Technological Solutions for Improved Water Security in Somalia

Access to nutritious food and clean water is essential for human survival and prosperity and their absence can have disastrous effects on individuals and societies. Globally, the consequences of poor clean water access result in approximately 829 000 deaths every year (UNICEF, 2023). Somalia is a country with poor standards of living and a climate with little and unpredictable amounts of rainfall. Consequently, the lack of access to quality freshwater and the ramifications that this poses to households, industry, and agriculture is a significant issue in Somalia. Therefore, this report will aim to find the status about the clean water access in Somalia as well as some possible solutions for improving the situation. It will focus on a couple of technological solutions, namely sand dams, solar-powered water cleaning and shade balls.

Somalia is a trouble-ridden country located on the horn of Africa. It is a relatively large country with around 17.6 million inhabitants divided into diverse groups (Utrikespolitiska Institutet, 2023). The country is a federal republic with an elected president holding the executive power. The legislation in Somalia is passed by the parliament and the head of government is the prime minister, who is appointed by the president (Britannica, 2024). Although the people in theory should have great influence over the politics in Somalia through elections for parliament and president, the seats of power in government are in reality divided amongst a handful of powerful clans in accordance with a pact. Two self-ruling autonomous states are located inside the internationally recognised borders of Somalia, namely Somaliland and Puntland. The local areas of Somalia are dominated by numerous clans which are commonly at conflict with each other, or the central government (euaa, 2023). The public sector is also the most corrupt in the entire world (Transparency.org, 2022).

The most important industry by far is agriculture which stands for 62.7 per cent of GDP (Utrikespolitiska Institutet, 1990). The efficiencies in the sector are small, however, with the average farm size only being around 2-4 acres (IPC Info, 2005). These factors combine to make life harsh as well as fuelling conflicts. Moreover, with growing threats of climate change, the situation is likely to worsen in the future.

Life in Somalia is difficult for most, with big families of on average 6.2 people (Somalia Health and Demographic Survey, 2020), usually living in smaller huts made of simple building materials (Nations Encyclopedia). Food security is poor and the food available is lacking nutritional value since calorie-rich foods like pasta and rice make up an excessive portion of the diet. (Relief Web, 2020). However, many Somalis lack even this basic access to food, as can be seen by the fact that 23 % of children under five years of age are underweight (Somalia Health and Demographic Survey, 2020).

Lack of quality drinking water is one of Somalia's greatest challenges. Freshwater is a basic resource is fundamental to survival and wellbeing. A society requires it in great quantities and for many purposes: cooking, agriculture, industry and healthcare. The agricultural sector uses big quantities of water, including 73% of the global groundwater withdrawals, showing how necessary and prioritised it is in societies around the world (UNESCO, 2023). Moreover, irrigated farmland increases the yields of more than 100 % on average, meaning improved access to freshwater correlates with increased food production (The World Bank, 2022). However, only 58.3% of the population has some access to freshwater, and although this number has increased significantly from 23.7% in 2000, it remains a problem for food security for the foreseeable future (Gapminder, 2022). Somalia is in the tropical desert climate zone, with natural dry periods (Utrikespolitiska Institutet, 2023). For instance, the average rainfall in January is around 1 mm/month (ibid). Additionally, there are great variations of precipitation between years, making it even more difficult for farmers and communities to plan and create stability and food security (SIPRI, 2023). Furthermore, severe droughts are expected to become even more common in the future as an effect of climate change (ibid). Besides, as conflicts and weak economic growth persist in the country, the solution will have to be swift and efficient to prevent loss of life and economic output.

Widespread malnutrition is one of Somalia's greatest challenges. One of the primary reasons for this is climate change, which causes food insecurity through conflicts as well as increasing the likelihood of extreme weather events such as droughts and floods. Above one million people in Somalia had to flee from their homes because of climate change in 2022 alone, rendering it one of the single greatest challenges. Furthermore, the global temperature is predicted to rise steadily in the coming decades, meaning the problem could worsen in the coming years. An efficient solution is needed for solving such a large challenge with limited resources.

