

Trend-line Analysis and Severity Assessment of Water Supply and Sanitation (WSS) of Rural and Urban Area in Somalia

Eng. Abdirahman Ismail Dhaqane,
Dean, Department of Civil Engineering, Mogadishu University

Eng. Aminul Islam Sohan
Lecturer, Department of Civil Engineering,
Mogadishu University.

Abstract

Due in large part to rapid urban population growth in Somalia, this growth will likely increase challenges to municipalities attempting to provide access to water supply and sanitation. This paper aims to characterize trends in access to water and sanitation in Somalia and recognize factors affecting those trends by the determination of severity score. The analyzed water supply and sanitation (WSS) coverage data from the year 1995 to 2010 was collected from Joint Monitoring Program (JMP) which is organized by renowned organizations WHO and UNICEF. From the available data can be predicted the future situation.

The urban of country was found to be increasing access in the categories of improved water supply and improved sanitation. In urban areas from 1995 to 2010, it increases from 24% to 70% of total improved water supply and reducing the amount of time spent collecting water and reducing open defecation. 80% urban people have access to the total improved sanitation. The urban area achieved the lowest severity score

than rural and total Somalia. On the contrary, in the rural area, people do not have adequate improved water supply opportunity and sanitation facility. 91% rural people are deprived of safe water where 41% of rural populations are dependent only on surface water without any treatment or purification. It is also found that 83% of rural people practice open defecation and unfortunately this rate is increasing day by day. As a result, the rural area got the maximum severity score.

Safe water access and sustainable sanitation is a burning need in Somalia. Especially the rural area is the most vulnerable study area in WSS sector. Development organizations should be concerned about the situation and it can be prescribed to raise more WASH (Water supply and Sanitation Hygienic) activities in Somalia.

Keyword: water, sanitation, trend line, Somalia, open defecation, rural, urban, improved, unimproved

Introduction

1.1 Background

Somalia has been a largely stateless society since Siad Barre's government fall in 1991. Somalia is slowly recovering from the civil strife that has hampered the country's development for the past decade (SWALIM, 2006). Parts of the country such as Somaliland, Puntland, Galmudug, Maakhir, and Southwestern Somalia are internationally “unrecognized” autonomous regions. The remaining areas, including the capital Mogadishu, are divided into smaller territories ruled by competing warlords. Although the north of Somalia has some functioning government institutions, conflict prevails in many parts of South-Central Somalia (USAID, 2010). Accordingly, the delivery of water and sanitation services is not operated by any central government as the country is divided by local public entities. Whereas, recovery started in some urban areas influencing many Somalis to abandon their rural homes in search of better economy as well as to get rid of village conflict and natural disaster. This unpredictable placement trend of urbanization especially in pacific region, the water supply and sanitation is pulled down within the limited resource.

1.2 Framework of Study Area

Only the Somaliland and Puntland region has public water supply service. This public water supply system is operated by various water companies which are invested by local businessman and stakeholders. Most of the time, they seek for funding. These water companies provide service; government authority over water planning, policy, and regulation remains virtually nonexistent. Comparatively they are doing well than village or non-water supply zone. Sanitation facilities have no existing piped sewerage systems but a high number of users. In addition,

migration from rural areas has placed added pressure on the few facilities found in peri-urban areas where migrants are settling. About 3 million liters of water are trucked in every day to the camps for internally displaced persons (IDP) to save the lives of children and their families (Adam, 2009). The impact of this is widespread, with, as an example, poor coverage of water and sanitation services, coupled with poor hygienic practice, resulting in high rates of water-related disease such as diarrhea, (including cholera), which accounts for about 20% of the county's under five mortality (UNICEF, 2011). To some extent, temporary facilities have become permanent investments. To maintain these facilities, local organizations and the humanitarian community de-sludge using vacuum tankers. However, de-sludging in this case does not avoid water table contamination because infiltration is not stopped as in a septic tank. Few latrines are equipped with septic tanks and two-thirds of these are not managed. In areas where displaced people have settled, almost no sanitation facilities exist. This forces most to resort to open defecation on the periphery of peri-urban areas and refugee camps (USAID, 2010).

