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Customer's Complaints as Valuable Tools for Improving Water Supply Services

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Abstract

Access to a safe and passable water supply greatly affect the health, economic productivity and quality of life of the people. Unfortunately meeting this need is a major challenge facing urban communities in Rwanda today. Water and Sanitation Corporation (WASAC) as a superintend institution to water supply in Rwanda is trying to improve water supply services unless to meet the demands of safe and adequate drinking water to Kigali city inhabitants still a challenge, Where customer's complaints on water supply services observed in a different regions. Considering and be cautious about these complaints is crucial, This would help to reveal the gaps and persuade to water supply services improvement and the establishment of complaints handling strategies is a good way of heightening water supply services, which are the foremost intent of this research. These were attained by laboratory testing using water samples from three different sectors: Rwezamenyo in Nyarugenge district, Gikondo in Kicukiro district, and Gatsata in Gasabo district. moreover, these helped to assess water quality in the network system. in addition, rhetorical questions and interrogation were used to root out water-related issues linked with complaints. in this research water quality, quantity, cutoff, pipeline repair, tariff, and water bills linked to complaints were noted to be the frequent water supply-related issues. Mainly, Water quantity, Cutoff, and pipeline repair were noted to be the potential pronounced. According to WHO guidelines Copper, Zinc, Iron, Turbidity, Color in both sectors and water treatment plants (WTP) are found to be in normal range 1 mg/l, 3 mg/l, 0.3 mg/l, <5NTU, 15APHA respectively. The Increase of Turbidity from NZOVE treatment plant 0.55 NTU and 4.1 NTU in GATSATA Sector indicates broken pipelines, therefore Chlorine residual is used as water additive to control microbes, disinfect within water distribution system. only 28.4% of customers raised issues while 72.6% did not announce their issues to supply utility and 91% are strongly agreed that it is not easy to communicate with Water provider. The analysis proposed that communication is necessity among customers and water supply utility in order to get imformation easliy from water utilities whereby it will be based on Mobile telephone SMS alert.

Keywords

Water Distribution System, Mobile Telephone SMS Alert, Network System, Kigali City Inhabitants, Treatment Plants

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1. Introduction

Access to improved water supply and sanitation, along with better management of water resources, plays a crucial role in developing countries by impacting communities' well-being and national development plans [1]. Therefore drinking water quality must be checked at a regular time interval because the use of contaminated drinking water can cause the human population suffers from various of water-borne diseases [2]. Although, in most cases, water source that causes such diseases/epidemics is not the municipal piped water supply, but it is very urgent to monitor the supply. Therefore, this performance indicator must be regularly monitored, the benchmark value for which is 100 percent [3]. The worldwide water loss average is estimated at 30% [4]. Which

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ensue in the same portion of energy loss [5]. to date, The pollution of drinking water sources is gradually increasing, due to limited financial capabilities and poor infrastructure, which force communities to directly consume water from farm wells, springs, and rainwater stores without prior treatment [6]. In 2015, the study for 665 people, showed that 1 in 10 for the world people wew drinking unsafe water, and most affected people are in sub-Sahara Africa [7]. and less than half of the population has access to a sanitation facility that meets the WHO/UNICEF Joint Monitoring Program (JMP) definition of improved [8]. Moreover, the water losses enhance the environmental burden resulting from extra water withdrawals [9]and give rise to water scarcity. Generally, Water scarcity befalls when the water supply is inadequancy to meet water demand. This condition arises as a consequence of a high rate of aggregate demand from all water-using sectors compared with the available supply, under the prevailing institutional arrangements and infrastructural conditions [10].

There is an urgent need for increased awareness among African leaders so that adequate strategies can be made for development under conditions of severe water scarcity [11]. However, Accessing of improved water and sanitation services in Rwanda has constantly increased in recent years; the rate of increase is still insufficient to achieve the country's stringent Vision 2020 targets [12]. This is because safe and clean water is considered to be a major factor in social-economic development [13]. Moreover, preserving these gains and best practices from national water and sanitation programs while strengthening decentralized implementation capacities remains a challenge. Overall, only 47.3% of the populations are served with an improved water supply within 500 meters of their home [14], And 49% of households spent 30 minutes or longer on a round-trip to the water source [15]. But, The situation is most serious in Kigali, where the current production of about 90,000 m³/day covers only three-quarters of the demand of about 120,000 m³/day [16, 17] To this day, The Country is committed to ensuring the availability and sustainable management of water and sanitation for all by 2030, as The newly adopted the Sustainable Development Goals (SDGs), in particular Goal 6 state [18]. Additionally, The high population density, expanding industrialization and urbanization, inappropriate waste and wastewater management, high rainfall intensity, and the country's high elevation are among the key sources of water pollution (not needed) [19]. Kigali, the capital city of Rwanda has been demographically growing and is expected to double from 1.13 million of the population in 2012 to two million by 2020 [20].

