Original Research Article

Assessment of off-season water supply situation: The case of Abetifi in the Kwahu-East District of Ghana.

ABSTRACT

The main aim of this study was to investigate the characterizing features of off-season water supplies in the Kwahu-Abetifi Township situated in the Kwahu-East District of Ghana.
A cross sectional descriptive survey was employed for the research.
The study was conducted in the Kwahu East district of Ghana between August 2017 and December 2017.
The stratified random sampling (SRS) technique was employed where the study area was divided into five (5) strata of mixed social classes. In all, a total of 200 respondents (with 40 respondents randomly selected from each stratum) were interviewed using prepared and validated questionnaires. Data obtained from the completed questionnaires, were analyzed using the statistical Package for the Social Sciences (SPSS).
It was observed that frequency occurrences for different durations at which people accessed water and returned to their homes were not the same ($\chi 2 = 83.52$, df =3). Durations respondents used in accessing water and returning to their homes were as follows: Approximately (Appx.) 15 minutes (10%, n=200); Appx. 20 minutes (16%, n=200); Appx. 35 minutes (22%, n=200); and greater than 40 minutes (52%, n=200). Accessed water were perceived to be potable (68%, n=200) and were generally used for different domestic purposes ($\chi 2 = 23.56$, df =2) including drinking (19%, n=200), cooking (47%, n=200), bathing and washing (34%, n=200).
The community people including school-going children in the study area, trek long distances and stay in long queues to access water. They however spend long hours in accessing water for use in their homes during the dry season. The study underscored the need for the revamp of broken down water supply systems in the study area and expansion of existing ones by Government to ease and improve accessibility to adequate and potable water supplies mostly during the dry season.

Keywords: Sustainable water system, potable water supply, off-season, accessibility, proximity, affordability

1. INTRODUCTION

Water they say is life. Ensuring the provision of adequate and potable water supplies to communities across all facets of life around the world is very critical. Good health, livelihood enhancement, sustainable development among other key aspects of life all hinge on the supply of clean and sufficient quantities of water that can be reliable at all times [9,14].

Worldwide, it is estimated that, the total cost of water insecurity affecting the global economy is US$500 billion [24]. Over the years, there have been incessant concerns at the international, regional, sub-regional and grass root levels concerning issues of potable water supplies to people. Aside the concerns, water supplies in most parts of the world face challenges including but not limited to scarcity. It therefore becomes very prudent to address water related issues in the context of scarcity and security, water, sanitation and health (WASH) crisis, with water infrastructure deterioration and destruction to reverse the threatening water trends. Despite the enormous efforts to improve the supply of potable water to people worldwide, 663 million people suffer inaccessibility to 'improved' drinking water sources [6]. Moreover, the 'improved' water is perceived by many as either not safe,

unreliable or not affordable. In respect of water safety, levels of arsenic above WHO standards in drinking water consumed by 45 million people in Bangladesh have been documented [5].

In Ghana, scarcity situations have not been different as some communities continue to suffer stern water shortages usually during the lean season. Several community water connectivity exist, but equally an appreciable number of communities continue to receive their share of supply challenges, perhaps as a result of frequent system break down and other factors.

1.1 The global water cycle and situation

Water, being an important element of life, cycles between land, the oceans and the atmosphere through solid, liquid and gaseous phases. Precipitation from the atmosphere gets to land, underground aquifers and oceans. Rivers get their supplies from groundwater as water moves through sediments and rocks. Rivers intend provide freshwater discharge into seas. Water finally evaporates or transpires from the ocean and land into the atmosphere to complete the cycle.

Earth's water resources including rivers, lakes, oceans and underground aquifers are under stress in many regions worldwide. Of the 70% portion of the earth's water cover, only 2.5% is freshwater. This limited resource is to support an estimated 9.7 billion of the world's population by 2050 [13]. In sub-Saharan Africa, high population growth triggers high consumption rate of this limited resource. Worldwide, some regions are endowed with freshwater than others as a result of global circulation patterns which translate to distinct wet and dry phases of multi-annual climate cycles.