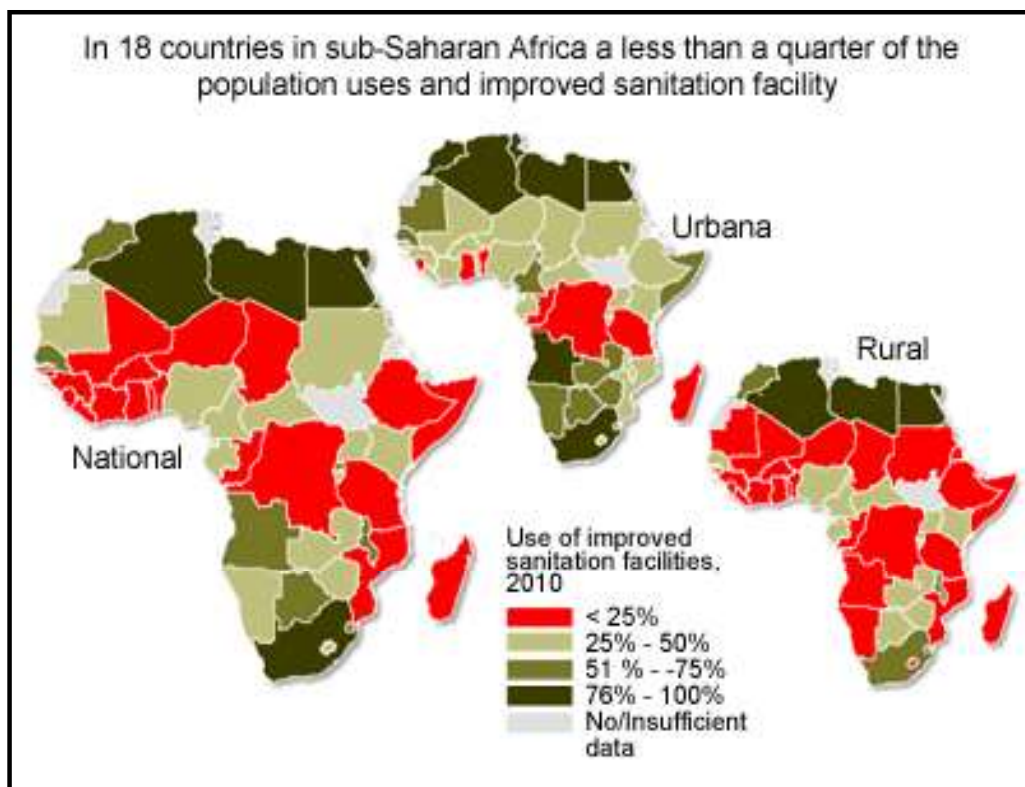


Figure 1: The Competitive Condition of Improved Sanitation in Sub-Saharan Africa

Source: Sohan, 2016

Access to clean and safe water in Somalia is one of the main challenges due to a combination of factors; arid climate, chemical concentration of water sources and human-induced conflict. Moreover, existing water sources are inadequate in terms of accessibility, quality and quantity. The high concentration of chemical components and salinity in the groundwater makes it unsafe for human consumption and even with the presence of surface water it is often contaminated, therefore needing treatment (IOM, 2014) Water scarcity and increasing rainfall variation is a main problem in Somalia. Many of its regions have experienced severe droughts followed by severe flooding. Rural populations are particularly vulnerable for both of the cases as they don't have enough resource or adaptive capacity. Moreover, brutal conflicts

have erupted in localized areas as water scarcity has increased. As they do not have enough sanitation system, they practice open defecation. Different charitable organizations have had to implement major water trucking operations and other measures to deliver water to drought-affected victims. After controlling this situation, the humanitarian agencies, NGOs, and the donor community try to implement Water, Sanitation and Hygienic (WASH) through boreholes and latrine installation in rural community.

1.3 NGO Involvement in WSS Sector

Donor involvement in Somalia's Water Supply and Sanitation (WSS) sector is primarily a humanitarian operation. Very little focus has been devoted to WSS financial, managerial, and technical issues. Somalia receives aid from several multilateral and bilateral sources. The United States is the largest bilateral donor while the European Union is the largest multilateral donor to Somalia. Other major donors include the World Bank, Italy, Japan, Sweden, Norway, the Netherlands, Britain and Denmark. Minor donors include Canada, Finland, Germany and Egypt. Several UN agencies, particularly the United Nations Development Program and United Nations Children's Fund, provide assistance as well. Most humanitarian operations are coordinated through UN – Somalia.

2. Methodology

The whole research was done under five major parts of methodology. Data collection, simulation, analysis, assessment, finding with adaptations was the main process of the study (Figure-1).

Water and sanitation data from the year 1995 to 2010 is extracted from JMP report. JMP is Joint Monitoring Program organized by World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) which is recognized worldwide. Collected data are simulated in two major sections: water and sanitation. These parts are also divided into different segments (Table-1).

Table 1: Data Simulation Ladder in Water and Sanitation Sector

<i>Drinking Water Ladder</i>			
Improved Water		Unimproved Water	
<p>Piped water on premises: Piped household water connection located inside the user’s dwelling, plot or yard.</p>	<p>Other improved drinking water sources: Public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, rain water collection.</p>	<p>Unimproved drinking water sources: Unprotected dug well, unprotected spring, cart with small tank/ drum, tanker truck, bottled water.</p>	<p>Surface drinking water sources: River, dam, lake, pond, stream, canal, irrigation channels.</p>
<i>Sanitation Ladder</i>			
Improved Sanitation		Unimproved Sanitation	
<p>Improved sanitation facilities: are likely to ensure hygienic separation of human excreta from human contact. They include the following facilities: - Flush/pour flush to: - piped sewer system - septic tank - pit latrine - Ventilated improved pit (VIP) latrine - Pit latrine with slab - Composting toilet</p>	<p>Shared sanitation facilities: Sanitation facilities of an other wise acceptable type shared between two or more households. Only facilities that are not shared or not public are considered improved.</p>	<p>Unimproved sanitation facilities: do not ensure hygienic separation of human excreta from human contact. Unimproved facilities include pit latrine without a slab or platform, hanging latrines and bucket latrines.</p>	<p>Open defecation: when human faeces are disposed of in fields, forest, bushes, open bodies of water, beaches or other open spaces or disposed of with solid waste.</p>

