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**Table** **of** **contents**

* Introduction
* What is water and sanitation Infrastructure
* The scarcity of water in Africa and the developing countries
* Factors that influence water scarcity in the developing countries
* Water and health
* Diseases cause by contaminated water
* Water treatment in developing countries
* Impact of Covid 19 pandemic on the water sector in developing countries
* Case study
* Solution to water crisis or scarcity in the developing countries
* Advantages and disadvantages of water and sanitation Infrastructure to the body
* Alternative water sources
* Conclusion.

**Water and Sanitation Infrastructure in developing countries.**

**Introduction**

The accessibility to improve in water and sanitation Infrastructure has been looked at as a very crucial process Saving people most especially infants from the adverse health outcome like diarrhea, typhoid fever, amongst many that threatens human health. This process of improving on water and sanitation Infrastructure in the developing countries has stimulate world wide donors communities to develop some aids aimed towards this process. Clean and accessible Water is very important to human but yet over 40% of the global population does not have access to sufficient Clean water. This lack of water especially in the developing countries has posses a lot of treats to several sector like the food security which has been proven that agriculture uses about 70% of the world accessible fresh water.

Developing countries are most affected by water shortages, flooding and poor water quality and infrastructure as 80% of illnesses threatening loves in the developing countries are link to inadequate water and sanitation Infrastructure. This illnesses are as a result of pollution or the rise in Sea level contaminating water sources with adverse human activities that risk this water sources. This stress from lack of water and sanitation get to affects girls and women more as they are engage in economic activities more than men like household choice and agricultural management which turn to alter their health and safety.

Efforts in improving water and it’s relations like sanitation and Infrastructure in delivery safe water for Consumption and all related uses in the developing countries are not enough to ensure water services. This call on use to endlessly cheap in all efforts and strategies to ensure access by the population to save water which depends on the country and it’s social needs. Below is a detail elaboration and expansion on the topic water and Sanitation Infrastructure in developing countries

**What is water and sanitation Infrastructure.**

**What is water:** water is a substance which compose of the chemical element hydrogen and oxygen and it exist in the gracious, solid and liquid state. Sanitation refers to public health conditions related to clean drinking water and the treatment and disposal of human waste and sewage. This sanitation system include the capture, storage, transport, treatment and disposal or reuse of this human wastewater. Water infrastructure refers to the underground highway of pipes that bring to us on the surface water which is a resources sustain life and take it away from us to waste water after use. Therefore to get clean water for Consumption domestic agricultural and other purpose of use for human activities is important to think of water sanitation and good water infrastructure. This sanitation also refers to the provision of safe facilities and services for human waste disposal. According to W.H.O and UNICEF many people worldwide and most especially those in the developing countries lack access to basic sanitation facilities and drinking water. This inadequate access to clean water sanitation has put a lot of threat to lives especially children every day by contributing to lives lost through dead and increase the level of poverty for most of the families and communities as most income that could have been use on other things will be use in the treatment of health complications cause by water borne diseases like diarrhea, cholera and others. With these challenges at hand we need to jointly unit our hands to take concrete steps to get clean water and Sanitation Infrastructure they save our environment and lives. This water can be gotten from different sources such as streams, rivers, oceans, wells, reservoirs and others that when properly handle and purify can be save for drinking.

**Water scarcity in Africa and developing countries**

It has been predicted that by 2025 if water has not been well manage by most countries in the developing countries which include Africa, the scarcity of water will be at it dangerous level that will risk humanity who will suffer from fresh water shortages. The water scarcity in Africa are cause by physical and Economic scarcity, rapid population growth and climate change. This water scarcity does not hold to getting water but the lack of fresh water resources to meet the standard water demand if the population. Some countries if this developing countries go through a seasonal scarcity of water like the sub Saharan Africa which has a plentiful supply of water but it unevenly distributed leading to frequent flood and drought in some parts. This increase in the scarcity of water indicate a leading challenge in the sustainable development has been so due to the increasing number of the river basin which has been reach through the combine demand of agriculture and other sectors whose impact ranges from health most especially those of women and girls, education, agricultural productivity and sustainable development.