Despite the fact that developed countries have more water available than most of the countries in Africa, Asia and the Pacific, some areas are water-stressed because the available water sources are being depleted at very high rates [16]. It is envisaged that, global water demand would increase by 50% by the year 2030 [23]. Water supply situation, moreover is estimated to be worsened with an approximately 3.9 billion (over 40%) of the world's population, to dwell in severely water-stressed basins [13]. Vicinities with water-stressed situations, consequently makes people seek water from very distant sources. With water scarcity affecting over 40% of the world's population, there is the need for urgent interventions and implementation of highly workable strategies [19].

The United Nations and the international community however, set targets to reduce the number of persons with inadequate potable water and sanitation by 2015. Meeting this target was to provide an extra 260, 000 people per day with clean drinking water and 370,000 people per day with improved sanitation through the year 2014 due to the escalating global water demand [22].

1.2 Community water supplies in Ghana

In most rural communities of Ghana, people rely on all sorts of water sources during the wet season including streams, rivers, dug wells, ponds, boreholes, rainfall, etc but face the challenge of dryness or severe drought getting to the end of the year. Most commonly, people who dwell in these areas resort to these available water sources, which might not be potable but use them unknowingly at the highest health risk [17]. Provision of clean water, is thus imperative in ensuring that people do not suffer likely detrimental diseases and other health risks.

Again, personal hygiene is very essential, and must not receive less attention because of water inaccessibility [8]. Daily per capita water consumption is reliance on accessibility, which could primarily be defined by distance, time, reliability and cost [8]. There is a higher health benefit when water is rather at the household level. Interventions by Governments, International organizations, and Non-Governmental Organizations have made it possible for several rural communities in Ghana to boast of pipe-borne water for which their accessibility, reliability, permanence, and cost effectiveness are also matters of concern.

Potable water accessibility challenges limit personal and household hygiene, which intend affect public health. A supply system that would ensure the everlasting needs of people and also accessible to all without denying the living poor and the healthy living is key for the development of human lives. There is the utmost need for an affordable and efficient rural water supply system that is sustainable and hinges on an effective logical management framework [12].

Sustainable water management is very fundamental in realizing most of the sustainable development goals most especially SDG 6. Thus ensuring the sustainability of rural water supplies through effective management systems is worth considering. This will make people and their immediate environments continue to obtain the right quantities of potable water for growth and development. In most instances, rural water systems unreliability occur due to system breakdown, financial constraints, lack of sense of responsibility for service payment leading to systems failure, poor or no system evaluation and the failure in implementing evaluation recommendations. These factors limit the efficient performance of rural water supply systems.

2. METHODOLOGY

2.1 Study area

The study area, Abetifi-Kwahu is located in the Kwahu-East District of the Eastern Region of Ghana. It is geographically located on (6° 40' 0" N, 0° 45' 0" W). Known as the highest inhabited point in Ghana, the town is located about 2080ft above sea level and prides itself with a very serene weather condition and temperature averaging 25°C. The area is well- drained with to some extent, forest vegetation cover. Abetifi is characterized with two seasons in a year, the wet and dry seasons. The over 15,000 populace of the study area are engaged in several economic activities including farming, trading and public service work.

Abetifi-Kwahu as the name goes has been and still known for its severe perennial dry season water crises making life difficult for its inhabitants during this portion of the year. The town used to be connected to the water lines of the Kotoso water treatment station making it easier for people who lived mostly in bungalows accessed water in their homes at the time. For the past two decades, the supply lines connected to this water station are damaged and have not been fixed, making the people access quantities of water that are described as scarce and frustrating to find during the dry season.

Towns like Nkwatia and Mpraeso are connected to the Ghana Water Company Limited lines but Abetifi has not yet seen its share of this connectivity. During the dry season, rivers, streams dry up leaving only the few constructed bore holes with standing pipes and dug wells for the use of the over thousand inhabitants of the community. People moreover have to trek long distances to access the available water sources. School-going children waste precious times accessing water from the available supply points making them late for school consequently affecting their academic work.