Data is analyzed using Microsoft excel to get output as well as its representation. Trend line analysis of simulated data are verified with the coefficient of determination r^2 .

$$r^2 = 1 - \frac{SS_r}{SS_t} \dots\dots\dots \text{(Equation 1)}$$

Where, r^2 = coefficient of determination of straight trend line

SS_r = the sum of squares of residuals of water and sanitation coverage value

SS_t = The total sum of squares of water and sanitation coverage value

The straight line equation is used for trend line analysis and for the future prediction. The straight line equation is

$$y = mx + c \quad \dots\dots\dots \text{(Equation 2)}$$

Where, y = Percent coverage of water/sanitation

m = Gradient or slope of the trend line

x = Water/sanitation coverage year

C = The percent coverage of water/sanitation intercept value

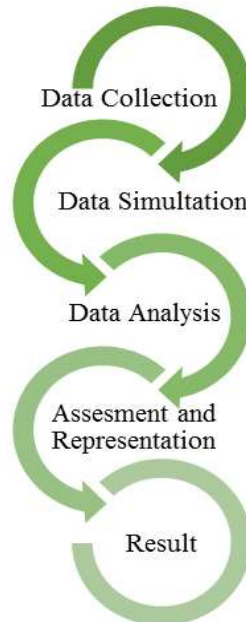


Figure 2: Process Flow Diagram of the Research Study.

To visualize the scenario satisfactory and severity in WSS's study ingredient; the following chart is prepared in six satisfactory and severity scale.

Table 2: Scaling of Sudy Ingredients

<i>Improved System</i>					<i>Unimproved System</i>				
Water Supply	Sanitation	Coverage percent	Scale of satisfaction	Severity score	Water Supply	Sanitation	Coverage percent	Scale of satisfaction	Severity score
Piped water supply, other improve-d water source,	Improved and shared sanitation	90-100	Excellent	0	Surface water and other unimproved	Open defecation and unimproved satiation	0-10	Excellent	0
		80-90	Good	1			10-20	Good	1
		70-80	Adequate	2			20-30	Adequate	2
		50-70	Moderate	3			30-50	Moderate	3
		30-50	Poor	4			50-70	Poor	4
		0-30	Severe	5			70-100	Severe	5

The improved water supply (%) and improved sanitation (%) are scaled up by six satisfactory criteria and 6 severity criteria. The satisfactory criteria are excellent, good, adequate, moderate, poor and severe. As well as severity score is given storm 0 to 5. When satisfactory scale is “excellent” the severity score is “0” and for satisfactory scale “Severe” the severity score is “5”. Maximum severity “5” is considered the worst situation and the maximum satisfactory scale “excellent” refers to the appropriateness or adequacy of sustainable water and sanitation.

For example, when improved WSS coverage 75% the satisfactory scale is “Adequate” and severity score is “2”. If same result 75% is considered for unimproved section, the satisfactory scale is “Severe” and severity score is “5”.

This satisfactory scale and the severity score will help to judge the past, present and future condition at a glance. It will also help to compare with any country’s satisfaction as well as severity at a same platform. But there are some limitations of this scaling too. The coverage percentage is divided in six assumed criteria; 90-100 %, 80-90%, 70-80%, 50-70%, 30-50%, and 0-30% for improved. On the other hand, for unimproved WSS coverage percentage are assumed 0-10%, 10-20%, 20-30%, 30-50%, 50-70%, 70-100%.

3. Results and Discussion

3.1 Trend line of Water Supply Coverage in Somalia

In Somalia, 42% of people are using unimproved water source and 27 percent of people are using surface water whereas only 20 percent of people have improved water source (figure 3). Other 11 percent of people use other improved water source. In the year 1995, it was almost same ration of the distribution factors.

From trend line analysis it can easily be found that, in the year 2015, there was a possibility to meet total improved water supply and unimproved water supply might meet at the same point which is almost 35 %. According to the vice versa trending, it is a matter of hope that after 2020, most of the people in Somalia will be involved using the improved water supply. In the same time it is a matter of regret that, surface water using trend line has a parallel increment with the improved water supply system. For example, in the year 1995 improved water supply was covered by 21 % of people where surface water was 18 % again, in the year 2010, gradually 31% and 27%.

3.1.1 Trend of Water Supply Coverage in Urban Area

Total improved water supply shows an increasing trend line. From 1995 to 2010 it increases 24% to 70%. From 2000-2005 the maximum increasing of improved water supply is almost 22%. Improved water supply shows vice versa result from other unimproved where the other improved water supply shows decreasing trend line (Figure 4-b). As well as the surface water use is also decreasing.

Total unimproved has a significant decreasing trend line. In the year 1995 it was 70% and in the year 2010 it decreases up to 26% (Figure 4-a). Maximum decreasing is from 2000 to 2010 and it was 21%. 2002-2004 was the most significant year both for improved and unimproved water supply. In this year total improved and other unimproved met each other for the same value 48%. At the same time improved water supply starts larger and unimproved started decreasing than improved. On the other hand, surface water use is not significantly decreasing. In 1995 it was 6% and in the year 2010 it was 4%. But less percent of surface water use is better than others.

