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Tanzania, Water and Sanitation

Utilizing Technology to Improve Clean Water and Sanitation in Tanzania

An old Lebanese proverb, "hygiene is two-thirds of health," accurately describes the importance of having access to clean water and sanitation. This is something that is often overlooked and taken for granted in many developed countries, like the USA. In 2012, Tanzania, a developing nation in East Africa, launhed its First National Sanitation Campaign; its key message was '*usaf ni ustaarabu unaanza na sisi.'*, which roughly translates to "cleanliness is civilization, it begins with us" (Mwakitalima et. al, n.d.). However, even though Tanzania spends approximately 70% of its health budget on WASH (water, sanitation, and hygiene) related diseases, 4 million people in Tanzania lack access to safe water, and, another 29 million lack access to improved sanitation (*Tanzania Population (Live) - Worldometers*, 2023). To avoid exposure to countless WASH-related diseases and ensure the quality of food crops and prepared meals, these numbers must reduce significantly.

Tanzania is the largest country in East Africa and, as of July 16th, 2023, has a population of 67,601,593 (*Tanzania Population (Live) - Worldometers*, 2023). A typical Tanzanian household has four to five members; the average for urban areas is 4 whereas the standard for rural areas is 5. Tanzanian homes are usually built from mud, bricks, and concrete blocks with metal roofing. Fireplaces in homes are rare; if a family needs heat, they will often light a stove in the room. Windows differ throughout Tanzania: in urban areas, sliding panels of glass with bars and sliding mosquito mesh are common, in more suburban areas, glass-free windows with mesh are common, and in small villages, windows may have bars with no mesh or glass (*HGTZ: Home Construction Methods in Tanzania*, 2017).

The typical Tanzanian diet is based on starches: millet, sorghum, beans, and pilaf. The most commonly eaten food is *Ugali,* a dough made out of cassava flour, maize, millet, or sorghum and is served with a sauce that contains meat, fish, beans, or other vegetables (White, 2021). Vegetables such as *biringani* (eggplant)*, nyana* (tomatoes)*,* beans, *muhogo* (cassava)*,* spinach, and maize are frequently eaten. As smallholder family farms in Tanzania represent 83% of all agricultural holdings and contribute to 75% of the nation's agricultural output; most Tanzanians get their food from their backyard and sell surplus food to people who are not farmers (*Tanzania - ALIGN*, n.d.) In rural areas, Tanzanians only eat meat once a week at most. This traditional Tanzanian diet causes less inflammation and a healthier composition of bacteria and fungi in the gut than a more Western diet (Stražar et al., 2021).

In 2015, the Tanzanian government removed all of the school fees that were required for lower-secondary schools and as a result, enrollment in lower-secondary schools increased by 31.6 percent (Thelwell, 2019). However, secondary schools in Tanzania are not free and even public schools can end up costing about 300 dollars a year once the cost of uniforms, shoes, and school supplies are added up (*How Much Does School Cost? | Scolastica*, n.d.). On November 24th, 2021, Joyce Ndalichako, the Education Minister, removed the ban that prohibited adolescents mothers from returning to school after pregnancy;

this encourages more females to stay in school and receive an education, but more can still be done to protect girls' rights to education (Hall, 2022).

The healthcare system in Tanzania has improved significantly over the past couple of years; however, it is not nearly as good as those in developed nations or even those in South Africa. The country's public health care system is struggling due to a shortage of trained medical staff, a lack of funds, and limited access to adequate medical technology (*Tanzania Healthcare System for Expatriates - Expat Financial*, n.d.). Since most of the hospitals are located in cities, people residing in rural areas must travel to cities to get treatment. Over 60% of healthcare facilities are run by the government and the other 40% are run by faith-based organizations; however, Tanzania is progressing towards universal healthcare and the government even allocated 387.9 million dollars for the health sector (International Trade Administration, 2022). Up to 40% of this budget is financed by international donors; this includes the United States government, which contributes through organizations such as the USAID, The United States Agency for International Development, and the CDC, Centers for Disease Control and Protection (International Trade Administration, 2022).

An increase in clean water and good hygiene practices would be beneficial in cutting down healthcare costs. Furthermore, it will help increase the number of girls who receive secondary education in Tanzania because the girls will not need to travel many kilometers to bring back clean water for their families. Some alarming statistics regarding clean water and sanitation in Tanzania are that 43% of Tanzanians are relying on water that does not meet the safety standard and about 12% of the country is using the bathroom outside on the ground in fields, forests, or along the countryside. This is causing human waste to be flooded into rivers, springs, and ponds by the rain (Lifewater, 2019). Additionally, 17% of Tanzanians have no place to wash their hands, and another 35% of the population have a hand-washing facility but no reliable source of safe water or soap; even worse, the percentage of people practicing open defecation and those who have no place to wash their hands have largely remained constant since 2000 (Lifewater, 2019).