2.2 Sampling and sample technique

The study employed the use of a set of validated semi-structured questionnaires to seek information on the characteristics of the available water supplies in the study area during the dry season. In all, 200 respondents from individual households including institutional bungalows, flats, compound houses, semi-detached houses, etc were contacted and questions pertaining to the subject matter under study posed to them. The stratified random sampling (SRS) technique was employed in that regard. The whole of the Abetifi township was accordingly divided into five (5) strata with each stratum consisting of a mixed social classes of households (lower, middle, and higher living classes). This was then followed by a random selection of forty (40) respondents from each designated stratum to constitute the study sample. This technique was employed to avoid biasness in the sample selection process.

3. RESULTS AND DISCUSSION

3.1 Proximity to water supply points

Public Stand posts made up of several taps connected to a service line (a borehole) as described by one author [11] and dug wells are primarily patronized by the folks in the study area during the dry season as the available streams are dried up. Some authors [10] describe a reliable service as the one which is easy to access without one going through unnecessary stresses. Results of the study refuted this assertion; water accessibility at supply points in the study area has always been faced with challenges during the off-season period. Proximity to stand posts and dug wells have invariably been a major challenge in rural communities for which the study area was not an exemption. In most

times, the community people trek long distances before accessing the available water as shown in Figure 1 below.

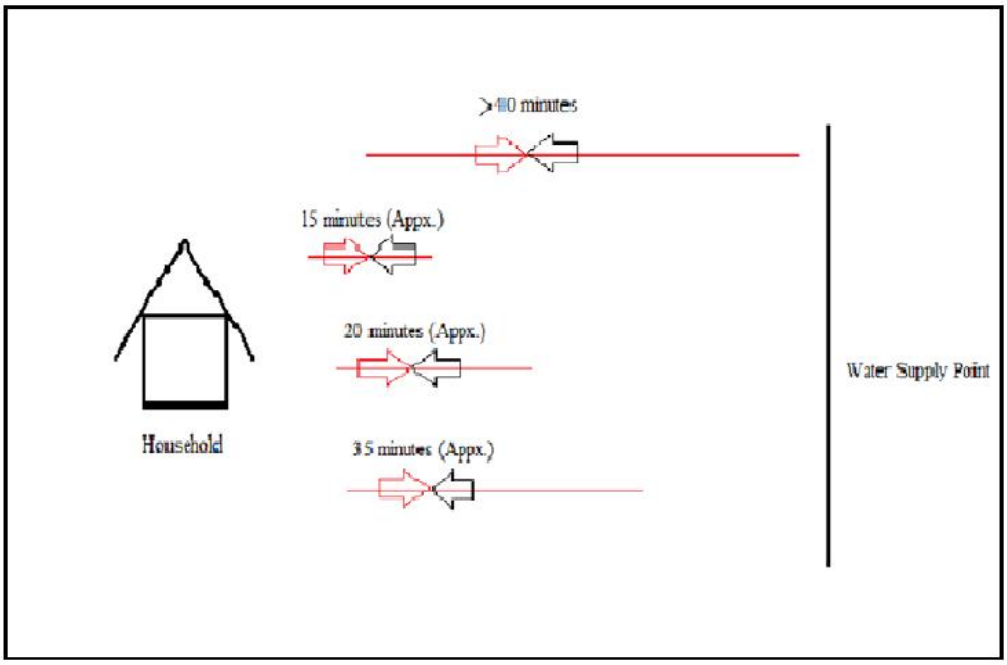

Fig.1. Distances respondents cover in accessing water from supply points and returning home during the dry season