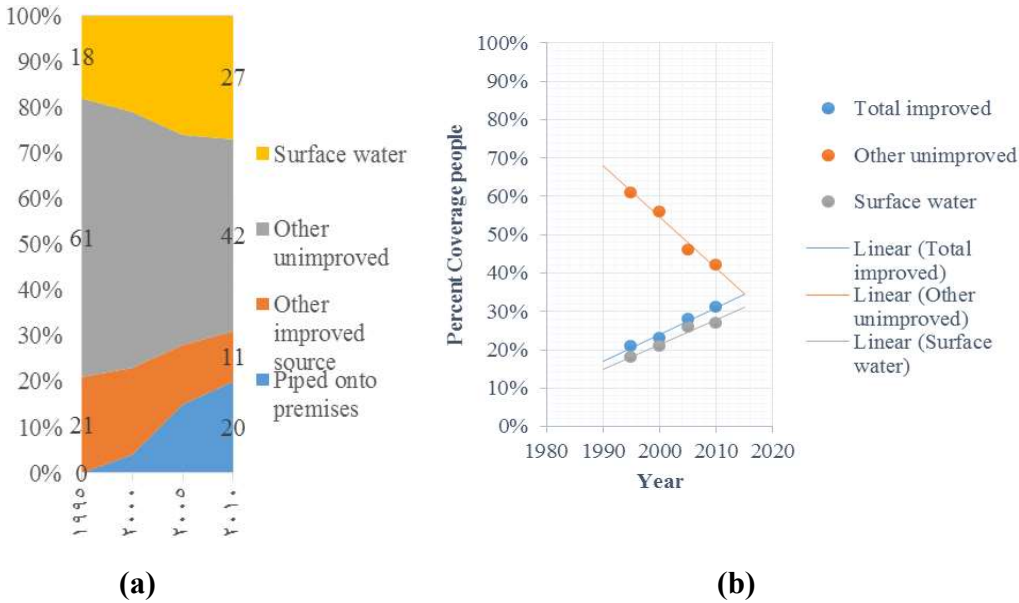


Figure 3: Total Water Supply Coverage in Somalia over 15 years (a) in Volume and (b) Trend line Analysis

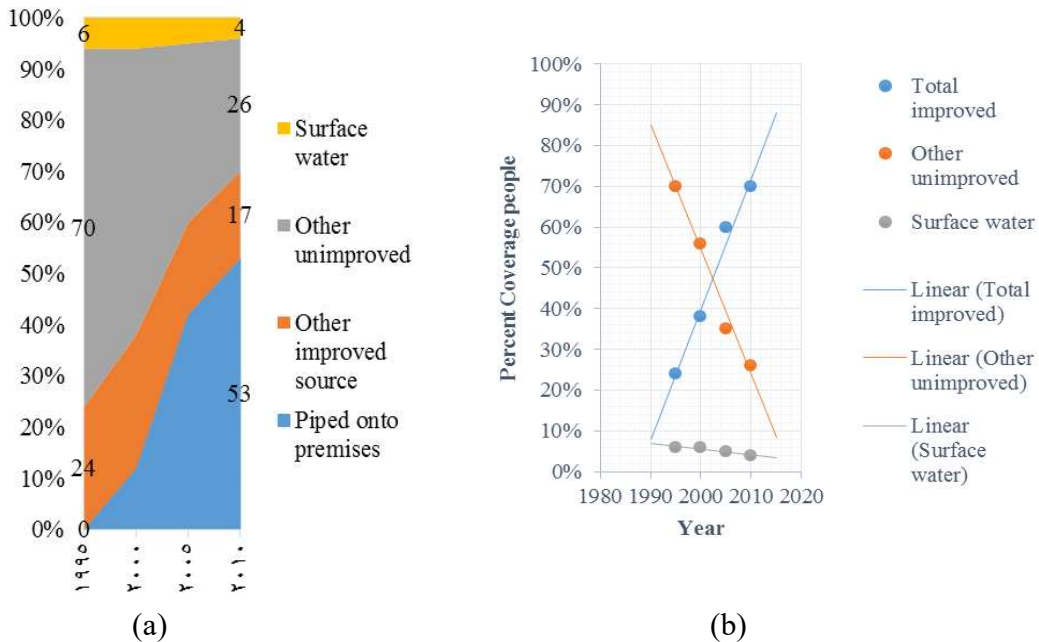


Figure 4: Water Supply Coverage of Rural Area in Somalia over 15 years (a) in Volume and (b) Trend line Analysis

3.1.2 Trend Water Supply Coverage in Rural Area

In rural area people do not have enough improved water supply opportunity. Moreover, then it is decreasing day by day.

From the year 1995 to 2010 it has decreased from 20% to 9% (Figure 5-a) . From trend line analysis (Figure 5-b), here is a chance to meet 0% of improved water supply within 2010. The other unimproved is also decreasing as parallel to the improved water supply. But use of unimproved water is significantly larger than improved and surface water. The total unimproved water used 57% in the year 1995 but in the year 2010 it was 50%. Only 7% decrease over 15 years. Surface water use is increasing day by day. It is a matter of regret that rural people take surface water without any treatment. In the year 1995 it was 23% but over the 15 years it increases 18%, so it was 41% in the year 2010. From trend line analysis, we can say, surface water and total unimproved water supply will meet together within the year 2015. After 2020 maximum people may use surface water, which can be the largest amount of people in the rural.

