the Prime Minister. But like Gandhi and many others before him, Modi too hasn't really addressed with sincerity the herculean problems in the path of making India clean, especially in rural areas. In fact even the international agencies like the World Bank and the United Nations not to speak of the moribund Public Health Engineering departments at the Centre and the States and various national and international NGOs active in the Water Supply and Sanitation (WSS) sector in this country have skirted the difficulty of this problem to save on costs and have gone around designing and implementing practically unworkable and environmentally unsustainable WSS Services.

Even though I have designed and implemented a workable and environmentally sustainable water supply and sanitation system in our office in the city of Indore and also studied this problem in detail as part of my Ph D, I had never grappled with the problem at a larger scale and so was not aware of the various practical intricacies involved in its solution especially in rural areas. An opportunity arose this year when it was decided to construct toilets and bathrooms in the Rani Kajal Jeevan Shala residential school for Adivasi boys and girls that our organisation runs in the village of Kakrana on the banks of the River Narmada in Alirajpur district of Madhya Pradesh. There were only three toilets for the girls and women on the campus earlier but given the huge adverse health effects of open defecation in close proximity to the school by more than a hundred boys and men it was decided to construct fifteen bathrooms and fifteen toilets. Detailed below is the saga of the successful implementation of this WSS project and how it has been an immense learning exercise for all those involved, including a so called expert like I!!!

The biggest problem with toilets in rural areas that is generally brushed under the carpet and overlooked is water supply. Toilets across the country are being built in the hundreds of thousands since the clarion call given by Modi but in most of these, there is either no or inadequate provision for water supply. Consequently, toilets across the country and especially public toilets, stink to high heaven and most private toilets built in rural homes remain unused. In rural areas where households have to bring water from a distance from tanks, streams, public wells or hand pumps for their drinking and cooking use, it requires great motivation on their part to get say fifteen more buckets or so for a five member household for bathing, flushing and keeping the toilets and bathrooms clean instead of bathing and defecating in the open. Even if they were to get these fifteen buckets of water, it would give rise to the problem of disposal of the waste water of almost equal proportions. Dry pit latrines without proper treatment of the sewage, which are promoted by policy makers across the world, as a consequence, to get round the high cost implications of providing adequate water supply to the toilets and treating the waste water properly, give rise to both a foul stench and contamination of the ground and surface water. Thus, Modi's Clean India campaign has mostly led to the construction of stinking toilets which are either not being used or if used are then contributing to greater pollution of the ground water than in the case of open defecation.

The enormity of this problem was brought home to us in the construction of fifteen pairs of toilets and bathrooms in the Rani Kajal Jeevan Shala in Kakrana in two blocks of ten and five units for boys and girls respectively as shown below.

The quality of construction of the toilets and bathrooms was fairly good with brick and cement mortar, vitrified tiles, UPVC pipes and brass and ceramic fittings as shown in the picture below.

The campus has a hand pump in which there is inserted a two phase submersible pump of one horsepower (HP). Initially after the toilets and bathrooms were constructed they were fitted with two numbers of one thousand litre tanks in addition to the one thousand litre tank that was already there for the three toilets built earlier. These tanks were connected to the submersible pump. However, this total of three thousand litres of water supply proved totally inadequate for servicing fifteen bathrooms and eighteen toilets. The tanks would empty out within a few minutes during the morning hours of heavy use and then filling them up again and again was a big problem. Later during the day the tanks would remain empty and so the children would have to cart water in buckets from the handpump to the toilets over a distance of over a hundred metres which is a labourious exercise. Given this water shortage the toilets began to stink badly and became a potential health hazard. Moreover, the three septic tanks for treating the sewage were also improperly designed and the outflow from them was collecting near the tanks and creating a stinking pool of dirty water that was contaminating both surface and ground water. One of the septic tanks had even cracked due to improper design and construction that left one of the brick walls of the tank exposed without a retaining support, as a result of an inadequate understanding of the topography and soil quality of the area on the part of the mason who constructed it, adding to the problems.

To rectify the situation it was decided to build a ten thousand litre concrete tank on top of the highest hillock in the campus so as to provide enough water storage for the present and future needs of the school at all points as shown in the picture below.

This then brought us up against a new problem of filling this tank with water. The one HP submersible pump could deliver water at a very slow rate to this tank which is at a height of about 20 metres above the hand pump. Matters were compounded by the fact that the voltage of the electricity supply was low and often fell to 160 Volts or so instead of the standard 240. Ideally the Madhya Pradesh State Electricity Board should be providing 240 Volt three phase AC supply to rural areas so that farmers can run pumps of 3 HP and upwards for irrigation purposes. However, the reality in most remote areas of the state is, that the supply is in two phases of low voltage of about 160 Volts with the third phase remaining even less at 20 to 30 volts and effectively non-functional for running pumps. That is why throughout rural areas in the state, two phase capacitor driven 1 or 2 HP pumps have become popular. However, given the low voltage there is a limit to the head up to which these pumps can raise water. The submersible pump of 1 HP took eight hours to fill up the hill top tank and often when the voltage became very low it would stop pumping altogether.

