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CURRENT AND FUTURE CHALLENGES FOR BETTER WATER SUPPLY SUSTAINABILITY IN SOMALIA

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Abstract : **Maintaining water supply is linked to our daily routine and is a vital issue for every individual in Somalia and around the world. Sustainable water supply systems should provide an adequate quantity and quality of water for a given demand without compromising future capacity to expand that volume and superiority. Water frameworks in the realm of sustainable progress must not include exploitation of water in the strict sense, but must include frameworks in which the use of water is generally required. Water is accordingly at the center of climate change adaptation as it is the central link between the climate system, mortal society and the environment.**

For Somalia, water is the mainstay of social, economic, and environmental growth and component.

Nevertheless, the increasing pressure on water and the associated disaster is a growing problem. Somalia is a water scarce country with just 411 cum of renewable freshwater per capita (as of 2017 [01]) (World Bank, 2020). This is a glaring decline over time from 2,087 cum in 1962 [2] (ibid.) and far below the initial figure of 1,000 cum per capita per time advocated by UN. In the face of rapid population growth, the deteriorating superiority of groundwater resources due to overexploitation, overpopulation, and pollution poses an additional challenge. In addition, these threats are exacerbated by climate change, which has manifested itself in alternating waterfalls and water scarcity. As the mean periodic water decline is projected to increase by 1%, 3%, and 4% by 2030, 2050, and 2080, respectively [3] (using the 1981-2000 reference period) (FGS, 2015), and combined with increasing variability, more severe failures and cataracts are expected in the coming years. Climate change, environmental degradation, and the increasing struggle for scarce water, strained rangelands, and other natural reserves are the main causes of insubstantiality, degradation, risky poverty, and food insecurity.

Keywords. **Somalia, Water supply, Water challenges, Sustainability of water supply, Water resources.**

I. INTRODUCTION

i. Context

Somalia, officially the Federal Republic of Somalia, is a country in East Africa. The republic borders Ethiopia to the west, Djibouti to the northwest, the Gulf of Aden to the north, the Indian Ocean to the east, and the Federal Republic of Kenya to the southwest. Somalia has the longest coastline on the African mainland. Its territory consists mainly of plateaus, plains and highlands. Warm conditions prevail throughout the year, with sporadic monsoon winds and uneven rainfall. Water resource management, sustainability, and development are important to the country's development and growth, which is why improving a National Water Resources Strategy (NWRS) is an important part of the country's development agenda. Somalia can be divided into nine main watersheds, with the Juba and Shabelle rivers playing a very important role in Somalia, the second being referred to as the breadbasket of Somalia.

Climate change, environmental degradation, and the increasing struggle for scarce water, strained rangelands, and other natural resources are the main causes of threat, alienation, dangerous poverty, and food insecurity. This poses a notable challenge in facilitating access to water for Somalia's estimated population of about 16 million in 2020, which is growing at a rate of 3% per year [5] (United

Nations Department of Economic and Social Affairs, 2019), with an expected population of 38 million by 2050.
Against this backdrop, the water authority in Somalia is pressured by limited horizontal and vertical harmonization between water sector organizations and people's sector organizations that support socioeconomic expansion.

ii. **Water supply**

Water supply, obtainable water on condition that to meet a certain need. If the need is domestic, manufacturing, or agricultural, the water must meet both qualitative and quantitative requirements. Water supplies can be obtained through various types of engineering measures, such as boreholes, dams, or catch basins. Population growth, economic expansion, and dietary changes have resulted in ever-increasing demand for water and, consequently, stress on water resources. In many parts of the world, there is persistent water scarcity, which generally refers to the fact that the demand of all sectors and the environment for water cannot be satisfied due to the influence of the water routine on the water supply or the superiority of water.
The supply of fresh water that sustains social health and ingenuity is ultimately consistent and accounts for only about 1% of the world's available water. High-quality, non-saline water is of paramount importance worldwide to meet the growing demand for staple foods, fuels, feeds, and oils.748 million people worldwide lack access to a reliable supply of high-quality drinking water, and current indicators do not reflect the safety and reliability of water sources. Expanding requirements for access to safe drinking water means significant improvements for many billions of people.