3.2 Trend of Sanitation Coverage in Somalia

According to the result of 2010, most of the people in Somalia practice open defecation and it is more than 50 percent. It is a matter of regret that the improved sanitation system is only 23% which was 21% in the year 1995 so it has not changed significantly.

From trend line analysis the improved sanitation and open defecation practice is in increasing trend, other unimproved is decreasing trend and the shared latrine holds the constant liner trend. From the figure 6, it is clear that, there is no significant change over 15 years of sanitation practice in Somalia. Shared latrine is increasing in urban and decreasing in rural area so it balances. Though improved is increasing in urban area but decreasing in rural area. So, Urban area is improving day by day, whereas, the village in Somalia is going to be vulnerable.

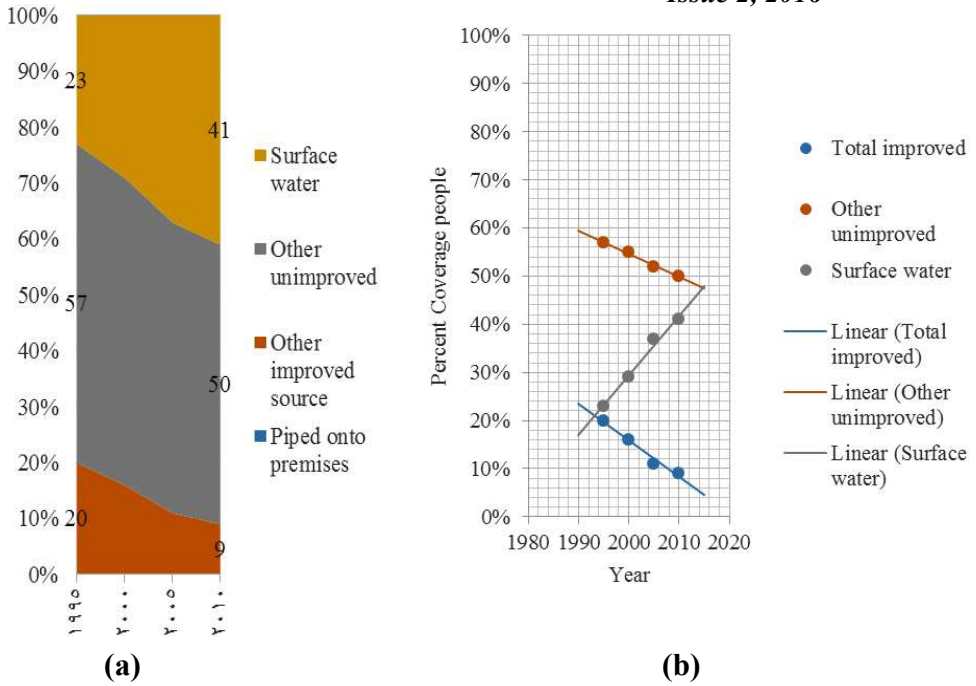


Figure 5: Water Supply Coverage of Rural area in Somalia over 15 years (a) in Volume and (b) Trend line Analysis

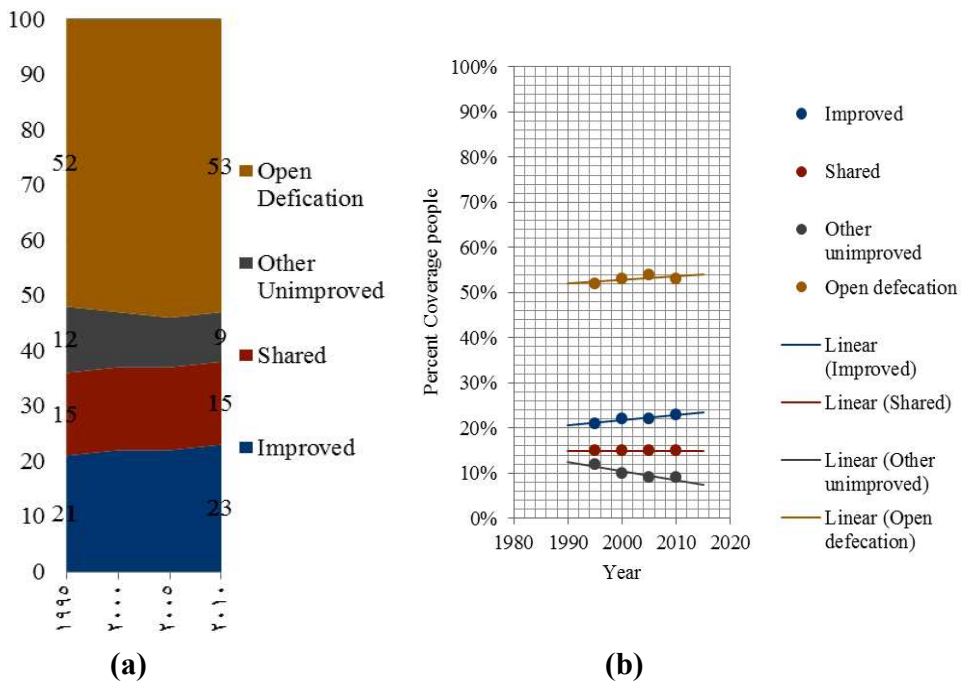


Figure 6: Sanitation Coverage in Somalia over 15 years (a) in Volume and (b) Trend line

3.2.1 Trend of Sanitation Coverage of Urban Area in Somalia

Improved sanitation system is increasing day by day. In the last 15 years (1995-2010) it increases 10% which is from 42% to 52%. From trend line we can find from the year 2006 more than 50% of urban people are fascinated by improved sanitation.