Frequency occurrences for different durations at which people accessed water and returned to their homes were not the same ($\chi 2 = 83.52$, df =3). The study revealed that 16% and 22% of the respondents spent approximately 20 minutes and 35 minutes respectively to access water and return to their homes (Table 1). A few (10%) claimed they spent approximately 15 minutes doing same. Appropriately, the number of respondents who were only able to access water and return to their homes in approximately 15 minutes was 20. A relatively larger proportion of the sampled population (52%) rather spent more than 40 minutes to access water from the available supply points and return to their homes. The longer duration could have possibly been attributed to longer distances one has to pursue in accessing water amid queuing times. Those who may find queuing to access water frustrating leave their containers in the custody of water sales personnel who man the stand pipes so they could be served in their absence. Despite the fact that such people do not waste time waiting at the water supply point, there is always a longer time before they are able to access the water again in such a water-stress period. The implication is that, households have to manage quantities of water for a period before they could access the water supplies again. Households with larger family sizes are the ones that suffer from this challenge the most.

Table 1. Duration used in accessing water and returning to homes

Duration for accessing water	Number of respondents	Percentage of respondents	Chi-test
Appx. 15 minutes	20	10	
Appx. 20 minutes	32	16	
Appx. 35 minutes	44	22	83.52**
> 40 minutes	104	52	
Total	200	100	

***Significant at 5% level Critical point value for χ^2 = 7.81*
Source: *Field survey, 2017*

3.2 Uses, wholesomeness of accessed water and health issues

There was indeed significant different forms by which people in the study area use accessed water (χ^2 = 23.56, df =2) and such differences did not arise purely by chance. When asked, respondents gave several uses of accessed water. Respondents use water for drinking (19%), cooking (47%), bathing & washing (34%).

Table 2. Uses of water accessed by respondents

Uses of accessed water	Number of respondents	Percentage of respondents	Chi-test
Drinking	38	19	
Cooking	94	47	
Bathing and washing	68	34	23.56**
Total	200	100	

***Significant at 5% level Critical point value for χ^2 = 5.99*
Source: *Field survey, 2017*

The various uses of accessed water indicated by the respondents were not surprising as the majority of them (68%) claimed the supplied water was good with only a few (32%) making mention of its particulate nature (Table 3). One author [2] attested to the fact that water from dug wells in rural areas have over the time been challenged with the lack of quality tests and as such stands a higher risk of compromising people's health.

It is imperative for community water supplies to be of good quality to ensure the safety of consumers [10]. Consequently, Researchers [3,4,21] have attributed many health challenges and diseases to unhygienic rural water supplies. Very importantly, ensuring supply of good quality water in their right quantities safeguards primary health of people as well as socio-economic development [1]. Compromising universal water, sanitation and hygiene is thus not what one would ever wish for.

Table 3. Perceived quality of available water supply in the study area

Perceived water quality	Number of respondents	Percentage of respondents
Good	136	68
Salty	0	0
Bad odour	0	0
Tainted water	0	0
Particulate water	64	32
Total	200	100

Source: *Field survey, 2017*

Globally, approximately 3.5 million deaths and a daily record of 1,000 child mortality occur as a result of unsafe water, poor sanitation and hygiene [16,18]. When the basic water accessibility level is not attained, achieving a proper personal hygiene as well becomes very difficult to envisage. Time and distance thus come into play in determining the volumes of water that people are able to access to meet their personal hygiene needs [8]. According to these authors, the levels at which people are able to access water for use can be linked to the assurance of their health (Table 4).

Table 4. Summary for requirement for water service level (accessibility) to promote health

Service level	Access measure	Needs met	Level of health concern
No access (quantity collected often below 5l/c/d)	More than 1000 m or 30 minutes total collection time	Consumption: cannot be assured. Hygiene: not possible (unless practised at source).	Very high
Basic access (average quantity unlikely to exceed 20l/c/d)	Between 100 and 1000 m or 5 to 30 minutes total collection time	Consumption: should be assured. Hygiene: hand washing and basic food hygiene possible; laundry/bathing difficult to assure unless carried out at source	High
Intermediate access (average quantity about 50l/c/d)	Water delivered through one tap on-plot (or within 100 m or 5 minutes total collection time)	Consumption: assured. Hygiene: all basic personal and food hygiene assured; bathing and laundry should also be assured	Low
Optimal access (average quantity 100l/c/d and above)	Water supplied through multiple taps continuously	Consumption: all needs met. Hygiene: all needs should be met.	Very low