To properly address the issue of water scarcity within this African countries the UN economic commission for African emphasis the need to inverse in the development of Africa's potential water resources to reduce the rate at which people suffer to get water, ensure food security and protect the economic gain by effectively managing factors and activities like drought, flood and desertification that contribute or lead to water scarcity. This can be achieved by laying emphasis on some human activities that helps preserve water like implementation and improvement of digging of wells, clean and water storage tanks and rain water catchments system that can store water for future use. The water scarcity can be define as either the scarcity in availability due to physical water shortages or scarcity in access due to lack of adequate infrastructure. They are two types of water scarcity as earlier mentioned above which are the physical water scarcity which occurs in situation where there is not enough water to meet all the demand of human including that needed for ecosystem to effectively function and secondly the economic water scarcity which is cause by lack of investment infrastructure or technology to draw or get water from Rivers equity and others Water sources. It can also be due to the insufficient human capacity to satisfy the demand for water. This water scarcity is due or is a result of natural and man made causes which rank the physical water scarcity as the leading problem affecting people in the developing countries and also globally.

Over exploitation of water sources by human and physical factors contributed to the shrinking of many African’s lake like the lake Chad that has been a great source of many activities and hat helps humanity has now shrunk in the volume putting human and it’s activities at risk

**Factors that influence water scarcity**

1. **Size of the population.** Developing countries has very fast increase in population which has influence the scarcity of water supply to the population due to it increase in demand. Also as the population increases water resources is gradually diminishing due to the increase in the habitation in places that were previously water sources. With a high demand for improvement in health quality of live, food security and lubrication of industrial processes growth which all needs the usage of water placing severe constraints on the water available to meet up with this goals activities. The rise of population in urban cities due to migration has also threatens water to be scarce or fluctuates in some of these urban cities leading to water imbalance in supply and demand. The pollution of water resources mostly in urban centers has also been due to the increase in population that generate a lot of sewage that at times are dump in to water sources like streams, rivers without proper treatment which turn to infects and contaminate water and it sources.
2. **Climate change.** The emissions of greenhouse gases and other human and natural activities like deforestation and earth quake that has lead to global warming and eventually climate changes. When global temperature continue to rise, rainfall will increasingly become a beast of extremes, long dry spells, dangerous floods and eventually climate changes. The long term impact of this climate change include changing pattern of rainfall affecting agriculture and reducing food security worsening water security decreasing fish resources in large lake like that of lake Chad which is due to rising temperature, shifting vector-borne diseases, rising sea level affecting low-lying coastal areas with large population and rising water stress. These impacts can drastically affects the quantity and quality of water that people need to survive In the developing country
3. **Pollution.** Some areas in the developing countries are bless with abundant water but pollution has made it very unsafe for human activities untreated sewage and waste water from human activities such as factories industries and many more has cause serious problems as some water sources that could have been save for human use and consumption can be contaminated through the penetration of pollutants like the sulphuric acid through the soil in to streams and rivers leaving human being with scarcity of clean water.
4. **Poverty.** Developing countries lack at times money to maintain water to be clean and safe for human activities. This leaves many of this areas with water scarcity as the population can not afford for water treatment like buying chlorine, water filters and other use for water purification. This further go a long way to risk the lives of the population as when they consume contaminated water will suffer from sickness and some eventually die in the long run. The above factors and many more has affect water quantity and quality causing water scarcity.

**Diseases caused by contaminated water**

Safe and ever ready water is very important for public health and well being of the general public regardless of it usage which can be for drinking domestic use, food production or recreational purposes. A country's economic growth can be improved by improving water supply and sanitation when water resources are better manage. In 2010 UN General Assembly recognized the right of all citizens to water and sanitation in the developing countries. Good drinking water is from a good source that is free from contamination like faces, chemical and sewage.