Shared latrine is also increasing year to year but the rate is slow. It increases only 6% over 15 years. Other unimproved are almost constant over 15 year's analysis. In the year 1995 it was 16% and in the year 2010 it was only 15%. Open defecation in urban is satisfactory decreasing. Over 15 years it decreases from 18% in the year 1995 to only 3% in the year 2010. From trend line it can be assumed that in the year 1991 open defecation and the use of shared latrine was in same percent and in the year 199-97 open defecation and unimproved was in the same percentage. After 1998 it crosses down from the situation. So, finally it can be said, that total improved sanitation system is developing and total unimproved sanitation system is decreasing in the urban area of Somalia. Hopefully next up gradation of data we can find no open defecation in Somali urban area.

3.2.2 Trend of Sanitation Coverage of Rural Area in Somalia

In rural area the trend line of open defecation is unsatisfactory increasing. It increases 68 percent to 83%, that is, about 15% from the year 1995 to 2010. So every 5 years 5% of rural people are involving themselves in open defecation practice. This practice is very unhygienic and causes water borne diseases like diarrhea.

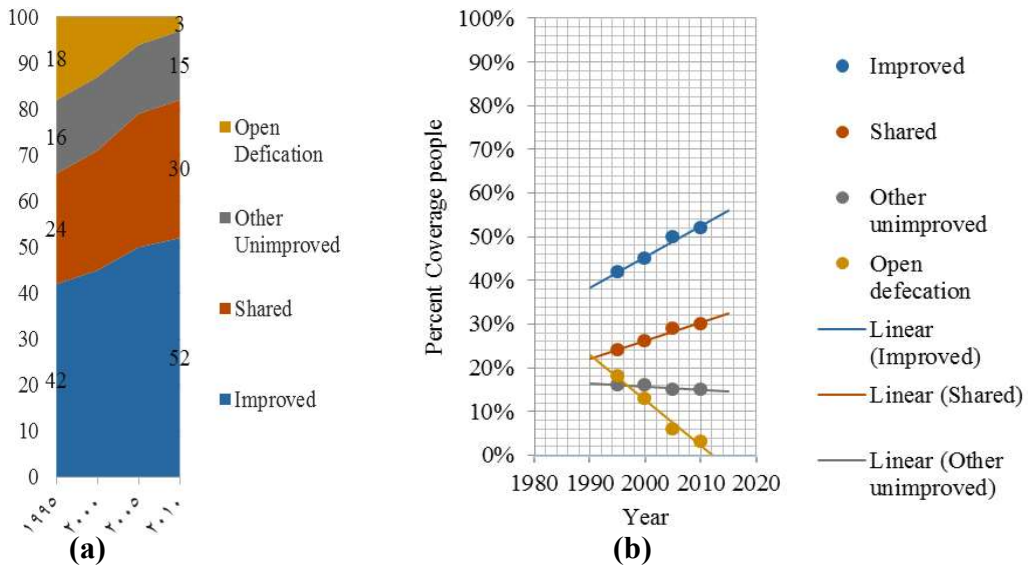


Figure 7: Sanitation Coverage of Urban Area in Somalia over 15 years (a) in Volume and (b) Trend line

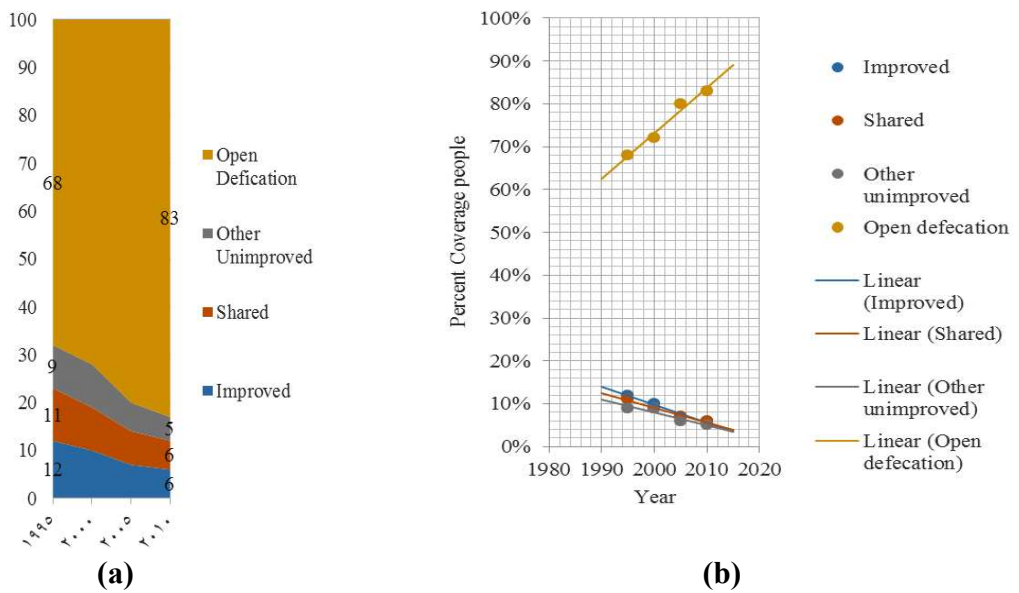


Figure 8: Sanitation Coverage of Rural Area in Somalia over 15 years (a) in Volume and (b) Trend line