Nowadays, The population is growing faster than the provision of services [21]. In 1996, the population was 358,200, but by 2012, it had increased to 1,135,428 [22]. Adequate clean water and sanitation are crucial for health and well-being for the region of highly population growth as in Kigali city, unfortunately, poor governance of water and sanitation systems means that many suburbs and rural areas lack services, and where they are available, the quality of service is unsatisfactory. However, Urban water resources should be pursued through strong management integrated policymaking, efficient resource allocation and utilization, and efficacious information collection [23]. Water needs in Kigali city are only met at 50% or less especially in dry season in a city with urbanization growth rate of more than 9% annually [24]. Based on National Strategy for Transformation (NST1) as adopted in October 2017, households with access to improved drinking water source without considering time and distance was estimated at 85% in 2017. While about 84% of households use improved sanitation services, without considering some criteria like sharing between two or more households [25]. Both population increment and Kigali city surface expansion have created a burden that the existing basic infrastructures can't sustain. Among the infrastructures that are in limitations, sanitation and water supply is on the forefront of challenging constraints that this newly growing city is undergoing [26]. The population's daily water need is estimated at 90,000 m^3 while EWSA's daily production for Kigali city is 64,000 m^3 leaving a deficit of 26,000 m^3. Kigali city is supplied by 3 water treatment plants and 7 pumping stations having installed capacity of 81,350 m^3 [27]. Current situation of water supply services in city of Kigali, Water and Sanitation Corporation is a new company legally incorporated in Rwanda under Law [28]. The Water and Sanitation Corporation (WASAC) is the entity setup to manage the water and sanitation services in Rwanda as a result of the Government of Rwanda (GoR) decision to unbundle the national utility former EWSA.

In drinking water industry, removal of organic and inorganic matters should be well monitored otherwise leads to water turbidity and odor. The particles that cause turbidity in water range in size from colloidal dimensions (approximately 10 nm) to diameters of the order of 0.1 mm [29]. Presence of color in water may indicate the presence of organics and if organics are there and the water has been subjected to chlorination, the chances of the existence of THM's are considerable. Careful attention to pH control is necessary at all stages of water treatment and distribution system to ensure satisfactory water clarification and disinfection and also to minimize the corrosion of water mains and pipes in household water systems [30]. Beside, the drinking water industry, customer input is often used as a valuable indictor of product safety and quality [31]. According to The US

Environmental Protection Agency (USEPA) has incorporated customer complaints warning system that also include water quality monitoring and notification by public health or law enforcement agencies [32]. For certain classes of compounds, customer complaints have the advantages of facilitating relatively early detection compared with laboratory analysis or clinical diagnoses and thus allow for more rapid response. Therefore, this study discuss the customer's complaints about water related and focuses on using those complaints as a valuable tool for improving water supply services in Rwanda.

2. Materials and Methods

2.1. Data Collection and Analysis

For this research, the following approaches were considered to obtain correct, updated and comprehensive findings, alo, primary and secondary data were used. secondary data were collected from literature review of publications, documents, records, and irrigation project monthly reports. while the primary data were collected throughout site visit for the observations and surveys techniques. Moreover These data were obtained by interviewing different water providers and the local customers from three chosen sectors to acquire accurate information about different problems encountered in water supply services in City of Kigali. Furthermore, the samples of water have been taken at site to laboratory in order to test water properties. the authors applied a purposive or judgmental sampling which is a strategy in which particular settings persons or events are selected deliberately in order to provide important information that cannot be obtained from other choices [33].

Therefore, ArcGIS software and Laboratory Water tests were used for data processing and analysis, where as investigation was conducted right in summer when dry season in on pick. Therefore, observation was based on facts observed in Kigali city.

2.2. Study Area Description

This study was conducted in capital city of Rwanda (Kigali) which consists by three districts: Nyarugenge, Gasabo And Kicukiro Districts. However, three selected Sectors used In This Research are:Rwezamenyo Sectors in Nyarugenge district, Gikondo Sector in Kicukiro district and Gatsata Sector in Gasabo district. Generally, Water issues are raised in these Sectors.