iii. **Water supply sustainability in Somalia**

Sustainable water supply means seeking new trustworthy and resilient tactics for numerous human needs for water that do not consume water sources and native economies or have long-term negative impacts on the environment. Agriculture consumes about 70% of the world's current water supply, while domestic and industrial consumption is about 8% and 22%, respectively. Drinking water for domestic use is usually obtained from surface or groundwater sources, otherwise from rainwater harvesting. Other sources include fog or humidity collection, bottled water, or low-impact purification of snow or seawater.
Water is at the heart of sustainable development and is essential for socioeconomic growth, healthy ecosystems, and human survival. It is motivated to improve population health, prosperity, and productivity while reducing the burden of disease across the planet. It is essential for producing and sustaining a wide range of benefits and services for society. Water, a limited and indispensable resource, is essential to human well-being. Only when properly managed is it renewable. By 2025, two-thirds of the world's population will live in water-scarce countries, as more than 1.7 billion people live in river basins where human use exceeds natural recharge. Water management can play an important role in increasing the resilience of social, economic, and ecological systems in the face of rapid and unpredictable change, even though water can be a serious barrier to sustainable development.

iv. **Challenges for better water supply sustainability**

The world's water resources are already under great pressure. Global warming and population growth will only exacerbate these problems. Improving water supply, sanitation, and hygiene systems is among the Sustainable Development Goals to be achieved by 2030. However, in underdeveloped countries, particularly in sub-Saharan Africa, it remains difficult to ensure long-term sanitation and hygiene. For this reason, a thorough analysis of previous and recent work on sanitation and hygiene challenges in Somalia was conducted. The results show that topography, lack of skilled and experienced staff, ineffective policies and strategies, people's habits and attitudes, rapid population growth, socioeconomic disparities among urban dwellers, and lack of financial resources together constitute most of the barriers to sustainable sanitation and hygiene in Somalia. In addition, it was found that Somalia can achieve sustainable sanitation and hygiene if there are policy commitments, increased public education and awareness about sanitation, and collaboration between the government, nongovernmental organizations, civil society, and communities to address sanitation issues. Climate change will further exacerbate the situation. Hundreds of millions of people in China, India, and other Asian countries depend on river flows fed by melting Himalayan glaciers. These glaciers are melting, and many will disappear this century, taking water supplies with them. Hundreds of millions more people depend to some extent on snowmelt. Even if snowfall rates remain constant, climate change will alter the timing of these runoffs. Warmer temperatures will cause snowmelt to flood rivers earlier in the spring, making them inaccessible during long, dry summers.
In general, Somalia faces a number of difficulties (current and future) that should be analyzed, dried out, and studied to achieve a good outcome for the challenges, because water sustainability is linked to our daily lives and is an important issue for all people in Somalia and around the world. In addition, some of the obstacles are due to government problems, such as lack of a plan or budget allocation for developing sustainable water supply, etc. And some of the difficulties are due to people's good deeds, such as dropping drops and collecting water. The fact that both Shabelle and Juba reverses are located in the Ethiopian border area also has an impact and could be difficult. Climate change is also a barrier to improving the sustainability of water supply in Somalia.

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II. METHODOLOGY

Since there are many problems in the water sector and there is not enough fresh water for domestic use and also for agriculture and industrial products, the main states of the country are facing water shortage in the last 30 years, especially in the last 3 years there is an extreme drought due to water happiness and water stress, so it is necessary to find and collect factual data and studies. To get support from the public and government to make sure the future results are fair. The strategy of this research is to tell ways and other important methods such as (deed drop i.e. collect and conserve water and harvest water and how to fetch from sources) and weaknesses such as (how to remove obstacles) to build a good plan and maintain vital strategy and how to solve the water supply problems that are challenged and make comparative in the system and projected between Somalia water supply and developing countries for water supply as shows (Figure 1) and how effective the water management system is as well as how much water is in this area.