If the condition becomes constant after the 2027, all rural people may be involved with the practice of open defecation at the same time improved will be 0% which is a great threat for the environment. On the other hand, improved sanitation system, shared sanitation system and other unimproved sanitation system are decreasing in a same ratio. Gradually there conditions in the year 2010 are 6%, 6% and 5%. Shared latrine is decreasing due to internally displaced people (IDP). They are shifting to urban, so the village is not improving economically. As a result, people cannot make effort for improved sanitation and practice the unhealthy open defecation.

3.3 Assessment of WSS in Somalia

3.3.1 Assessment of Water Supply Coverage

The total summary of the study of water supply with satisfactory scale and severity score is represented by Table 3. According to the satisfactory scale and severity score the total improved water supply system is “adequate” in urban and the severity score is only 2. From the year 1995 to 2010 the trend line is increasing, the severity score is decreasing while the r^2 value of the trend line is 0.9816. On the other hand, surface water shows a declining trend line with the r^2 value of 0.8909, the satisfactory scale is “excellent” and “severity” score is 0. The other unimproved in urban area is also declining, the satisfactory scale is “good” and severity scale is only 1.

On the other hand, the opposite situation is found in rural area. The total improved water supply is declining, the severity score is five which is maximum, the satisfactory scale is minimum which is “severe” while the r^2 value is 0.9757. But, other improved and surface water coverage is “moderate”. It is a matter of attention that surface water use is increasing in rural area.

If the total Somalia is considered; the total improved, unimproved and surface water are respectively “poor”, “moderate” and “adequate” for the satisfactory scale and the severity scores are respectively 4, 3 and 2.

3.3.2 Assessment of Sanitation System Coverage

The significant result comes from the summary of sanitation system in Somalia by the assumed scale is representing table 4. For the open defecation, the urban area’s result is showing “excellent” satisfactory result with 0 severity value where, the satisfactory result is “severe” with the severity value 5 in rural area. Not only this score but also the trend line is saying that the condition is going to be serious in rural area. Even the rural area affects the whole Somalia’s result. The total Somalia is showing “poor” satisfactory scale with 4 severity points, the trend line is increasing. The improved system is showing “severe” satisfactory value for both improved sanitation systems, the severity score is maximum, 5.

Table 3: Water Sply Assessment by Severity Score

Study Area	Analyzing Category	Total Improved	Other Unimproved	Surface Water
Urban	Trending pattern	Increasing	Declining	Declining
	r^2	0.9816	0.9797	0.8909
	% people coverage*	70%	17%	4%
	Satisfactory Scale	Adequate	Good	Excellent
	Severity Score (0-5)	2	1	0
Rural	Trending pattern	Declining	Declining	Increasing
	r^2	0.9757	0.9931	0.9856
	% people coverage*	9%	50%	41%
	Satisfactory Scale	Severe	Moderate	Moderate
	Severity Score (0-5)	5	3	3
Total Somalia	Trending pattern	Increasing	Declining	Increasing
	r^2	0.9761	0.9727	0.9481
	% people coverage*	31 %	42%	27 %
	Satisfactory Scale	Poor	Moderate	Adequate
	Severity Score(0-5)	4	3	2

*The “Percent people coverage” data is only for the year 2010.

Table 4: Sanitation sStem Assessment by Severity Score

Study Area	Analyzing Category	Improved	Shared	Other Unimproved	Open Defecation
Urban	Trending pattern	Increasing	Increasing	Declining	Decaling
	r ²	0.9661	0.9692	0.8	0.9797
	% people coverage*	52 %	30 %	15 %	3 %
	Satisfactory Scale	Moderate	Poor	Good	Excellent
	Severity Score (0-5)	3	4	1	0
Rural	Trending pattern	Declining	Declining	Declining	Increasing
	r ²	0.9692	0.9797	0.8824	0.9703
	% people coverage*	6 %	6 %	5 %	83 %
	Satisfactory Scale	Severe	Severe	Excellent	Severe
	Severity Score (0-5)	5	5	0	5
Total Somalia	Trending pattern	Increasing	Constant	Decreasing	Increasing
	r ²	0.9	-	0.8333	0.4
	% people coverage*	23 %	15%	9%	53%
	Satisfactory Scale	Severe	Severe	Excellent	Poor
	Severity Score(0-5)	5	5	0	4

*The “Percent people coverage” data is only for the year 2010.

