

Constraints of efficient domestic water supply management in Sudanese cities

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Abstract: *Urban population in Sudan is estimated to consume 20 liters per capita per day while rural population is about 8 liters only yet at a half times the cost per liter. People in pre-urban centers (e.g. Khartoum and Port Sudan), who constitute about 35 % of the total Urban population, generally do not have access to safe water. This paper focuses in identifying the threats or constraints of sustainable supply (in terms of quantity and quality) of and access for water to Sudanese urban centers of Sudan. Reviewing the available literature, interviewing, as well as, EIA technique (cause – and- effect relationship) were used to satisfy the above mentioned objectives. Sustainable domestic water supply in urban areas of Sudan is found to be affected by three groups of factors: those affect the quantity and quality as well as institutional and managerial factors.*

Factors responsible for water shortage of drinking water in urban areas can be summed up in the following: rapid urban expansion which resulted from poor development and absence of essential infrastructure in rural areas, insufficient number of domestic water treatment plants, limited capacity of net works, and failure of investment in water supply to match the growth of needs. While the demand is increasing of water losses are also increasing as a result of leakage and breakdown. The unaccounted for losses in the distribution systems in Khartoum are as high as 40%. The quality of urban water supply is also questionable. The following factors were identified to affect water quality: contamination of surface water by heavy loads of suspended loads during the flooding season, septic tanks and soak-away wells in urban areas and distribution networks are old and potential weak links. These factors present a constant threat of contamination of ground water sources. Whereas Institutional and managerial challenges of fresh water consumption in Sudanese cities are: lack of institutional foundation and legislations related to production and distribution of drinking water at both national and states levels, insufficient number of well-trained staff needed for water resource development, production and distribution of water, weak flow of credit to finance development projects in the state had led to poor or insufficient coverage of the actual expenses of water supply and sanitation, delay in paying the water fees by the customers made the situation even more worse, deterioration in the working environment at all levels in different water supply treatment plants or bore-hole stations, poor coordination between the Public Water Corporation and State Corporations with regard to integrated planning for developing water resources and specifying priorities for the water production and distribution., there is no agreed standards and specifications for equipments and spare parts needed for the safe water production, weak provision of water safety to protect surface and ground water resources, no application of technical and modern innovations with regard to the production of safe water because of scarce financial resources, Lack of coordination between the state water resources authorities and Ministries of Industry, Health, Education and other related government departments to protect water resources.

Keywords: efficient, constraints, institutional challenges.

1. Introduction

Water is indispensable for human existence and survival. Two-five liters of water perday is required by an adult human, depending on climate and amount of work performed. Water is also needed for cleaning, washing, bathing, laundry, etc.

A consideration of general conditions in Sudan may appear to show that water is found in abundance due to the existence of Nile and its tributaries. Nevertheless, the situation concerning drinking water is very pressing.

In view of water scarcity and prevalence of polluted sources, water supply projects needs to be encouraged and initiated for socioeconomic development and progress of the nation, taking in consideration the need to choose safe, adequate, convenient, continuous and reliable source[1]. The main sources of water in Sudan can be categorized as follows: **Surface water:** It originates mostly from rainfall and includes large rivers, ponds and small upland and seasonal streams, etc.

Ground water: Investigations carried out by Rural Water Supply Corporation indicated 1.4 Km³/year of ground run-off

and 42km³ in storage. There is no doubt that the country would immensely by monitoring and exploiting these resources is an economical and practical way. The situation of the ground water relative to many parameters such as types and characteristics of soils, aquifer capacity, direction of flow, etc. govern this water. Good quality water could be expected to be found almost everywhere in Sudan excluding Uum-Rowaba reservoirs where there is a high range of dissolved solids.

Rainfall: The amount of water to be collected depends on the quality of rainfall, which is subject to the size of the catchments area, rainfall internally duration and distribution. In Sudan the annual rainfall distribution decreases northwards with a mean exceeding 1500 m.m./year in the south and an average of 30 m.m./year in the North [2].

Institutionally domestic urban and rural water supply were two separate bodies till the endorsement of the legislation number 1155 in 1994 which unifies them under the umbrella of "Domestic Water Corporation" in all Sudanese states. It aims at provision of sufficient and safe drinking water for both humans and animals. It should work in collaboration and co-ordination

with the authority in concerned. Moreover, this body is responsible for the supervision of National waters 'projects, credits and grants, and specifying the standards of domestic water and training staff. Water demand for urban and rural areas is estimated to be 3688 million cubic meters per day (20-50 liters per individual in the rural and urban areas, respectively [3]

2. Objectives:

This paper aims at identifying the challenges and Threats of inefficient domestic fresh water consumption in Sudanese cities

3. Methods

Reviewing the available literature, interviewing, as well as, EIA technique (cause – and- effect relationship) were used to satisfy the above mentioned objective

4. Results and Discussion.

Challenges and Threats of Fresh Water Consumption in Sudanese cities were found to be as follows:

4.1. Water and Health hazard

Threats and health hazards related to the consumption of fresh water are summarized into the following:

a) Pollution

Pollution can be classified as: Physical, chemical, biological and from radioactive materials. The possible sources of fresh water pollution are: nitrogen, nitrates, and bacteria. Suspended matter has the following impacts:

- 1) Suspended matter is aesthetically displeasing and the biological degradation of the organic matter may result in harmful by products.
- 2) It provides adsorption site for harmful chemicals or biological organisms which may adversely affect the flora and fauna of the stream.
- 3) Upon settling down the suspended particles affecting negatively the aquatic organisms of the bottom water.
- 4) The suspended matters reduce the light thereby result in reduced photosynthesis and corresponding loss of food production which in turn affects the life of the consumers depending on the aquatic flora for their nutritional requirements.

In concerns with the turbidity of the Nile water treatment plants, the water is used to with high turbidity levels during the flooding season which may reach as high as 384 NTU. This makes water chemically unacceptable for human consumption

b) Floods and Run-off hazards can be represented by the flooding of the Nile and its tributaries, wadies(valleys) , rain fall storms. These sources have negative impacts on human settlements, agricultural lands and essential infra-structure such as roads and bridges. Normally poor water drainage often results in water stagnation which facilitates the breeding of mosquitoes of Malaria, flies other harmful insects.

c) Drought

Drought resulted in the deterioration of agricultural and livestock production and enhances poverty. All these impacts has led to the displacement of rural communities in River Nile State to the nearby urban centers such as Khartoum State where they compete with the original population over resources and essential community services which include for sure the domestic water supply services.

d) Diseases related to Water:

They can be classified into: Diseases resulted from the mismanagement of water resources such as Malaria and bilharzias, from drought and water scarcity such as trachoma which is an eye-disease, diseases related to floods such as Malaria, typhoid, Bilharzias and diarrhea and disease related to water pollution e.g. weak bones.

4.2. Institutional and managerial challenges of fresh water consumption in Sudanese Cities

- a) Lack of institutional foundation and legislations related to production and distribution of drinking water at both national and states levels
- b) Insufficient number of well-trained staff needed for water resource development, production and distribution of water.
- c) Weak flow of credit to finance development projects in the state had led to poor or insufficient coverage of the actual expenses of water supply and sanitation.
- d) Delay in paying the water fees by the customers made the situation even worse.
- e) Deterioration in the working environment at all levels in different water supply treatment plants or bore-hole stations.
- f) Poor coordination between the Public Water Corporation and State Corporation with regard to integrated planning for developing water resources and specifying priorities for the water production and distribution.
- g) There is no agreed standards and specifications for equipments and spare parts needed from the safe water production.
- h) Weak provision of water safety to protect surface and ground water resources .
- i) No application of technical and modern innovations with regard to the production of safe water because of scarce financial resources
- j) Absence of monitoring system of water quality in all states of Sudan except Khartoum.
- k) Lack of coordination between the state water resources authorities and Ministries of Industry, Health, Education and other related government departments top protect water resources in the State from pollution and to prepare land use map for Sudan [4].

4.3. Threats to Fresh water Consumption

These threats can be summarized as follows:

4.3.1 High population growth rate and rapid urban expansion as a result of climatic factors e.g. drought and poor rural development.

Most government offices, industries, business, educational institutions, Hospitals, communication and transport are found in big cities. They therefore attract capital investments and grow further. The two dominant demographic trends in Sudan are rapid population growth and even faster urbanization. These are attributed to be caused by the following factors:

- Drought and desertification eliminating rural livelihoods,
- Mechanized agricultural schemes taking rural land from traditional farming communities,
- Conflict – related insecurity forcing abandonment of rural livelihoods, and
- General fight from rural poverty in search of better livelihoods and services such as hospitals and schools in the cities [3]

4.3.2 Under – investment in infrastructure and utilities to date, not only has urban planning mostly been focused on metropolitan Khartoum, but the plans that have been fully implemented due to under-investment in infrastructure and utilities.

4.3.3 Historical lack of planning although the capital has recently seen considerable investments, its size, high growth rate and historical lack of planning still constitute major challenges.

4.4 Expansion of informal settlements in Khartoum and its impact:

The capital is sprawling rather than dense: population density in metropolitan Khartoum was estimated at approximately 163 persons per square kilometer in 2004. This low figure is due to the fact that 92% of Khartoum’s dwelling plots contain one-level developments of 300 – 500 square meters per plot [4] Moreover, the expansion of built up areas were carried out at the expense of the lands suitable for agriculture, forests and wildlife, while increased abundant at low prices, cool and therefore needs less energy for cooling , easy and quick in construction and easy to be maintained by the people themselves[4].