Most water sources (rivers, lakes, etc.) are contaminated by practices such as open defecation, doing laundry, and washing dishes at water sources and sewage. Therefore women, particularly those who live in rural areas, have to spend multiple hours per day walking several kilometers to try and get clean water. This leads to more gender-based violence (women run the risk of being attacked while walking long distances) and a higher chance of girls dropping out of school. Despite sending women on kilometer-long walks to get clean water from pumps, a large share of poor households still use and consume contaminated water. Good water quality is especially important for the elderly and children because these two groups are at a higher risk of suffering from illnesses from contaminated water due to a weakened immune system. Poor water quality can lead to malnutrition, diarrhea, typhoid, polio, and cholera, which are all WASH diseases. This in turn will increase the healthcare costs for families.

Food also runs the risk of being contaminated due to unclean water. In a study in Dar es Salaam, a commercial port city in Tanzania, the preparation of food was found to be one of the highest sources of fecal indicator bacteria on women's hands (Pickering et al., 2010). *Enterococcus faecalis* causes many serious human infections, such as urinary tract infections, endocarditis, bacteremia, and wound infections. To be treated for this, people will have to go to a hospital which raises the healthcare costs for their

families. Furthermore, contaminated water which has fecal matter that is used for irrigation can cause nutritional imbalances within the plant or the crop; this is linked to foodborne illness from microbes, parasites, and viruses in humans. Nutritional deficiencies can cause stunted plant growth, death of plant tissue, yellowing of the leaves, and the gradual death of the plants (Silva & Uchida, 2000).

The Tanzanian government is well aware of the drawbacks of not having clean water and sanitation; as such, they have tried to implement several measures and strategies to improve those conditions. One such strategy was Tanzania's National Sanitation Campaign (NSC). The first phase of the NSC was a four-year program that ran between 2011 through 2015 that aimed to improve water supply and sanitation in rural areas (Chitty et al., n.d.) By helping Tanzanians have access to clean water and sanitation in their homes, the government would be allowing children in these homes to have the opportunity to go to school and get an education instead of walking many kilometers to collect clean water. The campaign was successful in raising awareness as 61% of survey respondents stated that they had heard about the NSC; among these respondents, 86% of them recognized that using or building an improved latrine is good for one's health and safety (Chitty et al., n.d.). However, despite the awareness of the health benefits that result from improved sanitation, the majority, close to 60%, of the population still use traditional pit latrines. And of these facilities, 57% of them were reported to be in poor hygienic conditions. Additionally, even though more than half of the survey respondents claimed to have heard of the NSC, only 16% of households reported having improvements made to their latrines (Chitty et al., n.d.). Therefore, it can be concluded that while the NSC program was successful at raising awareness and educating the rural population in Tanzania about clean water and sanitation, there was an overall lack of implementation.

Another strategy that the Tanzanian government has implemented to help their rural populations have access to clean water is the solar-powered Water ATM. In order to use these machines, a user places their card on the machine's scanner and the machine dispenses the desired amount of water. Most Water ATMs are designed to operate 24 hours per day (Rite Water, 2020). On August 15th, 2022 Tanzania launched its first Water ATM in Morogoro (World Waternet, 2022). Water ATMs are advantageous because they use reverse osmosis (which prevents waterborne diseases), reduce the dependency on unclean or packaged/bottled water (which is typically expensive), are powered by a renewable solar energy source, and provide a major source of water in areas where drinking water is scarce. In Tanzania, Water ATMs provide 20 liters of water for 25 Tanzanian shillings (about 1 US cent). This is relatively cheap; however, some people question whether water ATMs are a viable solution to improve access to clean water (Next Billion, n.d.). A major concern among critics is that water ATMs disconnect the consumer from the water ecosystem (Root, 2019). Additionally, having a lack of spare parts results in a limited capacity to repair broken schemes and a Water ATM has a lifespan of merely 10 years and costs 1200 dollars a year (Chanda, 2020).

As a possible replacement for the use of Water ATMs in rural communities, I would recommend the installation of Life Pumps. Created by Design Outreach, an Ohio-based non-profit organization, this hand pump is already being used in countries such as Zambia, Kenya, Ethiopia, Malawi, and Mali. It reaches up to 150 meters underground, three times the depth of standard hand pumps, has a lifespan of 30 years and costs $5,000; this includes the cost of educating the community about using the pump and determining the areas in which it is viable to set the pump up (Design Outreach, n.d.). Local Design Outreach partners will be the ones who drill the wells, install the pumps, and provide proper maintenance

and training to ensure the longevity of the LifePump, and all this will be done in partnership with the local communities. The only downside to the Life Pump would be that it does not meet the needs of the entire Tanzanian population. The pump needs to pull water upward from an aquifer and since most aquifers are found in porous and permeable rocks (such as limestone), the Life Pump would not be effective in urban areas; however, it has proven to be a very effective resource in rural communities (Design Outreach, n.d.). As the pump cannot be installed in urban areas, Water ATMs can continue to be used in those areas.