Sand dams are reservoirs of clean water stored inside a mass of sand. Compared to other methods of water storage, this is more suitable for usage in dry areas since the sand greatly reduces water evaporation. (World Bank, 2022). Sand dams are cost effective and efficient, and work even during the worst dry periods. They work by collecting water and sand that flows through seasonally active rivers inside concrete walls running perpendicular to the flow of the river. They provide several benefits over other ways of water storage. Firstly, evaporation is prevented since the moist cannot escape from the sand and mud (ibid). Secondly, the flow through sand cleans the water from most impurities, generally making the water drinkable unless previously heavily contaminated, for instance by heavy metals (ibid). Lastly, sand dams prevent the reproduction of waterborne parasites as well as the malaria mosquito, making the water and the surrounding areas safer (ibid). Once built, sand dams are very durable and are expected to withstand more than 100 years of use without any significant maintenance (UNFCC). Building sand dams requires some planning ahead since it is almost impossible to construct them in a running river. The construction phase therefore needs to start in the dry period. The negatives of sand dams are that they are not possible to implement everywhere. They need a solid riverbed and walls, preferably made of stone, to minimise the leakage into the ground (World Bank, 2022). They also require engineering and infrastructure in form of roads or other transportation to transport some of the necessary materials.

A similar solution is the usage of shade balls to prevent evaporation. They are made of durable plastic with carbon covers and are spread out over the water surface. Shade balls are designed to absorb UV light and prevent heat transfer, which greatly limits water evaporation (Ferris, 2016). Compared to sand dams, they are more expensive, last shorter and cannot be produced locally.

Another solution to the lack of freshwater in Somalia is to make use of the surplus of unclean water during the rainy seasons and clean it using solar power technologies during the dry seasons. Somalia has a sunny climate with an average of 3000 sun hours per year, 34 % of all hours of the year (RCREE). This, combined with its proximity to the equator makes it suitable for solar power (ibid). One of the major advantages of solar cells for energy production compared to other forms of energy is that it is modular and possible to implement on smaller scales closer to communities. It works without key infrastructure and is especially useful during times of crisis since it also does not depend on

advanced equipment like generators for energy conversion. For instance, in 2019, a group of scientists from Malaysia were able to construct a water-cleaning device using 2 modules of 120 W solar cells along with a rechargeable battery. This device produced around 0.2-0.5 litres/hour (Solar power based portable water purification system, 2019). More refined products utilising similar technology also exist. One example is Solvatten which is able to produce 10 litres of pure, drinkable water every 2-5 hours (Solvatten). The price of around SEK 1300 might be too much for large-scale use, but in offgrid communities and during crises, it may be the only option (ibid). Especially during times of flooding, the availability of water is great, although it is seldomly clean (Solar power based portable water purification system, 2019). Furthermore, since it is completely modular and independent of other infrastructure, systems like these can provide clean water for much of the day, regardless of ongoing crises or lack of infrastructure. The primary drawback of water purification using solar power is that it is expensive compared to the water output. Another issue is that it only produces clean water during sunny conditions, which although reliable given Somalia's warm and sunny climate is enough to render the expensive system useless the majority of time. For these reasons, solar powered purification will never be able to alone provide all the water needs for a society, however, it is a great compliment in rural areas or during natural disasters when other infrastructure fails.

In conclusion the clean water access in Somalia is inadequate, especially in the dry and poor rural areas of the country, where it is needed the most. This results in the spreading of infectious diseases as well as inefficient agriculture, effects that lead to numerous deaths and widespread suffering. With ongoing conflicts combined with the advent of a more extreme climate situation, cheap and sustainable ways of producing large amounts of clean water are necessary. Sand dams provide a way of storing and purifying large quantities of water for a long time and can provide the backbone for water access in locations with the right geographical properties. Solar-powered water cleaning is another option that is best used in rural areas or during crises but cannot alone sustain agriculture and industry. Overall, widespread investment into sand dams where possible as well as infrastructure for distributing this water to other places is a feasible technological solution for improving food and clean water security in Somalia for the long term.

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