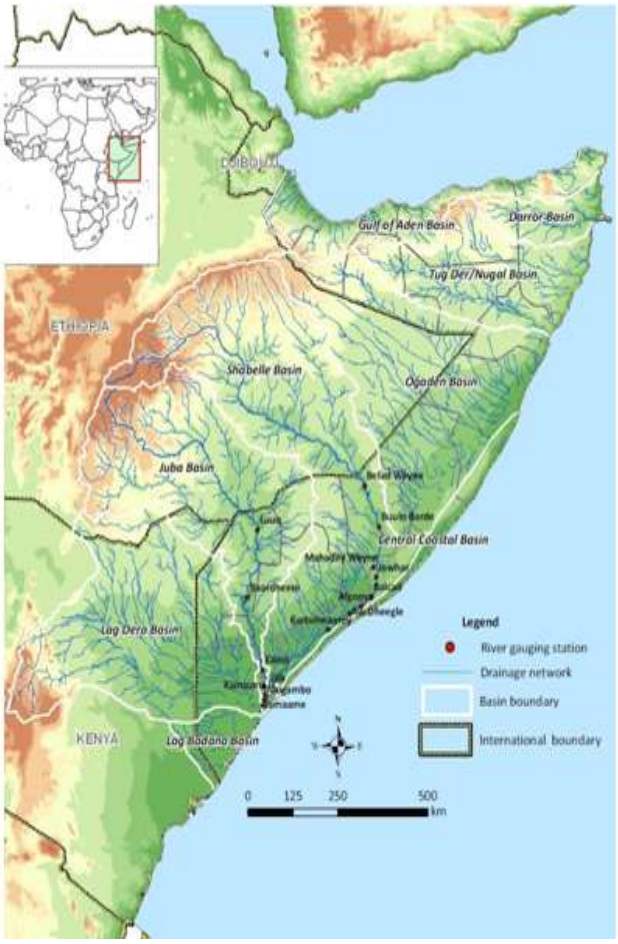

Figure 1 Show the Drainage Map of the study area, Somalia

This study explores the concept of water sustainability and develops UNICEF water sustainability standards for Somalia. It analyses and evaluates several cases of water use in Somalia in different sectors.

III. DISCUSSIONS

I. Water resources in Somalia

Rivers, streams, lakes, reservoirs, springs, and groundwater are examples of spring water. There are a variety of water sources, such as rivers, wells, and rain.

a) Rivers

The great rivers play an important role in the geography of Somalia.

- **Shebelle River**

The longest river in Somalia is the Shebelle. The highlands of Ethiopia serve as the beginning and end points of the river's 702-mile course. Only when it rains is the section of the river that runs along the Somali coast active. The mix of natural events such as evaporation and man-made activities such as irrigation has caused the river to dry up during periods of low rainfall. During the rainy season, the Jubba River, which receives water from the Shebelle River, empties into the Indian Ocean.

- **Jubba River**

Similar to the Shebelle, the Jubba River originates in Ethiopia and has a length of 624 kilometres. This river flows south from the Ethiopian border. Some of Somalia's most productive agricultural lands are believed to be located near the Jubba. Hyenas, lions, gazelles, giraffes and hippos are just some of the creatures that live in the alluvial plain between the Jubba and Shebelle rivers. In addition, this flat land is necessary for local agriculture and export products. The main export commodities are rice and sugarcane, while local markets are supplied with maize, sesame, fruits and vegetables. One obstacle to ongoing agricultural production is flooding and lack of water.

- **Dawa River**

In terms of size, the Dawa River is the third most important river in Somalia. It rises in the mountains east of the town of Aleta Wendo in Ethiopia, but flows through the southeast of the country for 279.6 miles. It then forms part of the border between Ethiopia and Kenya before continuing into Somalia. This river empties into the Jubba in Somalia. Gold and titanium minerals have been discovered in its valley.

- **Environmental Threats to Somalian Rivers**

The trend of decreasing regional rainfall and the resulting droughts are two of the greatest threats to Somalia's rivers. Although some of the rivers listed above flow year-round, climate change has caused their tributaries to dry up recently. Aridification, disappearance of wildlife habitat, and impaired agricultural production are the consequences

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of this loss of a reliable water source. In addition, water scarcity in this country will contribute to slower and stagnant economic growth, deterioration of human health, and an increase in poverty. Before it is too late, the Somali administration must implement a plan for managing the country's natural resources. To protect the country's biodiversity and overall well-being, other governments and organizations must also fight to halt the effects of climate change.

- **Water Resources Management and Monitoring Systems**

Management of the water resources of the Juba and Shabelle rivers aims to contain flooding and ensure a continuous supply of irrigation water. The traditional Somali view is that access to land near rivers is a prerequisite for water use, while no permit is required for water abstraction. The previous Somali government enacted water regulations that govern how agencies involved in water management operate. One example is the Natural Water Resources Law of 1984, which restricted access to and use of the waters of the Juba River. The central government created a legal and institutional framework to control water use at the national and regional levels. In addition, systems were put in place to control flooding and irrigation. For example, in Middle Shabelle, flood flows were diverted to the Jowhar Reservoir, a large natural depression that can store up to 200 million cubic meters of water and regulate floods downstream. When water levels were low, water diverted into the JOSSR was returned to the river, providing much-needed water for irrigation upstream and alleviating drought conditions during this time. With the collapse of the Somali government, gains in flood and agricultural water control and management were soon reversed. Due to vandalism and lack of maintenance, the facilities created were no longer functional, and the irrigation and flood control infrastructure was destroyed. As a result, flooding occurred repeatedly in the Juba and Shabelle river basins, leading to massive economic losses.