Sanitation condition is comparatively better in urban area. But this result is not so good. From the table 4, improved sanitation coverage is only 52% and the other improved is only 30% whereas their satisfactory results are respectively “moderate” and “poor”. So, the severity values are also respectively 3 and 4.

This is a matter of concern that the improved sanitation facility is only “moderate” in urban area but “severe” both for rural and total Somalia. As well as the open defecation is only “excellent” in urban but in rural area it is “severe” and in the total Somalia it is “poor”. This condition is less than the target of the Millennium Development Goals (MDG).

3.3.3 Final Severity Score Assessment in WSS Sector

For the water supply sector,

The total score = Total Improved + Other Improved + Surface Water
 $= 5 + 5 + 5 = 15$.

Where, the achieved severity score in Urban is $= 2+1+0 = 3$ out of 15

the achieved severity score in Rural is $= 5+3+3 = 11$ out of 15

the achieved severity score in Somalia is $= 4+3+9 = 9$ out of 15

Table 5: Severity Matrix for Water Supply System

	Total Improved	Other Improved	Surface Water	Summation (out of 15)
Urban	2	1	0	3
Rural	5	3	3	11
Somalia	4	3	2	9
Summation (out of 15)	11	7	5	

For the sanitation sector,

The total score = Improved + Other Improved + Other unimproved + Open defecation
 $= 5 + 5 + 5 + 5 = 20$.

Where, the achieved severity score in Urban is = $3+4+1+0 = 8$ out of 20

the achieved severity score in Rural is = $5+5+0+5 = 15$ out of 20

the achieved severity score in Somalia is = $5+5+0+4 = 14$ out of 15

Table 5 and table 6 the severity matrix respectively express the severity score for urban, rural and total Somalia. It also can calculate the severity score for all study ingredients. The figure 9 represents the total severity scenario in all study area of Somalia.

Table 6: Severity Matrix for Sanitation System

	Improved	Other Improved	Other unimproved	Open defecation	Summation (out of 20)
Urban	3	4	1	0	8
Rural	5	5	0	5	15
Somalia	5	5	0	4	14
Summation (out of 15)	13	14	1	9	

For water supply system, severity score is maximum (11 out of 15) in rural area. Total improved and surface are maximum (11 out of 15). So it can be said that rural area is more vulnerable for surface water access or is no improved water supply system. Again, the sanitation system of rural area is under threat. Other improved is also most vulnerable in total study area. These two points should be focused by the development authority. The total Somalia result is influenced by rural area because the absence of improved water supply and open defecation has scored maximum (5

out of 5). It can be said that, the rural area even total Somalia is vulnerable for sustainable sanitation because they gain maximum severity score respectively 13 and 14 (out of 20). At the same time improved and other improved, in a word total improved sanitation is in worse situation as they gain the maximum severity score. Comparatively water supply system is less severe than sanitation facilities in total Somalia, but this difference is not so significant.

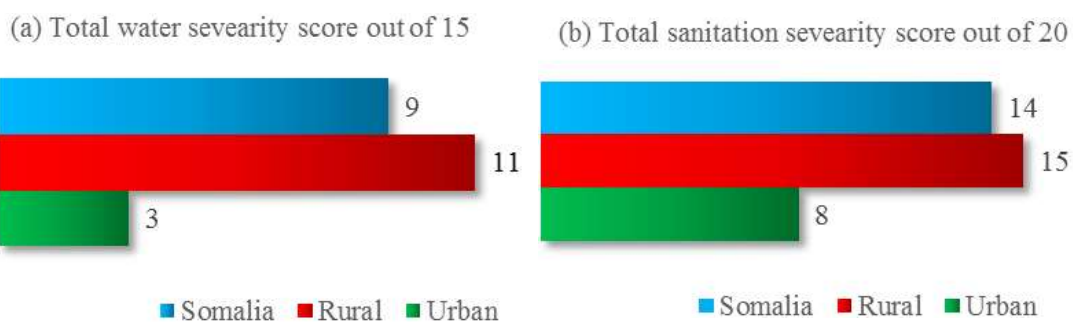


Figure 9: Severity Score of WSS in Somalia

4. Conclusion and Recommendation

The urban area is developing and urban is declining day by day in WSS sector. To put in place sustainable solutions for clean drinking water for many regions in Somalia is needed. Rehabilitation of boreholes, water wells and make projects aimed for rainwater harvesting can be applied. Dams can be constructed to benefit large populations both for irrigation and livestock.

NGO, INGO, GO should come forward to improve the management of sanitation, hygienic facilities through seminars and workshops, provide adequate water treatment to minimize water borne diseases, i.e. bilharzia, diarrhea, and cholera. They can train the local community and extend water management knowledge both in harvesting, hygiene, and sanitations. They can implement water storage facilities at both

communal and household levels to raise consumption of water in the target groups.

The donors should provide guarantee of water supply in the target villages in correct quantity and quality. They can focus on basic training for all water vendors in each target village and the village sub-committee and take them through implementation steps. If they ensure sufficient water to benefit households and water, Somalia will be changed.

Supply gap assessment up to WASH cluster standards is a burning need for the researchers. Policy makers also have a great impact on this sector. So the contribution of every professional like businessman, teacher, job holder, journalists, and researchers can bring a fruitful result for the whole Somalia.

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