In addition, I recommend the installation of a compost toilet such as an Eco Loo. As said above, the lack of implementation of improved hygiene facilities was one of the main downfalls of Tanzania's 2011 - 2015 NSC. Of the few latrines that were built through the program, most of them were traditional pit latrines. Pit latrines are disadvantageous for a few reasons: the pit may release a foul odor, it can be a favorable breeding ground for flies and mosquitoes, and it can often pollute groundwater if it is not placed carefully. An EcoLoo is a sustainable toilet that is eco-friendly and sewage, energy, and water free. The removal of solid waste is not required and it isolates and eliminates disease-carrying pathogens. The only negative that is associated with the installation of the EcoLoo is the cost: it costs 800 dollars to install each Eco Loo and 60 dollars for the yearly microbe supply (EcoLoo Group, n.d.)). Unlike the Life Pump, however, the Eco Loo can meet the needs of the Tanzanian population as it can be used in a wide range of areas: rural areas, refugee camps, high-rise buildings, etc. Another advantage of installing the Eco Loo instead of using traditional pit latrines is that an Eco Loo would allow people to fertilize their soil with organic matter which would better their soil's health and increase crop yield and H_20 retention in soil (EcoLoo Group, n.d.).

This project could be managed and overseen by the Tanzanian government. As they have already started the National Sanitation Campaign, a strategy designed by the Tanzanian Ministry of Health and funded by the Global Sanitation Fund (GSF), they can continue to use the outreach strategies implemented by this campaign, but focus on distributing more of the funds to implementation rather than just outreach. The Tanzanian government would also need to partner with NGOs (non-governmental organizations) such as Design Outreach and the Eco Loo group so that they will be able to install their technologies. In addition to funds from the Global Sanitation Fund, Tanzania can also count on outside sources for financial assistance as most LifePumps are already funded by donations from various people and/or organizations.

The Government of Tanzania (GOT) estimates that it will require about $1.2 billion annually to achieve their target goal of having universal access to water by the year 2030, and that $200 million will be required annually in order to eliminate open defecation in Tanzania by 2025 (Tanzania, 2022). Although Tanzania's WASH sector budget allocation are highly biased in favor of water supply investment over investments in sanitation and managment of water resources,, USAID activities are currently estimated to provide over one million Tanzanians with access to an improved water supply and help over two million people gain access to improved sanitation facilities by 2025; the USAID's budget for their New WASH Activity, which aims to increase access too sustainable water and sanitation services across Tanzania, is $25 million to $49.99 million (Tanzania, 2022). Some of the money from this budget could be allocated to financing new technologies such as the LifePump and the EcoLoo. In addition to USAID funding, Tanzania also received a new $300 million International Development Association (IDA) credit and a $4.9 million Energy Sector Management Assistance Program (ESMAP) grant for their Sustainable Rural Water Supply and Sanitation Program (SRWSSP); this will allow the SRWSSP to expand the program

from 86 distinct councils in 17 different regions to 137 district councils in 25 regions of the country, where they would be able to install new technologies like the LifePump (van Leggelo-Padilla & Nabeta, 2022).

However, the Tanzanian government will need to work on better improving the communication and collaboration between districts, as that was one of the factors identified as something that could be improved by the National Sanitation Campaign (Chitty et al., n.d.) This could be done through monthly meetups of different district leaders; they could discuss how clean water resources and sanitation facilities are improving in their districts in response to the implementation of new plans. Additionally, having a specific person in charge of overseeing each of the districts' progress would help the GOT determine which districts need more funding.

Although the Tanzanian government, the Tanzanian Ministry of Health in particular, plays a massive role in ensuring that this project is successful, the role of community members is equally as significant in implementing this plan. Since they are the ones who will be using the new technologies every day, they need to be educated on how to use them. Therefore, educational policies about new technologies will also need to be something that is funded by the Global Sanitation Fund to make this project successful, at least for the EcoLoos since education about the LifePump is already provided. This could be done in local community outreach centers headed by people who are already educated about the technology; these outreach centers can also be used to raise awareness regarding sanitation and hygiene. Furthermore, the government can also continue raising awareness about sanitation and teaching about new technologies in schools. If teachers reinforce discussions about hygiene with practical demonstrations of good hygiene practices it will encourage more students to adopt these practices in the future. Another important component of education will be to ensure that these hygiene practices are being reinforced in homes. Therefore, outreach activities for families and communities are important: this can include tasks such as putting up posters regarding hygiene practices, setting up a school WASH club that organizes good hygiene practice demonstrations in the community, or involving communities in the construction or operation of sanitation facilities. By continuing to teach about sanitation and hygiene in primary schools, the Tanzanian government will be able to ensure that the next generation is well aware of the benefits associated with good hygiene practices and reduce the percentages of WASH-related diseases in the future.

Inadequate sanitation is a leading cause of poverty in many developing countries, including Tanzania; by creating access to clean water and promoting healthy hygiene practices, Tanzania will lessen the spread of waterborne diseases, reduce healthcare and medicinal costs, increases the chances of girls having an education, and ensuring that the food that is being cooked is safe for consumption. The Tanzanian government continues to work towards better sanitation access for all of its citizens, and as a part of its Vision 2025, they have pledged to increase access to sanitation to 95% by 2025 (United Republic of Tanzania, 2011). Although the task may prove challenging, it will no doubt benefit both the citizens and the country as a whole.

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