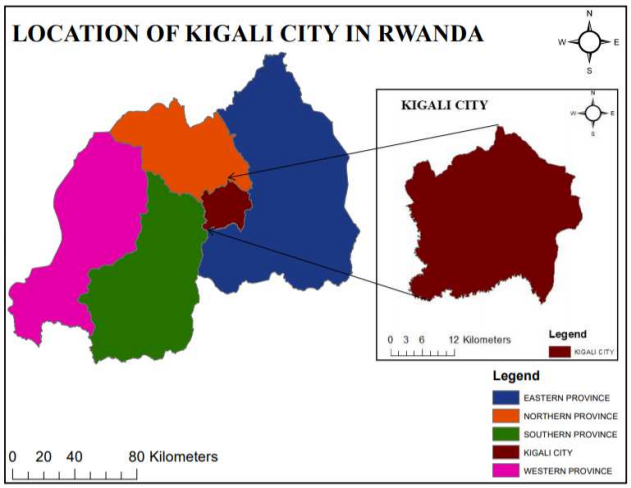

Figure 1. Map of RWANDA indicating location of KIGALI city and Provinces.

3. Result

3.1. Major Water Supply Problems with Categories

WASAC customers are categorized into four different categories: Public Tap, Residential, Non-Residential as well as Industries. therefore Water Tariff differs from categories whereby 1m^3 for Public Tap and the flow rate per m^3 is 323. for Residential, if consumption per month varies 0-0.5m^3 cost is340, if it varies6-20m^3 cost is720, and if it varies 21-50m^3 cost is 845, and if consumption per month exceed 50m^3 the cost is 877. For Non-Residential, if consumption per month varies0-50m^3, the cost is 877, if above is 50m^3, the cost is 895. for Industries, the flat rate per m^3 is 736. Note that Applied Tariff is in RWF (VAT Exclusive) [34].

Table 1. Information collected through questionnaires from different Customer category.

Category	Quality	Quantity	Cutoff	Repair	Tariff	Water Bill	Total
Public Tap							
Frequency	3	73	42	51	19	12	200
Percentage	1.5	36.5	21	25.5	9.5	6	100
Residential							
Frequency	1	75	59	34	25	6	200
Percentage	0.5	37.5	29.5	17	12.5	3	100
Non-Residential							
Frequency	3	65	89	11	12	20	200
Percentage	1.5	32.5	44.5	5.5	6	10	100
Industries							
Frequency	19	91	7	1	80	2	200
Percentage	9.5	45.5	3.5	0.5	40	1	100

As shown in the above Table 1, among 200 informants interviewed, they have shown that problems of quality, Quantity, Cutoff, Repair (the problems of repairing the water pipelines), Tariff and Water bill as the major issues related to water supply services. The results (Table 1) also showed that the high rate of informants in all categories, more than 32% are facing water quantity problems while quality related problems occur in law rate, not exceed 9.5%.

Thus, authors considered 50 interviewers form different sectors whose home's tap connect to different line for the project as sample size.

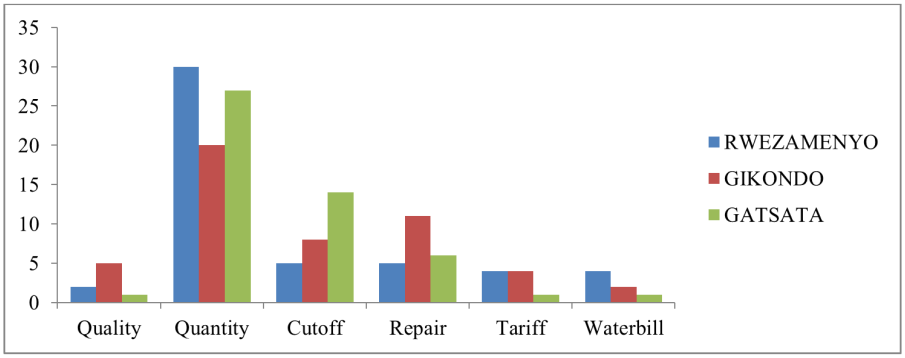

Figure 2. water related problems in different sectors.

Based on the findings in this study as shown in Figure 2, it was realized that Water quantity highly occurs in all those 3 sectors especially in Rwezamenyo sector, tariff and water Bill problems are comparatively low. Water quality has been shown as one of the major water problems especially in Rwezamenyo Sector, where laboratory tests has been conducted to measure the organic and inorganic matters in water before and after water treatment process.