Contaminated water and poor sanitation and Infrastructure are greatly linked to transmission of diseases like cholera, diarrhea, dysentery, typhoid, polio and hepatitis A. The absent, inadequate or inappropriately management of water and sanitation or it infrastructural part expose people in a community or Individually to preventable health risks or danger of infection and diseases when this water, sanitation hygienic infrastructure is lacking. When we fail to manage industrial and agricultural waste water, sewages and others water contaminants most especially in the urban centers if the developing countries, many people will have high risk of developing water borne diseases that when not properly treated will lead to high dead rate especially maternal and child mortality. Therefore to reduce this dead rate and infection around the globe especially those in the developing countries which are highly impacted there is a great need for good water and sanitation Infrastructure.

Also when we improve water sources and make the sources accessible, people spend less time and materials I getting it and turn to be more productive in other ways like spending less on health due to lack or less illnesses cause by water borne diseases. The international authorities on public health and water quality WHO has take the lead globally in putting efforts to prevent transmission of water borne diseases by advising government and individual on the development of health based target and regulations. WHO has also put in place a guide line in drinking water, safe use of waste water and safe recreational water environment. This guide line are based on managing risks which has being of great help since 2004 in the developing countries. This frame work recommends establishment and supplementation of water safety plans by water suppliers to identify and manage risks from catchments to consumers do as to reduce contamination. An example of such is the joint action by WHO and UNICEF about issues of water and health sanitation and hygiene in health care facilities. In 2015 these two agencies jointly developed WASH FIT ( water and sanitation and hygiene in health facility improvement tool ) who is a adaptation of the water safety plan approach which is aim to guide small primary health care facilities in low and middle income setting through a continuous cycle of improvement through assessment, prioritization if risks and definition of specific targeted action and in 2019 report describe practical steps that countries can take to improve water sanitation and hygiene in health care facilities most especially those in the developing countries. This health facilities require adequate quantity and quality of water in order to get and maintain a high quality of hygiene and hygienic environment. To improve sanitation appropriately waste disposal and personal hygiene are as crucial as this areas of health facilities have been recognize by WHO as environment with a high prevalence of infectious diseases agent where staff, patients, care giver and neighbors if the said health facilities face unacceptable high risks of infection if environmental health is inadequate. With water and sanitation hygiene WHO guide line recommend that health center should have consistent running water, Clean toilets safe refuse disposal, clean beds and birthing rooms.

**Water treatment in developing countries**

Getting assess to Clean and safe drinking water is a major problem many people face today world wide most especially in the developing countries. According to environmental protection agency passage of the clean water act in 1972 and the safe drinking water act in 19974, any water supplied to the public must meet a minimum standard to ensure safe water and public health. Therefore it is very important to confirm your water has been treated or purify before drinking. There are many methods of water purification use in the developing countries today with each method having it’s merit and demerits. Below are some of the methods use;

1. **Boiling;** it is the cheapest and safest method of water purification. Water sources can render most of our drinking water unsafe for drinking like contamination by germs and parasites which can not be seen with bear eyes but they have an Effects which can be live threatening. In this case drinking water is connected and boil for this germs and others contaminants to die then allow to cool in a cover container before drinking.
2. **Filtration;** it is one of the effective way of purifying water when you use the right multimedia filter which effectively take away or remove compound from water. This method uses chemical and physical processes to purify water to make it safe for human Consumption by eliminating both the large compound and small contaminate that causes diseases . This method is of added advantage in that it does not completely eliminate all mineral salt giving an added advantage to it.
3. **Distillation;** this method utilized heat to collect pure water in the form of vapor when water is collected with it’s contain if contaminants like chemicals and heat to it boiling point, it is then allow at this boiling point until it vaporizes. Since water has a lower boiling point compare to other contaminants. This vapor is directed and collected in to a condenser to cool. When it is cool it is then reverse in to liquid water which is very clean and safe for drinking and the other contaminants which certainly have a higher boiling point are left as sediments in the container.
4. **Chlorination;** chlorine is a powerful chemical that has been use for so many years to treat water from bacterial, germs, parasites and others. As it has an ability of killing them. It can be in the form of powder or tablet which when dissolve in water perform it function especially when the water is at more than 21 decree Celsius.