Source: *Howard and Bartram, 2003 [8]*

3.3 Community water costing and reliability

Most often, water supply systems have broken down primarily as a result of managerial as well as financial challenges. Researchers have over the years explained and made it clear on the essence of developing a more efficient system. A key factor in ensuring the sustainability of rural water supply systems is the ability and willingness of community people to pay for the service provided. As indicated in figure 2 below, reliable payments for water service will ensure that community water supply management framework works effectively. In that case, such water supplies must be potable, reliable, and easily accessible without spending longer time in accessing them.

The challenge of rural water supply systems sustainability transcends local and regional boundaries. There is however the utmost need for full community involvement and support, in the project during its design, construction and management in order to ensure its sustainability. These when done, would go a long way in ensuring the financial as well as the managerial strength of the system. Good financial management certainly needs to be strictly adhered to in order to cater for the operational and maintenance needs (O&M) of water supply systems and as well ensure their robustness and sustainability (Figure 2).

At the time of the study, a 25 litre container full of water cost 40 Ghana pesewas (US$0.08) with a 30 litre container going for 50 Ghana pesewas (US$0.10) at water stand posts. The respondents however described these prices as fair and were willing to pay without hesitation. Apparently, the volumes of water accessed by the respondents were not affected by cost but perhaps other factors [7]. Some respondents had shown high interest in household connectivity to the Ghana Water Company lines and were ready to pay for bills they would receive from the company if connected to its lines whilst others called for the construction of more mechanized boreholes at vantage points for easy accessibility of the greater majority during the dry season. Apparently, this was in line with [20] who had argued the need to reduce water accessibility distance and encouraged household connections.

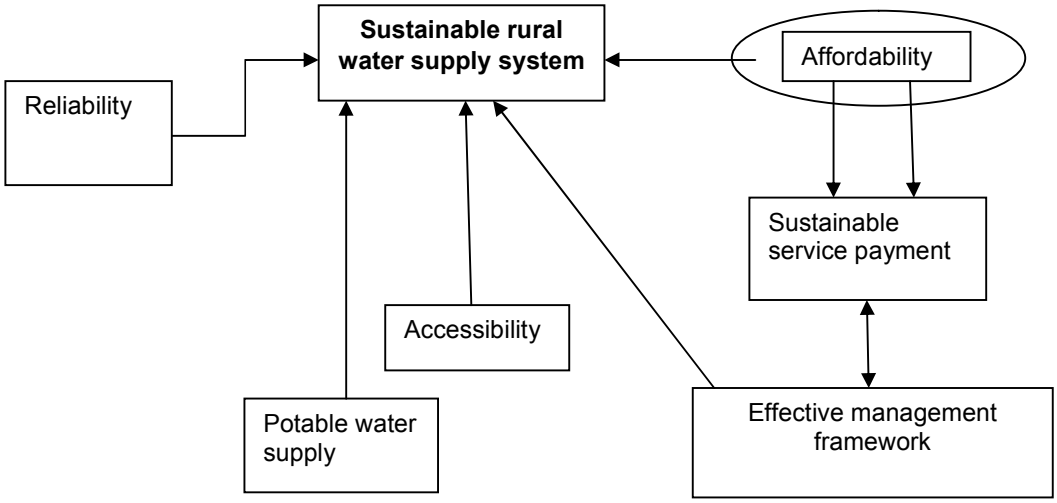

Fig.2. A model sustainable rural water supply system (Source: The Authors, 2018)

4. CONCLUSION

Water supply in Abetifi-Kwahu during the dry season is a challenge to the extent that inhabitants who can only afford resort to purchasing water from neighbouring towns that are connected to the Ghana Water Company Limited lines increasing cost of assessing water and consequently living standards during this period. People have to move long distances and again be in long queues before they are able to access the available water supplies in Abetifi during the dry season. They therefore spend long hours in assessing water for use in their homes.

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