3.2. Laboratory Test

During the laboratory test, three water samples were taken from each of the following sectors: Rwezamenyo in Nyarugenge district, Gikondo in Kicukiro district and Gatsata in Gasabo district. The test conducted on pH, temperature, color, Turbidity, Iron, Zinc, copper, chlorine, E-coli residual and coliform for the purpose of assessing water quality in the stated sectors. Fecal coliform bacteria are typically used as indicator organisms in water quality surveys [35], During the lab test on E-coli, the results indicated that there are no coliform in water sample taken from all Sectors. This was confirmed by the data from treatment plants feeding city of Kigali which also indicate absence of coliform. Water treatment plants feeding city of Kigali are Kimisagara water treatment plant, Karenge water treatment plant as well as Nzove water treatment plant [36]. The table 2 below indicates the water quality from customers and treated water from the stated treatment feeding city of Kigali, where the average water quality conducted in three months: January, February and March in 2018. The results presented in the table are the average of three samples for each parameter.

Table 2. Showing the result of treated water from treatment plants.

Parameter	Unit	Rwezamenyo Sector	Kimisagara Wtp	Gikondo Sector	Karenge Wtp	Gatsata Sector	Nzove Wtp	WHO Guidelines
PH		6.3	7	7.5	7.47	8.7	7	6.5<PH<8.5
Temperature	°C	25.8		26		25		
Color	APHA	-	7.9	-	7.7	-	8	15APHA
Turbidity	NTU	2	1.86	1.6	0.77	4.1	0.55	<5NTU
Iron	mg/l	0.047	0.04	0.05	0.019	0.042	0.07	0.3mg/l
Zinc	mg/l	0.04	0.06	0.035	0.027	0.03	0.04	3mg/l
Copper	mg/l	0.098	0.09	0.65	0.008	0.74	0.075	1mg/l
Cl residual	mg/l	0.8	0.78	1.5	1.07	0.12	0.65	0.2-0.5 mg/l

As show in table 2, Turbidity from NZOVE treatment plant is 0.55 NTU while increase up to 4.1 NTU in GATSATA Sector indicates broken pipelines within water distribution (Cutoff or Repair) which is most cause of water pollution in sector.

According to WHO guidelines, water quality supply varies between 6.5<PH<8.5. form the treatment plants pH fall within the normal range, however water obtained from Rwezamenyo is low, while in Gatsata Sector was found in acidic range.

Copper, Zinc, Iron, Turbidity and Color in both sectors and water treatment plants (WTP) are found to be in normal range 1 mg/l, 3 mg/l, 0.3 mg/l, <5NTU, 15APHA respectively according to WHO guidelines.

Chlorine residual can be used as water additive to control microbes, disinfect in adequate quantity. During laboratory

test the chlorine residual obtained are:0.8mg/l, 1.5mg/l,0.12mg/l in(Rwezamenya, Gikondo and Gatsata sectors). and chlorine residual from treatment are: 0.78mg/l, 1.07mg/l,0.65mg/l in (Kimisagara, Karenge and Nzove water treatment plants). these indicates the high quantity of chlorine residual used.

3.3. Complaint Made About Water Related Issues

To express that there is a discontent of a certain service delivering, some customers raised their difficulties even though it is so tough to communicate with the water services supply provider.

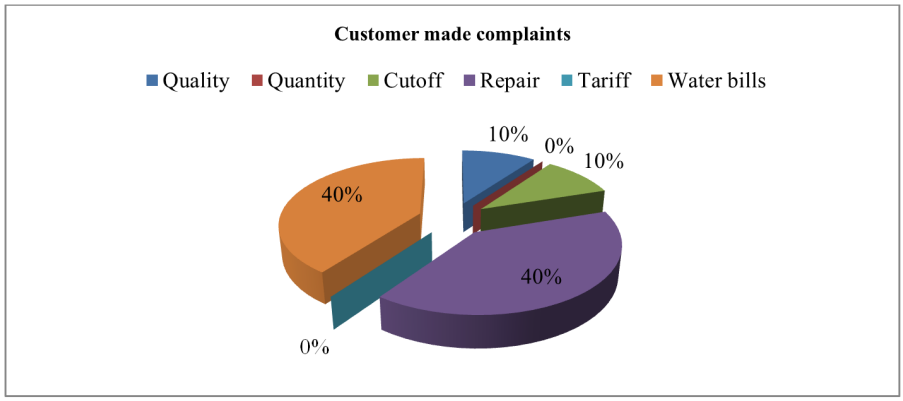

Figure 3. Number complaints made and those who faced water supply problems.

Within 27 Customers faced with the water quality problem, only 1 Customer made complaints. 16 Customer faced the water quantity and Tariff problem, none made complaints. 30Customer faced the Cutoff problem, 1 Customer made complaints. 35Customer faced the Repair problem, 4 made complaint. 40Customers faced the water bills problem only 4 made complaints.