Key Statistics for Khartoum

Indicator	Statistics
Annual growth rate	4 %
Number of shanty towns surrounding metropolitan Khartoum 1986	96
Estimated population of unauthorized settlements	2 – 3 million
% of central Khartoum covered by water networks	71 %
% of Khartoum connected to sewage system	28 %
% of Khartoum using pit latrines and other basic systems	68 %

Source: UNEP (2007)

4.5 Inadequate and unsafe- drinking water supply:

Sudan actually has sufficient natural water resources in the form of rivers, lakes and seasonal streams and ground water to supply drinking water for the population in virtually all areas, except for some parts of northern desert.

Sudan is classified as one of the countries that face insufficient water supply since the available share of an individual in Sudan is 787.5 cubic meters per annum (Un classified countries as water supply deficit when their individual share is less than 1000 cubic meters per year. Sources of water supply in Sudan are Water networks, Water purchased. from vendors and hand operated pumps [1].

The constraints in supplying adequate and safe drinking water supply are principally due to:

- a) Lack of extraction and purification infrastructure
- b) Under-investment and poverty: these are core obstacles for the supply of water throughout Sudan.
- c) Historical and current conflicts which have exacerbated the problem of .Khartoum’s water supply which is threatened in various ways: sewage can be sucked into water pipes when water pressure falls, boreholes are at risk from the

contamination by septic tanks and siphons as well as pit latrines. As the result of what are previously mentioned, different sources of sewage can pollute both ground and surface drinking water sources.

d. Sanitation and sewage

Problems with sanitation are evident throughout Sudan, and inadequate facilities are the norm rather than the exception outside metropolitan Khartoum. Village fringes, disused lots and seasonal watercourses are commonly used as open toilets, with predictable health consequences. Sanitation issues are most apparent in displaced Person’s settlements that have not been reached by international aid efforts. Such settlements are typically found on the outskirts of towns, and are generally very crowded and unsanitary. Large-scale aid-organized camps are usually in better condition but often face major challenges due to crowding and poor location.

Sewage systems have been installed in Khartoum, but these facilities, which cover only a quarter of the population , are now massively overstretched and not functioning properly. As a result, a large amount of untreated sewage is pumped back into the Nile, with obvious health implications for downstream communities. Most other cities have some form of sewage drainage system but no treatment, so that effluent is discharged directly into the nearest watercourse. In the very dry areas and in towns without a sewage network, the standard solution for the more affluent communities (including the international aid community) is to use a septic tank. When tanks are full, they are emptied by a suction tanker and the contents are dumped, usually in the dry bed of a local seasonal watercourse. This process is particularly inequitable as it essentially transfers the waterborne disease risk from the affluent to the poor, who take their water from such watercourses.

The majority of the urban population of Sudan relies on basic latrines or septic tanks that are emptied by truck. In this case, the load is transferred to the Khartoum sewage works that are emptied by truck. In this case, the load is transferred to the Khartoum sewage works. Though there is a sewage network in Khartoum, it does not cover the entire city and no longer works properly, as it is stretched well beyond capacity [4]

.From other hand the shortcomings in water quality and sanitation in Sudan are directly reflected in the incidence of waterborne diseases, which make up 80 percent of reported diseases in the country. The incidence of disease is highly seasonal: the greatest problems usually occur at the start of the wet season as the rains and run-off mobilize the faecal matter and pollution that have accumulated during the dry season.

The very limited water monitoring that has been carried out has confirmed bacteriological contamination of the Nile in Khartoum state and elsewhere in northern Sudan. Limited groundwater monitoring in metropolitan Khartoum

Improvement of standards of living of urban communities has resulted in the increase of water consumption for drinking as well as domestic uses and this is consequently reflected in insufficient domestic water supply regardless of the substantial increase in water production from riverine domestic water supply. Moreover, the wastewater production is found to increase the burden on the already deteriorated present sewage treatment plants in Khartoum State. This will increase t5he risks of flowing of sewage water into the main Nile and the Blue Nile and its effects on water quality and in the enhancing of water-borne diseases.

e) Rapid agricultural and industrial development has resulted in increase in fresh water consumption and the polluted waste

water which is definitely affecting also the water and therefore there is a sustainable deterioration in water quality.

f) Irrational use of natural resources in general and water resources, in particular.

h) Road building activities as well as heavy truck are usually resulted in the leakage in the main water transmission lines.

i) Reduction in water consumption during winter season results in the destruction in main transmission lines of water due to the increase in water pressure. These has resulted in the deterioration in the asphalt roads and increase the incidence of water borne diseases due to accumulation of stagnant fresh water in these streets[3]-[5]

5. Conclusion

The present achievement and improvement is that 93% of the Khartoum population is now enjoying improved water access (2005). Before 2000s Khartoum had suffered from high shortages of water due to continuous electricity blackout. High losses of water was and still being witnessed in Khartoum due to the corrosion of the networks of domestic water supply as well as the reduction in water consumption during winter season which increases the water pressure leading to breakage of the old pipes. Roads are used to being flooded and a lot of damages to the asphaltic roads in Khartoum State occur periodically as well as heavy trucks which do the same as the increase of water pressure [6]

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