**Impact of Covid 19 pandemic on the water sector in developing countries.**

Covid 19 pandemic has negatively affected the economy of developing countries and the world at large. The water industry was adversely affected which has slow down and changes many ways of live both positively and negatively. This Covid 19 pandemic crisis pointed at the importance of recognizing water access as a public health priority. Due to lack of water accessibility, scarcity and poor water due to sanitation and Infrastructure meeting the needs and goals set aside by the WHO to fight against this pandemic has been very difficult in the developing countries most especially in the sub Saharan countries in Africa that lack basic water to meet their daily needs. The practice of hand washing for at least 12 times daily called for the use of abundant water which called for the government and the private sector in looking for lasting solution to this water shortages so as to meet up with the goal of reducing and eliminating this pandemic which one of the way was to provide safe water, sanitation and wastes management which is very vital for protecting human health. Apart from the policy if hand washing that consume a lot of water there has also a great change in water use which is associated with people staying at home and good hygiene practices. This challenges of increase in water consumption has cause water supply companies to increase supply to meet up with the demand thus improving and modernizing some of these developing countries to develop new skills in the water sector.

**Case** **study in Cameroon;**

**Challenges in kumbo community to improve water supply management.**

This case study point us on how deteriorating drinking water supply services delivery can trigger community mobilization leading to a complete take over of management of the system by the local community . It also shows us how participatory management is important in resolving water catchment conflicts and improve cost recovery

**Description**

The kumbo water supply system was initiated in the late 1960s and was realize in 1972 with a complex ownership claim by the Nso community water. This project was realize with the support if the people of Canada through the efforts of an elite of Nso. The government of Cameroon also gave a support by playing a role of a diplomatic and technical services. Due to this little support from the government, the kumbo counsel started over billing the population of kumbo in water consumption which forces many to return to unprotected water sources like streams for their daily water need for over 60 stand pipes were disconnected. There also existed for over 30 years of conflicts over the use of catchment areas by the locals and the municipal water system management. This was due to the forcefully ejection of the locals from their farm land by the Paramount traditional authorities.

**Action taken**

In 1991 the local population took to the street to campaign against this excesses billing that force the SNEC under the counsel to resign from their power that the water project was now manage by the local population who are under their elected management board of leaders. This management board was called the kumbo water authorities (KWA).

**Out** **come**

The kumbo water authorities (KWA) has now reopen those stand pipes that were disconnected and further extended water supply to areas that were lacking. This has resulted in the establishment of an inclusive and a joint participatory community water governance of the KWA that involve key stakeholders like the land owners in the catchment areas . This authorities have also acted in participatory protection and conflicts resolution over the catchment areas. This action brought peace that let to an increase in the willingness to pay for the services due to the more reliable services and better communication between the KWA and the local population most especially those in the catchment areas.

**Key lessons**

Command and control decision making and deteriorating drinking water supply services can be trigger for social and political instability as well as sources of water related conflicts. Authorities base on community organization can be a good platform to enhance participatory governance for the efficient and effective management of water resources and conflicts resolution.

**Solution to water crisis or scarcity in the developing countries**

Despite the high demand of water in the developing countries, fresh water scarcity has been recorded for the pass years while we have seen a need to come out with suggested solutions that can help eradicate this water crisis. Here is a look at the point where expert feel needed solutions will come.