Therefore, Figure 3 revealed that only 28.4% of customers report their problems to WASAC, this obviously shows that the greater numbers (71.6%) of customers do not communicate with the Authority. In addition Customers experience frequently these problems during the rainy season and the reparation of pipe network.

3.4. Customers Perception on Water Problems

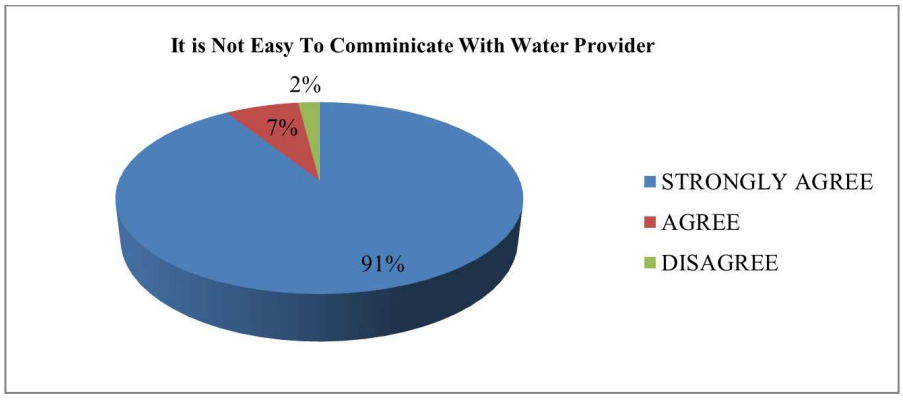

Figure 4. To communicate water providers.

This study, as illustrated in Figure 4 revealed that 91 percent of informants strongly agreed that it was not easy to communicate with provider in case there is a problem. However, 7 percent of them disagreed and 2 percent strongly disagreed with the statement.

4. Discussion

The aged water distribution networks are a crucial constraint faced by water providers, where the pipe network leaks occur more frequent. Additionally, water turbidity increased from the treatment plant to the consumer 1.86-2, 0.77-1.6, 0.55-4.1 NTU Rwezamenyo, Gikondo and Gatsata Sectors respectively. This may result in addition of chlorine residual to the treatment plant as shown in Table 2, chlorine residual to Kimisagara, Karenge, Nzove WTP is 0.78, 1.07, 0.65 mg/l respectively while Chlorine (Cl) residual recommended by WHO guidelines is 0.2-0.5 mg/l [37].

Consequently, Lack of direct leak detection system is the prior factor that cause water quantity issues due to lacking information about leakage as shown in Figure 1, water quantity problems and water bills relates to the error in meter readings and water meter defect used in household frequently occur in all sectors.

To reach Rwanda's Vision for 2050 under appropriete integrated water resource management (IWRM), require to entertain for rural population with safe and passable water. the new orientations of the Government's sector policy that seeks optimal use of water resources and adequate access to water and sanitation services for all, and the current economic evelopment and poverty reduction strategy – EDPRS (2008 – 2012). some of priority key pillars is to access adequate services and sanitation for the populations and the use of water to promote income-generating activities to alleviate poverty [38]. There should be require the establishment of handling procedures of water related issues. These procedures have to be in terms of agreement between customers and water providers. these should require regular reporting of an issues related to water. and communication should be smoothly, As shown in figure 4. 91% of the customers claim about communication with water provider. Once achieved, it will help the Government and WASAC to carry out appropriate planning of the sector activities by harmonizing the approaches, standards and technologies in water supply and sanitation.

This way based on SMS alert for notifying the problem where is addressed. This will facilitate to obtain quick information to water utilities through SMS alert between customers, water supply branches and headquarter.

5. Conclusion

Ultimately, accessibility and reliability of water supply services in City of Kigali especially in Rwezamenyo, Gikondo and Gatsata sectors was found to be inadequate. Addtionaly, Water related problems are still occurring particular long period of pipelines vulnerable to leakages, collapse during heavy rains without reparation. Whereby water pipes 'network does not ease water flow-in. Beyond all those cases, water becomes a very expensive product which they can't afford given the informally estimated minimum wages of a Rwandan casual worker in Kigali which raise the tariff problems, therefore Water billing and tariff should be set in a way the richest pay progressively more than the poorest. Therefore the application of human rights based approach will be considered in managing basic resources such as water. The results obtained on biological parameter investigated on Escherichia-coli showed that there are no coliform in delivered, where it indicates (0/100ml). moreover, Water responsible utiliy(WASAC) should use leakage detection program/services for detecting water supply network system as sustainable solution for water related issues. these will ensure people to get enough and patable water. Further studies are suggested to analyze the impact of using leak detection program for the distribution system and its implementation.

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