Given the uncertainty of electric supply we installed a 5 HP diesel generator and this improved the delivery of water by the pump but this was an expensive option that could be adopted only in emergencies when there was no electricity supply at all due to load shedding and not regularly. To solve this problem it was decided to lift water from an open well shown below that was there in the campus which was being used only for irrigating the two vegetable farms in the campus. The submersible pump in the hand pump was to be used henceforth only for drinking water purposes.

The problem was that this open well too had a 1 HP pump on it and unlike submersible pumps these pumps have less power and so it could not push water up to the hill top tank located at a distance of 250 metres and height of 25 metres from the well. First we replaced this pump with a 2 HP pump from Kirloskar Brothers but that too did not work. We then chose a 2 HP pump from another company and that also failed to work. Finally, a third pump from yet another company was able to lift water up to the hilltop tank, thus solving the problem temporarily. There was a small hiccup as the weight of all the water in the pipeline proved too much for the plastic foot valve that we had put at the end of the suction pipe and it went kaput!! We then replaced it with a more robust foot valve. Currently the water level in the well is very high and just 2 metres below ground level. But as summer approaches and the water level goes down it is likely that the pump will not be able to lift water to the hill top tank. Therefore, in future we will have to make a further investment in replacing the 1 HP submersible pump in the hand pump with a 2 HP one.

The bigger problem was regarding the disposal and reuse of waste water. Huge amounts of waste water were being generated from the bathrooms and toilets and these were being released untreated into the surface and ground near the septic tanks and were polluting the water sources of the school and also other farmers nearby in the village. First the cracked septic tank was repaired with reinforcement and supported by a retaining wall to ensure that it did not crack again as shown below.

Then a water treatment system was put in place to clean the water flowing out of the septic tanks. This consisted of plastic 200 litre drums laid horizontally filled successively with brick crush, sand and charcoal as shown below. Though the use of these three purifiers is well established, it is the first time in India that they have been put into a horizontal drum assembly to reduce the costs involved in water treatment. Since space is not a constraint, this is a very cheap and effective system.

The water from the septic tanks enters this system of tanks and gets purified while passing through them to reach a Biological Oxygen Demand level less than the 30 mg/litre value for release into the soil prescribed by the Central Public Health and Environmental Health Organisation. However, instead of releasing this water into the soil it is being collected in a tank and recycled to flush the toilets thus saving considerably on the use of potable water for this purpose as shown below. The waste water consequently flows in a closed loop repeatedly after being treated. The excess treated waste water is used for gardening and plantation purposes. There is a vigrorous soil and water conservation and plantation exercise going on in the school to improve both water and biomass availability so as to eventually make the campus energy sufficient also.

So now the toilets in the school are being used regularly, they are not stinking and the waste water is not polluting the environment resulting in a sanitised atmosphere conducive to good health. A very happy resolution of the exasperating and persistent problem of cleaning India in a remote corner of its vast expanse. However, this has not been achieved without considerable difficulty. Kakrana is situated in hilly terrain 45 kms distant from the nearest town of Kukshi where all the hardware, cement, steel, sanitary fittings and pumps are available on sale. There are no competent, masons, plumbers and electricians available in Kakrana and so they have had to be brought from Indore and Ahmedabad all of three hundred kilometres away to implement the project. Consequently the average cost per a unit consisting of a bathroom and toilet has worked out to be a whopping Rs 70,000. The Government, international agencies and NGOs on the other hand want to build these units for Rs 20,000 by skimping on the costs of water supply and waste water treatment and that is why they end up making a royal mess of the whole exercise and India remains as unclean as ever. We had initially budgeted for Rs 40,000 per each bathroom and toilet unit but due to the complexities of the problem, eventually the cost escalated. Even now there is a need for a further investment of about Rs 5000 per unit to replace the submersible pump in summer. Even if we economise on the use of vitrified tiles, ceramic and brass fittings and quality of construction there is no way in which the cost can be less than Rs 50,000 per bathroom and toilet unit at current prices. This is something that no poor rural household will be able to afford and so it must be borne by the Government if it wants to see a clean India. Like in the case of education, so also in the case of sanitation and water supply, the investment is easily recovered through greater productivity of individuals.

Incidentally this is a decentralised system and so the cost is comparatively low. If the same system were to be designed for the whole village of Kakrana then the cost would go up considerably because centralisation in the case of WSS leads to higher per unit costs. This is in fact the main reason why in metropolitan cities like Mumbai and Delhi water supply is inadequate and waste water is mostly being released untreated into the soil and water bodies resulting in these cities having stinking rivers that are biologically dead flowing through them. So the only way to a clean India is to implement decentralised WSS systems combined with water harvesting like the one in Kakrana not only in rural areas but also in the cities and towns.

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