1. Education to Change consumption and life style : educating the general public and motivation of new behaviors such as coping with water scarcity which requires overall of all forms of consumption ranging from individual use to supply chain. The education can also reach the entire population on how to invert new water conservation technologies
2. Improve irrigation and agricultural practices. Agricultural practices which are very common in the developing countries uses a lot of water in meeting up with the cultivation for a fruitful yield. Improving irrigation can help close the gap between supply and demand. Therefore switching to a new modern technology has become an appealing solution to water scarcity.
3. Improve water catchment and harvesting: these water catchment are very essential most in areas with no other reliable water sources. On the other hand those with worst effects of climate change are over having rain water harvesting system of which these efforts provide independent control of water resources.
4. Look to community base governance and partnership; elected members of the community that know of how the areas is and were to locate and harvest fresh water will be of great help in improving water supply. A good partnership with those of good will also cheap in great support for the realization of the water project
5. Improve distribution infrastructure; poor Infrastructure is very devastating to health and the economy. It waste resources adds cost, diminishes the quality of life and allow preventable Water borne diseases to spread amongst vulnerable population most especially children of the thus developing countries.

**Advantages and disadvantages of water and Sanitation in developing countries to the humanity.**

* **Advantages**

1. **Water transport** nutrients and waste products: the human system rely on water to transport all the different substances we need to survive. Blood which carries oxygen and nutrients to the cells contain 83% of water which also plays a good role in eliminating waste products from the system.
2. **Water regulate the body’s chemistry as sufficient fluid is** very essential to preserve the balance of electrolytes like sodium, potassium and magnesium which regulate cellular processes which control nerve communication, heart function and muscle contractions.
3. **Water plays a role in thermoregulation as when the body gets** too hot the body sent water and salt to your skin to release the heat as sweat and when it is cool your blood vessels contract to preserve warmth.
4. **The digestive juice contain water that break down** the food for the body to absorb the nutrients and drinking a lot of water makes it easier for the body to move the food through the intestine reducing the risks of constipation
5. **Access to safe water and sanitation increases** economic return by impacting household finances.

**Disadvantages**

1. **To acquire water and Sanitation Infrastructure in the developing countries,** water will have to go through the process of treatment that requires cost in purchasing the treatment equipment.
2. **To get a constant water** supply it will require sufficient rain fall and large river catchment for the collection of enough water for treatment and constant supply
3. **At times certain areas** can provoke earthquakes when dams are constructed.
4. **Lack of water in the human** system can cause dehydration which lead to malfunction of the body parts that can lead to dead at times or I’ll health.
5. **Contaminated water and poor sanitation Infrastructure** are highly link to the transmission of diseases such as cholera, diarrhea, dysentery, typhoid and many more other health challenges.

**Alternative water sources**

The demand and uses of water can also be made with alternative water sources. Alternative water sources are sustainable sources of water which are not supply from fresh surface water or ground water that can offset the demand for freshwater. These alternative water supply support water resilience by providing diverse water sources. Examples of this alternative water sources include;

* Harvested rain water from roof
* Harvested Storm water
* Reclaim waste water
* Gray water
* Captured condensate
* Atmospheric water generation
* Discharge water from water purification processes
* Foundation water
* Blowdown water
* Desalinated water

**Conclusion**

**Lack of** access to adequate and appropriate water and Sanitation Infrastructure and hygiene can be chronic public health challenges which contribute to the spread of diseases in developing countries and the world at Large of which the situation can be made worse during environmental disasters and environmental health and public health emergencies.

In response to this public health disasters and emergencies, prevention of open defecation and waste containment that get in to our water sources are very critical to reduce the spread of these diseases and while planning for a long term waste management, immediate water and sanitation Infrastructure solutions are very often needed to minimize the spread of diseases and scarcity of water. Only a portion of the world population most especially those in the developing countries have access to clean water and sanitation Infrastructure which is very vital to maintaining public health and prevention outbreak of diseases therefore let’s joint hands to help protect and maintain our water sources to help fight in achieving good health through the consumption and good access to fresh water and sanitation Infrastructure. A human body consist of approximately 60% water and while you can go for weeks without eating, you will only survive for a few days without water as WHO recommend drinking at least two liters of water daily to be healthy and hydrated.

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