- **Major Rivers Of Somalia**

Table 1. Discribes us the major rivers of Somalia and their origin and length of each river.

No	Somalia's Major Rivers Name	Length of the River
1	Shebelle River	702 miles (Cooperative with Ethiopia)
2	Jubba River	624 miles (Cooperative with Ethiopia)
3	Dawa River	279.6 miles (Sharing with Kenya and Ethiopia)

b) Ground water

The Somali population relies on groundwater for household water, livestock, and small-scale agriculture, except for those living along the Juba and Shabelle rivers. Boreholes, shallow wells, and springs are the main sources of groundwater in Somalia.

The majority of boreholes in Somalia are the main source of water because they provide water when other sources dry up and are available year-round. Most boreholes in the country are between 90 and 250 meters deep, although in some places they can reach a depth of more than 400 meters.

Most shallow wells are no deeper than 20 meters. Depending on the aquifer, these wells yield different amounts of water in different regions. The average production rate from shallow wells ranges from 2.5 to 10 m3/hour, and from boreholes from 5 to 20 m3/hour.

Somalia faces many obstacles in developing new groundwater resources, one of the greatest of which is poor water quality. Most groundwater resources throughout the country have salinity levels above 2,000 S/cm, which is above the limit required for drinking water. In addition, many of the shallow wells are not weatherproof, making them susceptible to contamination from microorganisms and other sources.

The alluvial deposits and worn bedrock traversed by the two year-round rivers in southern Somalia contain the best hydrogeologic locations for groundwater exploration along the major togas. Groundwater flows along two pathways in the areas enclosed by the Gulf of Aden, Darror, and Nugal catchments. The first path connects the southern highland areas of the Gulf of Aden with the northern coastal regions. The second is a north-south connection that follows the Haud and Sool plateaus. The hydrogeologic division largely parallels the surface drainage division. The following are some areas with good groundwater potential:

- The alluvial plains of the Juba, Shabelle, and Lag Dera rivers.
- The old drainage networks of the Mudug-Galgaduu, including Galkayo and Dhuusamarreb.
- In the Juba and Shabelle basins, the Baydhaba plateau, Buur, Waajid and Damassa regions.
- In northern Somalia, there are plateaus and valleys (Sanaag region, Haud plateau, and Darror valley).
- In the central coastal belt and northern coastal regions, there are shallow aquifers in the sand dunes (freshwater lenses).

c) Rain water

Somalia experiences considerable evaporation of surface waters due to low rainfall and hot temperatures. The low humidity and downward velocity of the air are the main factors contributing to the low and unpredictable rainfall in Somalia. In addition, Somalia is located on the leeward side of the highlands between Kenya and Ethiopia, which exposes the country to additional light precipitation. Gu and Deyr form the bimodal rainfall distribution of Somalia. Throughout the country, the seasons arrive at different times. Gu, the first main season, lasts from March to July, and deyr, the second, from August to November. In general,

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April to June and October to November are the months with the most rainfall during these seasons. Jilaal and Haggai,
Which occur between December and March and July and August, respectively, are the country's two dry seasons. Based on the pattern of average annual rainfall, Somalia has a desert to arid subhumid climate. Rainfall is significantly influenced by the Somali Jet and the intertropical convergence zone. Other important factors that lead to strong variations within the country are orographic and coastal influences. The areas with the highest precipitation include the Shabelle and Juba basins, with annual averages of 460 and 427 mm, respectively (SWALIM, 2007). Although precipitation decreases further inland to the south, with Upper Shabelle (Hiran and surrounding areas) receiving up to 400 mm per year, the region between Shabelle and Juba valleys receives comparatively high precipitation of about 500-700 mm per year. Further north, the annual rainfall decreases, except for the areas near Sheikh, Hargeisa and Borama, which receive 500-600 mm. In the Ceerigavo area, 400 mm of precipitation per year may fall. On the north coast, the annual rainfall is low, less than 100 mm. The same is true for the interior of the north coast. (Lasanod, Qardo and Scuscuban). Central Somalia and the rest of the northern region receive an average of 200 to 300 mm per year. The southern regions of Juba, Shebelle, Mogadishu and Bay have the greatest rainfall potential in Somalia, according to the three diagrams.

Water resource management system.

Water actually gives life to all people in Somalia. In particular, the environmental pressures caused by population growth, urbanization, industrialization, and climate change have become a major issue of global concern. Freshwater resource is one of the most affected resources. Threats and risks to the quantity and quality of a natural resource that is critical to human life, health, and social and economic activities are increasing due to the demand for the world's freshwater resources. Climate change is projected to have direct impacts on populations by increasing the frequency of extreme events such as floods and droughts, raising sea levels, altering seasonal precipitation patterns, and affecting the recharge of glaciers, snowpacks, and groundwater. The importance of sustainable water resource management cannot be underestimated.

SWALIM actively promotes the use of water information by decision makers to conserve and improve water resources and effectively manage groundwater and surface water for domestic, agricultural, commercial, industrial, recreational, and environmental uses. Use early warning systems to reduce loss of life and property due to water-related natural disasters such as floods and droughts.

Contribute to the sustainable development of Somalia's physical and economic resources for the benefit of present and future generations.

Water is a valuable resource that affects the functioning of all economic sectors in Somalia, as the country is mainly characterized by drought. The majority of Somalis depend on agriculture and livestock, which increases the demand for water in the country. Most of Somalia is arid or semi-arid, and only a few regions receive enough rainfall to support rain-fed agriculture. Irrigation is the only practical solution. In the southern basins-especially along the Juba and Shabelle rivers-irrigated agriculture is widespread. It is less common in the northern basins and in the natural oases. Most of Somalia still relies heavily on livestock as a source of income. Over the years, the SWALIM project has established surface and groundwater monitoring systems in Somalia to support the planning, development, and long-term use of the country's precious and valuable water resources.

IV. CONCLUSION

Water is the driving force of nature; it is the greatest natural resource, but only 3% of it is fresh water, and only a third of it is usable for agriculture and cities. The rest is either buried too deep or frozen in glaciers.

Aquifers - underground freshwater reservoirs - are now the main source of water for over 2 billion people. Rising global income levels have increased demand for water-intensive products such as manufactured goods, meat, and dairy products, putting pressure on freshwater supplies. This increase in global freshwater consumption has led to the depletion of more than half of the world's major aquifers, a situation that is certain to worsen as demand increases. Freshwater supplies are projected to decline by 40% at this rate, threatening the security of vital resources such as food, water, and electricity.

Climate change can threaten ecosystems and habitats that protect vital water resources as the planet warms, limiting people's access to these resources.

When a country has enough water to meet the needs of all stakeholders, from agriculture to communities and industry, it is said to have a sustainable water supply. In addition, it means that the availability of water is not affected by the impacts of climate change, such as drought and insufficient rainfall or flooding caused by abundant rainfall. Sustainable water also refers to water that is provided in the most effective manner while maintaining an economic balance between supply and demand. Combining conventional water treatment methods with renewable energy sources can lead to energy-neutral water sustainability. Water sustainability also refers to the efficient and comprehensive management of water resources. A sustainable, coordinated, and comprehensive approach to water management is currently needed because of the multiple demands on water resources.

A water supply system will only be viable if it allows for efficiencies on both the supply and demand sides. If efforts to meet water demand are focused on preventing water waste, they will be sustainable. Reducing waste helps reduce

water use, which delays the demand for new water sources. On the supply side, it is critical to improve the ability of water utilities to manage and maintain their systems and reduce water losses, leakage, and energy use. A fair pricing structure and "smart" investment plans are also important to ensure cost recovery. All options for increasing water supply must also be evaluated in the context of the entire life cycle.

The use of water-efficient technologies can significantly reduce demand by reducing water consumption. Investments in less water-intensive industries and more energy-efficient structures lead to more sustainable water supplies. Adoption of water-saving technologies is feasible because of the tangible prospects of financial savings, social benefits (such as cooperation among different sectors of society to achieve a common goal, environmental awareness among the population, etc.), and a variety of environmental benefits. A sustainable water supply requires a series of coordinated actions, not a single tactic. It depends on everyone's willingness to conserve water, government regulations, and changes in the construction sector, redesigned industrial processes, and land use, among other factors. To ensure the sustainability of the system, it is difficult to develop mechanisms of regulation, incentives, and affordability.

Compliance with ethical standards

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